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Abstract:
The purpose of this Risk assessment report is to define how the X-FLEX associated risks will be assessed, monitored and handled. The management process provides the tools, processes, and procedures which will be used to assess and control risk events. The report also describes the roles of the different partners in the project and internal coordination mechanisms. A table summarizing the risk management plan is presented at the end of this report.

Keywords:
Risk assessment, Risk event, Risk exposure, Risk handling, Risk management, Risk monitoring

Revision History

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Executive Summary

Throughout the duration of the X-FLEX project, the management process will identify and monitor technical, managerial, financial and ethical risks that might affect the project's progress towards its objectives, in order to carry out mitigation actions as early as possible.

While the Work Package (WP) Leaders are responsible for the risk assessment and monitoring within their WPs, the Project Coordinator (PC) will be ultimately responsible for the oversight of the entire project against milestones and for the risk management effectiveness.

Risks can arise from unexpected technical difficulties or scientific findings, poor communication or co-operation between the partners, resource shortage by the partners, objectives not achievable in terms of budget or feasibility, partners leaving the consortium, human operational errors: planning errors, poor quality, etc. Risks need to be identified as early as possible and their probability and impact need to be evaluated in order to assign them a rating. According to the magnitude of the rating, risks will be handled and/or monitored until they are considered low.

Risks will be continuously updated and included in the risk management plan tables.



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1 INTRODUCTION

The consortium's experience in managing complex international projects in conjunction with its technological competence, permits to identify the main areas of possible risks. The management process described in this deliverable will identify and monitor internal and external risks as well as any other issues that might affect the project progress towards its objectives. This process will be carried out throughout the project implementation, in order to undertake mitigation actions as early as possible.

The main areas of identified risks are the following:

- **Technical risks:** Lack of competence to overcome unexpected difficulties.
- **Managerial risks:** Lack of key resource availability or schedule risks which could delay the project milestones.
- **Financial risks:** Deterioration of the economic situation of a partner, which imposes a stop or an unacceptable reduction of the partner's activities.
- **Ethical risks:** Negative consequences of misconduct which can affect legal liabilities and cause ethical or reputational harm (the monitoring of ethical issues is fully described in the deliverable D10.1).

We also consider the possible combination of these main negative factors, which could result in an even greater impact.

The level of technical risk is intrinsically reduced by the composition of the X-FLEX consortium, thanks to the participation of a well-assorted set of industries, research centres, universities and end-users deeply involved in the development process, with a demonstrable consolidated experience as leaders in the technological areas in which each of them contributes to the project. All the X-FLEX partners have been involved in H2020 innovation actions and have experience to manage and mitigate risks.

All in all, the main set of managerial, financial and ethical risks have already been identified and properly handled. The list will be revised and updated periodically.

The periodic risk review activities will monitor existing and new risks in the project and define clear action plans for minimizing the impact. It will identify progress and success in risk mitigation and will increase or decrease the priority and severity of the measures, based on the evaluation of potential impact, time to mitigate and risk probability. Table 2 and Table 3 will be periodically reviewed and updated during the duration of the project, according to the current status at the time of review.

For the X-FLEX project, a risk is defined as an event that may or may not occur in the future, which could potentially have a negative effect on the team's progress and success. A risk has a severity of impact and a probability of occurrence – formal definitions can be found in next section.

1.1 DEFINITIONS

1.1.1 Risk

Risk is a measure of the inability to achieve overall project objectives within defined cost, schedule, and technical (performance and quality) constraints. It is measured by a combination of two parameters (1):

- The probability of failing to achieve a particular outcome (**likelihood**)
- The consequences of failing to achieve that outcome (**impact**).

For X-FLEX, risk is a measure of the difference between actual performance of a process and the known best practice for performing that process.



1.1.1.1 Risk event

Risk events are those events within X-FLEX that, if they go wrong, could result in problems in the development of the expected research results, production and assessment of the X-FLEX tools, and dissemination of the results. Risk events should be defined to such extent that the risks and causes are understandable and can be accurately assessed in terms of likelihood/probability and consequence to establish the level of risk.

