



# MEEP

MareNostrum Experimental  
Exascale Platform

## D3.1 “Exploitation strategy”

Version 1.1

### Document Information

Contract Number	946002
Project Website	<a href="https://meep-project.eu/">https://meep-project.eu/</a>
Contractual Deadline	30/06/2020
Dissemination Level	Public (PU)
Nature	Report ( R )
Author	Xavier Salazar (BSC)
Contributors	
Reviewers	John David Davis (BSC), Elisenda Rasero Rebull (BSC), Sergi Madonar (BSC)



The MEEP project has received funding from the European High-Performance Computing Joint Undertaking (JU) under grant agreement No 946002. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and Spain, Croatia, Turkey.

© 2020 MEEP. The MareNostrum Experimental Exascale Platform. All rights reserved.

## Change Log

Version	Description of Change
V 0.1	ToC
V1.0	Initial draft for internal review
V1.1	First complete version after internal review

# Index

Change Log	2
1 Executive Summary	4
2 Introduction	4
3 Context	5
4 IP Management	6
IPR Strategy	6
IPR Analysis	8
IP Flow	8
5 Market and Technology Watch	9
Preliminary Market analysis	9
Initial Value Chain and stakeholders	10
6 Exploitation Strategy	11
Plan for Exploitation Activities	11
Sustainability	12
7 Conclusion and next steps	13
8 Annex 1: Exploitation Plan Template	14

# 1 Executive Summary

The objective of exploitation is to ensure that the results of MEEP will not remain limited in academic or research laboratories, rather to promote it to the potential market. Therefore, to conduct exploitation it is necessary to identify the potential exploitable assets, day-to-day management of knowledge and IPR issues, explore possible target market and users, analyze competitive environment, identify the main exploitation routes for the consortium and develop a sustainable exploitation plan and strategy.

The following deliverable presents the initial plan. It is not the intention of this report to present the progress – as this will be done in subsequent progress deliverables. This report focuses on the high-level plan on how exploitation will be implemented. Hence main processes are described.

Given the public nature of this report, any further detail can also be provided in subsequent deliverables as they are turned to confidential (or extended as part of confidential annexes).

## 2 Introduction

In order to ensure future exploitation, effective innovation management is of paramount importance. Innovation management processes are fully detailed in section 3.2 of the DoA under the Work Package 3 and include day-to-day management of knowledge and IPR issues and the iterative creation of an exploitation plan and a technology roadmap.

Main objectives of the Work Package are:

- IPR management of the exploitable assets of the project
- Identification of relevant market and technology trends
- Definition of most appropriate exploitation paths to reach the market

Main deliverables are:

- D3.1 Exploitation strategy (M6): Outlining the exploitation strategy and how this will be implemented.
- D3.2 Exploitation progress report (M18): Presenting the progress of the exploitation activities including IPR management, initial market analysis and exploitation plan.
- D3.3 Final exploitation plan (M36): Final report on exploitation activities

Innovation Manager (IM)

In order to maximize the exploitation of the results, the chances of them reaching the market, IPR issues are coordinated by an Innovation Manager (IM), who is the point of contact for the Technical Board members and project partners. The IM is responsible for planning and managing IPR issues and supporting the Technical Manager and the other partners in the decision making process related to their IP. The IM also ensures that IP is managed in compliance with H2020 and with the rules agreed in the consortium agreement. The IM also helps to identify commercialization opportunities and raise the awareness of the importance of exploitation.

