

# Boost

BIG DATA FOR FACTORIES

## Big Data Value Spaces for Competitiveness of European Connected Smart Factories 4.0

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Participant organisation name	Acronym
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Visual Components	VIS
Automatismos y Sistemas de Transporte Interno S.A.U.	ASTI
Telefónica Investigación y Desarrollo SA	TID
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The University of Edinburgh	UED
Institute Mines Telecom	IMT
Industrial Data Space E.V.	IDSA
FIWARE Foundation EV	FF
GEIE ERCIM EEIG	ERCIM
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\*LHF 4.0 – Lighthouse Factory 4.0 \* RF – Replication Factory 4.0

## Executive Summary

The document describes the BOOST 4.0 Risk Management Plan, which assures the ability to acknowledge the risks and thus manage risks by mitigating measures. This plan contains V1, V2 and V3, with V1 identifying and assessing initial 21 risks mainly in three categories: general risks (management & legal), technical and innovation risks and impact risks.

The present deliverable on risk management applies a quantitative methodology in defining the three levels of different risks. They were then assessed in terms of probability and impact, resulting in a prioritised list of threats on basis of their foreseen risk level (risk=probability x impact). Probability and Impact for each threat were defined on a scale between 0 and 1 according to a low medium-high. Moreover, mitigation measures are introduced to reduce original risks, which effect being assessed by the comparison of original risks presented without those measures and the actual risks presented with those measures. In the end, a risk assessment matrix is presented to visualize this assessment.

This deliverable is the first release of the Risk Assessment and Management Action Plan at M3; there will be other release at M9 and a final V3 in M18. The main objective of the document is to ensure the analysis and management of the risks inherent to a research and innovation project including risk identification, risk quantification, identification of appropriate measures to manage the risk as contingency planning, and risk tracking and control, in particular in order to:

- identify, resolve and control technical, scientific, impact and management risks that might rise during the project,
- anticipate and manage changes related to the project.

Risk is the main uncertainty in any organization, which should be identified and organised before they exacerbates enough to affect the running of the project. The ability to manage risks and the knowledge of the risks are key to the project success. The plan will be accomplished in V2.

**Keywords:** Project management, risk, mitigation, management, technical, impact.

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## Table of contents

Executive Summary .....	5
1 Introduction.....	9
1.1 Purpose and scope .....	9
2 Risk analysis background and goals .....	10
3 Risk management methodology .....	11
3.1 Risk identification and assessment .....	11
3.2 Risk management and mitigation measures .....	13
3.2.1 Management Risks (General) .....	13
3.2.2 Legal Risks (General).....	14
3.2.3 Technical Risks.....	14
3.2.4 Impact Risks.....	16
4 Conclusion .....	17

## List of Figures

Figure 1 Boost 4.0 Working Packages Flow Chart .....	9
Figure 2 Effect of mitigation measures .....	16

## List of Tables

Table 1 Classification of probability and impact (risk matrix) .....	12
Table 2 BOOST 4.0 related generic risks (management).....	13
Table 2 BOOST 4.0 related generic risks (legal).....	14
Table 2 BOOST 4.0 related technical risks .....	15
Table 2 BOOST 4.0 related impact risks.....	16

## Acronyms

CA	Consortium Agreement
CPPS	Cyber-Physical Production System
DoA	Description of Action
EC	European Commission
GA	General Assembly
IPR	Intellectual Property Regulations
KPI	Key Performance Indicator
REI	Responsible Exploitation & Innovation Board
RRI	Responsible Research & Innovation
TCC	Technical Coordination Committee
WP	Work Package



# 1 Introduction

There are three versions of Risk Management Plan proposed in the project life time to track, assess and mitigate potential risks during the project lifetime. The D1.4 is the first version of the series, the other two will be respectively delivered in M9 and M18.