1.1.2 Types of risk

Technical Risks are the risks associated with the evolution of the research results and the X-FLEX tools development affecting the level of performance necessary to meet the requirements of the project.

Managerial Risks are those associated with the adequacy of the time estimated and allocated for the design, development, and deployment of the system. Three kinds of risk events exist in the X-FLEX project:

- Lack of resources availability
- Non-realistic or reasonable schedule estimates and objectives
- Project execution falling short of the schedule objectives as a result of failure to mitigate technical risks.

Financial Risks are associated with the ability of the project to achieve its cost objectives as determined in the X-FLEX project (2). Two kinds of risk events have been identified:

- Non-accurate or reasonable cost estimates and objectives
- Project execution not meeting the cost objectives as a result of a failure to mitigate technical risks.

Ethical Risks are associated with the respect and the protection of the privacy of the involved end-users. Two kinds of risk events are defined:

- Absence of participants consent
- Infringement of personal data.

1.1.3 Risk rating

The risk rating is the value that is given to a risk event based on the analysis of the likelihood/probability and impact of the event. For X-FLEX, risk ratings of *Low*, *Moderate*, or *High* are assigned based on the following criteria:

- **Low:** Has little or no potential for degradation of performance and/or quality, disruption of schedule, increase in cost, or degradation of end-users' privacy. Actions within the scope of the planned project and normal management attention should result in controlling acceptable risk.
- **Moderate:** May cause degradation of performance and/or quality, disruption of schedule, increase in cost, or degradation of end-users' privacy. Special action and management attention may be required to control acceptable risk.
- **High:** Likely to cause significant degradation of performance and/or quality, disruption of schedule, increase in cost, or degradation of end-users' privacy. Significant additional action and high priority management attention will be required to control acceptable risk. This type of risk may be subject to a report to the European Commission Project Officer.

1.1.4 Contingency plan

Once identified and assessed, risks need to be traced in their status (Risk Monitoring) and in their mitigation measures if needed. Thus, the contingency plan should cover the registration and reaction to the change of environmental conditions to avoid risk events.

2 RISK MANAGEMENT ORGANISATION AND RESPONSIBILITIES

Each partner will have the responsibility to report immediately to their respective Work Package (**WP**) **Leader** any hazardous situation that may arise and could affect the project objectives or their successful completion. If necessary, they will also have to inform the **Project Coordinator (PC)** directly. Any change in time schedule of deliverables or in the allocated budget must be reported to the corresponding WP Leader or to the PC. Furthermore, in order to minimise the potential impact of these unlikely situations, each WP leading partner will have a **backup leading partner** in case the initial WP leader becomes unavailable. In case of problems or delays, the **Project Steering Committee (PSC)** will be consulted, and it may install task forces to take the necessary actions. In case that no resolution is reached, the **Project Management Board (PMB)** will be consulted and will establish mitigation plans to reduce the impact of risks occurring.

2.1 PROJECT COORDINATOR (PC)

ETRA, the X-FLEX **Project Coordinator** is the overall risk manager and responsible for:

- Monitoring the project to identify any new or changing risks
- Updating the initial risk list with the support of the consortium
- Briefing the consortium on the status of X-FLEX risks during Consortium Plenary meetings
- Monitoring the effectiveness of the risk management strategies
- Tracking efforts to reduce high risk to acceptable levels
- Facilitating consortium-level risk assessments during PMB meetings
- Combining risk briefings, reports, and documents as delivered by the WP leaders and required for project reviews by the Commission.

2.2 WORK PACKAGE LEADERS (WP LEADERS)

The **Work Package Leaders** are responsible for the risk assessment within their work packages:

- Risk identification
- Risk owners' identification
- Risk analysis
- Risk handling
- Risk information to the PC (in case of moderate or high risk)
- Risk monitoring
- Briefing the respective WP members on the status of risks
- Tracking efforts to reduce low and moderate risk to acceptable levels
- Preparing risk briefings, reports, and documents required for project reviews during PSC meetings.

