ETSEIAT

Departament de Projectes d'Enginyeria

EARTH CLIMATE CHANGE OBSERVATION

ECCO

Deliverable 4

Quality and Risk Management

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1. Quality Management Plan

1.1. Quality Assurance Approach

The ECCO Project does not simply conform with improving product and service quality, instead it is deploying extensive activities to perform the world's top quality management in order to provide the highest level of satisfaction in all aspects to our customers and stakeholders. To achieve this, the quality department deploys various quality improvement activities, with attention also given to improving quality management.

The quality assurance will be applied to products during the pre-production in order to know whether what will be made meets specifications and requirements, and during manufacturing production runs by validating samples meet specified quality controls. Quality assurance is also applied to software to verify that features and functionality meet objectives, and that code is relatively bug free prior to shipping or releasing new software products and versions.

In order to assure quality, some procedures will be performed:

- Audit charter updates by phase.

  (Once per project phase)

- Audit plan content and updates, project priorities, and task estimation.

  (Once per project phase)

- Audit the following project activities:
  - Quality (weekly)
  - Communications (weekly)
  - Project progress (weekly)

- Audit stage checkpoints.

  (Once per project phase)

- Audit project reviews by phase.

  (Once per project phase)

Other techniques and tools that will be used in the quality assurance approach of the ECCO project are:

- Project checklists: This involves development of a list of all critical steps involved in the manufacturing process. As each step is completed, a line manager or shift manager should check off that step on the checklist. This diligent technique prevents neglect or avoidance of important procedures throughout production.
- Process reviews: The production processes and assurance standards against industry benchmarks and best practices will be regularly reviewed. This helps the project ensure that the standards align with current process and do not lag with other companies.

Moreover, and regarding the technical parts of the project related to the development of software, controls and verifications will be done periodically in order to guarantee the quality assurance.

All methods and tools will demonstrate conformity with the internal quality assurance detailed in the ECCO document "ECCO Procurement Quality Requirements" (ECCO_D_22MFG4).

General Quality Standards (ISO/EN) that must be followed and accomplished are, depending on the task:

- 9100- Quality System for Aerospace Manufacturers
- 9101-Checksheet for 9100
- 9110-Quality System for Aerospace Repair Stations
- 9111-Checksheet for 9110
- 9120-Quality System for Distributors
- 9121-Checksheet for 9120

1.2. Quality Control and Improvement Approach

ECCO project will assure that the final products fulfil the quality requirements by the Quality Control Approach.

The procedures, processes, methods and tools used in performing the quality control activities depend in which area it is being done.

Data validation:

The validation of the laboratory data is essential to assure the quality control. The following procedures will be followed:

- Proper chain-of-custody and sample handling procedures followed.
- Parametric holding times met.
- Samples prepared and analysed according to specified methods.
- Instrumentation calibrated according the specified methods.
- Calculations performed correctly and verified.
- Transcription of final data correct.

The data sheet of each laboratory test will collect all the procedures below in order to assure they have been done correctly and the data obtained is reliable. Specifically, it will collect the information below using a checklist scheme.

Software:

In order to assure the software quality control, all the standards that must be followed will be written in the documentation standards. The next documents will be elaborated:

- Coding standards: description of all the coding standards.
- Comment standards: description of all the comment standards.

It is important to assure an optimum development of the software the standards to be perfectly stablished.

During all the software development, some procedures will be done regularly in order to ensure the quality and detect possible errors:

- Check that assumptions and criteria for the selection of data and the different factors related to data are documented.
- Check for transcription errors in data input and reference.

- Check the integrity of database files.
- Check for consistency in data.
- Check that the movement of inventory data among processing steps is correct.
- Check for uncertainties in data, database files etc.
- Undertake review of internal documentation.
- Check methodological and data changes resulting in recalculations.
- Undertake completeness checks.
- Compare Results to previous Results.

Once an error is detected, the person who discovered the error is responsible for reporting it to the Task Manager. Then, the software engineers try to solve the problem and when this is already solved, all the changes and patches made are written down in a document that collects all the code modifications with the date and description of each one.

Also verification and validation procedures will be done along all the project in order to answer two main questions:

Verification: "Are we building the product right?" The software should conform to its specification.