The project strategic board is responsible for the risk management of the project and the pilot activates to avert potential risks that endanger the progress and accomplishment of the project. This deliverable focuses on the original 21 risks at the initial stage of the project and are planned to be re-assessed regularly and used as elements to link the progress to the capacity to impact significantly in the research and industrial domains. A deep analysis of potential failure modes will be carried out in the following versions.

## 1.1 Purpose and scope

The D1.4 as specified in the DoA, BOOST 4.0 has identified 3 main classes of risks: Management; Technical & Innovation risks due to the ambition of the scientific and pilot work packages, like for instance achieving a seamless big data interoperability or models transforming current engineering practices or allowing advanced simulation (simulated reality) or forecasting (harmonized production planning) capabilities. Impact risks due to the market acceptance and/or to complexity of the BOOST 4.0 solutions.

The relationship of different working packages has been demonstrated in the flow chart showed below. (Figure 1)

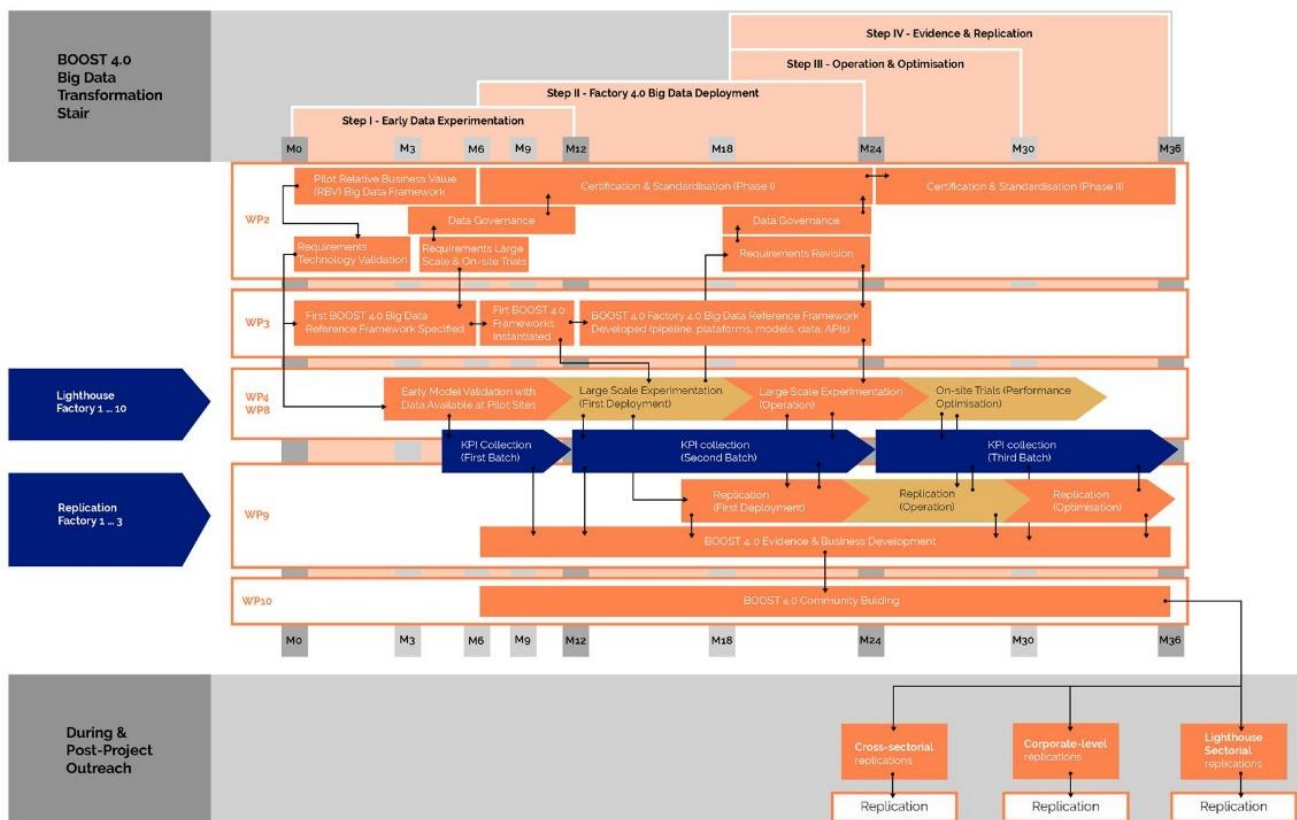


Figure 1 Boost 4.0 Working Packages Flow Chart

## 2 Risk analysis background and goals

The accomplishment of the series of risk management plan relies on the project management board, an efficient and functioning organisation with the mandate of the Project Management Board in terms of:

- Project organisation, responsibilities, authority
- Project planning & control
- Results, documentation & data control

The Risk Plan is a support to the Project Management activities.

## 3 Risk management methodology

### 3.1 Risk identification and assessment

Risk Management is adopted to manage project issues and conflicts. The challenging mission of BOOST 4.0 is to accomplish the ambition of the scientific and pilot work packages, like for instance achieving a seamless big data interoperability or models transforming current engineering practices or allowing advanced simulation (simulated reality) or forecasting (harmonized production planning) capabilities. In this perspective, we identify three main classes of risks:

- Generic management risks exist due to the size and complexity of the project, due to the distribution of competencies in several organizations, due to the ecosystem nature of the consortium where heterogeneous interests co-exist and parties from the industry, the academy and non-profitable organs need to collaborate in the BOOST 4.0 consortium.
