Admont

D9.3

Risk Assessment Plan

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Abstract:	The risk assessment plan shows how potential risks are assessed and mitigated in order to avoid any negative influence on the ADMONT project objectives. The interrelated risk assessment plan – risk identification, handling and monitoring – were established.
Keywords:	risk identification, risk assessment, qualitative risk analysis, quantitative risk analysis, risk monitoring, contingency plan

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Executive Summary

The ADMONT risk assessment plan describes how the project contemplates to manage risks, intends to predict risks, estimates impacts and defines mitigation measures. It outlines the management components, the approach and tools used. In order to be aware of the central project activities in relation to the project timeline, the critical path of the ADMONT project has been defined. Within ADMONT, the iterative and interrelated steps of risk identification, risk analysis and monitoring as well as risk handling are accompanied by easy-to-use tools, clear responsibilities and efficient communication channels towards effective risk management. On this basis, a probability/severity matrix supports the regular qualitative evaluation of risks. As the ADMONT consortium is aware of the swift changing environment it is contributing to, risks are regularly monitored, mitigation plans updated and actions taken, if necessary.

This document outlines the risk assessment procedure established within ADMONT based on scientific theoretical background, including project-specific risks and the latest status of them.

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Chapter 1 Introduction

"Avoiding rocks on the road to success" [1] - following this guiding principle, the ADMONT consortium has established an effective project risk management strategy to avoid tripping over rocks on the road to successfully reach the planned project outcomes or go even beyond.

ADMONT is a unique, innovative ECSEL project focused on a powerful and versatile More-than-Moore (MtM) pilot line for Europe increasing the diversification of CMOS process technologies. The combination of existing expertise, technological capabilities and the manufacturing capacity of industrial and research partners creates a whole new ecosystem within Europe's biggest silicon technology cluster "Silicon Saxony". The distributed pilot line utilizes various MtM platform technologies for sensor and OLED processing in combination with baseline CMOS processes in a unique way and incorporates 2.5D as well as 3D integration of silicon systems into one single production flow. Developing and dealing with such an ambitious and highly innovative project, only *"innovation, fused with an agile, sophisticated approach to risk management, can create a powerful, value-driving partnership."* [2]

According to the ISO 31000 standard on risk management, a **risk** can be defined as an "*effect of uncertainty*" towards parts of objectives. An effect is described as a positive or negative deviation from the expected work-plan. Every step towards the project objectives has an element of risk that needs to be managed. [3]

In the context of risk management, **uncertainty** exists whenever the knowledge or understanding of an event, consequence, or likelihood is inadequate or incomplete. [3]

Risk management describes a coordinated set of activities and methods which supports the control of risks that may affect the projects ability to achieve part of its objectives. The project's risk management process is meant to form part of the project management routine at all stages of the project lifecycle. [3]

In order to raise awareness for the central project activities and as a starting point for risk management, a critical path has been defined, which is described in Chapter 2. Failing to follow a structured project risk management process for projects in a self-disciplined manner would quickly lead to project failure. [1] Therefore, within ADMONT a clear structured process of risk identification, risk monitoring & analysis and risk handling has been established (see Chapter 3). This process already started with the risk identification during the proposal phase, continued in all process steps within the first year of the project and will accompany ADMONT throughout the project's lifetime. In order to settle this process as a vital one, communication as well as easy tools turned out to be critical factors. Chapter 4 displays the practical risk assessment of ADMONT including an evaluation of probability and severity as well as mitigation plans for defined risks. Chapter 5 is concluding and summarizing the way ADMONT is dealing with risk management and how it will be continued.

Chapter 2 Critical Path of the project

As a starting point for risk management, the critical path of ADMONT has been defined in order to be aware of the central project activities. The critical path determines the targeted time to complete the project and the critical activities, which might be able to threaten the project objectives (Figure 1).

The essential technique for using critical path method (CPM) is to construct a model of the project that includes the following:

[1] A list of all activities required to complete the project (typically categorized within a work breakdown structure),
[2] The time (duration) that each activity will take to complete,
[3] The dependencies between the activities and,
[4] Logical end points such as milestones or deliverable items.

This process determines which activities are "critical" (i.e., on the longest path) and which have "total float" (i.e., can be delayed without making the project longer).

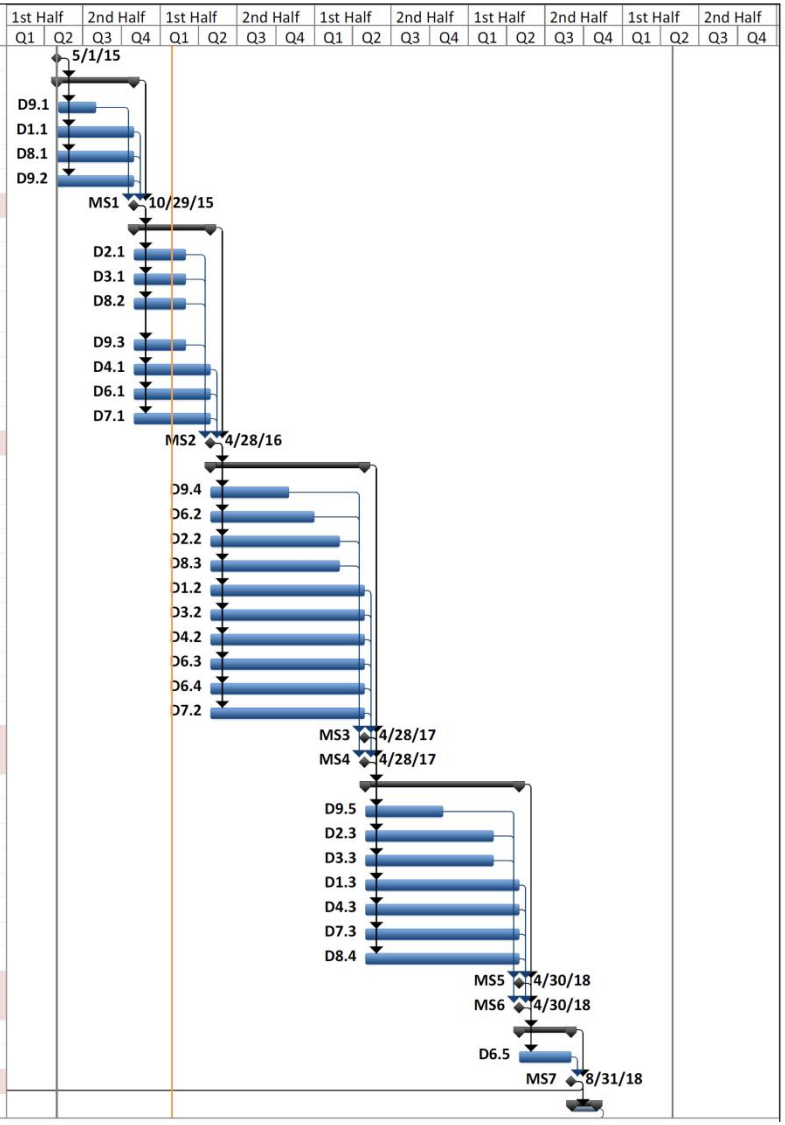
There are different software programs available to calculate and monitor the critical pass. ADMONT is using Microsoft MS-Project for GANTT chart generation and CPM. The GANTT chart included all dependent and independent activities, deliverables and milestones in our project timeline and is the basis from our work plan in part-B in our project proposal. The critical path is based on all milestones and deliverables (individual tasks are behind the deliverables), with total float being part of the shortest possible duration for the overall project. In other words, individual tasks on the critical path prior to the constraint might be able to be delayed without elongating the critical path.

