CREXDATA

Critical Action Planning over Extreme-Scale Data

D1.1 Quality Assurance Plan

Version 1.0

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Author	Nikos Giatrakos (TUC)
Contributors	Antonios Deligiannakis (TUC)
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V1.1	Antonios Deligiannakis (TUC)	31/10/2024	Incorporated Reviewer Comments

Contents

Executive Summary

In accordance with the objectives of Work Package 1, this deliverable is dedicated to describing the conduction of continuous quality assurance activities for the operation of the project and the production of its scientific and technical results. Task 1.2 is concerned with the management of the quality of the produced deliverables, software, and other project outputs throughout the project's lifespan. Moreover, the current deliverable examines potential risks and risk management procedures.

Quality assurance is about verifying that the project processes are adequate to lead to high-quality outputs. The plan foresees quality assurance procedures of technical results, scientific results, reports and deliverables that are produced by CREXDATA. Information flow, communication and reporting are described as quality process monitoring tools.

Risk management is also considered as an aspect of quality, since risks that are unforeseen or remain unmanaged can severely affect both technical and scientific progress, let alone its quality. The project risk management methodology includes the steps for conducting risk identification, risk assessment, determination of risk response strategies and risk monitoring processes. The objectives of project risk management are to decrease the probability and impacts of events or circumstances adverse to the project success. Risks are identified and assessed by all partners, while the risk management process is orchestrated by the Project Coordinator. Every identified risk is evaluated and tagged with a probability and impact and is accompanied by a specific avoidance and/or mitigation plan. A Risk Management Registry is created and updated throughout the project's lifespan to systematically document the identified risks together with their assessment and mitigation strategies.

The procedures described in the present document are in line with current best practices in project management and they are well suited to the project, i.e., they are effective and do not require excessive quality control overheads.

1 Introduction

The purpose of the Quality Assurance Plan is to provide a single point of reference on the quality assurance processes during the lifetime of CREXDATA. The current deliverable describes how the project executes its day-to-day activities from a quality perspective, ensures that uniform quality control procedures are defined, and their execution is continuously monitored. It exposes the proposed risk management approach of the project for managing and controlling all project risks. Moreover, this plan prescribes the roles and responsibilities of the partners with respect to risk management, risk identification, as well as risk assessment and mitigation plans.

The use of the present guidelines ensures better collaboration among the consortium partners during risk identification and mitigation. This deliverable is to be used by all project partners to ensure quality assurance of project processes and outputs and prevent possible deviations from the project work plan.

In our quality assurance approach, we consider information flow, well-established communication channels and frequent reporting activities as prerequisites to achieve high quality results in the scope of CREXDATA. We therefore start our discussion in Section 2 below by outlining relevant procedures that have been prescribed and are implemented in CREXDATA.

In Section 3, we present the quality assurance procedures that are used in delivering technical and scientific results in the scope of the project as well as make sure that high quality documents are produced. In a nutshell, to achieve high quality technical results, an agile development model is used, functional and non-functional requirements are taken into consideration in the scope of the project's use cases, quality checks on software pieces are provisioned in white, grey or (when the other two are not possible to implement) black box fashion. With respect to the scientific results of the project, their quality is measured in terms of the reputation of their publication venues and their documentation within the scope of the respective project deliverables. Finally, the deliverables and presentations of the project abide by respective templates. Deliverables, in particular, undergo a well-defined internal reviewing process. All the above are assisted by project collaboration platforms and tools for creating an open-source code repository, perform version control, issue and version tracking.

Section 4 is devoted to risks and risk management procedures. It describes the roles and responsibilities in risk identification and management. It outlines the risk management process and provides a Risk Management Registry for CREXDATA. Finally, Section 5 includes conclusive remarks.

2 Towards Quality Assurance: Information Flow, Communication Channels & Reporting Procedures

Information flow, throughout the project lifetime, among the project partners is considered as a prerequisite for achieving high quality collaborative work conducted in CREXDATA. Therefore, in this section we start by describing the channels that have been established at the various levels of project management to make sure that quality control is performed, and potential risks are identified early, as well as appropriate mitigation measures are applied in a timely manner.

2.1 CREXDATA Teleconferences

The CREXDATA consortium participates in teleconferences (telcos for short), via Zoom[1], typically on a bi-weekly basis, with exceptions for religious or public holidays (Easter, Christmas) and when the telcos would have taken part near a CREXDATA meeting. A timeslot has been reserved by all partners which currently corresponds to every second Thursday at 14:00 CET. In these telcos, at least one participant per project partner is connected. Typically, the context of each telco involves:

- An agenda that is compiled and disseminated by the Coordinator, four working days before the telco, with topics related to the progress of short- and medium-term objectives of the project as well as administrative and project management issues.
- A progress report by each partner individually with respect to the project tasks they lead and/or participate to, working papers and of software components that are being developed.
- Additional topics per partner request.

The project reports are uploaded by the Coordinator at the internal project collaboration environment that has been set using the MSTeams[2] platform, immediately after the end of the telco. Figure *1* illustrates a snapshot of bi-weekly telco progress reports that have been uploaded at MSTeams.

In that, the context with respect to all discussed points, including potential risks or conflicts on technical or scientific issues, is tracked and made known to the whole consortium.

Besides regular telcos as described above, every partner retains the right to ask for a bipartite call with other partners of the project. For instance, it is often convenient for technical partners (such as TUC, NCSR, RapidMiner, CNR, Fraunhofer) to discuss use case related, domain-specific issues with use case partners (UPB, BSC, MT, UoA, etc). Such calls take place separately at the end of the regular telcos or at another appointed date and time.

[1] https://zoom.us/
[2] https://www.microsoft.com/el-gr/microsoft-teams/group-chat-software/