2.3 PROJECT STEERING COMMITTEE (PSC)

The **Project Steering Committee** is responsible for:

- Monitoring the assigned risks and informing the PC of any threats or opportunities to the project
- Assessing the probability that a risk will occur and specifying the criteria used to assess the probability
- Assessing the impact of risks on project cost, time, scope, and quality objectives, and specifying the criteria used to assess the impact.



2.4 PROJECT MANAGEMENT BOARD (PMB)

The **Project Management Board**, composed of the PSC and WP Leaders, is responsible for developing and/or updating the risk response strategy.



3 RISK MANAGEMENT PROCESS

This section describes the X-FLEX risk management process and provides an overview of the X-FLEX risk management approach. Figure 1 shows, in general terms, the overall risk management process that will be followed in X-FLEX and includes risk identification, analysis, handling and monitoring. The whole risk management process shown in Figure 1 is discussed in the following paragraphs, along with specific procedures for executing each function (1).

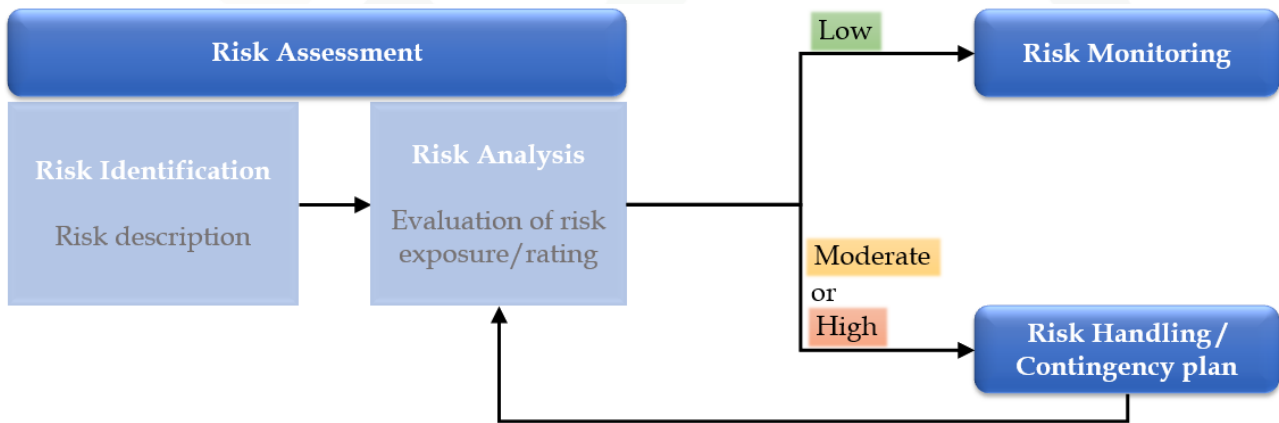


Figure 1: Risk Management Process

3.1 RISK ASSESSMENT

Risk assessment includes the identification of critical risk events/processes, which could have an adverse impact on the project, and the analysis of these events/processes to determine the likelihood of occurrence/process variance and consequences.

Risk assessment is an iterative process. Each risk assessment is a combination of risks identified/analysed in the previous phase and the identification/analysis of risks on current milestones/deliverables according to the project objectives.

3.1.1 Risk Identification Process and Procedure

Risk identification is the first step in the assessment process. The basic process involves searching through the entire X-FLEX project plan to determine those critical events that would prevent the project from achieving its objectives.

All identified risks will be documented in the Risk Management Tables – see section 0 – with a description of the risk, its identification number, its rating, the concerned WPs, and the risk-associated contingency plan.

The basic procedure of identifying risks consists of the following steps:

1. Understand the requirements and the overall project quality and performance goals
2. Identify the processes and activities (tasks) that are needed to produce the results
3. Evaluate each activity/task against sources/types of risk.