In ADMONT all milestones are dependently connected as the longest serial chain of activities. The milestones are dependent from the deliverables (with task and sub-task behind) and are the driver for constrains to fulfill the milestones in time.

In ADMONT the project management is using CPM to monitor and manage all milestones and deliverables and if there are time delays we will us methods like “pull in”, “resource management”, “prioritize activities” or “task forces” to come back on track. If project delays appear, the project coordinator and the coordination committee will tightly work together with the “Governing Council” (as described in Section 3.3).

Figure 1, below displays the critical path of ADMONT and indicating the current status with the yellow line. The consortium successfully reached Milestone 1 and is currently continuing with the work and Deliverables requested to reach Milestone 2. Until now, work is on track and minor risks are handled successfully (as described in Chapter 4).

ID	Task Name	Start	Finish	Text1	Resource Names
1	Project Start	Fri 5/1/15	Fri 5/1/15		
2	**Deliverables MS1**	**Fri 5/1/15**	**Thu 10/29/15**		
3	**D9.1**	Mon 5/4/15	Fri 7/31/15	Internal and external IT communication	**TEC**
4	**D1.1**	Fri 5/1/15	Thu 10/29/15	Business Process Model (BPM) and Specification Sheet	**XFAB**
5	**D8.1**	Fri 5/1/15	Thu 10/29/15	Data Management Plan (DMP)	**XFAB**
6	**D9.2**	Fri 5/1/15	Thu 10/29/15	1st Technical Interim Report	**XFAB**
7	**MS1**	Thu 10/29/15	Thu 10/29/15	Specification for all WPs done	**XFAB**
8	**Deliverables MS2**	**Fri 10/30/15**	**Thu 4/28/16**		
9	**D2.1**	Fri 10/30/15	Mon 2/29/16	Specification and Planning	**XFAB**
10	**D3.1**	Fri 10/30/15	Mon 2/29/16	Process Qualification Plan	**XFAB**
11	**D8.2**	Fri 10/30/15	Mon 2/29/16	Initial report and updates on dissemination, exploitation and standardisation activities	**XFAB**
12	**D9.3**	Fri 10/30/15	Mon 2/29/16	Risk Assessment Plan	**XFAB**
13	**D4.1**	Fri 10/30/15	Thu 4/28/16	Report on status of technology implementation	**FhG**
14	**D6.1**	Fri 10/30/15	Thu 4/28/16	Detailed statement of work document	**XFAB**
15	**D7.1**	Fri 10/30/15	Thu 4/28/16	System Specification and system related pilot line requirements	**SMT DD**
16	**MS2**	Thu 4/28/16	Thu 4/28/16	1st Periodic Report	**XFAB**
17	**Deliverables MS3&4**	**Fri 4/29/16**	**Fri 4/28/17**		
18	**D9.4**	Fri 4/29/16	Mon 10/31/16	2nd Technical Interim Report	**XFAB**
19	**D6.2**	Fri 4/29/16	Fri 12/30/16	Public IT component and architecture specification	**SYS**
20	**D2.2**	Fri 4/29/16	Tue 2/28/17	Verified Process	**XFAB**
21	**D8.3**	Fri 4/29/16	Tue 2/28/17	Intermediate business plan and exploitation report	**OKM**
22	**D1.2**	Fri 4/29/16	Fri 4/28/17	Draft of Line capability report including key performance indicators	**XFAB**
23	**D3.2**	Fri 4/29/16	Fri 4/28/17	Process Design Kit	**XFAB**
24	**D4.2**	Fri 4/29/16	Fri 4/28/17	Report on system integration and device verification status	**FhG**
25	**D6.3**	Fri 4/29/16	Fri 4/28/17	Internal IT architecture and solution specification	**SYS**
26	**D6.4**	Fri 4/29/16	Fri 4/28/17	Prototype for RFID based smart material identification	**RRO**
27	**D7.2**	Fri 4/29/16	Fri 4/28/17	System Design and Verification	**FhG**
28	**MS3**	Fri 4/28/17	Fri 4/28/17	1st pilot phase for 035 CMOS & system integration started	**XFAB**
29	**MS4**	Fri 4/28/17	Fri 4/28/17	IP verification 1st generation finished, PDK implemented	**XFAB**
30	**Deliverables MS5&6**	**Mon 5/1/17**	**Mon 4/30/18**		
31	**D9.5**	Mon 5/1/17	Tue 10/31/17	3rd Technical Interim Report	**XFAB**
32	**D2.3**	Mon 5/1/17	Wed 2/28/18	Optimized Process	**XFAB**
33	**D3.3**	Mon 5/1/17	Wed 2/28/18	IP block libraries	**XFAB**
34	**D1.3**	Mon 5/1/17	Mon 4/30/18	Update of Line capability report including	**XFAB**
35	**D4.3**	Mon 5/1/17	Mon 4/30/18	Report on technology implementation and device status	**FhG**
36	**D7.3**	Mon 5/1/17	Mon 4/30/18	System test and specification approval	**SA**
37	**D8.4**	Mon 5/1/17	Mon 4/30/18	Final business plan and exploitation report	**OKM**
38	**MS5**	Mon 4/30/18	Mon 4/30/18	Report on technology implementation and device status	**FhG**
39	**MS6**	Mon 4/30/18	Mon 4/30/18	Final business plan and exploitation report	**OKM**
40	**Deliverables MS7**	**Tue 5/1/18**	**Fri 8/31/18**		
41	**D6.5**	Tue 5/1/18	Fri 8/31/18	Prototype for real-time factory analysis and control systems	**SYS**
42	**MS7**	Fri 8/31/18	Fri 8/31/18	Prototype for real-time factory analysis and control systems	**RRO**
43	**Deliverables MS8**	**Mon 9/3/18**	**Wed 10/31/18**		