Validation: "Are we building the right product?" The software should do what the user really requires.

The set of techniques and tools for process improvement that will be used is the Six Sigma. It seeks to improve the quality output of process identifying and removing the causes of defects and minimizing variability in manufacturing and business processes. Thus, set of quality management methods that will be used are mainly empirical and statistical. The project methodology chosen is the DMAIC.

The DMAIC project methodology has five phases:

- Define the system, the voice of the customer and their requirements, and the project goals, specifically.
- Measure key aspects of the current process and collect relevant data; calculate the 'as-is' Process Capability.
- Analyse the data to investigate and verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.

- Improve or optimize the current process based upon data analysis using techniques such as design of experiments, poka yoke or mistake proofing, and standard work to create a new, future state process. Set up pilot runs to establish process capability.
- Control the future state process to ensure that any deviations from the target are corrected before they result in defects. Implement control systems such as statistical process control, production boards, visual workplaces, and continuously monitor the process.

1.3. Quality Roles and Responsibilities

The following table identifies the quality-related responsibilities of the project team and lists specific roles and quality responsibilities.

Table 1. List of quality roles and responsibilities

Role:	**Responsibilities:**
Project Manager	• Responsible for management, review and approval of planning, strategy and testing execution and tools. • Provide formal sign-off on all deliverables • Review of results and defects to determine/assess impact to overall project plan and implementation schedule. • Works with the all the other managers to establish timetables and agree on a Quality Assurance plan. • Assure that practice of quality control measures is documented, communicated and adequate to ensure agreed quality levels for the ECCO project. • Oversees determination of need, selection, implementation and maintenance of quality control measures and tools. • Facilitates weekly quality assurance meetings and maintains the meeting agenda. • Assure training plan addresses all project skill levels. • Assure project management gap resolution.
Administration Services Manager	• Coordinate communication about the status of quality assurance efforts to stakeholders. • Work with the Project Manager, Engineering Managers and Stakeholders to assist with the writing of use cases and test cases.

Role:	**Responsibilities:**
Engineering Managers	• Responsible for the design and test planning and coordination for their module. • Assure their work package is complete, trackable and on-schedule. • Provide formal sign-off on all deliverables of their module. • Primary point of communication for engineers and technicians. • Have a better understanding of the business/functional requirements for their unit. • Provide guidance and assistance on the engineering team. • Provide feedback on the design and test processes to the project manager. • Technical leadership for the project, including design and test approach. • Selectively review test and simulation results and reconciliation for completeness and accuracy. • Verifying the quality of the requirements, including requirement definition, design, and testability. • Staying current on latest design and test approaches and tools, and transferring this knowledge to the team.
Engineers	• Understand and follow design and test processes and responsibilities. • Report the work developed. • Record any new defects uncovered during their labour. • Provide comments on any defects that are discovered.

Role:	**Responsibilities:**
Laboratory Cooperation	• Provide training and assistance to engineers to ensure they are following agreed design and test reporting processes. • Work with the Engineering Managers to ensure that test design cases and scenarios are assigned and being tested. • Provide status reports to the module manager. • Identify and assess defects uncovered in testing. • Assist in the validation of use cases and test cases. • Create and maintain testing environments. • Migrate objects to appropriate test environments. • Allocate technical resources to address defects/issues during testing phases.

2. Risk Management Plan

2.1. Definitions of Probability

To evaluate the potential risks of the project, a definition of the probability used is necessary to quantify it correctly. A scale of 1% - 100% is used to set the probability of a risk to occur during the project. The maximum (100%) means that the risk is unavoidable, and the minimum (1%) that is very difficult to occur

Table 2. List of definitions of probability

Probability	Description	Probability Score
Very High	It is a fact and unavoidable	(81 – 100) %
High	High probability to happen	(61 – 80) %
Medium	Half probability to happen or not	(41 – 60) %
Low	Low probability to happen	(21 – 40) %
Very Low	Too difficult to happen	(1 – 20) %

2.2. Definitions of impacts by objective

To specify the effect of a risk into the overall project, a scale from 1 to 5 is set to quantify the impact. 5 means the highest impact on the project, and 1 the lowest. In the tables below, a quantification of the risks is explained, evaluating the scope and quality, schedule and costs impacts individually.