- Technical & Innovation risks are due to the ambition of the project to create a seamless industrial data space across Europe integrating machines, processes, platforms, services and workforce along the full product and process life-cycle
- Impact risks are due to the complex dynamics in the market, the communication gap existed from Innovation solutions and the difficulty to gain quick access to the market and/or to the complex portfolio to be presented by the BOOST 4.0 solutions.

During the initial phase of the project, BOOST 4.0 has identified 21 risks within these categories, which will be expatiated in the table below (Table 2 to Table 4). A list of risks and related action list is reported in the following sections. The risks are divided in different classes. There is a mix between internal risks and external ones.

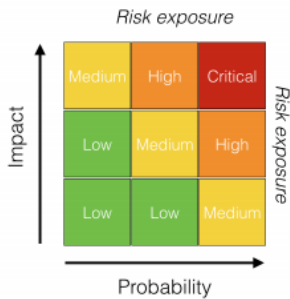
- **Internal risks** are the ones related to specific project management and consortium ability and efficiency in dealing with its tasks and fulfilling its purposes.
- **External risks** are more related to the impact vision and are subject to market and environmental factors.

The following tables provide the lists of risks the project recognises and manages. This list of risks is bound to evolve over time due to the developments of the project and its achievements, and including the risks re-evaluation in terms of impact and frequency. This issue is the initial plan collected in M3 and initially evaluated in M7.

Each risk is evaluated through two kinds of marks:

- **Probability:** This evaluation is related to the likelihood or potential frequency of occurrence of the considered risk (or unexpected event) that may lead to trouble:
  - Low (0-0.4): the risk is unlikely to occur or can occur not more than once during the project;
  - Medium (0.4-0.7): the risk is relatively likely or can occur twice or three times during the project;
  - High (0.7-1): the risk is likely or can occur more than three times during the project
- **Impact:** the evaluation is related to the effect of the risk occurrence on the project organisation and results. The higher the impact, the higher the lead-time or effort involved to recover back to good conditions in the running project:

- High (0.7-1): the effect will strongly disturb the project and the effort or lead-time to recover will be significant or too long to reach expected objectives
- Medium (0.4-0.7): the effect will disturb the project but will not impact the duration of the project or attainment of objectives
- Low (0.1-0.4): the effect will slightly disturb the project but good running conditions can be recovered rapidly.