ID	Task Name	Start	Finish	Text1	Resource Names
44	**D5.1**	Mon 9/3/18	Wed 10/31/18	Prototypes of miniaturised electronic systems for molecular diagnos	**IMMS**
45	**D5.2**	Mon 9/3/18	Wed 10/31/18	Low power sensors and energy efficient devices	**FhG**
46	**D5.3**	Mon 9/3/18	Wed 10/31/18	Prototype of smart health disposable bioanalytical sensors and wireless biosensor systems	**IMMS**
47	**D9.6**	Mon 9/3/18	Wed 10/31/18	4th Technical Interim Report	**XFAB**
48	**MS8**	Thu 1/31/19	Thu 1/31/19	Prototypes for smart system integration	**SA**
49	**Deliverables MS9**	**Thu 1/31/19**	**Thu 2/28/19**		
50	**D2.4**	Thu 1/31/19	Thu 2/28/19	Validated and Stabilized Process	**XFAB**
51	**D6.6**	Thu 1/31/19	Mon 4/29/19	Prototype for intralogistic automation systems	**RRO**
52	**D1.4**	Thu 1/31/19	Mon 4/29/19	Demonstrator Manufacturing Report	**XFAB**
53	**D3.4**	Thu 1/31/19	Mon 4/29/19	Update of IP block libraries	**XFAB**
54	**D3.5**	Thu 1/31/19	Mon 4/29/19	Long Term Quality Stability Information	**XFAB**
55	**D4.4**	Thu 1/31/19	Mon 4/29/19	Demonstration and application	**FhG**
56	**D5.4**	Thu 1/31/19	Mon 4/29/19	Prototypes of disposable lab-on-a-chip devices based on MtM pilot line CMOS process integrated with MEMS and Microfluidics for rare cells manipulation	**SIB**
57	**D6.7**	Thu 1/31/19	Mon 4/29/19	Prototype for interfaces within the virtual pilot line	**XFAB**
58	**MS9**	Mon 4/29/19	Mon 4/29/19	Final project meeting, reports, documentation	**XFAB**
59	Project End	Mon 4/29/19	Mon 4/29/19		

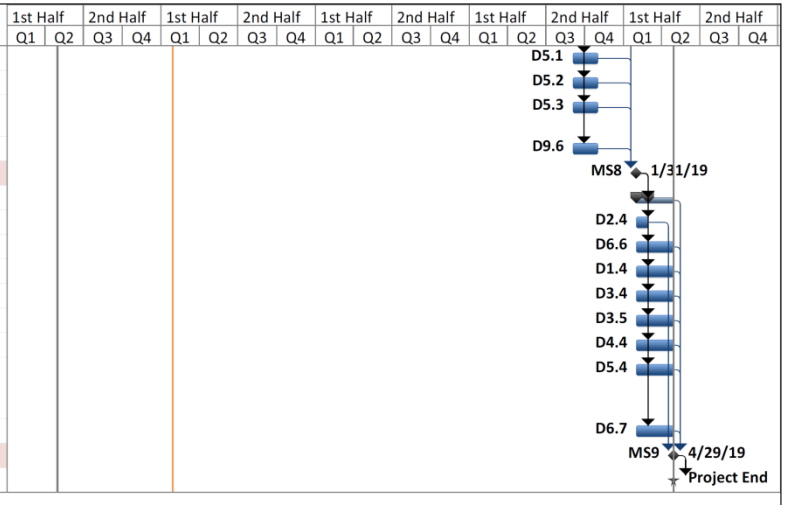


Figure 1: ADMONT critical pass analysis (milestones and deliverables are dependently connected)

Chapter 3 Risk Management Procedure

This chapter is focusing on the risk management procedure that systematically applies management policies, processes and practices on project activities.

Within ADMONT we basically established a risk management framework including three major strides, which are correlating and interacting continually:

- Risk identification (Section 3.1)
- Risk analysis & monitoring (Section 3.2)
- Risk handling (Section 3.3)

The set up of the risk management process needed to be aligned with the project objectives and might be adjusted if required due to changes in the research objectives. The risk management procedure has been established around the routine project work and is accompanying the project through its lifetime. Figure 2 indicates that project stakeholders (EC, related projects, suppliers etc.) and the project environment (regulations, duties, etc.) form the outermost layer, are influencing causes of risks, which may impact the project collaboration with the project objectives in the centre of attention.