Table 3. List of scope/quality impacts

Scope/Quality Impact	Description	Scope Impact Score
Very High	Risks that produce several impact on the project and its results, been unable to achieve the desired objectives	5
High	Risks that produce important impact on the project and its results, reducing the quality of the desired objectives under the acceptance criteria	4
Medium	Risks that produce a moderate impact on the project and its results, reducing the quality of the desired objectives but still above the acceptance criteria	3
Low	Risks that produce a low impact on the project and its results, reducing the quality of the desired objectives but well enough.	2
Very Low	Risks that produce an insignificant impact on the project and its results	1

Table 4. List of schedule impacts

Schedule Impacts	Description	Schedule Impact Score
Very High	Risks that produce several impact on the project schedule, delaying the schedule more than 3 months	5
High	Risks that produce important impact on the project schedule, delaying the schedule by 2 - 3 months	4
Medium	Risks that produce a moderate impact on the project schedule, delaying the schedule by 1 - 2 months	3
Low	Risks that produce a reduced impact on the project schedule, delaying the schedule less than 1 month	2
Very Low	Risks that produce an insignificant impact on the project schedule with no delays	1

Table 5. List of cost impacts

Cost Impacts	Description	Cost Impact Score
Very High	Risks that produce several impact on the project cost, incrementing the final cost of the project greater than 20%.	5
High	Risks that produce important impact on the project cost, incrementing the final cost of the project between 16% and 20%.	4
Medium	Risks that produce a moderate impact on the project cost, incrementing the final cost of the project between 11% and 15%.	3
Low	Risks that produce a reduced impact on the project cost, incrementing the final cost of the project between 6% and 10%	2
Very Low	Risks that produce an insignificant impact on the project cost lower than 5%.	1

2.3. Probability and Impact Matrix

In the probability and impact matrix, the final evaluation of the risk is done. For each combination of probability and impact an evaluation from extreme to minimum is set. Impact for each risk is evaluated using the system exposed in the risk rating section, taking into account the scope and quality impact, schedule impact and costs impact.

Risks that are evaluated as extreme risks are critical and some counter measures must be applied to prevent it, or if is not possible, to reduce its impact. The risks that are evaluated as minimum are negligible and will not be taking into account during the risk management.

Impact **Probability**	**1**	**2**	**3**	**4**	**5**
Very High	Low Risk	Moderate Risk	High Risk	Extreme Risk	Extreme Risk
High	Minimum Risk	Moderate Risk	High Risk	Extreme Risk	Extreme Risk
Medium	Minimum Risk	Low Risk	Moderate Risk	High Risk	High Risk
Low	Minimum Risk	Low Risk	Low Risk	Moderate Risk	High Risk
Very Low	Minimum Risk	Minimum Risk	Low Risk	Moderate Risk	High Risk

Figure 1. Probability and impact matrix

Only risks that have a probability higher or equal to medium and presents a probability higher or equal to 3 will have a contingency plan (including budget contingency and time for the schedule).

2.4. Risk Rating

In order to identify the position of the probability impact matrix, risk rating should be defined to calculate the overall impact of the risk taking into account the individual impact that has been defined in the table above.

$$Impact = 5 \cdot \left(\chi_{scope} \cdot \frac{I_{scope}}{5} + \chi_{schedule} \cdot \frac{I_{schedule}}{5} + \chi_{costs} \frac{I_{costs}}{5} \right)$$

Where the variables $(\chi_{scope}, \chi_{schedule}, \chi_{costs})$ defined are the weight of each impact in parts per unit. The sum of the variables of the same risk should be equal to 1.