Classification	Numerical Representation
Low	0 to 0.4
Medium	0.4 to 0.7
High	0.7 to 1

Table 1 Classification of probability and impact (risk matrix)

**Risk** is therefore measured in terms of multiplication of probability and impact;

$$\text{Risk Level} = \text{Probability} * \text{Impact} \quad (1)$$

with the levels of severity and color codes as shown above.

WP leaders and other key partners have established risk mitigation plans to reduce the impact and likelihood of the risk occurring, as well as action plans to manage the risk should it arise. This integrated approach to risk management will enable the project office effectively control business, intellectual property, technology, people, management, environment and other implementation risks that may arise.

Such mitigation measures have an impact on the actual probability of the risk in the form

$$\text{Actual Risk Level} = (\text{Original Risk Probability}) * (1 - \text{Mitigation Effect}) \quad (2)$$

with an impact on the severity of the risk after mitigation measure application following the risk level formula above.

Unresolved issues or conflicts impacting the project plan will be escalated to the appropriate theme board, project coordinator and then if required to the GA. Should the need arise the necessary partner assembly will be convened to vote on the issue or dispute in question.

The present deliverable on risk management applies a quantitative methodology in defining the three levels of different risks. They were then assessed in terms of probability and impact, resulting in a prioritised list of threats on basis of their foreseen risk level (risk=probability x impact). Probability and Impact for each threat were defined on a scale between 0 and 1 according to a low medium-high. Moreover, mitigation measures are introduced to reduce original risks, which effect being assessed by the comparison of original risks presented without those measures and the actual risks presented with those measures.

**Risk Assessment.** The Risk Assessment for BOOST 4.0 is based on Failure Mode and Effects Analysis (FMEA). Though this method was first developed for systems engineering, it has proven to be sufficiently powerful for risk analysis in all types of projects to examine potential failures in products or processes. It is used to evaluate risk management priorities for mitigating known threat-vulnerabilities. FMEA helps select remedial actions that reduce cumulative impacts of life-cycle consequences (risks) from a systems or process failure (fault). The basic process was originally to take a description of the parts of a system (a high-level architectural overview), and list the consequences for each part that fails.

## 3.2 Risk management and mitigation measures

The following is the list of risks table with colour coded for different level of risks. The comparison between original risk and actual risk vividly demonstrate the effectiveness of mitigation measures, which are testified in the % of risk reduced