Innovation Management

In order to ensure that the results of the project will not remain confined in academia or research labs, but will find their route toward the market, proper innovation management is of paramount importance. The innovation manager will work closely with the project coordinator to ensure a proper exploitation path as explained in the DoA. Innovation management processes include both day-to-day management

of knowledge and IPR issues and the iterative creation of exploitation plan and technology roadmaps. To be more concrete, the innovation management process will include: (1) Creation of an IPR repository; (2) monitor IPR compliance with H2020 and consortium agreement rules; (3) facilitate any related conflict; (4) facilitate the creation of commercial agreements between partners leading to joint exploitation after the end of the project; (5) Monitor the project to guarantee consistency between technical and marketing choices; (6) monitor the market during the whole duration of the project, particularly concerning evolution of the technology, potential customers and existing and emerging competitors; (7) alert the General Assembly in case of inconsistencies with the exploitation goals; and (8) plan initiatives that combine technical and exploitation objectives to create business models for defining and exploitation path of most relevant innovations within the project.

### 3 Context

It is noteworthy to highlight the obligation to exploit the results and some of the related terms are part of the contractual obligations defined in the Grant Agreement and further specified in the Consortium agreement—especially article 28.1 referring to the “Obligation to exploit the results”.

*Each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure ‘exploitation’ of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:*

*(a) using them in further research activities (outside the action);*

*(b) developing, creating or marketing a product or process;*

*(c) creating and providing a service, or*

*(d) using them in standardization activities.*

Some other relevant articles and definitions:

Article 26.1 the definitions of **‘Results’**: *any (tangible or intangible) output of the action such as data, knowledge or information— whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.*

Article 27.1 Obligation to protect the results: *Each beneficiary must examine the possibility of protecting its results and must adequately protect them [...].* For that reason, if a partner wants to submit a patent application, it will inform the project’s general assembly and must be included in reports to the European Commission through regular management reports.

Article 27.3 Applications for protection of results (including patent applications) filed by or on behalf of a beneficiary must [...] include the following sentence:

*“The project leading to this application has received funding from the European High-Performance Computing Joint Undertaking Joint Undertaking (JU) under grant agreement No 946002. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and Spain, Croatia, Turkey”.*

Data and knowledge management: Partners will operate a shared repository for data, licensed technologies and documentation. There is not a significant amount of research “data” to be gathered during, hence participations such as “Open Research Data” do not have much applicability. Green or Gold open access for publications will be given when possible.

Other key aspects according to the corresponding terms of EU grant agreements and also further developed where needed in the consortium agreement include: The IP background list, access rights, foreground knowledge and IP ownership, patents, open source and standards and confidentiality.

## 4 IP Management

IP management is a key element for the exploitation of the results. The main activities include:

- Identification of background and foreground for the creation of IP portfolio.
- Assessment of IPR including the selection of the most appropriate protection mechanism according to exploitation strategy.
- Day-to-day management of IP issues that may arise.

An IP repository will be created to identify project exploitable assets including both HW and SW assets. Regarding procedures to protect IPR, the main idea is to adopt a hybrid approach (open and closed) for the HW related IP, depending on the business choices of the IP owners. For the SW, where possible, open source licensing choices will be sought in order to foster the creation of an ecosystem.

### IPR Strategy

Management of Intellectual Property Rights (IPR) is very important for a sustainable project. Therefore, it is important to follow a certain strategy to obtain maximum results by minimizing definite conflicts. Below is the IP management flow chart proposed for the IPR strategy, which has been prepared by BSC for European project IP management.