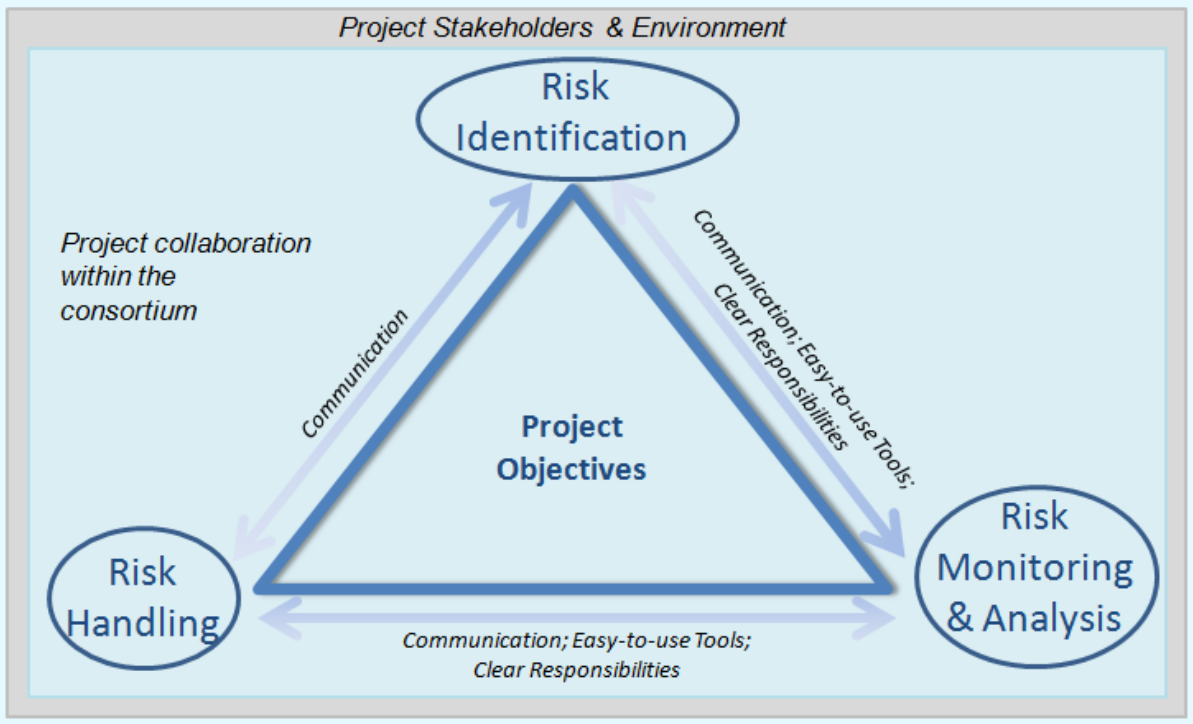


Figure 2: Risk Management Procedure

Taking into consideration all project-environmental factors, channels to allow the efficient implementation of the three major steps in the shown risk management procedure needed to be established. On one hand, a clear structure for communicating risks including clear responsibilities are required and need to be assured with all partners. On the other hand, it has to be easy for the partners to perform risk management by themselves through easy-to-use tools.

How the above mentioned tools and steps have been integrated into the project and how they will support to mitigate negative consequences for the project will be described within the following subchapters.

3.1 Risk identification

"Risk identification is a process that is used to recognize, find, and describe the risks that could affect the achievement of objectives."[3]

The target of risk identification is being aware of possible risk sources in addition to the events and circumstances that could affect the achievement of objectives. Further, it includes the identification of possible causes and consequences.

The identification of risks started already during the proposal phase. When developing the idea for an innovative technological advancement, it needs to be formed the way it creates the most value at an acceptable level of risk. For the identification of risks in such a highly innovative field it is necessary to have experts, who understand on the one hand, the technical challenge and its impact and have on the other hand deep insights to the industry and market needs. The ADMONT consortium unifies all these know-how in its consortium and is therefore, capable of identifying the risks for the innovative action pursued in ADMONT.

Risk identification has not terminated after the proposal phase, but it is rather a continuous process of attaching awareness for potential risks. To address this awareness best, the governing council defined the WP Owners as risk managers for their WPs. The WP Owner is an expert in the field his or her WP is concentrating on and therefore, the most capable person to identify risks. On project level, the technical lead and coordinator (X-FAB) pays close attention to the identification of potential risks. This structure and distribution of responsibilities allows the continuous identification of new risks and encourages the discussion of potential risks within Telco's, face-to-face meetings and the WPs themselves.

The risk table shown in Chapter 4 allows all partners to add new risks at any time, as it is easily accessible all time. In case any risk reassessment is necessary or new risks arise, partner can note it down and develop mitigation measures.

3.2 Risk analysis & monitoring

"Risk analysis is a process that is used to understand the nature, sources, and causes of the risks that you have identified and to estimate the level of risk. It is also used to study impacts and consequences and to examine the controls that currently exist. To monitor means to supervise and to continually check and critically observe - it means to determine the current status." [3]

The process of risk analysis and monitoring is iterative, which means that the risks are evaluated, mitigation measures are updated and the progress will be monitored on a regular basis.

Before setting up the structure and requesting inputs from the project partners, we faced the challenge of making our risks measureable and tangible. While a merely quantitative approach is not applicable due to the high degree of innovation, a pure qualitative approach would be hard to evaluate. Therefore, a mixture of quantitative and qualitative elements has been chosen and is described in the following Section.

Quantitative and qualitative approaches to risk analysis

"Qualitative Risk Analysis assesses the priority of identified risks using their probability of occurrence, the corresponding impact as well as other factors such as the time frame and risk tolerance. When using quantitative analysis the risk level can be estimated by using statistical analysis and calculations combining severity and probability." [3]

While qualitative risk analysis is performed for all project risks, quantitative risk analysis has a more limited use within the ADMONT project, based on the type of project risks, and the limited availability of data to conduct a quantitative analysis.

Our quantitative analysis of risks is using a probability and severity matrix to prioritize the risks. The WP-owners are asked to indicate probability and severity of the stated risks, which have been identified in the previous step.

Probability describes the relative likelihood that a risk will eventuate. It can be defined, determined, measured objectively or subjectively and can be expressed either qualitatively or quantitatively.[3] The probability may be dependent on various factors like the project environment, consortium characteristics, external effects, technological breakthroughs etc. For the evaluation of the ADMONT project risks the following classifications were defined:

- **High** – More than *<70%>* probability of occurrence
- **Medium** – Between *<30%>* and *<70%>* probability of occurrence
- **Low** – Below *<30%>* probability of occurrence

Severity defines the effects and consequences, a project may face in case of risk occurrence. The severity may be influenced by various risk triggers arising from the project environment, consortium characteristics, external effects, technological breakthroughs etc. and may affect the technological and financial performance as well as the schedule of the project. [3]

- **High** – Risk has the potential to greatly impact the projects technological and financial performance as well as the schedule
- **Medium** – Risk has the potential to impact the projects technological and financial performance as well as the schedule
- **Low** – Risk has relatively little impact on the projects technological and financial performance as well as the schedule

Classifying risks with the indicated scale, allows the appraisal if any action might be needed. The qualitative analysis further includes the assessment if a risk did materialize as well as an explanation for the current situation. This is needed as basis for the decision if any measures need to be taken in a further step. The description of the current risk status also supports the deeper understanding and specification of the risk. At this point quantitative elements step into. The detailed assessment of the risk may include explanations of further effort requests, additional expenses etc. needed to deal with the risk consequences, which makes it quantitatively measureable.

The practical implementation of the qualitative and quantitative analysis within the ADMONT project can be found in Chapter 4.

3.3 Risk Handling

The process of risk handling starts, once a risk is assessed as likely to occur (medium/high) and has an impact (medium/high) on the project. At this point a WP-owner correlates with the technical leader and the coordinator to define

- if countersteering measures need to be taken, and
- Which project level (project bodies) will be appropriate to deal with the risk.

All work package owners set up the coordination committee. The progress of the specific WPs will be monitored by the WP-owner and is reported to the coordination committee on a monthly base through Coordination Committee calls. The project coordinator summarizes

these reports on a yearly base and informs the national authorities, ECSEL boards. The project coordinator reports on a half year base to the governing council. He also manages the interdisciplinary collaboration between the consortium members and the communication to external stakeholders (national authorities). All monetary claims and the project accounting on the whole is part of the project management team (see Figure 3). The governing council supervises and advices the project coordinator. The council consists of delegates from the consortium and external stake holders.