In this kind of project the schedule and the scope and quality are the most important factors in order to accomplish the initial scope and the desired objectives. So, the following criteria is stablished in order to compute the overall impact of each risk.

$$\chi_{scope} = 0.35\,, \chi_{schedule} = 0.35\,, \chi_{costs} = 0.30$$

2.5. Risk Identification and assessment

Table 6. List of risk identification and assessment

Risk ID	Risk Statement	Probability	Impact			Score	Response
			Scope/Quality	Schedule	Cost		
R.1	Software bug detected during the test and validation phase	Very High	5	5	3	4.4	Mitigation: check software during its development to detect programming errors
R.2	Malfunction of the sensors selected during its integration	Low	5	4	3	4.05	Mitigation: stablish close contact with sensors' outsourced company and be aware of any changes in the integration requirements
R.3	Simulation software not accomplish the expectations of INDRA (customer)	Very High	4	5	5	4.65	Mitigation: create a very close contact with INDRA in order to know its requirements
R.4	Dissemination of the project is not successful and not achieved the desired objectives	Medium	2	1	1	1.35	Transfer: dissemination will be transferred to an expert company
R.5	Lack of innovation on the developed systems and software	Low	5	1	2	2.7	Avoidance: all changes of design are allowed to improve innovation

Risk ID	Risk Statement	Probability	Impact			Score	Response
			Scope/Quality	Schedule	Cost		
R.6	Lack of communication between work-packages and project manager	Medium	3	4	3	3.35	Avoidance: periodical meeting with the different work-packages responsible
R.7	Economic risk due to changes in commodity prices	Medium	2	1	4	2.25	Acceptance: control the cost evolution of the project along time.
R.8	New systems and procedures used during the development that could create operational issues	Low	2	3	2	2.35	Mitigation: well prepared definition of the procedure to follow
R.9	Human Resources issues due to illness, personnel reduction among others	Medium	3	5	1	3.1	Acceptance: personnel control and anticipation in unexpected personnel reduction
R.10	Insufficient laboratory's facilities in order to carry out the desired tests and validations	Medium	4	3	3	3.35	Transfer: Laboratories will be outsourced, so risk is transferred to third parties

Table 7. List of revised risk identification and assessment

Risk ID	Revised Probability	Revised Impact			Revised Score	Owner	Actions
		Scope/Quality	Schedule	Cost			
R.1	High	3	3	2	2.7	Manager of each department	Focus on the resolution of the bug and increase the human resources if it is needed to accomplish the schedule and scope
R.2	Minimum	3	2	1	2.05	Electronics department manager	Develop and matching network to allow the integration and if it is not feasible contact with the company to redesign it
R.3	Medium	4	5	4	4.35	Navigation and communication department manager	Modify the software to accomplish the requirements
R.4	Minimum	2	1	1	1.35	Communication manager	Recall the desired objectives given to the expert company
R.5	Minimum	5	1	2	2.7	Project Manager	Take the necessary measured to achieve to desired level of innovation including redesign and propose alternatives

Risk ID	Revised Probability	Revised Impact			Revised Score	Owner	Actions
		Scope/Quality	Schedule	Cost			
R.6	Minimum	3	4	3	3.35	Project Manager	Stablish more effective collective meetings and individual tracking of each work-package
R.7	Medium	2	1	2	1.65	Administrative service manager	Use the contingency budget to afford the new unexpected outcomes
R.8	Minimum	1	2	2	1.65	Project Manager	identify and change possible issues on the procedures and clear it to all work-packages workers
R.9	Medium	3	3	1	2.4	Administrative services manager	Be aware of possible human resources reduction and contract if it is needed
R.10	Minimum	4	3	3	3.35	Project Manager	Search for a certified and qualified laboratory to carry out all tests and validations