3.1.2 Risk Indicators

It can be helpful to watch the following indicators to identify risks:

- Lack of stability, clarity, or understanding of requirements: Requirements drive the research and the design of the X-FLEX tools. Changing or poorly stated requirements guarantees the introduction of performance, cost, and schedule problems.
- Failure to use best practices virtually assures that the project will experience some risk. The further the deviation from best practices, the higher the risk.
- Insufficient or inadequate resources: People, funds, schedule, and tools are necessary ingredients for successfully implementing a process. If any are inadequate, to include the qualifications of the people, there is risk.
- Test failure may indicate that corrective action is necessary. Some corrective actions may not fit available resources, or the schedule, and may contain risk.
- Negative trends or forecasts are cause for concern and may require specific actions to regain control.
- Transparency and good communication between the PC, WP Leaders and all partners is a critical success factor for X-FLEX. Failure to provide available information actively as well as to demand required information actively will both introduce considerable risk.

3.1.3 Risk Analysis Process and Procedure

Risk analysis is an evaluation of the identified risk events to determine possible outcomes, critical process variance from known best practices, the likelihood of those events occurring, and the consequences (impact) of the outcomes. Once this information has been determined, the risk event may be rated against the project’s criteria and an overall assessment of risk exposure (low, moderate, or high) may be assigned (3).

The basic procedure for analysing risk comprises the following steps:

1. Gathering of all identified risks
2. Assignment of likelihood and impact to each risk event to establish a risk rating
3. Prioritisation of each risk event relative to other risk events
4. Quantitative analysis.

For each risk identified during the risk identification process, an assessment of risk exposure using likelihood and impact is performed. This quantitative approach is schematised by a risk assessment matrix (Figure 2jError! No se encuentra el origen de la referencia.).

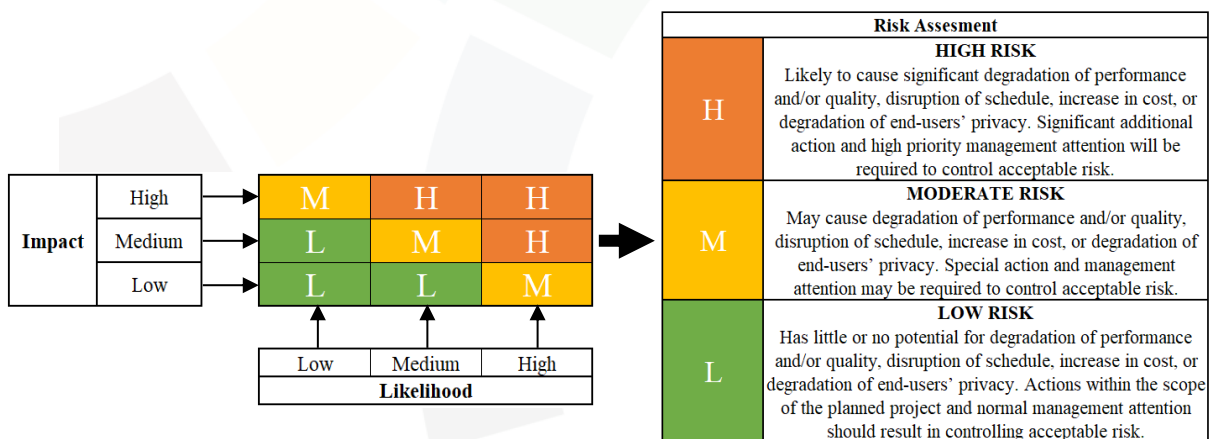


Figure 2: Risk Assessment Matrix

The likelihood and impact of each risk are assessed as follows:

- **Likelihood:** For each risk event identified, the probability of the risk to happen is determined. There are three levels of probability (Low, Medium, High) for this project.

- **Impact:** For each risk event identified, the magnitude of the consequences induced by the occurrence of the event is determined. There are three levels of consequence (Low, Medium, High) for this project.

3.1.4 Evaluation of Risks

To complete the risk assessment process, the quantitative evaluation assigns a rating to each risk (low, moderate, high). This delivers an overview on the risk status over the entire course of the project and is part of the risk table in section 0.

During Risk Analysis, it is possible that identified scenarios of occurring risk events embroil several impact areas. In this case, the worst case of the risk assessment (high risk, moderate risk, low risk) is applicable and influences the required actions as described in the matrix. Of course, all identified consequence areas must be identified and recorded.