### 3.2.1 Management Risks (General)

Risk Management Registry																
Risk Identification							Risk Evaluation			Risk Response		Risk Monitoring & Control				
ID	Status	Risk Type	WP	Event/Threat	Cause	Effect	Original Probability	Impact	Original Risk Level	Mitigation Measures	Mitigation Effect	Actual Probability	Actual Risk Level	% Reduced	Responsible	Date of Review
1	Active	Management	WP1	Delayed deliverables	Slower learning curve of collaboration procedures (submission, revision, quality standards) reestablished for large lighthouse partnership	Slower project reporting ramp-up	0,80	0,7	0,56	Weekly/Bi-Weekly WP calls, Process tracking and periodic status check. Individual support from Project management office	0,3	0,56	0,39	0,3	Project Strategic Board	1st July
2	Active	Management	WP1-10	KPI used in the evaluation difficult to apply to some specific structures, leading to an unfair evaluation	Partners lack awareness and implemented KPI collection mechanisms	Delayed contribution to project and BDV-PPP programme	0,70	0,6	0,42	Early WP9 monthly calls with KPI and digital business managers and pilot owners to KPI preparatory work	0,4	0,42	0,25	0,4	Monitoring & KPI Evaluation Manager	1st July
3	Active	Management	WP1	Budget has been under-estimated or project objectives not fully achieved	Unforeseen resources (infrastructure, computing, human) need by partners to complete pilot	More limited or slower impact of BD pilot than initially anticipated	0,20	0,8	0,16	Regular evaluation of pilot plan (6 month) in terms of impact and resource required to move pilot to next level (laboratory-large scale-fully operational) . Project ammendements	0,5	0,10	0,08	0,5	Project Strategic Board	1st July
4	Non-Active	Management	WP1	Deliverables not approved by the EC	Low quality of deliverable inputs. Low quality in presentation of project proress & achievements	Additional work to extend project activities. Reformating and resubmission of deliverable	0,40	0,8	0,32	Quality Control of all reports in every procedure. Quality of inputs controlled at Trial Handbook and Deliverable level	0,6	0,16	0,13	0,6	Quality & risk Management. Pilot Management Board	1st July
5	Active	Management	WP1	Difficulty in reaching a shared vision of project objectives / activities among partners	Diverging technical or business agendas behind pilot and platform piloting	Low generalisation and common lesson learned and best practice generation	0,60	0,6	0,36	Continuous revision of Boost 4.0 WP2 general pilot framework and WP3 open big data pipelines, platforms and infrastructures	0,3	0,42	0,25	0,3	Technical & Innovation Board	1st July
6	Active	Management	WP1	A partner leaves consortium before the end of the project. Key knowledge missed	There is a change in technical and/or business priorities in the partner	Need for knowledge and expertise replacement	0,30	0,5	0,15	Reliable partners sign commitment to participate. Partners have overlapping skill profiles to be able to reorganize the activities to cover the loss of a partner. Community built around boost 4.0 in bdva, fof communities	0,5	0,15	0,08	0,5	Project Strategic Board	1st July
7	Active	Management	WP1-10	Tight time constraints or ambitious requirements	Pilot ambition is high and complex and aligned collaboration activities need to timely be operated.	Two speed pilot progress with different levels of pilot maturity	0,70	0,65	0,46	Identify, within the requirements, those that are mandatory, those that are optional. Review the requirements status as the software development or integration progresses through periodic meetings. Revision of roles and responsibility of partners. Amendments where applicable.	0,4	0,42	0,27	0,4	Project Strategic Board	1st July

Table 2 BOOST 4.0 related generic risks (management).

### 3.2.2 Legal Risks (General)

Risk Management Registry																
Risk Identification							Risk Evaluation			Risk Response			Risk Monitoring & Control			
ID	Status	Risk Type	WP	Event/Threat	Cause	Effect	Original Probability	Impact	Original Risk Level	Mitigation Measures	Mitigation Effect	Actual Probability	Actual Risk Level	% Reduced	Responsible	Date of Review
8	Active	Legal	WP3-8	GDPR compliance issues in carrying out pilots	Pilots identify the need of using personal data for the implementation of pilots	The use of personal data needs to comply with EU directives and CA agreements	0,05	0,8	0,05	CA defines the liabilities of all parties, the extreme low probability of using personal data. Data Governance data will supervise agreed governance procedures are followed	0,9	0,01	0	0,99	Pilot Management Board	1st July
9	Active	Legal	WP3-8	Business-critical data released consortium-wide or made public by inadvertence	Misuse of confidential data without the suitable written agreements between the parties	Breach of confidentiality	0,10	0,7	0,08	CA defines the liabilities of all parties and the strict procedures to be followed by parties. Increased control procedures to be in place	0,8	0,02	0	1	Pilot Management Board	1st July
10	Active	Legal	WP1, 9, 10	IPR conflicts resulting in stop of partnership or results are not delivered by partners	Joint ownership of results is not clear	Stop exploitation of results	0,80	0,9	0,72	Arbitration mechanisms set in CA and GA are triggered.	0,3	0,56	0,5	0,3	Project Strategic Board	1st July

Table 3 BOOST 4.0 related generic risks (legal).