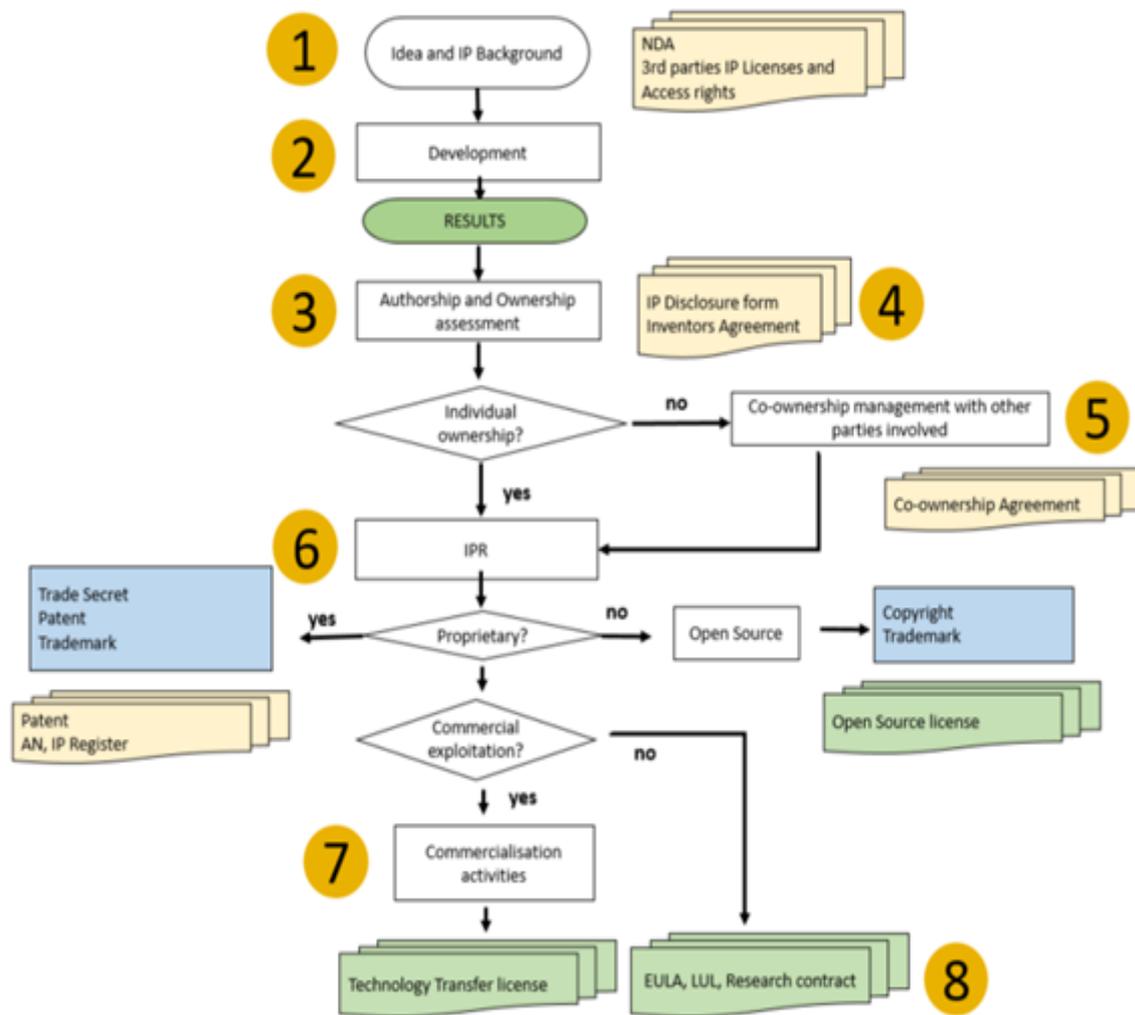


Figure 1: IP management flow chart

### 1. Idea and Background:

As a result of the activity of the project, scientific results are generated and also there are existing technologies to be improved and incorporated that have to be considered (Idea and IP Background). The research staff will be responsible for detecting, together with the Innovation Manager and other personnel involved, those technologies.

Also, they will raise a hand when there is the need to sign NDAs to share sensitive information in the execution of research activities. The NDA will be managed with the support of our legal services in negotiation with the other party.

### 2. Development

The research staff will be responsible for diligently managing the use of third party IP and ensuring that they have the rights to such use.

### 3. Authorship and ownership assessment

Research staff and the innovation manager, will be responsible for authorship and ownership assessment, and to fill the IP disclosure form and inventor's agreement.

#### 4. Disclosure Form

The first step will be to fill out the IP Disclosure form identifying the inventor team, the projects where it has been developed, intentions, protection and sign if appropriate an agreement of inventors which establishes the percentages of contribution to the invention of each researcher as well as their institutions of origin.