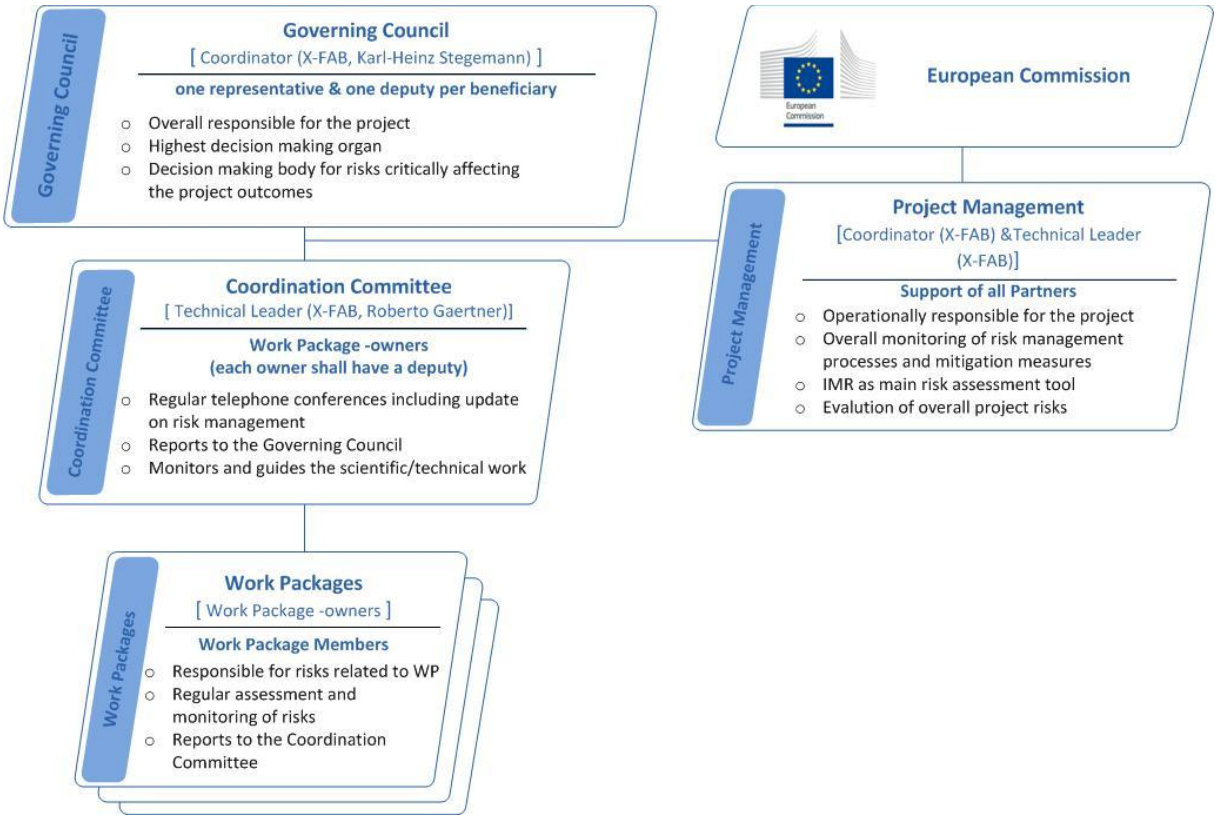


Figure 3: Project Bodies in ADMONT

The governing culture of ADMONT is based on democracy, co-determination and clear leadership. Each body will operate on separate levels and have its own area of responsibility and decision-making power. Based on the expected impact of a risk, the coordinator will assemble the GC or CC in a telephone conference to discuss countersteering measures. For risks that affect the overall strategy, and may threaten part of the project outcomes, the GC, as the highest decision making body will deal with this risk. Risks causing minor delays or minor changes in the work plans will be handled by the CC.

The GC and CC members are experts in their fields and therefore, capable of estimating the effects of the risks as well as of countermeasures. The responsible body discusses if the already proposed mitigation plan is still suitable or if other actions need to be taken or are more suitable to the risk occurred. The decision regarding the countermeasures will be taken according to the voting rules defined in the Consortium Agreement (based on MCARD model). Basically, the WP -owner will be in charge of appropriate realization of the defined risk mitigation measures. All applied measures, arising challenges or chances will be documented in the risk table.

Beside the decision making bodies in the ADMONT structure, the governing council supports the consortium with external, unprejudiced view. This can also be seen as a risk minimizer as it makes sure that the project outcomes will meet the market expectations and do not fail to meet substantial market-specific needs.

Chapter 4 Managing ADMONT risks

This chapter illustrates the implementation of the previously described risk tools into the ADMONT project structure. It presents the defined risks, risk types, shows the development of the risks based on probability/severity estimations at several evaluations and tries to assess the current status of the risk. As the WP-owners are the main responsible persons for the risks of their WPs, this section is built up on WP level.

Within the proposal conception risks have been split into 3 different types in order to ease up the allocation of risks to the different matters:

- **Technical –** technical objectives are in danger or cannot be fulfilled.
- **Schedule –** risks causing delays and affecting the overall schedule
- **Cost –** risks adding cost to the project or envisioned products.

The ADMONT consortium took the stated and classified risks into consideration during the proposal phase, set key milestones and analyzed the dependencies between activities. Small to medium-sized delays have been taken into account in the overall project planning. Any major delay with impact to the project schedule will be fully tackled by the project procedures. The project organization is fully capable of taking on any financial risks arising during the project duration. All partners are fully aware of their common project responsibility according to EC regulations.

Furthermore, as described in detail in Section 3.2, a probability/severity matrix is used to qualitatively evaluate the risk status. The scale for these variables has been defined as low, medium or high and is described in the table below.