### 3.2.3 Technical Risks

Risk Management Registry																
Risk Identification							Risk Evaluation			Risk Response			Risk Monitoring & Control			
ID	Status	Risk Type	WP	Event/Threat	Cause	Effect	Original Probability	Impact	Original Risk Level	Mitigation Measures	Mitigation Effect	Actual Probability	Actual Risk Level	% Reduced	Responsible	Date of Review
11	Active	Technical	WP3 & WP4-8	The big data solutions are not flexible and scalable enough to be applied in various realistic and complex scenarios.	Open pipelines & platforms are generic and not issue to customise and configure to the needs of the pilots	Pilots cannot reach the expected scale	0,6	0,6	0,36	Use cases partners will be deeply involved during the requirements analysis to analyse different processes complexity and to evaluate the usability of different tools in real scenarios. Early prototyping & early performance testing of tools in Lab conditions	0,3	0,42	0,25	0,3	Pilot Management Board. Technical & Innovation Board	1st July
12	Active	Technical	WP2 & WP4-8	Pilot partners are not able to provide the necessary data sets - quantity, timeliness, QA	Data confidentiality and data management agreements are not in place among consortium partners	Large scale pilot experimentation is delayed	0,60	0,8	0,48	All solutions are developed and tested in parallel with at least two use case partners. If the available data do not meet the project objectives, corresponding datais generated by simulations.	0,2	0,48	0,38	0,2	Pilot Management Board. Technical & Innovation Board	1st July
13	Active	Technical	WP3	Industrial Data Space Information model is inadequately capturing information required for applications	Data models cannot be agreed, open source reference implementations not available and data system adaptors are too complex or impossible to develop	The scope of European Industrial Data Space piloting will be reduced. Individual pilot outcomes not affected	0,20	0,9	0,18	The information model will be developed in parallel to the respective use cases (model is fit for use). Agile development methodology for the vocabularies and IDS connectors. Full engagement of open initiatives	0,4	0,12	0,11	0,4	Pilot Management Board. Technical & Innovation Board	1st July

Risk Management Registry																
Risk Identification							Risk Evaluation			Risk Response			Risk Monitoring & Control			
ID	Status	Risk Type	WP	Event/Threat	Cause	Effect	Original Probability	Impact	Original Risk Level	Mitigation Measures	Mitigation Effect	Actual Probability	Actual Risk Level	% Reduced	Responsible	Date of Review
14	Active	Technical	WP2-3	Security and scalability of the reference architecture are compromised	Hyperledger and active network monitoring cannot work at the expected scales and within the desired time response times	The security level is reduced or the final performance KPIs are reduced	0,60	0,7	0,42	The early prototypes of security framework of Industrial Data Space looks on performance to align pilot business processes and technology response	0,3	0,42	0,29	0,3	Pilot Management Board. Technical & Innovation Board	1st July
15	Active	Technical	WP2	Lack of alignment / integration with state-of-the-art digitalization approaches and tools	Pilots select in-hous implementations not aligned with standards and heavily linked to legacy	Reduced replicability and openness	0,30	0,9	0,27	Promote the use of open vocabularies, open standards and industry 4.0 reference frameworks (RAMI 4.0) in the development of big data solutions	0,5	0,15	0,14	0,5	Pilot Management Board. Technical & Innovation Board	1st July
16	Active	Technical	WP3	Complexity of the predictive service marketplace.	Data analytic models are too complex and algorithms not based on standard techniques	High algorithm customisation	0,70	0,7	0,49	Providing categories of algorithms to deal with different needs of analytics and different phases of the factory 4.0 lifecycle	0,3	0,49	0,34	0,3	Pilot Management Board. Technical & Innovation Board	1st July
17	Active	Technical	WP4-8	Considering the huge amount of data to gather from the Pilots Data Systems, scalability problems.	Infrastructure requirements exceed the available capacity of current digital infrastructures	Revision of volume requirements for pilot	0,80	0,9	0,72	Early stage assessment between platform providers and data providers (pilot) of full scale operation of digital infrastructure (security, data volume)	0,3	0,56	0,5	0,3	Pilot Management Board. Technical & Innovation Board	1st July
18	Active	Technical	WP4-8	Benchmark values for complexity are unavailable	Novelty of pilot makes impossible a priori assessment	Intermediary milestones in the pilot needed to refine complexity assessment	0,90	0,3	0,27	Per business process assessment of technical pilot requirements is needed.	0,2	0,72	0,22	0,2	Pilot Management Board. Technical & Innovation Board	1st July
19	Active	Technical	WP9	Fail in the definition of the exploitation model or inappropriate business models for BOOST 4.0 outcomes	The business value is uncertain	Pilot impact in operations low to justify future replication	0,20	0,7	0,14	Revise continuously business value and progress of investment plans related to the progress of the pilot achievements	0,4	0,12	0,08	0,4	Pilot Management Board. Project strategic Board	1st July
20	Active	Technical	WP4-8	Pilot infrastructure facilities are not enough to accomplish the project ambition	Pilot business processes demands are beyond technical capabilities	Mismatch between technical capabilities and business impact	0,50	0,9	0,45	Assesment needs to be narrowed down to individual process level to ensure business value generation	0,8	0,10	0,09	0,8	Pilot Management Board	1st July