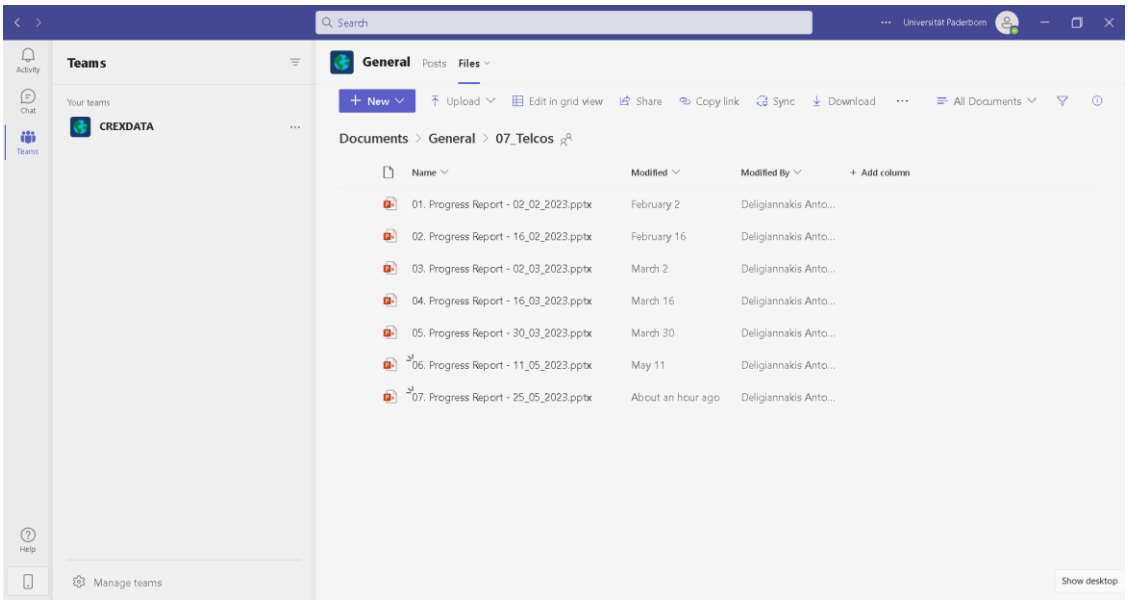

Figure 1: Snapshot of Bi-weekly Telco Notes Uploaded at MSTeams

2.2 CREXDATA Meetings

Besides the regular telcos, it is important for the consortium as a whole to meet, either in person or virtually, presenting their work in detail, collaborate on future work according to the workplan or even organize coding camps to more quickly advance on technical matters regarding the CREXDATA architecture. The CREXDATA meetings plan has been built since the project's kick-off meeting with all scheduled meetings appointed, approximately, every four months as shown in Figure *2*. This meeting plan remains subject to slight modifications per project partner request, but the consortium is aware about it and has approved it.

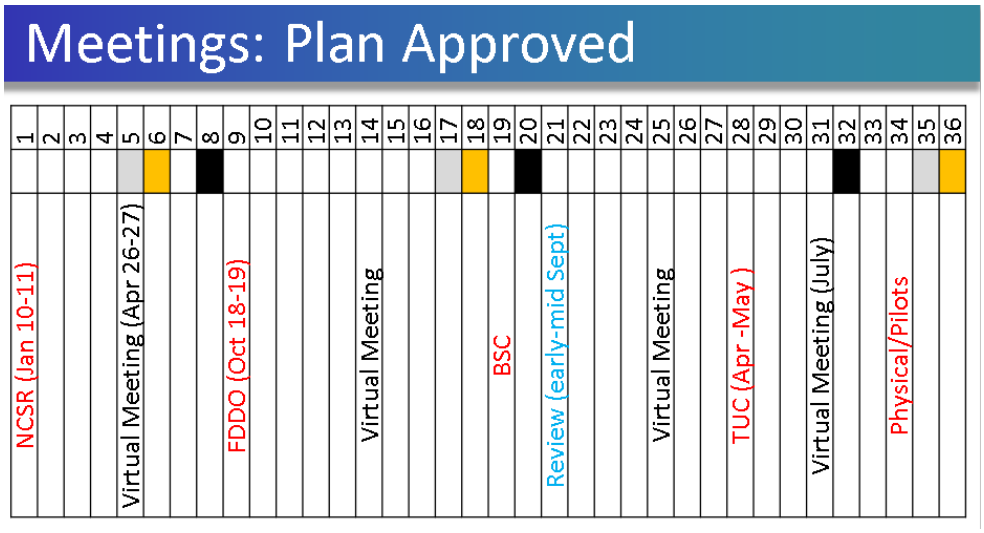

Figure 2: CREXDATA Meetings approximately every four months. M1-M36 of the project are shown in the first table row. Gray/orange cells denote months when deliverables are prepared/submitted. The meeting dates (third row) are accompanied by the plenary meeting organizer.

All participants are reminded of plenary meeting dates at least 30 days in advance. An agenda is compiled and disseminated to project partners by the Coordinator no later than two weeks before the meeting. The template and an exemplary agenda used in CREXDATA kick-off meeting is included in Appendix A. Each project partner is expected to present the progress made in the WPs they lead and/or the tasks they participate, but the Coordinator also notes desired current topics that the partners should cover in their presentation according to the project's workplan.

At the end of each CREXDATA meeting and no later than two working days after the completion of a plenary meeting, at least the following files are uploaded at the project's collaboration page at MS Teams:

- Presentations (.pptx, .pdf files) given by each participant.
- The meeting agenda, as described above.
- Recordings of the meeting are provided to the partners.

2.3 CREXDATA Emailing lists

To further ease communication within the consortium the following mailing lists have been created and used for relevant matters as noted below:

- General project list: data01@googlegroups.com
- Weather Emergencies mailing list: emergencycasecrexdata@googlegroups.com
- Financial management board list: CREXDATA-finance@googlegroups.com

3 Quality Assurance Procedures

We distinguish the following categories of the quality assurance procedures in the project:

- Procedures related to the quality of technical results
- Procedures related to the quality of scientific results
- Procedures related to the quality of the reports provided throughout the project's lifespan.

3.1 Quality Assurance of Technical Results

Figure 3 provides a generic illustration of the develop and test approach in the project, based on the agile software development model. Our methodology has been utilized with remarkable success in recent EU projects under the same coordinator. Use case data and requirements are the input to the software development process. Development stages progress according to our workplan so that the intended results are aligned with the specific objectives of CREXDATA. Throughout the development cycles, outcomes undergo small to large-scale monitoring, testing and evaluation phases. CREXDATA's integrated prototypes and pilots, as prescribed in the Grant Agreement, having been qualified via technological evaluation and testing, yield the project's actual results. Overall, the evaluation of the actual results can provide feedback at certain software implementation stages.

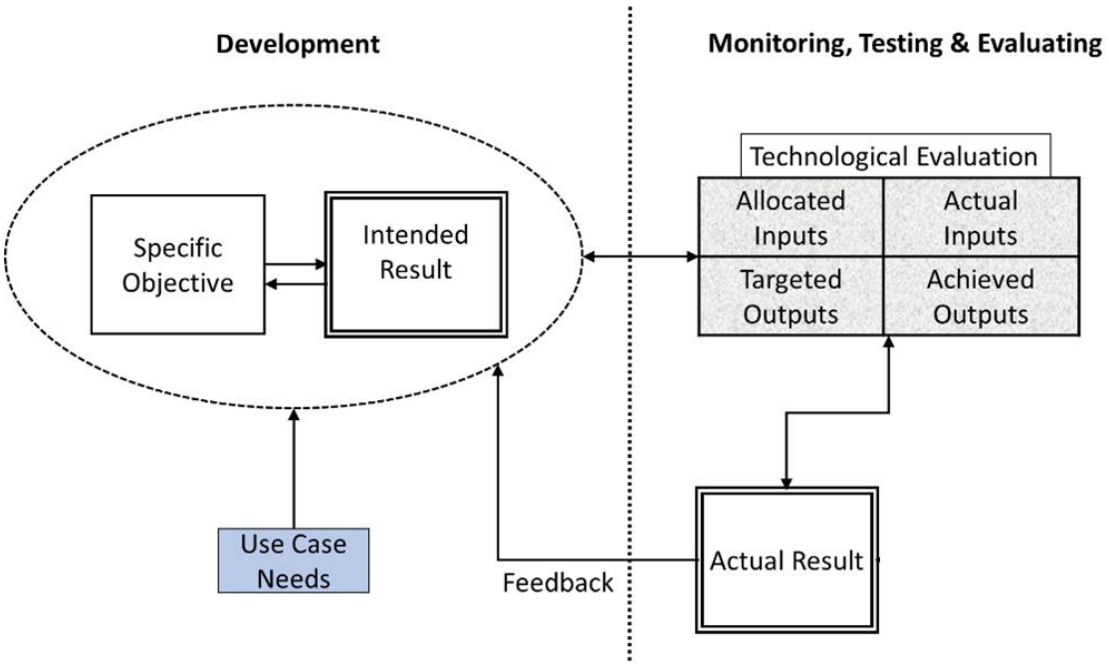

Figure 3: CREXDATA's Develop and Test Cycles

The types of testing applied in CREXDATA involve functional and non-functional aspects. Functional and non-functional requirements are included in the software development lifecycle by engaging use case needs, expressed by expert users, in the development process.