	Low [L]	**Medium [M]**	**High [H]**
Probability	Less than *<30%>* probability of occurrence	Between *<30%>* and *<70%>* probability of occurrence	More than *<70%>* probability of occurrence
Severity	Risk has relatively little impact the projects technological and financial performance as well as the schedule	Risk has the potential to impact the projects technological and financial performance as well as the schedule	Risk has the potential to greatly impact the projects technological and financial performance as well as the schedule

4.1 All WPs [M01-M48; X-FAB]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Communication problems between partners and/or work packages	Sched	Kick-off meeting will be held to establish personal contacts; Project Handbook for the day-to-day management of the project will be set up.	Dec. 2015	x				x		no	no	Project handbook is installed an basic for our delay work, management structures are active	no	Not applicable at the moment
Inconsistency between work packages	Tech	Continuous information exchange between WP-owners in Coordination Committee about the status and the interfaces. Early information flow via agile repository based communication approach.	Dec. 2015	x				x		no	no	Monthly coordination committee phone call and alignment meeting with all WP's	no	Not applicable at the moment
Confidential information is disclose	Sched	Establishment of a Consortium Agreement; Special mark as “confidential”.	Dec. 2015	x					x	no	no	Consortium and GA agreement are signed, confidentiality policy is defined	no	Not applicable at the moment
Early publication hinders patent application (and vice versa: patent application hinders publication)	Sched	Rules concerning procedures for publishing project results will be established.	Dec. 2015		x			x		no	no	Consortium and GA agreement are signed, rules are defined	no	Not applicable at the moment
WP specific risks	Tech	WP specific risks are considered and analyzed in the WP description.	Dec. 2015		x			x		no	no	WP specific risk management, escalation to coordination committee	no	Not applicable at the moment

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Lack of commitment from partners	Tech, sched, cost	Close contact between WP owners and technical leader, short feedback loops and personal contacts (regular WP leader telcos; physical technical meetings, etc.)	Dec. 2015			x			x	yes	no	KPS has trouble with national funding organization in Hungary, project evaluation and realize 1 year delay, support from EU officer needed	no	Not applicable at the moment

Table 1: All WPs Risk table

In section "All WP's" we have two risks with high severity and one with high probability in addition.

- Confidential information is disclose: has not occurred so fare (Consortium and GA agreement are signed, rules are defined)
- Lack of commitment from partners: only KPS (new Oncompass) has trouble with national funding organization in Hungary. Support from our project officer was requested and agreed on 19th January 2016. All other partners are stable and strongly committed.

4.2 WP1 Requirements, Specifications and Demonstration of the MtM Pilot line [M01-M48; X-FAB]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Loss of a key partner from an application domain	Tech, cost	Partners are present from several application domain (automotive, avionics), thus ensuring a market-oriented result even in case of the loss of the partner.	Dec. 2015	x					x	no	no	XFAB and FhG institutes are stable	no	Not applicable at the moment

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Business models of individual pilot line members conflicts with business model of ADMONT	Tech	BM will be carefully defined considering all BMs of the individual line members and potential users within the WP1 during ADMONT set up phase.	Dec. 2015	x				x		no	no	Business model is described in D1.1 in consensus with all pilot line members	no	Not applicable at the moment
Heterogeneity levels of core competencies (quality system, manufacturing system) between pilot line members.	Tech	BM of ADMONT will take care of individual differences during set up phase and provide structures to handle heterogeneous levels of competencies.	Dec. 2015		x			x		no	no	Basic quality requirements are included in D1.1, data delivering and format are agreed	no	Not applicable at the moment
Delay in the delivery of the needed subcomponents from the other WPs	Sched	Close collaboration within the consortium to early detect delays and take required actions.	Dec. 2015		x				x	yes	no	Not applicable at the moment	yes	Project management and communication system is installed, monthly coordination committee phone call, governing council is installed and involved

Table 2: WP1 Risk table

In section “WP1” we have two risks with high severity.

- Loss of a key partner from an application domain: All FhG institutes are stable and reliable. The FhG central organization takes care on financial stability. X-FAB Dresden GmbH & Co.KG generated financial losses in 2014/2015 caused by restructuring the production line from 6” to 8” capability. The mother company X-FAB Group Erfurt takes over all losses and financial risks (letter of awareness is submitted to EU validation committee and accepted).
- Delay in the delivery of the needed subcomponents from the other WPs: All WP’s are in time after 12 month running time. No action necessary so far.

4.3 WP2 0.35µ High-Voltage Technology & Sensor Interfaces [M01-M48; X-FAB]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Significant delay due to technical issues of the developed technology which occur only during characterization/ qualification	Tech	Technology-specific risk management will be applied during planning of the tasks (apply FMEA scheme). For the critical items, preliminary tests will be performed early during development	Dec. 2015	x					x	no	no	Only wafer with devices in spec will be delivered to lab investigation, PCM and in-line parameter monitoring	no	Not applicable at the moment
Technology specification does not obey requirements of target applications of pilot line	Tech	During task 2.1 it needs to be ensured that the specific requirements of all target products of the MtM pilot line are considered in the target specification.	Dec. 2015	x					x	no	no	Input from all WPs for target specs are collected and are basis for technology and device development, common workshop from WP2/3	no	Not applicable at the moment

Table 3: WP2 Risk table

In section “WP2” we have two risks with high severity.

- Significant delay due to technical issues of the developed technology which occur only during characterization/qualification: The 1st MPW runs and process development lots are all in specification and delivered with no quality deviations. Early warning is coming from in-line measurements or PCM test. Fast reaction (rework) or restart from wafer is part of our risk management, if technical issues are visible.
- Technology specification does not obey requirements of target applications of pilot line: The specification phase with all WP’s is closed with M6 technical report. All requirements are in agreement with the pilot line performance. Together with new requirement from internal or external pilot line user risk evaluation is again necessary.

4.4 WP3 Design and Modelling for 0.35µ High-Voltage Products [M01-M48; X-FAB]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Mismatch between PDK content and circuit design requirements hinders IP development	Tech	Establish regular review meetings early in the project to ensure requirements are fulfilled	Dec. 2015	x					x	no	no	Alignment between WP5/7 and WP3, common workshop between WP2/3/5 in Nov 2015	no	Not applicable at the moment
Delays in IP development slow down overall project progress	Tech	Set up realistic planning considering all constraints and review progress on a regular basis	Dec. 2015		x			x		no	no	IP development and MPW runs are started in all technologies	yes	Cycle time monitoring from all MPW runs, regular review meetings
Delay in the delivery of the needed subcomponents from the other WPs	Sched	Close collaboration within the consortium to early detect delays and take required actions.	Dec. 2015		x				x	yes	no	Not applicable at the moment	yes	Project management and communication system is installed, Monthly coordination committee phone call, governing council is installed and involved

Table 4: WP3 Risk table

In section “WP3” we have two risks with high severity.

- Mismatch between PDK content and circuit design requirements hinders IP development: To prevent this risk a workshop between WP5/7 and WP3 was organized in November 2015. A list of IP block developments is agreed and presented on our technical meeting in January 2016.
- Delay in the delivery of the needed subcomponents from the other WP’s: In result from our technical meeting in January all WP’s are on track and no delay happen. Periodic monitoring is installed.