2.6. Risk Data Sheet

Table 8. Risk R.1 data sheet

<table>
<tr><td>Risk ID:
R.1</td><td colspan="5">Risk Description:
Detect a bug into the software developed in the tests and validation phases.</td></tr>
<tr><td>Status:
Closed</td><td colspan="5">Risk Cause:
This kind of risk would be caused by a programing error created during its development, and maybe by other programing factors that are not taking into account.</td></tr>
<tr><td rowspan="2">Probability</td><td colspan="3">Impact</td><td>Score</td><td>Response</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td rowspan="2">4.4</td><td rowspan="2">Mitigation: check software during its development to detect programming errors.</td></tr>
<tr><td>Very High</td><td>5</td><td>5</td><td>3</td></tr>
<tr><td rowspan="2">Revised Probability</td><td colspan="3">Revised Impact</td><td rowspan="2">Revised Score</td><td rowspan="2">Owner</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td></tr>
<tr><td rowspan="3">High</td><td rowspan="3">3</td><td rowspan="3">3</td><td rowspan="3">2</td><td rowspan="3">2.7</td><td>Manager of each department.</td></tr>
<tr><td>Actions</td></tr>
<tr><td>Focus on the resolution of the bug and increase the human resources if it is needed to accomplish the schedule and scope.</td></tr>
<tr><td colspan="6">Secondary Risk:
The continued checking during the development may affect the workers and reduce its efficiency.</td></tr>
<tr><td colspan="6">Residual Risk
Human factor is unavoidable, so this risk cannot be avoided. However, applying the response indicated this risk can be mitigated.</td></tr>
<tr><td colspan="4">Contingency Plan:
If this error is detected, a meeting with the managers of each department and the project manager should be done. After this, the response indicated in the cell above should be applied.</td><td colspan="2">Contingency Funds:
14,180 €

Contingency Time:
7 months</td></tr>
</table>

Table 9. Risk R.2 data sheet

<table>
<tr><td>Risk ID:
R.2</td><td colspan="5">Risk Description:
Malfunction of the sensors selected during its integration into the ECCO systems developed in the project.</td></tr>
<tr><td>Status:
Closed</td><td colspan="5">Risk Cause:
This kind of risk would be caused by an unexpected software bug or to a hardware trouble (maybe dirt, bad manipulation…).</td></tr>
<tr><td rowspan="2">Probability</td><td colspan="3">Impact</td><td>Score</td><td>Response</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td rowspan="2">4.05</td><td rowspan="2">Mitigation: stablish close contact with sensors' outsourced company and be aware of any changes in the integration requirements.</td></tr>
<tr><td>Low</td><td>5</td><td>4</td><td>3</td></tr>
<tr><td rowspan="2">Revised Probability</td><td colspan="3">Revised Impact</td><td rowspan="2">Revised Score</td><td>Owner</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td>Electronics department manager</td></tr>
<tr><td rowspan="2">Minimum</td><td rowspan="2">3</td><td rowspan="2">2</td><td rowspan="2">1</td><td rowspan="2">2.05</td><td>Actions</td></tr>
<tr><td>Develop and matching network to allow the integration and if it is not feasible contact with the company to redesign it.</td></tr>
<tr><td colspan="6">Secondary Risk:
Possible failure of the company in charge of the sensor development.</td></tr>
<tr><td colspan="6">Residual Risk
Problems related to integration, but with the response selected it is reduced to minimum.</td></tr>
<tr><td colspan="4" rowspan="2">Contingency Plan:
No needed</td><td colspan="2">Contingency Funds:
No needed</td></tr>
<tr><td colspan="2">Contingency Time:
No needed</td></tr>
</table>

Table 10. Risk R.3 data sheet

<table>
<tr><td>Risk ID:
R.3</td><td colspan="5">Risk Description:
The simulation software developed not accomplish the expectations of the INDRA company.</td></tr>
<tr><td>Status:
Closed</td><td colspan="5">Risk Cause:
The main cause in this risk is the lack of communication between the team in charge of its development and the INDRA company</td></tr>
<tr><td rowspan="2">Probability</td><td colspan="3">Impact</td><td>Score</td><td>Response</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td rowspan="2">4.65</td><td rowspan="2">Mitigation: create a very close contact with INDRA in order to know its requirements</td></tr>
<tr><td>Very High</td><td>4</td><td>5</td><td>5</td></tr>
<tr><td rowspan="2">Revised Probability</td><td colspan="3">Revised Impact</td><td rowspan="2">Revised Score</td><td rowspan="2">Owner</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td></tr>
<tr><td rowspan="3">Medium</td><td rowspan="3">4</td><td rowspan="3">5</td><td rowspan="3">4</td><td rowspan="3">4.35</td><td>Navigation and communication department manager</td></tr>
<tr><td>Actions</td></tr>
<tr><td>Modify the software to accomplish the requirements</td></tr>
<tr><td colspan="6">Secondary Risk:
The redesign and development of the software could increase time and costs, and INDRA would not want to pay for it.</td></tr>
<tr><td colspan="6">Residual Risk
The risk of not accomplish the desired objectives due to time, costs and knowledge is still possible and must be taken into account.</td></tr>
<tr><td colspan="4">Contingency Plan:
If this error is detected, a meeting with the managers of each department and the project manager should be done. After this, the response indicated in the cell below should be applied.</td><td colspan="2">Contingency Funds:
24,060 €