Table 4 BOOST 4.0 related technical risks



### 3.2.4 Impact Risks

Risk Management Registry																
Risk Identification							Risk Evaluation			Risk Response			Risk Monitoring & Control			
ID	Status	Risk Type	WP	Event/Threat	Cause	Effect	Original Probability	Impact	Original Risk Level	Mitigation Measures	Mitigation Effect	Actual Probability	Actual Risk Level	% Reduced	Responsible	Date of Review
21	Active	Impact	WP10	The dissemination of the project results is not sufficient to create impact.	Message is not clear and interest from community is low	Boost 4.0 not accepted by community	0,50	0,89	0,45	Revise message, increase communicaton. Individual level outputs to be communicated (IDS, algorithms, infrastructures, vocabularies, standards...)	0,7	0,15	0,13	0,7	Public relationships & communications office	1st July

Table 5 BOOST 4.0 related impact risks.

The following illustration vividly shows the distribution of different risks and the drastic drop of the probability and risks of a risky event based on the first monitoring and control actions implemented during the first months of the project.

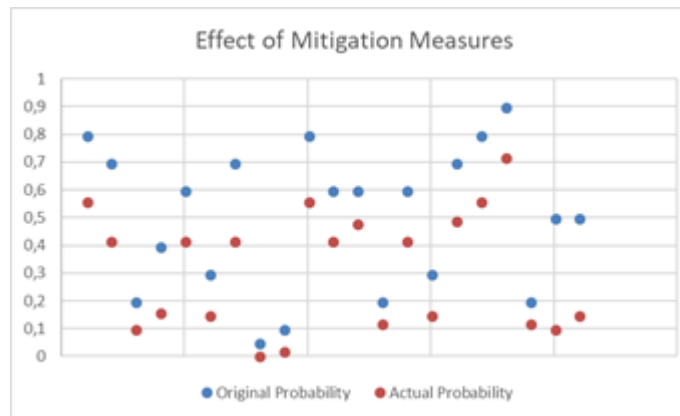


Figure 2 Effect of mitigation measures



## 4 Conclusion

Deliverable D1.4a Risk Management Action Plan V1 is the first of the three risk management deliverables planned in the project. The deliverable series represents the planning and implementation of the BOOST 4.0 risk management strategies and their continuous assessment.

The document has presented the various risks identified early in the project (M3) and a first assessment (M7) of those, reflecting the positive effect of the active risk management strategy selected and the appropriateness of the FMEA methodology to deal with an objective assessment of risk severity at all levels of project implementation.

Next activities in this area comprises continuous monitoring to allow the provision of feedback to the initial plans that might be updated if needed taking into account possible deviations, changes in the working environment or any unexpected factor that might appear during the whole duration of the project.

The document is going to be extended in D1.5 (M9) with risks related to the aspects raised by the first implementation of pilot activities at laboratory level. This document will also revisit the risk level of existing identified risks after 3 months of current monitoring & control.

D1.6 (M18) will provide an updated view of risk levels of the project and extend if necessary risks after large scale extension of the pilots and looking towards pilot replication and fully operational assessments.