3.2 RISK MONITORING

3.2.1 Risk Monitoring Process

Risk monitoring systematically tracks and evaluates the performance of risk-handling actions. Essentially, it compares predicted results of planned actions with the results actually achieved to determine the status and the need for any change in risk-handling actions. Risk exposure will be continuously re-evaluated and modified accordingly and the results of monitoring and control will be documented.

To ensure that significant risks are monitored effectively, risk-handling actions will be documented in the State of the play for risk mitigation table (Table 3) and analysed at each Consortium Plenary meeting. Identifying these risk-handling actions and events in the context of the work breakdown structure establishes a linkage between them and specific WPs, making it easier to determine the impact of actions on cost, schedule, and performance. If any new risks are identified by a partner, they will be analysed as those on the original risk list and then added in the register.

3.2.2 Risk Monitoring Procedure

Each member of the consortium is responsible for monitoring and reporting the effectiveness of the handling actions for the risks assigned.

Risks rated as **High** will be reported to the PC, who will handle and track them until the risk is considered Medium or Low and recommended for "Close Out".

Risks rated as **Moderate** will be reported to WP Leaders, who will also track them until the risk is considered Low and recommended for "Close Out".

Risks rated as **Low** are tracked within the work package and monitored continuously to ensure they stay low.

The risk management process is continuous. Information obtained from the monitoring process is fed back for reassessment and evaluations of handling actions to improve the process itself.

3.3 CONTINGENCY PLAN

3.3.1 Risk Handling Process

After the project's risks have been identified and assessed, the approach to handle each significant risk must be developed. There are essentially four techniques or options for handling risks (3):

- Avoidance (use of an alternate approach in order to avoid the risk event)

- Control (observe the environmental conditions which could influence an already assessed risk)
- Transfer (giving the liability to another party, usually by contract)
- Assumption (supposing the risk eventually happens, accepting it and proceeding with contingency plan).

For all identified risks, the various handling techniques should be evaluated in terms of feasibility, expected effectiveness, cost and schedule implications, the effect on the system's technical quality/performance and the most suitable technique selected.

The results of the evaluation and selection are documented in the foreseen risks management table – see Table 1. This documentation includes the following information, as far as possible:

- Plan of action
- Required level of effort and materials
- Estimated cost of implementation
- Assessment of the duration of risk mitigation
- Assessment of the effect on project milestones
- Recommended metrics for tracking the action
- List of all assumptions.

If new risks arise after the start of the project, the risk management process remains the same and the contingency plan will be documented in the unforeseen risks management table – see Table 2.

3.3.2 Risk Handling Procedure

The respective WP Leader (or in case of high risk, the PC) is responsible for evaluating the risk handling options that are best fitted to the project's circumstances. Once approved, these are included in the work package's or project's strategy or management plans, as appropriate.

For each selected handling option, the responsible consortium member will develop specific tasks that, when implemented, will handle the risk. The task descriptions should explain what has to be done, the level of effort, and identify necessary resources. The consortium member should also provide:

- Start date
- Completion date
- Effect on the project schedule
- Cost estimate. The description of the handling options should list all assumptions used in the development of the handling tasks.



4 RISK MANAGEMENT TABLES

According to the risk analysis performed jointly by the partners beforehand, risks of every type have been considered. Their level of likelihood and impact has been evaluated, and also, in case that the risk becomes a reality, a proposed set of mitigation measures have been established. Table 1 has been produced prior to the project launch; Table 2 and Table 3 have been reviewed and updated during the duration of the project periodically, according to the situation of each moment.