CREXDATA employs a mixture of testing strategies. For the algorithms that will be invented and developed in the scope of the project, a white box strategy will be employed, i.e., quality assessment and evaluation will be performed on the code and the internal structure of a CREXDATA asset.

For algorithms and pieces of code that are already used by use case partners, which constitute part of well-known algorithms in respective fields and where CREXDATA aims at customizing or integrating in broader software modules (e.g. simulation hypersuite), a grey box strategy may be employed, i.e., quality assurance and evaluation will be performed in areas of the code concerning how these algorithms interact with CREXDATA components, but without deep intervention on their internal program functions and operation. A representative example of where the grey box approach may be applicable are open-source simulation frameworks and libraries, such as those offered by Gazebo[3]. Such frameworks and respective libraries are well suited to be treated as grey boxes where appropriate, within the scope of a generic simulation hypersuite constituting an exploitable result of the project.

Finally, in cases of algorithms or products that may be used within organizations, such as products incorporating use case specific algorithms, evaluation will be performed using a black box approach, i.e., examine the functionality of the algorithm, inspect its output given a certain input, but without peering into its internal structures or workings. In a nutshell, the above approach ensures that the quality assurance process emphasizes on the outputs of the project itself and does not become chaotic by unnecessarily expanding to every possible algorithm that may be plugged in any given, user-defined workflow.

With respect to version control and tracking tools, a public code repository for CREXDATA's open-source code is available using Atlassian BitBucket[4], while MS Teams and MS Teams Planner is used as the repository, version control, issue and project tracking platform.

Additional measures for improving the quality of technical results involve:

- Coding camps that will be organized on the last day of certain CREXDATA plenary meetings to better coordinate the pluggability and interplay of the various components developed within the scope of the project and more quickly advance on technical matters. The organization of such coding camps will be decided by the General Assembly during the immediately preceding plenary meeting so that targets are set and progress in the various software pieces under development is made in the meantime. At least one expert in technical aspects and a developer per project partner needs to be present in every coding camp.
- Since open-source versions of the code will be available and will be continuously updated, the base of potential testers of the quality of technical results is amplified.
- Demonstrations of the functionality of the publicly available open-source code will be made at top-tier conferences and at industry-related events, as prescribed in CREXDATA's Grant Agreement and dissemination plan.

The quality of technical results is further guaranteed by the fact that the development of the CREXDATA architecture is led by RapidMiner, which is a world-class leader with extensive experience in delivering relevant products.

[3] https://gazebosim.org/libs
[4] https://bitbucket.org/crexdata/

3.2 Quality Assurance of Scientific Results

The scientific results of the project, including novel algorithms and use case specific studies, will be confirmed by their publication to top-tier, peer-reviewed scientific journals and conferences, according to the project's dissemination plan as described in the Grant Agreement and Deliverable D6.1.

In cases when well-known algorithms and models are applied, adapted or extended within the scope of CREXDATA use cases, their use will be well-documented and reasoned about within the corresponding deliverables in a per use case manner (WP2).

3.3 Quality Assurance of Project Documentation

This section is devoted to the description of the procedures that are followed to ensure the high quality of reports produced in CREXDATA.

3.3.1 Project Templates

3.3.1.1 Deliverable Templates

A general template for project deliverables has been created and is available for the partners at MS Teams project repository. This template is provided in both .docx and latex format and presents a basic common structure to all deliverables, including the mandatory elements: front page, document history, table of contents, executive summary, introduction, conclusions and references. The document provides also a number of heading formats and text formats that must be respected, as well as a unified format for inserting annexes. A sample of the deliverables' template is included in Appendix B.

3.3.1.2 Presentation Templates

A template for the CREXDATA presentations taking place in plenary meetings and dissemination events has been created and made available to the partners at MS Teams CREXDATA repository. The template is provided in Microsoft PowerPoint format. All CREXDATA project presentations to any internal or external entity to the project shall adhere to this template. A sample of the presentations' template is included in Appendix C.

3.3.2 Naming and Versioning

In general, the documents shall be named so that the following information can be distinguished: document identifier, title. In particular, the file name of project deliverables will include the deliverable (unique) identifier along with its title, for instance:

D1.1 Quality Assurance Plan.docx

for final, submitted versions, and

D1.1 Quality Assurance Plan _PartnerShortName.docx

for partner revisions/contributions/comments during the internal reviewing process. In case of successive edits by several partners multiple partner short names shall be appended in the document name. For instance:

D1.1 Quality Assurance Plan_Partner1ShortName_ Partner1ShortName.docx

Further document versioning is not needed since MS Teams keeps versions of documents uploaded under the same name anyway.

3.3.3 Internal Reviewing Process

CREXDATA deliverables are reviewed and accepted in three stages:

- **Acceptance by WP Leader**: each partner will submit the deliverables assigned to them to the relevant WP Leader. The WP Leader decides either to accept the deliverable and pass it on to the next stage of acceptance discussed below, or to provide the partner with instructions for improvement and date for re-submission.
- **Internal review by additional consortium members**: This stage begins at least four weeks before the deliverable submission deadline to the EC. For each of the project WPs, the Project Coordinator has assigned one additional consortium member as the internal reviewer for the deliverables of that WP. The internal reviewer should complete the process, at the latest, two weeks before the deliverable submission deadline, providing comments and suggestions for improvements. In case the deliverable is not accepted by the internal reviewer altogether, the Coordinator forwards comments to the WP Leader responsible for the deliverable, such that the deliverable is updated accordingly. The updated version of the deliverable should be then sent for acceptance to the Project Coordinator.
- **Acceptance by the Project Coordinator**: The project Coordinator reviews the deliverables based on their objectives noted on the Grant Agreement (GA) and in accordance with the task, work package and project goals. In case a deliverable is not accepted, the Coordinator will provide, no later than a week before the deliverable submission deadline, the relevant WP Leader with instructions for improvements and a date for its re-submission for another review round by the Coordinator.

The internal review process is completed upon the submission of the corresponding deliverable to the European Commission using the participants' portal. The aforementioned three stage process is visible to the consortium as a whole, being tracked using the projects collaboration page at MS Teams, as shown in Figure *4*. Again, this process exploits MS Teams support for document versioning and document history maintenance.