#### 5. Co-ownership

In the case of a shared invention, the co-authorship will be coordinated with the rest of the institutions and an agreement will be signed to that effect.

#### 6. Protection and IPR

At the same time, the best protection strategy will be studied, whether the invention is to be conserved as owner or to be opened as Open Source. Once the appropriate option has been established, the necessary steps will be taken to this end.

#### 7. Commercialization

In order to enhance exploitation of the Consortium Results, each partner shall have full ownership freedom of action to exploit the joint IP according to the agreements set up in the CA.

### IPR Analysis

A repository table to collect all the different IP assets of the project has been created - including all Software Components, its ownership, license type. TRL level (at the start and at the end of the project). The following template table will be used to compile and summarize all the components:

Software & Hardware Components	Owner	IP Protection or Licence Type	TRL
[Name]	[Project Partner]	[Licence Type / Open Source / Proprietary, etc]	[1-9]

Table 1: IP Repository Template for Software and Hardware components

The subsequent deliverable will include a full elaborated list of the Software and Hardware components. As this is a live document, the IPR analysis will be updated.

### IP Flow

The main results of the initiative include the creation and deployment of a prototype platform of an EU developed accelerator system with the intention to advance the development of such technology and foster its future uptake. It will include the implementation and porting of Linux, LLVM, and other software tools and packages to support the RISC-V ecosystem of the accelerator. Some test applications based on traditional HPC will be developed for demonstration purposes, as well. The design that is going to be run within MEEP is an emulation of the Exascale accelerator. The system will be used to validate the Exascale design and enable early software development for the Exascale accelerator. The following Figure2, below, depicts the main flow of IP that will be needed and generated both on HW and SW level.

- IP Flow

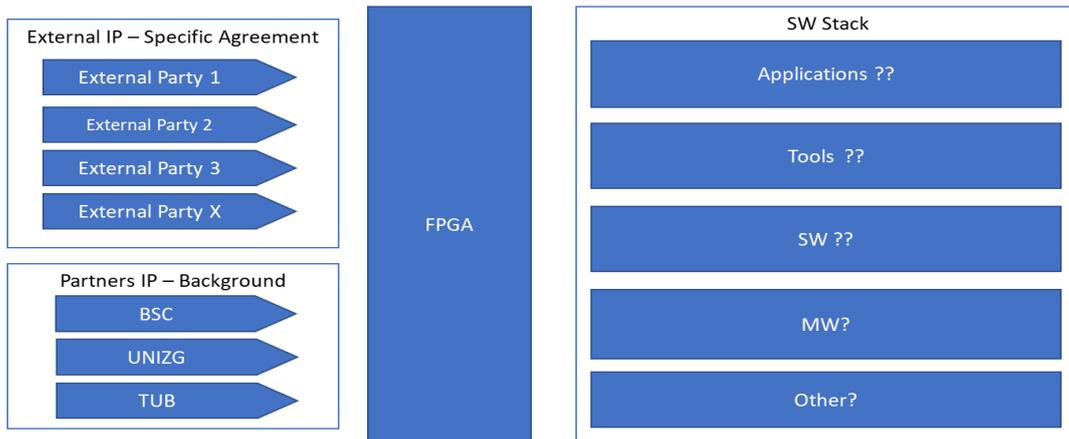


Figure 2: Main chart for IP flow

## 5 Market and Technology Watch

In order to get the best understanding of the exploitation context, it is important to identify the upcoming market and technology trends. A thorough market and technology watch will be done during the project, including the identification and analysis of target users and an assessment of the competitive environment and exploitation context.