Contingency Time:
1.5 months</td></tr>
</table>

Table 11. Risk R.4 data sheet

<table>
<tr><td>Risk ID:
R.4</td><td colspan="5">Risk Description:
Dissemination of the project is not successful and not achieved the desired objectives</td></tr>
<tr><td>Status:
Closed</td><td colspan="5">Risk Cause:
This kind of risk would appear if no new technologies are used to disseminate the projects idea, and if no international meetings with the indicated persons are done.</td></tr>
<tr><td rowspan="2">Probability</td><td colspan="3">Impact</td><td>Score</td><td>Response</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td rowspan="2">1.35</td><td rowspan="2">Transfer: dissemination will be transferred to an expert company.</td></tr>
<tr><td>Medium</td><td>2</td><td>1</td><td>1</td></tr>
<tr><td rowspan="2">Revised Probability</td><td colspan="3">Revised Impact</td><td rowspan="2">Revised Score</td><td rowspan="2">Owner</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td></tr>
<tr><td rowspan="3">Minimum</td><td rowspan="3">2</td><td rowspan="3">1</td><td rowspan="3">1</td><td rowspan="3">1.35</td><td>Communication manager</td></tr>
<tr><td>Actions</td></tr>
<tr><td>Recall the desired objectives given to the expert company</td></tr>
<tr><td colspan="6">Secondary Risk:
Secondary risk appears due to outsourcing the dissemination. Maybe the desired objectives are not accomplished and should be reminded to the outsourced company.</td></tr>
<tr><td colspan="6">Residual Risk
Residual risk is reduced to minimum by transfer to an expert company.</td></tr>
<tr><td colspan="4">Contingency Plan:
No needed</td><td colspan="2">Contingency Funds:
No needed

Contingency Time:
No needed</td></tr>
</table>

Table 12. Risk R.5 data sheet

<table>
<tr><td>Risk ID:
R.5</td><td colspan="5">Risk Description:
Lack of innovation on the developed systems and software</td></tr>
<tr><td>Status:
Closed</td><td colspan="5">Risk Cause:
Lack of innovation could be produced due to the long time required to finalize the project, increasing the possibilities to work with technology that at the end becomes obsolete.</td></tr>
<tr><td rowspan="2">Probability</td><td colspan="3">Impact</td><td>Score</td><td>Response</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td rowspan="2">2.7</td><td rowspan="2">Avoidance: all changes of design are allowed to improve innovation.</td></tr>
<tr><td>Low</td><td>5</td><td>1</td><td>2</td></tr>
<tr><td rowspan="2">Revised Probability</td><td colspan="3">Revised Impact</td><td rowspan="2">Revised Score</td><td rowspan="2">Owner</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td></tr>
<tr><td rowspan="3">Minimum</td><td rowspan="3">5</td><td rowspan="3">1</td><td rowspan="3">2</td><td rowspan="3">2.7</td><td>Project Manager</td></tr>
<tr><td>Actions</td></tr>
<tr><td>Take the necessary measured to achieve to desired level of innovation including redesign and propose alternatives</td></tr>
<tr><td colspan="6">Secondary Risk:
The continued checking and modifications on the original design could create confusion into the project.</td></tr>
<tr><td colspan="6">Residual Risk
No residual risk related to lack of innovation.</td></tr>
<tr><td colspan="4" rowspan="2">Contingency Plan:
No needed</td><td>Contingency Funds:
No needed</td><td></td></tr>
<tr><td>Contingency Time:
No needed</td><td></td></tr>
</table>