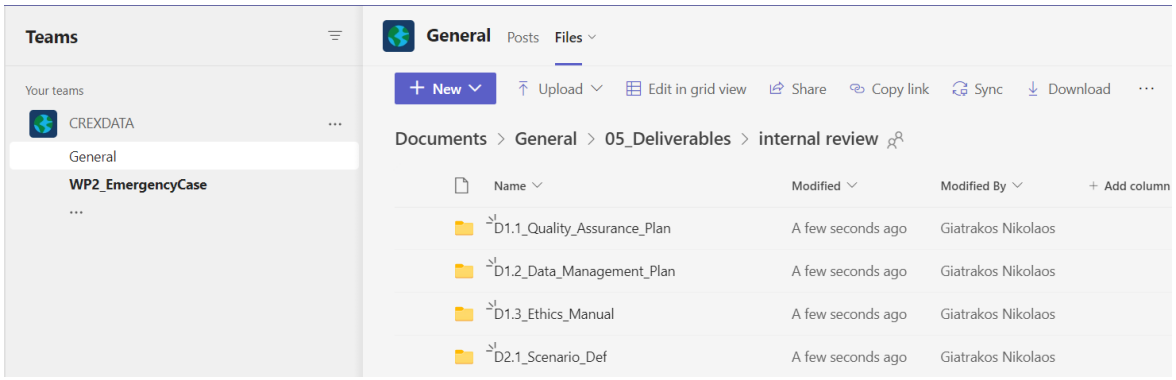

Figure 4: CREXDATA Internal Reviewing Process at MS Teams Project Repository

Table 1: Internal reviewer assignment of deliverables per WP

Work Package	Work Package Leader	Internal Reviewer	Final Approval
WP1	TUC	BSC/TUC/RM	Board
WP2	BSC	NCSR	TUC
WP3	RM	TUC	TUC
WP4	NCSR	FR/CNR	TUC
WP5	CNR	UPB	TUC
WP6	UPB	MT	TUC

Table 1 includes information about the WP Leader and the internal reviewer for the deliverables of each WP, according to the current internal reviewer assignment made by the Coordinator.

The internal reviewer has to check the quality of the deliverable concerning the issues listed below.

- Ensure conformance of the Deliverable to the Description of Action
- Check the document for
  - Clear and concise structure
  - Executive summary
  - Introduction / references to related documents
  - Check for references: text copied without reference
  - Formal presentation: document template used consistently.
- Recommend corrective actions, if necessary, in the form of comments on the .docx or .pdf file.

4 Risks and Risk Management Procedures

4.1 Roles and Responsibilities in Risk Identification and Management

As described in the GA, the Project Coordinator is responsible for all risk-related issues; however, each member of the consortium is responsible for informing the Project Coordinator of any contingencies that might have negative impacts on the success of the project.

The General Assembly is composed of senior representatives of each CREXDATA partner and is chaired by the Project Coordinator. The members of the General Assembly convene at least once every 6 months. The project coordinator may call for an extra meeting of the General Assembly should any emergencies arise. General Assembly meetings include discussion of the day-to-day activities and progress. Special emphasis is given to the issue of inter-relations between WPs. For the Annual Review and Final Assessment, specific review meetings are organized involving the assembly and representatives of the European Commission.

In each WP, three levels of guidance are deployed in the project: overall technical coordination (by the Project Coordinator), WP coordination (by the WP Leader) and Task coordination (by the Task Leader). The task guidance is implemented by expert scientists in the specific scientific topic of the task. The WP Leaders are responsible for the achievement of the overall WP objectives, enabling that the different tasks match and are coherent with each other. Each WP Leader is obliged to prepare and send an internal partner quarterly report to the Project Coordinator. Each WP Leader oversees the tasks performed in the relevant WPs on the operational level and reports to the Project Coordinator. In particular, each WP Leader has the following tasks:

- Inform the Coordinator of the project progress status, results obtained, and problems encountered, work scheduled, decision and questions and to implement decisions taken by General Assembly.
- Collect the information needed for the periodic progress reports and deliver these to the Coordinator.
- Facilitate the exchange of information between the WP participants.
- Organization and chairing of WP meetings at specific timeslots of the CREXDATA plenary meeting in accordance to the disseminated meeting agenda. WP meetings can be coupled to General Assembly meetings if necessary. Other WP-related technical meetings would be organized by the WP leaders, when necessary.

The Project Coordinator along with RapidMiner, WP Leader of WP3, who builds the CREXDATA architecture, will be responsible for the alignment of different WPs inputs and outputs and technical coherence.

4.2 Risk Management Process

Figure 5 illustrates the Risk Management Process in CREXDATA. Risk Identification is performed by the Coordinator, General Assembly, WP and Task Leaders according to their management responsibilities as described in Section 3.

Risks are issued in a Risk Management Registry by the Project Coordinator. This register will be accessible to all partners through MS Teams. The Risk Management Registry contains the following information: Risk Number, Description, concerned WP and proposed risk avoidance or mitigation measures.

Risk assessment for risks that are issued in the register follows by categorizing a risk as of High, Medium or Low Impact as well as estimating the probability of its occurrence. For risks involving the results of the project as a whole, i.e., span multiple WPs, the Project Coordinator and the General Assembly are responsible for Risk Assessment. Risks that are related to particular WP (e.g., at the task/deliverable level), the Project Coordinator works in collaboration with the WP Leaders to estimate their probability and impact. It is the responsibility of all CREXDATA partners to contact the Coordinator as soon as a previously unforeseen or occurred risk comes to their attention. If any new risks are identified by a partner, they will be analyzed as those on the original risk list and then added in the register.

For foreseen risks, two types of Risk Treatment are applied. Initially, if possible, avoidance measures are prescribed in the Risk Management Registry. Avoidance measures may be accompanied by mitigation measures in case avoidance is not achieved. Foreseen risks that may arise are accompanied by prescribed mitigation measures.