### Preliminary Market analysis

High Performance computing (HPC) is a growing market both in size and importance, The global HPC market was valued USD 27.28 billion in 2017 and is projected to reach a value of USD 39.58 billion by 2023, at a CAGR of 6.40% over the forecast period, 2018-2023<sup>1</sup>. HPC is at the core of digital transformation and its benefits are instrumental for science, industry and society. HPC is a key element for higher-end scientific fundamental research, new discoveries and technological breakthroughs, as it enables solving problems that had not been possible so far due to their complexity. They can range from the simulation of the functioning of the human brain<sup>2</sup>, climate predictions or drug discovery. HPC is also being widely used in industrial settings, such as automotive, factories or aeronautics, enabling them to become more productive as HPC technologies are converging with Data analytics and Artificial Intelligence. All this ends up significantly benefiting the society.

The relevance of HPC in Europe is remarkable. Europe is a leader in the use of HPC, and consumes about 29% of resources worldwide in spite of providing only 5% of them<sup>3</sup>. Unfortunately, Europe is also lagging behind, as only 19,2% of supercomputers listed at the Top500 are European and only 3 of them are in the top 10 (if we account EU28 + associated states)<sup>4</sup>. Industry-wise none of the principal HPC vendors is actually European. In all, Europe is not only risking being left behind in the global race, but is also dependent on non-EU technology in such a strategic sector.

<sup>1</sup> <https://www.marketwatch.com/press-release/global-high-performance-computing-hpc-market-2018-07-17>

<sup>2</sup> <https://www.humanbrainproject.eu/en/>

<sup>3</sup> High-Performance Computing in Europe: the state of play. <https://eurohpc-ju.europa.eu/#inline-nav-2>

<sup>4</sup> June 2020 filtered by continent: <https://www.top500.org/statistics/list/>

These trends and challenges have been acknowledged by the European Commission, who have been supporting the HPC development under the European Cloud Initiative as a key element for digitizing European industry, with an estimated investment of overall 2 billion in H2020 funding<sup>5</sup> and the establishment of the EuroHPC Joint Undertaking<sup>6</sup> with a 1 billion budget to develop and deploy the pan-European network of supercomputing facilities, while promoting a research and innovation system to foster adoption of European HPC technologies.

MEEP is aiming to facilitate developing the necessary technology to ensure next generations of exascale systems deployed in the near future are fully based in European assets.

The emergence of COVID-19 and all the measures being taken has recently turned into dramatic, in-depth societal changes. Market wise all forecasts are being revisited –taking into account all the social distancing is not only freezing the world's economy but it is expected to slow down the global economy. The HPC market is going to be affected, and previously forecasted expectations are flattened by 11-12% for the current year and high uncertainty of how this can affect in the mid-term/future<sup>7</sup>. On the other side, while purchase orders of infrastructure could be affected by the downturn, the actual usage of supercomputers / mid-size HPC servers is expected to grow faster than forecasted<sup>8</sup>. Trends are also different depending on the verticals, while some of them are expected to be dramatically affected, such as energy – oil and gas, automotive, others instead are expected to grow – such as life sciences / pharma related to drug discovery / health, given the attention.

In all, for MEEP, this situation is also seen as an opportunity: HPC has become a key tool for the fight against COVID-19. There are uncountable examples across Europe<sup>9</sup> and the whole world<sup>10</sup>, showing how instrumental HPC has become for finding solutions. MEEP partners hosting HPC facilities have been devoted to help with those efforts, such as BSC<sup>11</sup>, so in spite of the global downturn; more than ever the need for powerful HPC systems has proved to be necessary to tackle challenges.

## Initial Value Chain and stakeholders

The primary value chain is hereby presented in this section. This is a “live” document, so it will be updated as the project progresses. However, the detailed analysis will be provided based on individual exploitation plans in the future deliverable, as the project and its outcomes will be more mature. The following Figure 3, below, has been considered as a starting point.