Table 13. Risk R.6 data sheet

Risk ID: R.6	**Risk Description:** Lack of communication between work-packages and project manager				
Status: Closed	**Risk Cause:** This risk can be caused because of bad intern communication between team-workers due to lack of interest or personal situations				
Probability	**Impact**			**Score**	**Responses**
	Scope/Quality	Schedule	Cost		
Medium	3	4	3	3.35	Avoidance: periodical meeting with the different work-packages responsible
Revised Probability	**Revised Impact**			**Revised Score**	**Owner**
	Scope/Quality	Schedule	Cost		Project Manager
Minimum	3	4	3	**3.35**	**Actions** Stablish more effective collective meetings and individual tracking of each work-package
Secondary Risk: The implementation of new techniques in order to get a more efficient result in communication can cause an increase in time.					
Residual Risk The risk of a bad communication and an increase in time due to this situation is minimum taking into account the corrections to be done so there will produce minimum problems requiring no contingency in the project					
Contingency Plan: **No needed**				**Contingency Funds:** **No needed** **Contingency Time:** **No needed**	

Table 14. Risk R.7 data sheet

<table>
<tr><td>Risk ID:
R.7</td><td colspan="5">Risk Description:
Economic risk due to changes in commodity prices</td></tr>
<tr><td>Status:
Closed</td><td colspan="5">Risk Cause:
This kind of risk can appear if material prices exponentially increase due to any crisis or lack of the materials or the technology applied at that moment</td></tr>
<tr><td rowspan="2">Probability</td><td colspan="3">Impact</td><td rowspan="2">Score</td><td rowspan="2">Responses</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td></tr>
<tr><td>Medium</td><td>2</td><td>1</td><td>4</td><td>2.25</td><td>Acceptance: control the cost evolution of the project along time.</td></tr>
<tr><td rowspan="2">Revised Probability</td><td colspan="3">Revised Impact</td><td rowspan="2">Revised Score</td><td rowspan="2">Owner</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td></tr>
<tr><td rowspan="3">Medium</td><td rowspan="3">2</td><td rowspan="3">1</td><td rowspan="3">2</td><td rowspan="3">1.65</td><td>Administrative service manager</td></tr>
<tr><td>Actions</td></tr>
<tr><td>Use the contingency budget to afford the new unexpected outcomes</td></tr>
<tr><td colspan="6">Secondary Risk:
The secondary risk appears due to the possibility of a redesign in the project due to problems with the initial budget of this project</td></tr>
<tr><td colspan="6">Residual Risk
The risk of any change in the commodity prices is still important so it will be taken into account a contingency in order to reduce the impact on the project's budget</td></tr>
<tr><td colspan="4" rowspan="2">Contingency Plan:
If this problem is detected, the administrative and services manager should decide what kind of measured should be taken. After this, the project response indicated in the cell below should be applied</td><td colspan="2">Contingency Funds:
20,970 €</td></tr>
<tr><td colspan="2">Contingency Time:
1 month</td></tr>
</table>

Table 15. Risk R.8 data sheet

<table>
<tr><td>Risk ID:
R.8</td><td colspan="5">Risk Description:
New systems and procedures used during the development that could create operational issues</td></tr>
<tr><td>Status:
Closed</td><td colspan="5">Risk Cause:
This risk can be caused by the acknowledgement of operators due to fast technology improvement and the need of constant learning</td></tr>
<tr><td rowspan="2">Probability</td><td colspan="3">Impact</td><td>Score</td><td rowspan="2">Responses</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td></td></tr>
<tr><td>Low</td><td>2</td><td>3</td><td>2</td><td>2.35</td><td>Mitigation: well prepared definition of the procedure to follow</td></tr>
<tr><td rowspan="2">Revised Probability</td><td colspan="3">Revised Impact</td><td rowspan="2">Revised Score</td><td rowspan="2">Owner</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td></tr>
<tr><td rowspan="3">Minimum</td><td rowspan="3">1</td><td rowspan="3">2</td><td rowspan="3">2</td><td rowspan="3">1.65</td><td>Project Manager</td></tr>
<tr><td>Actions</td></tr>
<tr><td>Identify and change possible issues on the procedures and clear it to all work-packages workers</td></tr>
<tr><td colspan="6">Secondary Risk:
Secondary risk appears due to new technology that can cause problems in time and scope as operators should be able to learn new procedures in short times</td></tr>
<tr><td colspan="6">Residual Risk
Residual risk is reduced to minimum as it is mitigated with well prepared and defined procedures</td></tr>
<tr><td colspan="4" rowspan="2">Contingency Plan:
No needed</td><td colspan="2">Contingency Funds:
No needed</td></tr>
<tr><td colspan="2">Contingency Time:
No needed</td></tr>
</table>