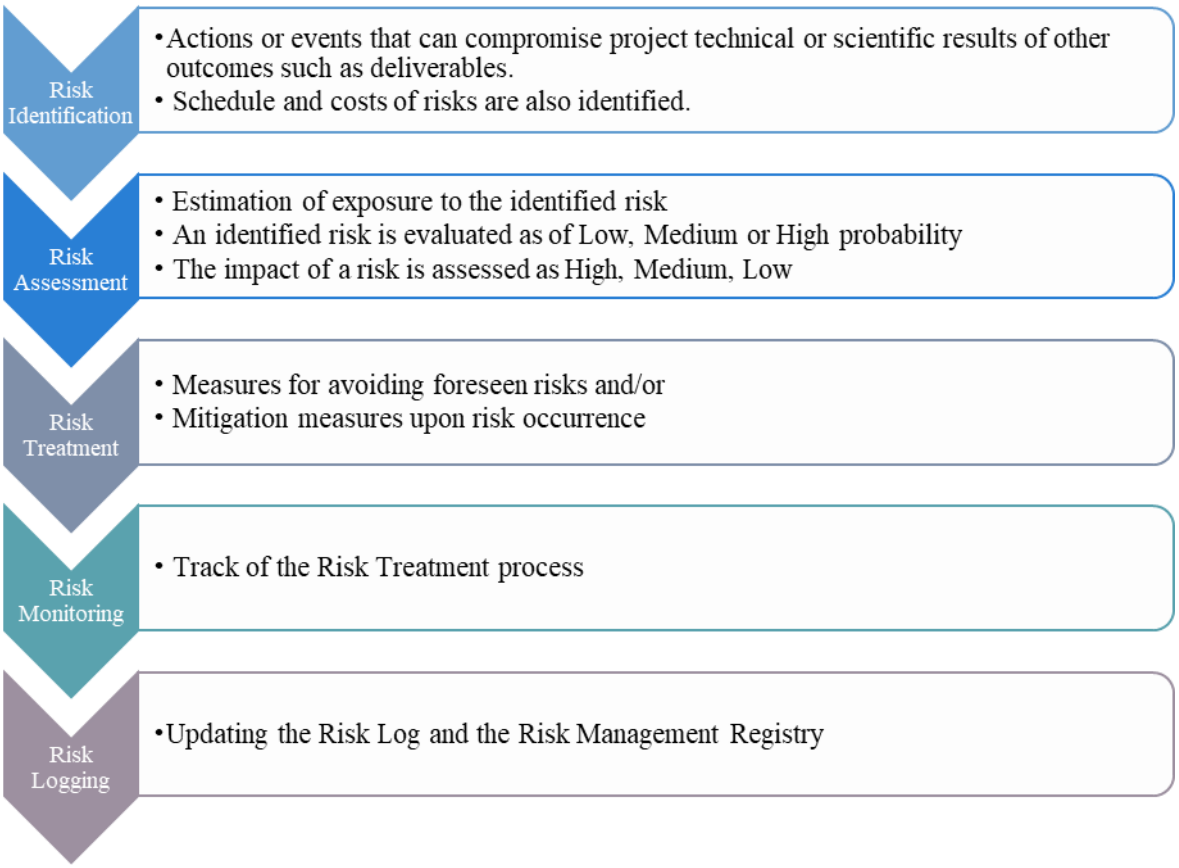

Figure 5: Risk Management Process in CREXDATA

Risk Monitoring involves the application of the avoidance and/or mitigation measures that are prescribed for each risk issued in the Risk Management Registry. The status and effectiveness of each risk and mitigation are judged and the Coordinator or WP Leader accordingly updates the Risk Management Registry. All responsible partners, as described above, make sure that the avoidance or mitigation measures are implemented. If a prescribed measure is proven not effective, Risk Assessment and Risk Treatment are repeated.

Logs about updates of the Risk Management Registry are automatically maintained by MS Teams itself and are visible by all partners.

4.3 The Risk Management Registry

Part of the Risk Management Registry has been submitted, reviewed and approved together with the project proposal and is included in Grant Agreement Annex 1 – Description of the Action (part A). A version of that part of the Risk Management Registry is included here, appropriately updated, given the developments in the project, where needed. The Risk Management Registry is expanded with more detailed risk identification and avoidance/mitigation measures.

Risk Number	**Description of risk (indicate level of likelihood & impact: Low/Medium /High)**	**Work package(s) involved**	**Proposed risk avoidance and mitigation measures**
Generic Risks			
R1	Consortium is not harmonious *(high impact, low probability)*	All	In such a case, the General Assembly will take actions to ensure that appropriate communication channels are established among the partners. The mitigation of these risks will be the responsibility of the General Assembly (as it will be the monitoring of all related situations). In case general issues are resolved at the General Assembly level, but inferior concerns remain by some partners, these will be resolved in bipartite meetings between the involved partners and the Coordinator. A final General Assembly meeting will take place afterwards to confirm all partners are aligned.
R2	A partner leaves the consortium	Depends on partner and assigned work package(s)/ tasks	The assembled consortium has scientific and managerial know-how to permit a seamless coverage. The General Assembly will decide how the non-covered project activities can be carried out by another CREXDATA partner; if this is not

Risk Number	Description of risk (indicate level of likelihood & impact: Low/Medium/High)	Work package(s) involved	Proposed risk avoidance and mitigation measures
	(low impact, low probability)		possible, another appropriate partner will be recruited.
R3	An SME or Industrial partner cannot fully fulfil its duties due to a takeover by another company *(high impact, medium probability)*	Depends on partner and assigned work package(s)/ tasks	The assembled consortium has scientific and managerial know-how to permit a seamless coverage. The General Assembly will decide how the non-covered project activities can be carried out by another CREXDATA partner; if this is not possible, another appropriate partner will be recruited. In fact, this risk arose during the lifetime of CREXDATA. Due to a partial takeover of MarineTraffic by Kpler, and to a change of strategy after the acquisition, MarineTraffic was not able to allocate the resources to the level required to manage the tasks allocated to them in WP2 “Use Cases, Simulators, Pilots and Demonstrators” of the project. Thus, a work share transfer to a new appropriate partner, “The Intelligent Transportation Systems Lab” of the University of the Aegean, was performed. An amendment has been submitted and successfully accepted by the project officer.
R4	Under estimation of project effort *(high impact, low probability)*	Any	The Coordinator and the General Assembly closely monitor the planned effort in a per WP fashion, while the WP Leader does the same for each task. Internal reports are provided quarterly, and relevant issues are discussed on par with CREXDATA’s plenary meetings to evaluate any such issue and assess its consequences.
R5	Data Sets not available (*high impact, low probability*)	WP3, WP4, WP5, WP6	Data has been made available since Day 1 of the project. The use case partners have provided the rest of the consortium with means to access data, descriptions and drivers to download/produce data involved in WP2. In case at any point more or different types of data are needed for scientific and technical result evaluation, use case leaders will keep up supporting the consortium. In case at any point, new data production takes time (for

Risk Number	Description of risk (indicate level of likelihood & impact: Low/Medium/High)	Work package(s) involved	Proposed risk avoidance and mitigation measures
			instance, collecting and pre-processing data from pilots to render them in a FAIR form), surrogate datasets by the CREXDATA simulation hypersuite will be used to temporarily provide surrogate datasets.
R6	Diverging technical objectives *(high impact, -)*	WP3, WP4, WP5	**Closed:** all technical partners have agreed on technical matters and currently work on developing low-scale prototypes.
R7	Unexpected difficulties in the implementation efforts or time-schedule *(high impact, low probability)*	Any	We will ensure that a phased, iterative development is carried out and that software is available early on, and thus delays will not halt progress. The General Assembly will carefully monitor the budget/resource consumption. If needed, budget and resources will be reallocated. In fact, a relevant issue arose in case of WP5 for TUC. Due a much higher need than originally anticipated for the use of Augmented Reality at the CREXDATA use cases, TUC moved funds from its direct personnel costs to the category regarding purchase costs. A respective amendment has been submitted and has been approved by the Project Officer.
R8	Consensus on technical interoperability issues is not achieved *(high impact, low probability)*	WP3	The Coordinator and WP leaders are in charge of continuously assuring that all development work is not diverging from agreed guidelines agreed on the GA (this process is being monitored by the Coordinator). For risk avoidance, the CREXDATA architecture is prescribed as pluggable and loose coupling-based by design. Therefore, in case the risk is materialized, it can be mitigated by different lightweight connectors for CREXDATA, loosely coupled architectural components can be created so that interoperability is achieved in any case.
R9	Project solutions do not meet	WP2, WP3, WP4,	For risk avoidance purposes, expert users from the use case are engaged in various project phases so as to capture their requirements and