4.5 WP4 Processes and Materials for integrated Sensor-Actuator-Systems [M01-M48; FhG]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Incompatibilities of materials and technological building blocks in integration schemes	Tech	Take the complete fabrication flow for all facilities into account in the integration conception phase	Dec. 2015		x				x	yes	no	(WP4.1) A new absorber material has to be introduced.	yes	In the R&D phase IPMS can handle the risk. A final solution is under discussion (HS, IPMS).
Technological building blocks i.e. material parameter for thermo elements don't meet the assumed requirements of individual systems	Tech	Use realistic assumptions for design and communicate technological results uninterrupted to enable consideration in system design	Dec. 2015		x				x	yes	yes	(WP4.1) CD loss of etch holes/alignment accuracy of back side lithography influences thermal insulating structures	yes	Intensive process improvement of back side etch is in progress, measurement tool for front side / back side will be purchased
Delays in setup of technological building blocks retard progress of system development	Tech	Set up realistic planning considering all constraints and control progress on a regular basis	Dec. 2015		x			x		no	no	Schedules for all tasks exists; ongoing control in regular task meetings	no	Not applicable at the moment
Applicable design rules don't fit the ideal demands of products	Tech	Careful preparation of product design by all involved partners to identify design issues and to find work around before tape out	Dec. 2015		x				x	yes	no	In the current development phase not assessable	no	Not applicable at the moment
Issues on the fabrication of Air based ultrasound transducers	Tech	Acquire commercial piezoelectric chips to demonstrate integration scheme	Dec. 2015		x			x		no	no	First fabrication based on concept started. Up to now no issues occurred	yes	Modified CMUT concept was developed, based on this larger CMUTs for air operation could be realized

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Specification of CMOS for CMUT ASICs is not reachable by X-FAB technology	Tech	Use FhG-ASSID interposer technology to integrated CMOS chips from other CMOS fabrication facilities	Dec. 2015	x				x		no	no	By limiting DC voltage supplied to the CMUT the XH035 is suitable to use	yes	Specification for DC voltage range was reduced
Laser dicing and TSV degrade organic materials on the CMOS during process	Tech	Plan fall back options like bond pads on CMOS surface and sufficient spacing between chips for alternative dicing	Dec. 2015		x				x	yes	no	Laser dicing: first test wafer has been diced by laser and shows no impact active chip area. Design rules of the dicing area between chips are in concept phase to minimize chipping of dicing edge. TSV: first bond tests have been made on test wafer - OLED deposition is planned next year.	yes	For TSV and laser dicing process are fall back options prepared to separate the wafer into single chips and realization of electrical connection to the chip if the new processes show low performance.
Atomic layer encapsulation show higher water vapor transmission rate than expected	Tech	Include organic buffer layer to increase planarization of chip surface and improve ALD-properties	Dec. 2015		x				x	yes	no	Tests are planned on first chip design with first wafers available mid of 2016	yes	An alternative encapsulation process without ALD has been discussed between FEP and IMMS.
Delay in the delivery of the needed subcomponents from the other WPs	Sched	Close collaboration within the consortium to early detect delays and take required actions.	Dec. 2015	x				x		no	no	WP4 needed specifications from other exists or are under discussion; measurement results from other WP's no planned for 2015	no	Not applicable at the moment

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Inconsistencies between CMOS/MEMS mask data (misalignment, fill structures) result in no working SoC solutions	Tech	Close collaboration between CMOS artwork and MEMS artwork to early detect problems, create a standard flow for design and mask fabrication in the pilot line	Dec. 2015			x		x		yes	no	Misalignment was found and eliminated by visual control of mask data	yes	Create a standard flow for design and mask fabrication in the pilot line is included in task list

Table 5: WP4 Risk table

In section “WP4” we have fife risks with high severity and one with high probability.

- Incompatibilities of materials and technological building blocks in integration schemes: No new knowledge or backup solution available. Experiments are necessary and not performed yet.
- Technological building blocks i.e. material parameter for thermo elements don’t meet the assumed requirements of individual systems: No new situation with status January 2016. Measurement tool for front side / back side will be purchased and is under negotiation.
- Applicable design rules don’t fit the ideal demands of products: In the current development phase not assessable.
- Laser dicing and TSV degrade organic materials on the CMOS during process: This process development is well under control and fall back solutions are discussed and available. First promising results are demonstrated and risk is lower as expected.
- Atomic layer encapsulation show higher water vapor transmission rate than expected: An alternative encapsulation process without ALD has been discussed between FEP and IMMS. First results are planned for Q3 2016. No further actions necessary.
- Inconsistencies between CMOS/MEMS mask data (misalignment, fill structures) result in no working SoC solutions: Misalignment between CMOS and MEMS is a normal technical challenge. To create a standard design and mask fabrication flow between all pilot line partners is included in our task list. Monitoring with 1st demonstrator flow is in planning.

4.6 WP5 Design for diagnostic Sensor and Actuator Products [M01-M48; IMMS]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Intolerance of the biological samples against the surface of the sensor chip	Tech	Alternative coating methods will be elaborated to provide a biocompatible sealing on the sensor chip surface.	Dec. 2015	x					x	no	no	Chemical coatings will be deposited by subcontractors that provide a homogenous surface	no	Not applicable at the moment
Rest of fabrication material remains on the bioanalytical sensor surface	Tech	The wafer or the individual sensors will be cleaned repetitively to remove contamination.	Dec. 2015	x				x		no	no	Sensors will be cleaned and re-evaluated because they might lose sensitivity after plasma cleaning.	no	Not applicable at the moment
Compatibility of the micropumps with in-vivo applications	Tech	Biocompatible coating is developed to encapsulate device avoiding it becomes repelled by the human body.	Dec. 2015	x				x		no	no	If the micropump is repelled from the body, new encapsulation and sealing needs to be deposited using subcontractor	no	Not applicable at the moment
Receipt of non-exact response on fluctuation of individual ion concentrations	Tech	Systematic step-by-step characterization of the system will be carried out with control on the available mobile ions.	Dec. 2015		x			x		no	no	The sensors need to be characterized and the type of ion-sensitive layer needs to be exchanged to increase sensitivity and specificity	no	Not applicable at the moment
Delay in the delivery of the needed subcomponents from the other WPs	Sched	Close collaboration within the consortium to early detect delays and take required actions.	Dec. 2015	x				x		no	no	Rescheduling is necessary	no	Not applicable at the moment

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Selectivity or sensitivity of the sensors against the cell response are not adequate	Tech	Failure analysis will be initiated and issues will be resolved or optimized in redesign.	Dec. 2015		x		x			no	no	The electronic circuits need to be adjusted as well as the biomarkers to produce stronger signal	no	Not applicable at the moment
Integration issues between OLED and CMOS	Tech	Failure analysis will be initiated including XFAB, FEP and IMMS and actions will be taken in agreement	Dec. 2015	x				x		no	no	Analysis of the process flow and physical measurements are necessary to identify the issues	no	Not applicable at the moment

Table 6: WP5 Risk table

In section “WP5” we have only one risk with high severity.