Table 16. Risk R.9 data sheet

<table>
<tr><td>Risk ID:
R.9</td><td colspan="5">Risk Description:
Human Resources issues due to illness, personnel reduction among others</td></tr>
<tr><td>Status:
Closed</td><td colspan="5">Risk Cause:
This kind of risk can be caused in any situation and any project, so it is a well-known risk, due to any health problem among other possibilities</td></tr>
<tr><td rowspan="2">Probability</td><td colspan="3">Impact</td><td>Score</td><td rowspan="2">Responses</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td></td></tr>
<tr><td>Medium</td><td>3</td><td>5</td><td>1</td><td>3.1</td><td>Acceptance: personnel control and anticipation in unexpected personnel reduction</td></tr>
<tr><td rowspan="2">Revised Probability</td><td colspan="3">Revised Impact</td><td rowspan="2">Revised Score</td><td>Owner</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td>Administrative services manager</td></tr>
<tr><td rowspan="3">Medium</td><td rowspan="3">3</td><td rowspan="3">3</td><td rowspan="3">1</td><td rowspan="3">2.4</td><td>Actions</td></tr>
<tr><td>Be aware of possible human resources reduction and contract if it is needed</td></tr>
<tr><td></td></tr>
<tr><td colspan="6">Secondary Risk:
The secondary risk can cause a time increase that will delay the project, therefore, it is applied some solutions in order to reduce this time problems</td></tr>
<tr><td colspan="6">Residual Risk
The risk of not solving the problem with an efficient solution can cause a problem in scope and time that will be taken into account with a contingency</td></tr>
<tr><td colspan="4" rowspan="2">Contingency Plan:
If this problem is detected the administrative services manager should start a plan to reduce the impact caused by human resources issues. After this, the response indicated in the cell below should be applied.</td><td colspan="2">Contingency Funds:
21,590 €</td></tr>
<tr><td colspan="2">Contingency Time:
15 days</td></tr>
</table>

Table 17. Risk R.10 data sheet

<table>
<tr><td>Risk ID:
R.10</td><td colspan="5">Risk Description:
Insufficient laboratory's facilities in order to carry out the desired tests and validations</td></tr>
<tr><td>Status:
Closed</td><td colspan="5">Risk Cause:
This risk can be caused by a poor qualified laboratory in charge of carrying out the tests and validations needed on the project or a misunderstood in the scope of the project</td></tr>
<tr><td rowspan="2">Probability</td><td colspan="3">Impact</td><td>Score</td><td rowspan="2">Responses</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td></td></tr>
<tr><td>Medium</td><td>4</td><td>3</td><td>3</td><td>3.35</td><td>Transfer: Laboratories will be outsourced, so risk is transferred to third parties</td></tr>
<tr><td rowspan="2">Revised Probability</td><td colspan="3">Revised Impact</td><td rowspan="2">Revised Score</td><td>Owner</td></tr>
<tr><td>Scope/Quality</td><td>Schedule</td><td>Cost</td><td>Project Manager</td></tr>
<tr><td rowspan="3">Minimum</td><td rowspan="3">4</td><td rowspan="3">3</td><td rowspan="3">3</td><td rowspan="3">3.35</td><td>Actions</td></tr>
<tr><td>Search for a certified and qualified laboratory to carry out all tests and validations</td></tr>
<tr><td></td></tr>
<tr><td colspan="6">Secondary Risk:
The secondary risks increases the problems in scope which will be solved transferring the laboratories to third parties</td></tr>
<tr><td colspan="6">Residual Risk
The residual risk is minimum so there will be no need to execute any contingency plan</td></tr>
<tr><td colspan="4">Contingency Plan:
No needed</td><td colspan="2">Contingency Funds:
No needed

Contingency Time:
No needed</td></tr>
</table>