Risk Number	Description of risk (indicate level of likelihood & impact: Low/Medium/High)	Work package(s) involved	Proposed risk avoidance and mitigation measures
	service provider and/or end user expectations *(high impact, low probability)*	WP5	expectations. Based on these, feedback is provided in subsequent project implementation rounds (Figure 3). The technical work package leaders are in charge of continuously ensuring that the project's evolutionary approach is followed. They perform additional implementation-micro-benchmarking-use case feedback rounds. The Project Coordinator and the General Assembly are of assistance, if needed.
R10	Deliverables are delayed or are of low quality *(high impact, low probability)*	All	The internal reviewing process starts four weeks before the deliverable submission deadline to avoid such risks. In case delays occur, telcos are organized under the supervision of the Coordinator, micro-management procedures are applied assigning particular sections of the deliverable to specific, involved partners with short-term, strict deadlines. The internal reviewing process is performed in parallel on versions of the deliverables provided according to these deadlines.
Use Cases			
R11	Requirement analysis and/or scenario definitions are unclear. *(high impact, medium probability)*	WP1, WP2	To avoid having the risk affect the project implementation, Deliverable "D2.1 Data handling, Joint Scheme for Pilot and Demonstrator Research Design, Requirements Analysis and Initial Scenario Definition" is scheduled on Month 6 of the project. Moreover, regarding the utilized datasets a version of the data management plan (Deliverable D1.2) has been created on Month 6 of the project. All partners have gone over the deliverable and have obtained a clear picture of all major use case aspects. In case more questions arise, telcos are organized among the involved project partners and dedicated time slots are devoted during plenary meetings to mitigate the risk.
R12	Use case evaluation does not	WP2	Task Leaders will perform additional quality checks on their code. WP Leaders will check if all possible analytics design and execution

Risk Number	Description of risk (indicate level of likelihood & impact: Low/Medium/High)	Work package(s) involved	Proposed risk avoidance and mitigation measures
	meet the set KPIs *(high impact, medium probability)*		parameters are appropriately set. Developer telcos will take place every other day. Dedicated coding camps will be appointed if needed. Documentation of the above processes will be created to be provided as lessons learned and/or best practices reports in the scope of CREXDATA.
R13	Required resources during test and develop phases are not reserved on time *(high impact, low probability)*	All	Use case partners possess the required infrastructure and will promptly schedule access to resources based on the CREXDATA workplan. The risk will be avoided by submitting respective requests well ahead of time. For instance, access to MareNostrum is possible through the European programme PRACE, which manages access to 80% of its computing hours. In case applications for reserving computing hours are not timely submitted to PRACE by the CREXDATA Consortium, there is a low probability of not acquiring enough resources during develop and test phases of the project. In case the risk does arise, until reserving enough resources to the main, operational platforms, access rights to alternative infrastructures will be provided. Following the previous example of MareNostrum, the Consortium can have access to https://hpc.grnet.gr/en/, https://www.bsc.es/marenostrum/minotauro, which will be exploited in the meantime.
R14	Technical difficulties of delays in setting the real-world evaluation pilot *(high impact, low probability)*	WP3, WP4, WP5	The real-world pilot is already being prepared and the first tests of the acoustic sensors will take place in mid-June. Working on the process of integrating these sensors on autonomous vehicles will follow. In the unlikely event of the risk being materialized, on par with continuing the process of setting up the pilot, as described in Task 2.5, the algorithms in WP4, WP5 will be validated using historical data and architectural integration will temporarily proceed based on these. Partners in charge of respective use case pilots will opt for obtaining such data for the

Risk Number	Description of risk (indicate level of likelihood & impact: Low/Medium/High)	Work package(s) involved	Proposed risk avoidance and mitigation measures
			project, by following internal organizational procedures.
Architecture			
R15	Technical difficulties or delays in system integration. *(high impact, medium probability)*	WP3	The adopted software development process allows early feedback and implements several fallback variants to prevent these difficulties. Detailed integration guidelines will be provided by RapidMiner which has relevant experience to avoid the risk. In case the risk occurs, the WP Leaders and the Coordinator will organize weekly developer telcos and, if needed, intercalary coding maps to overcome potential difficulties and speed up system integration. Dedicated Coordinator, WP Leaders and General Assembly meetings will take place. The Coordinator and the Leader of WP3 will review the prototype.
R16	Technical difficulties or delays in software stack implementation. *(high impact, low probability)*	WP3	With respect to the graphical tool implementation, RapidMiner's studio will be extended in the scope of CREXDATA. Given the fact that this is a product with an advanced level of maturity and acceptance, technical difficulties will be avoided or, in case they arise, staff with world-class experience from the project partner will be engaged to assist. With respect to software stack implementation, the respective technical similar mitigation measures to the above-mentioned risk shall be implemented.
Learning, Forecasting and Analytics			
R17	Execution plans provided by the optimizer do not considerably improve naive plans.	WP4	Additional optimization parameters and metrics will be incorporated in the optimization models. More statistics will be collected. Feature selection on the most important optimization parameters will be performed. Micro-benchmarks to train machine learning models and predict the performance of large analytics classes given a certain execution plan will be performed.

Risk Number	Description of risk (indicate level of likelihood & impact: Low/Medium/High)	Work package(s) involved	Proposed risk avoidance and mitigation measures
	(high impact, low probability)		
R18	Some existing network nodes do not provide adequate support for collecting statistics. *(high impact, low probability)*	WP4	Treat workflow operators as black boxes, obtaining measurements of what goes in and out of them. We will patch custom operator code so that it periodically emits some statistics without overloading the execution of the workflow itself. Platforms like MiNiFi[5] may be of assistance.
R19	Inaccurate event recognition and forecasting *(high impact, low probability)*	WP4	We will extend the use of machine learning techniques to refine the event patterns. This will be done in close collaboration between use case and technical partners. We will also expand the utility of probabilistic techniques in the decision-making module.
R20	Inefficient event recognition and forecasting *(high impact, low probability)*	WP4	Our designed agile development process will reveal this in early phases, which will allow us to detect this risk in the early phase of the project. Mitigation will consist of using performing hyperparameter tuning of CREXDATA forecasting module on par with the simulation hypersuite and the distributed learning algorithms developed in the scope of the project. Recent results on hyperparameter tuning, such as provided, large-scale pretrained hyperparameter tuning models [WDS+23] will be considered and exploited in this effort, if needed.

[5] https://nifi.apache.org/minifi/index.html

Risk Number	Description of risk (indicate level of likelihood & impact: Low/Medium/High)	Work package(s) involved	Proposed risk avoidance and mitigation measures
R21	Inaccurate learning models *(high impact, low probability)*	WP4	Engage in more/better training utilizing additional well-known datasets if needed. Exploit recent advancements on hyperparameter tuning such as [1, 2].
Transparent AI (TAI), Augmented Reality and Visual Analytics			
R22	Interplay between learning/forecasting outputs and TAI/VA/AR is problematic *(high impact, low probability)*	WP5	The risk is of low probability due to the fact that (i) T4.3 and T4.4 as well as T5.3 are all led by TUC, (ii) T5.2 and T5.3 are led by CNR and FR which have previously extensively collaborate in EU projects and (iii) early measures have been taken for risk avoidance. In particular, technical partners leading the TAI, AR and VA in the scope of CREXDATA have been gone through cycles of bilateral meetings to make sure the format of the output provided by WP4 can be ingested in WP5. In case inferior divergence arise between cycles, at any stage of the project, mitigation in the form of output reconfiguration, test and feedback iterations will be followed.
R23	End users not satisfied with level of transparency or AR or VA provided *(high impact, low probability)*	WP5	Early measures have been taken for risk avoidance. Technical partners leading the TAI, AR and VA in the scope of CREXDATA have been gone through cycles of bilateral meetings with use case partners to make sure they conceive their needs and what use case experts would like to keep/change in the way analytics outcomes are presented to them. Deliverable D2.1 submitted on M6 of the project also aids towards that direction. These interaction cycles essentially eliminate the risk of total divergence from user expectations. In case inferior divergence from end user expectations arise between cycles, at any stage