4.1 FORESEEN RISKS

Table 1: Detailed risk management plan for foreseen risks (4)

ID	Risk Description	Like.	Impact	WP	Contingency Plans
TR01	Insufficient details in the specification of the demonstrators' requirements that lead to incomplete information models or poor interoperability among systems.	Med.	High	2, 7, 8	All relevant partners will participate in the iterative process of the definition of information models and interoperability specification in line with overall project rationale.
TR02	Insufficient details or wrong selection of use cases and requirements or not deep enough that lead to underestimate the performance to achieve.	Med.	High	2, 7, 8	All the project partners will be involved from the beginning in the iterative process of the definition and selection of the use cases and requirements. Common meetings and workshops will be organized to build a common view.
TR03	Insufficient or corrupted raw measurement data collected from demonstrations to be used for the evaluation process.	High	Med.	7, 8	Use of several sources of raw measurement data to minimize the error possibility. Conduct a pre-evaluation procedure of the measured data to identify possible corruption or insufficiency and repeat part of the measurements if required. Standard and unified performance indicators will be used with post-processing.
TR04	Insufficient feedback collected from end-users during demonstration phase to be used for the evaluation process.	Med.	Low	2, 7, 8	Organize several meetings/workshops with end-users, prepare feedback forms in close co-operation with them, repeat end-user feedback collection procedure if needed.
TR05	Insufficient capacity of replication and evolution of concepts and services developed in the project.	Low	Med.	2, 7, 8	An extensive analysis will take place of the situation in other areas in order to define a roadmap for replication in different scenarios.
TR06	Lack of standards and interoperability problems among the different systems.	Med.	Low	2, 3, 4, 5, 6	A thorough analysis of existing standards, the selection of the most appropriate, use and evaluation will be conducted. Propose changes in the standards that are proper and new standards will be specified.
TR07	Insufficient equipment and facilities to perform all tests use cases.	Med.	Med.	3, 4, 5, 6	Careful specification of the tests will be performed. The already installed equipment will be completed with the necessary HW to run the demonstrators.



TR08	Insecure storage of pilot data/data breaches.	Low	Med.	2, 7, 8	Develop security policy for handling pilot data since the beginning and agree on how to implement it with pilot partners.
TR09	Demonstration tasks are limited due to constraints of infrastructure availability, market operations and regulatory framework.	Low	Med.	7, 8	We have already a good understanding on the infrastructure, markets and regulatory framework.
TR10	Insufficient or not proper KPIs selected or defined for both cross-site evaluation and impacts assessment.	Med.	Med.	7, 8	Use of well-known methodologies for KPIs selection and definition with the support of both X-FLEX AB and SG.
MR01	Unsuccessful exploitation strategy in terms of attracting the relevant stakeholders	Med.	Med.	8	A detailed analysis of the market and the products developed will be done during the project in order to detect the stakeholders and gaps in the market to be covered by the project.
MR02	Missing skills in the consortium when facing innovation and business challenges.	Low	Med.	All	The consortium is composed by experienced partners with complementary competences and access to a wide pool of knowledge and resources.
MR03	Underestimation or resources not well balanced for the design and development of the project products.	Med.	Med.	All	Regular monitoring of the work and reallocation of resources when needed will take place in every stage of the project.
MR04	A partner leaves the consortium, for example, because of deterioration of its economic situation.	Low	Med.	All	The corrective measures would be distribution to the remaining partners of the activity not fulfilled or to subcontract to a 3rd party, or a combination of the two.
MR05	Disagreement or lack of communication among consortium partners	Low	Med.	All	Continuous communication between all the partners / The PM is the responsible for solving conflicts during the project. If necessary, the GA will decide the right solution according to the CA.



FIN01	The risk that technology investments will become obsolete.	Low	Med.	All	Specific plans for effectively mitigating obsolescence risk will be done for each product produced during the project.
FIN02	The risk of a change in exchange rates against your favour.	Low	Med.	All	The use of hedging techniques, investing in hedged investments such as hedged ETFs, since the fund manager can hedge forex risk at a relatively lower cost.
FIN03	The risk of price increases in critical inputs (e.g. energy for the transportation industry).	Low	Med.	All	The partners will diversify their production, ensuring that alternative production is not subject to the same or similar price risk.
FIN04	The risk that competitive forces will reduce revenue (e.g. a price war).	Med.	Low	All	The consortium will make sure that we can differentiate our products and segment our customers.