- Intolerance of the biological samples against the surface of the sensor chip: At X-FAB are different materials for surface deposition available (AlSiCu, AlCu, Ti, TiN, W). Based on experimental results we change our bond pads from AlSiCu to AlSi for application with bio-marker or human cells. This material change reduced this risk.

4.7 WP6 Smart Production for the distributed MtM Pilot Line [M01-M48; X-FAB]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Inconsistent documentation of existing environments slow down the WP progress	Tech	Establishment of central documentation repository for collection of all central documentations.	Dec. 2015	x					x	no	no	IT structure is installed and a SVN surfer for data storage in use	no	Not applicable at the moment

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Migration schedule for replacement of existing IT landscape for factory control (MES, Middleware) fails due to complexity	Tech	Establishment of a migration review board for fast problem detection, as well as fast reaction.	Dec. 2015	x				x		no	no	Not applicable at the moment	no	Not applicable at the moment

Table 7: WP6 Risk table

In section "WP6" we have only one risk with high severity.

- Inconsistent documentation of existing environments slow down the WP progress: IT structure is installed and a SVN surfer for data storage in use since 2nd project month. Project handbook and data management procedures are available and active.

4.8 WP7 System Integration for Key Application Areas [M01-M48; SA]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Delay caused by issues in the field testing and/or life time testing	Tech	Perform risk analysis and mitigation prior to the field test and life time testing.	Dec. 2015		x				x	yes	no	Not applicable at the moment	no	Not applicable at the moment

Table 8: WP7 Risk table

In section "WP7" we have only one risk with high severity.

- Delay caused by issues in the field testing and/or life time testing: WP7 has his first deliverables after 24 month and all critical activities and demonstrator preparation between month 24 and month 48. A new risk assessment after 12 month is necessary.

4.9 WP8 Dissemination and Preparation of Exploitation [M01-M48; X-FAB]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Uncoordinated dissemination activities emerge during ADMONT operation	Sched	The partners will be urged to correlate their activities upon detection of any uncorrelated activities. Clear leadership is needed and experience gained from former projects will be applied to foster common dissemination activities and to funnel any dispersed actions together again.	Dec. 2015	x			x			no	no	Coordination of all dissemination activities is installed with activity tracking	no	Not applicable at the moment
Less standardisation effort than anticipated	Sched	Create additional awareness for the importance of standardisation tracks on all organizational levels of the project.	Dec. 2015	x			x			no	no	Not applicable at the moment	no	Not applicable at the moment
Dissemination/Exploitation is out of plan	Sched	The Task Leader monitors the dissemination/exploitation activities and will interfere immediately. The WP meetings should find workarounds.	Dec. 2015	x				x		no	no	Not applicable at the moment	no	Not applicable at the moment

Table 9: WP8 Risk table

In section “WP8” we have no major risks to be explained.

4.10 WP9 Project Management [M01-M48; X-FAB]

Description of risk	Type of risk	Proposed risk-mitigation measures	Date of last evaluation	Probability			Severity			Risk Level	Current assessment of risk			
				L	M	H	L	M	H	Action required?	Did the risk materialise?	Explanation	Did you apply risk mitigation measures?	Update of mitigation measures / actions taken to deal with occurred risk
Under performing partners	Costs	Close contact between WP-owners, technical leader and coordinator, short feedback loops and personal contacts (regular Coordination Committee Telco's, physical meetings, etc.)	Dec. 2015		x				x	yes	no	Not applicable at the moment	yes	Project management and communication system is installed, monthly coordination committee phone call, governing council is installed and involved
Conflicts between partners (technically and administrative)	Tech, sched	Conflict management through close and good contacts, frequent meeting (regular Coordination Committee telcos/meetings, Governing Council meeting, etc.)	Dec. 2015		x			x		no	no	Consortium and GA agreement are signed, conflict management is defined	no	Not applicable at the moment
IPR conflicts between partners or between groups of partners	Sched, costs	Early detection of the issue through close and good contacts, frequent meetings and a clear and unambiguous legal framework (e.g. CA). The coordinator, being a fully independent small entity, has acted successfully as IPR mediator between Industry, Research, and Universities before.	Dec. 2015		x		x			no	no	Not applicable at the moment	no	Not applicable at the moment

Table 10: WP9 Risk table

In section “WP9” we have only one risk with high severity.

- Under performing partners: Is not happening yet. Our first technical meeting in January was a good monitoring and showed that all WP’s are on track. Only minor delay in WP2 was shown and action taken. No further management activities necessary so far.

Chapter 5 Conclusion

The described risk management approach indicates how the ADMONT consortium is and will avoid tripping over rocks on the road to success. Based on theoretical inputs, as described in Chapter 3, the ADMONT risk management tends to professional identify, analyze, monitor and handle highly innovative project. The project consortium has been successful in handling the risks throughout the first year of the project, which is critical for a smooth project functioning. Although hardly any of the described risks materialized, the appropriate reaction from the project partners and proactive application of mitigation measures as well as ongoing communication helped to overcome the risks or potential threats. Nevertheless, the funding situation with the Hungarian partner delays their efforts, which is a pity and would be beneficial for the project, but is handled well within the consortium.

The ADMONT consortium is confident to identify, monitor and proactively mitigate risks with the established tools, in order to ensure timely and high qualitative outcomes. The risk assessment in ADMONT is a process which will last throughout the lifetime of the ADMONT project. Updates and assessments will be regularly performed by the consortium and reported within the Periodic Reports.

List of Abbreviations

GC	Governing Council
CC	Coordination Committee
CPA	Critical Path Analysis
CPM	Critical Path Method
DoA	Description of Action
MS	Milestone
PM	Person Month
RAP	Risk Assessment Plan
WP	Work Package

Bibliography

[1] Holland & Holland Enterprises Ltd. (2013): Project Risk Management, online: http://www.successful-project-management.com/project-risk-management.html

[2] Alon, Adi/Koetzier, Wouter/Culp, Steve (2013): The art of managing innovation risk, online: https://www.accenture.com/us-en/insight-outlook-art-of-managing-innovation-risk.aspx

[3] ISO 31000 (2009): Risk management, online: http://www.iso.org/iso/home/standards/iso31000.htm

[4] PMBOK (2004): A Guide to the Project Management Body of Knowledge, published by Project Management Institute; Newton Square, Pennsylvania (USA)