Risk Number	Description of risk (indicate level of likelihood & impact: Low/Medium /High)	Work package(s) involved	Proposed risk avoidance and mitigation measures
			of the project, small scale re-design, test and feedback iterations will be followed.
Dissemination, Exploitation and Innovation Management			
R24	Dissemination KPIs are not met. *(high impact, medium probability)*	WP6	The reach to scientific communities is already achieved as the technical partners already possess joint high-quality publications in top-tier scientific journals and conferences. Moreover, the Project Coordinator and MarineTraffic, member of BDVA, already participate in BDVA initiatives in presenting CREXDATA vision and outcomes to other relevant projects and to the industry. Special care should be taken, though, for achieving the posed KPIs regarding the outreach of the project to social media and Web 4.0 channels. RapidMiner and MarineTraffic with a vast audience base will intensify the efforts in attracting interest to present project. Videos, press releases and/or presentations to relevant communities will be conducted by all partners. The dissemination plan will be periodically evaluated against quantitative measurements related to the impact and visibility of the project. Correction plans will be enacted if needed.
Project Management			
R25	Lack of overall coordination *(high impact, low probability)*	WP1	Effective coordination is ensured by the managerial structure and through the project workplan. The Coordinator has extensive experience in coordinating large EU and national projects. In case of unforeseen events, a deputy has been appointed and if needed other experienced persons at the coordinating institute or at other experienced partners can take over coordination tasks.
R26	Quality assurance procedures are	WP1	The current document will constitute a common reference point regarding quality assurance and control. These procedures have been agreed by all partners. In case one or more partners

Risk Number	Description of risk (indicate level of likelihood & impact: Low/Medium/High)	Work package(s) involved	Proposed risk avoidance and mitigation measures
	systematically neglected by partner(s) *(medium impact, low probability)*		systematically ignore the guidelines prescribed in the current document, a General Assembly meeting will be held and the reasons will be investigated. In case there are sound reasons for objecting to the quality assurance process the corresponding partner(s) should devise alternatives, which will be accepted or not by the General Assembly under majority voting.

5 Conclusions and Perspectives

This deliverable presents the plans for quality assurance and risk management in CREXDATA. The procedures described are in line with current best practices in quality assurance and they are well suited for the project, i.e., they are effective without rendering quality controls a bottleneck for project progress. The Coordinator and the General Assembly will ensure that the processes, techniques and methodologies described will be rigorously applied.

No risk identified in this deliverable has a high probability of occurrence and the likelihood of most risks is low. The consortium has proactively treated many of the risks to avoid or reduce the probability of their occurrence. Apart from avoidance, proper mitigation measures are prescribed. In any case, as the project progresses many of the remaining risks will be updated in the Risk Management Registry maintained at CREXDATA internal collaboration page.

6 Acronyms and Abbreviations

- AR – Augmented Reality
- CA – Consortium Agreement
- D – deliverable
- DoA – Description of Action (Annex 1 of the Grant Agreement)
- EB – Executive Board
- EC – European Commission
- GA – General Assembly / Grant Agreement
- HPC – High Performance Computing
- IPR – Intellectual Property Right
- KPI – Key Performance Indicator
- M – Month
- MS – Milestones
- PM – Person month / Project manager
- TAI – Transparent AI
- VA – Visual Analytics
- WP – Work Package
- WPL – Work Package Leader

7 References

[1] Wang, Zi; Dahl, George E.; Swersky, Kevin; Lee, Chansoo; Nado, Zachary; Gilmer, Justin; Snoek, Jasper; Ghahramani, Zoubin (2023): Pre-trained Gaussian processes for Bayesian optimization. arXiv:2109.08215v5.

[2] Goyal, Priya; Dollár, Piotr; Girshick, Ross B.; Noordhuis, Pieter; Wesolowski, Lukasz; Kyrola, Aapo; Tulloch, Andrew; Jia, Yangqing; He, Kaiming (2017): Accurate, Large Minibatch SGD: Training ImageNet in 1 Hour. CoRR abs/1706.02677.

8 Appendix

8.1 Appendix A: Sample Meeting Agenda

CREXDATA – Kick of Meeting Agenda

Venue: NCSR Demokritos, 27 Neapoleos Str, 15341 Agia Paraskevi, Athens, Greece

Note: Each partner leading a slot should arrange with other partners involved in their tasks for the presentations

Day 1: 10.1.2023

09:00 – 09:10 Welcome (A. Deligiannakis/TUC, E. Alevizos/NCSR)

09:10 – 10:00 Introduction of Partners (All – 2-3 slides/partner, 3 minutes per partner)

- Key Personnel, Key Role/Contribution in the project

10:00-10:35 Introduction to the Project (A. Deligiannakis/TUC)

- Objectives
- Role of Partners
- Work packages
- Timing
- Discussion

10:35-10:45 WP1 – Ethical Implications (NCSR)

10:45-11:15 Coffee Break

11:15-13:00 WP2 – Use Cases, Simulators, Pilots and Demonstrators

- Weather Emergencies Use Case (UPB, other partners – 40 minutes)
- Health Crisis Use Case (BSC, URV – 30 minutes)
- Maritime Use Case (MT – 20 minutes)
- Pilots' Setup, Demonstrators and Evaluation (UPB, all – 15 minutes)

13:00-14:00 Lunch

14:00-14:30 Management Board Meeting (All – led by A. Deligiannakis/TUC)

- Deciding on next meetings
- Timing for preparation of deliverables
- Procedure of internal reviewing
- Other issues (per partner request)

14:30-14:50 Video Conference with Project Officer (Beatrice Plazzotta)

14:50-16:00 WP3 – System Architecture and Integration (RM)

- A demo of RM Studio is included in this time slot

16:00-16:20 Coffee Break

16:20-17:00 WP6 – Dissemination, Exploitation and Business Planning (BSC, UPB, DRZ)

17:00-17:30 Optional – Breakout groups (all)

Evening: Social Event
Day 2: 11.1.2023

9:00-10:50 WP4 – Learning, Forecasting and Analytics (NCSR, TUC, BSC)

- T4.1 & T4.2 (NCSR – 45 minutes)
- T4.3 & T4.4 (N. Giatrakos & V. Samoladas/TUC – 45 minutes)
- T4.5 (Maite Melero/BSC – 20 minutes)

10:50-11:15 Coffee Break

11:15-13:10 WP5 – Transparent AI, Augmented Reality and Visual Analytics (CNR, FR, TUC)

- T5.1 & T5.2 & T5.3 & T5.6 (CNR, FR – 75 minutes)
- T5.4 & T5.5 (K. Mania/TUC – 40 minutes)

13:10-14:10 Lunch Break

14:10-15:30 Discussion/Breakout groups on Use Cases and how to use technologies from WP3-5

- UPB, BSC, MT, please lead the discussion regarding the 3 uses cases
- A suggestion is to use a table with all tasks in WP3-5 and discuss for each one if and how it can be used in the use case that you are leading

15:30-16:00 Coffee Break

16:00-16:20 Detailed planning for the first 6 month (All)

- Each partner: Please create 1 or 2 slides with your plans for the first 6 months of the project

16:20-17:00 Discussion and wrap up

17:00-19:00 Organizational Meeting for Tasks T5.1, T5.2 and T5.3 (between CNR & FR)

8.2 Appendix B: CREXDATA Deliverable Template

DX.X Deliverable Name
Version X.X

Documentation Information

Contract Number	**101092749**
Project Website	https://crexdata.eu/
Contractual Deadline	M#, MM.YYYY
Dissemination Level	xxxxx
Nature	xxxxx
Author	Name (Partners' short name)
Contributors	Name (Partners' short name)
Reviewer	Name (Partners' short name)
Keywords	At least 3 words

CREXDATA has received funding from the European Union's Horizon Europe programme under grant agreement number 101092749.