ET01	Lack of cooperation of the project partners due to IPR issues.	Med.	Low	All	Possible IPR issues have been discussed among the partners already in the proposal phase and IPR and access right clauses will be included in the CA which will be signed before the project starts in order to avoid future disputes.
ET02	Insufficient protection of personal data managed during the project pilots.	Low	Med.	All	Specific procedures are defined to collect, storage, protect, retain and destruct sensitive and confidential personal information from participants of the project demonstrations.
ET03	The project contravenes ethical principles or applicable legislation.	Low	Med.	All	There are specific tasks in the project in order to ensure the compliance with the ethics requirements during the project.



4.2 UNFORESEEN RISKS

Table 2: Detailed risk management plan for unforeseen risks

ID	Risk Description	Like.	Impact	WP	Contingency Plans
TR11	Non-realistic requirements (both functional and operational)	Low	Low	All	All the project partners will be involved from the beginning in the iterative process for requirements validation. All partners (especially tool developers & pilot sites) participation and communication will be strongly encouraged.
MR06	Unexpected delay delivering deliverables	Low	Low	All	Regular monitoring of the project will be carried out. WP and task leaders will be supported by other partners not involved before.
TR12	Significant deviations from the planned technical expectations	Low	Low	All	Definition of intermediate validation points leads to early deviation detection for large duration processes. The TM will monitor the technical development process.
TR13	Technological inefficiencies/faults of components developed in the project	Low	Med.	All	The rigorous verification will prevent failures that could impact the project success. Maintenance will be provided by the demo partners. The TM will monitor progress and suggest prompt corrective actions if needed, to ensure components' suitability.
TR14	Lack of Transparency regarding the work of professionals (tertiary building consumers, etc.) in the pilot sites	Low	Low	7	The DMP will foresee the necessary provisions to mitigate this risk and any other similar that may arise during the project lifetime. Furthermore, during the pilot trials the responsible partners will inform participants and relevant authorities on the details, the scope and the purposes of the data collection and the necessary processes required in order to implement XFLEX project activities.
MR07	Low cooperation between the involved teams (scientific team, energy stakeholders, etc.)	Low	Low	All	More intense internal communication for all teams under the responsibility of the WP leader.



TR15	Potential safety and hazard issues due to batteries utilization (overheating, fire, electrolyte leakage etc.)	Low	Med.	7	At all time, partners should respect operating conditions in EVs and batteries, as well as check for compliance with maintenance and user manuals.
MR08	Planned number of participants cannot be reached in the dissemination activities	Low	Low	8	Utilization of professional networks of beneficiaries and awareness on social networks like LinkedIn, Twitter will be reinforced.
TR16	Problems with the installation of metering and control equipment	Low	Low	7	Regular monitoring of the procurement and installation process will be performed. Additional measures could be taken to have the task completed via subcontracting.
TR17	Difficulties in data processing/use due to their initial/raw format	Low	Low	7,8	Communication among the demo partners and tool developers regarding the existing data, data format and standards is carried out beforehand. Standard and unified performance indicators will be used with post-processing.
TR18	Unsuccessful selection/definition of the specific part of the network (MV, LV lines) used for the implementation of UCs and testing of tools	Low	Low	8	Active participation of the demo partners at UCs review and communication in order to decide on the criteria for the selected network sections included in the demo.

4.3 STATE OF THE PLAY FOR RISK MITIGATION

Table 3: State of the play for risk mitigation

ID	Period (Starting Date – Completion Date)		Did your risk materialise?	Comments
	DD/MM/YYYY	DD/MM/YYYY		
			[YES/NO]	[Actions of the Contingency Plan that were applied, Cost and schedule implications]



5 REFERENCES AND ACRONYMS

5.1 REFERENCES

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5.2 ACRONYMS

Acronyms List	
AB	Advisory Board
CA	Consortium Agreement
ETF	Exchange Trading Funds
GA	Grant Agreement
H2020	Horizon 2020 Programme
HW	Hardware
IPRs	Intellectual Property Rights
KPI	Key Performance Indicator
PC	Project Coordinator
PM	Project Manager
PMB	Project Management Board
PSC	Project Steering Committee
SG	Stakeholders Group
WP	Work Package



6 APPENDIX

- XFLEX Risk Management table_ver1.0



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