DX.X Deliverable name
Version X.X

Change Log

Version	Author	Date	Description Change
V0.1			
V0.2			
V0.3			

DX.X Deliverable name
Version X.X

Contents

DX.X Deliverable name
Version X.X

Executive Summary

This deliverable template consists of a general deliverable structure and formatting guidelines.

The deliverable structure can be adapted to the requirements of the given deliverable.

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- Model 1
- Model 2
- Model 3

DX.X Deliverable name
Version X.X

5 Acronyms and Abbreviations

Each term should be bulleted with a definition.

Below is an initial list that should be adapted to the given deliverable.

- CA – Consortium Agreement
- D – deliverable
- DoA – Description of Action (Annex 1 of the Grant Agreement)
- EB – Executive Board
- EC – European Commission
- GA – General Assembly / Grant Agreement
- HPC – High Performance Computing
- IPR – Intellectual Property Right
- KPI – Key Performance Indicator
- M – Month
- MS – Milestones
- PM – Person month / Project manager
- WP – Work Package
- WPL – Work Package Leader

DX.X Deliverable name
Version X.X

6 References

References should be end-noted.

DX.X Deliverable name
Version X.X

7 Appendix 1

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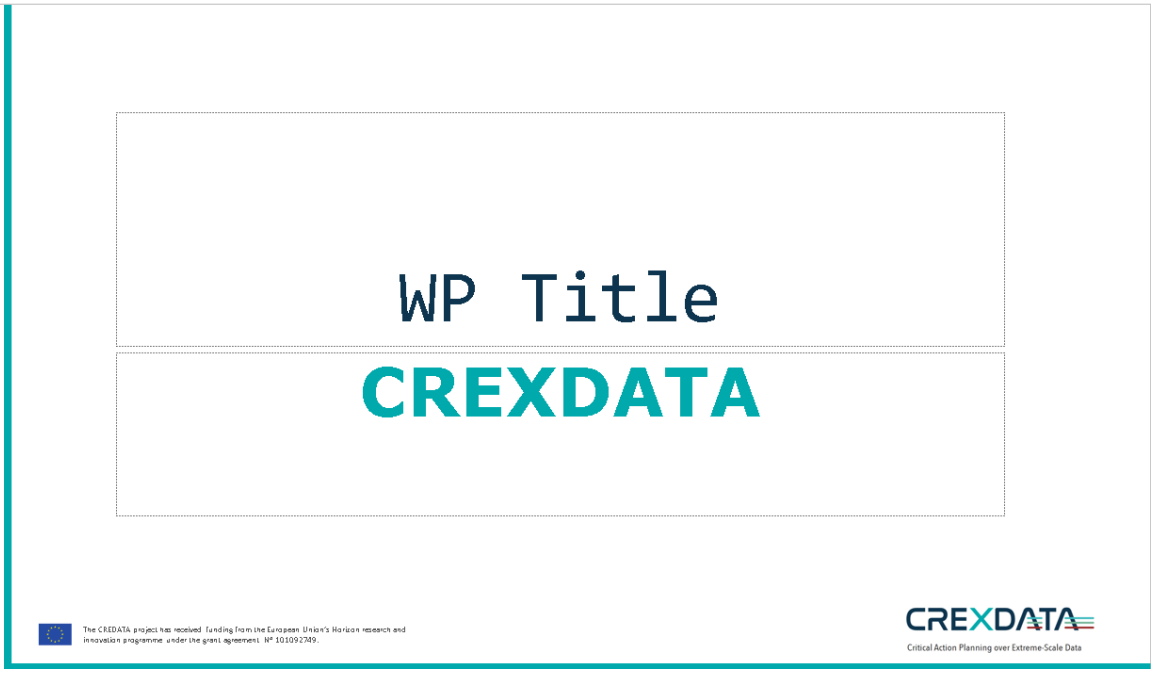
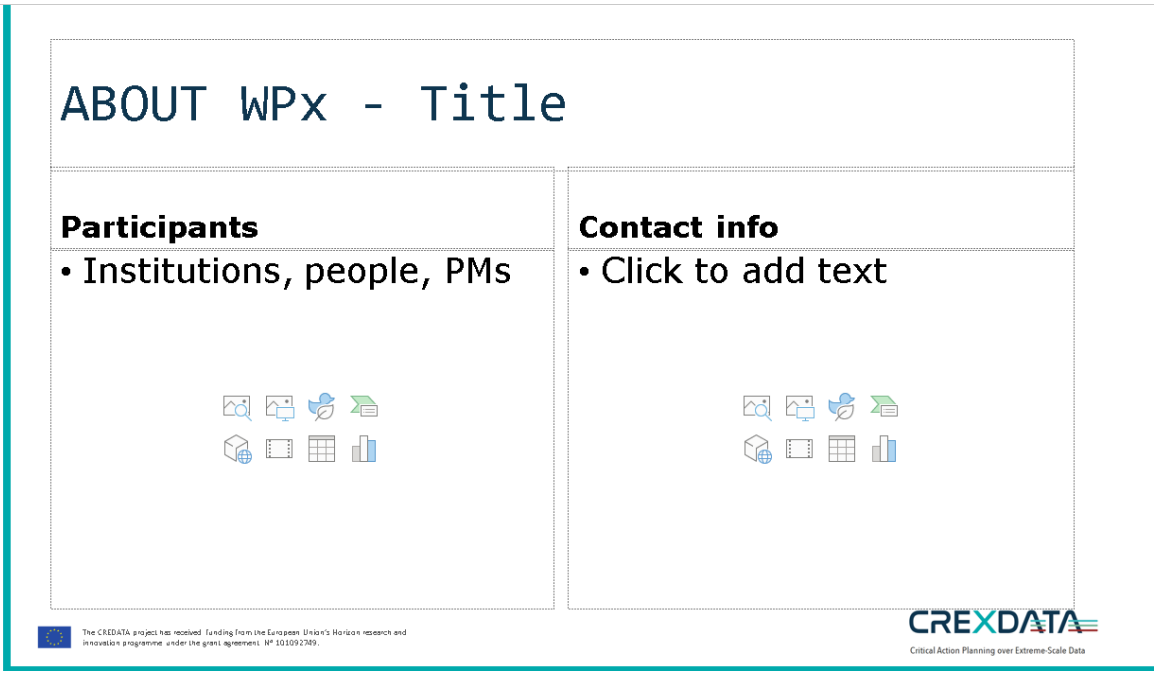
8.3 Appendix C: CREXDATA Presentation Template





WPX –Tasks & Deliverables

- Tasks
- Deliverables

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