Figure 3: Initial MEEP value chain

<sup>5</sup> <https://ec.europa.eu/digital-single-market/en/%20european-cloud-initiative>

<sup>6</sup> <https://ec.europa.eu/digital-single-market/en/eurohpc-joint-undertaking>

<sup>7</sup> <https://www.hpcwire.com/off-the-wire/intersect360-research-adjusts-2020-hpc-market-forecast-for-covid-19/>

<sup>8</sup> <https://insidehpc.com/2020/04/hyperion-research-forecasts-widespread-covid-19-disruption-to-hpc-market/>

<sup>9</sup> <https://prace-ri.eu/eu-hpc-fights-covid-19/>

<sup>10</sup> <https://www.forbes.com/sites/tiriasresearch/2020/04/06/us-high-performance-computing-takes-on-covid-19/#3994c0c6422f>

<sup>11</sup> <https://www.bsc.es/news/bsc-news/bsc-uses-bioinformatics-artificial-intelligence-and-the-computing-power-the-marenostrum>

It includes HW components that will be the building blocks of the system, the whole SW stack that will enable the system to function, the MEEP emulator platform, the applications built to run on the platform and the end users executing and using the applications.

Therefore, the main stakeholders are HW designers / developers, SW system developers, application developers and End users in the application domains. The levels of knowledge and skills of the different stakeholders are varied and need to be taken into consideration in the engagement activities and trainings

In subsequent deliverables, the market analysis will be expanded to include analysis of competition and state of the play and evolution of the market

## 6 Exploitation Strategy

Based on the identification of the project exploitable assets and the analysis of the exploitation context, the exploitation plans for the project results will be elaborated.

### Plan for Exploitation Activities

At this initial stage of the project to collect information about project exploitable assets and plan for exploitation activities, an “Exploitation Plan” template (attached in Annex) has been prepared by the Innovation Manager. All the partners of the consortium are required to fill out the Exploitation Plan during the execution of the project. At this early phase of the project, the feedback gathered from the partners about the plan for exploitation activities were captured in two main categories with several sub-categories. They are provided below:

Exploitation in Scientific Community:

- Further Internal Research
- Collaborative Research
- Standardization Activities
- Service Creation
- Licensing (For research purpose)
- Academic / Educational Use
- Others

Exploitation in Industrial Sector:

- Licensing (For commercial purpose)
- Product Development
- Service Creation
- Research with industrial partners
- Others

A repository table to collect all the exploitation activities of the project has been created. The sample table has been provided below:

Exploitable Assets	Owner	Exploitation Activity
[Exploitable Asset Name]	[Project Partner]	[List of Exploitation Activity] -

Table 2: Repository template for Exploitation activities related to Exploitable Assets.

All industrial dissemination activities that can lead to future exploitation will also be collected. The sample table has been provided below:

Partner	Event	Further Details	Place	Date
[Project Partner]	[Event Name]	[Any Future Exploitation Opportunity or Feedback Related to Project Results]	[Place of the Event]	[Date of the Event]

Table 3: Repository template for industrial dissemination activities.

## Sustainability

The design that is going to be run within MEEP is an emulation of the Exascale accelerators. The system will be used to validate the Exascale design and enable early software development for the Exascale accelerators.

The main exploitation path is clear and well defined: design and verify/validate an Exascale machine design and develop software, but the time when that machine will be implemented is outside the scope of this project. As an emulation platform, this can emulate other accelerators and/or be used as an accelerator for future projects as well. Both of these are exploitation paths that can be used by other pilots or testbeds. Furthermore, this infrastructure can also be reused for new/bigger FPGA-based systems in future testbeds and pilots and used in future Exascale platforms. Finally, discoveries from this platform will be used to inform the building of future testbeds, pilots and Exascale and Post-Exascale machines.

In order to define the main exploitation routes, one of the most important objectives is to gain acceptance of the technology. Dissemination and communication activities will help towards this acceptance. Academia will benefit by improving educational programmes, the realization of PhD studies, and training the next generation of experts. From a European perspective, this is an opportunity to create reusable EU IP and a related ecosystem that can be ready for building chips in Europe in the near future, and can attract further public and private funding.

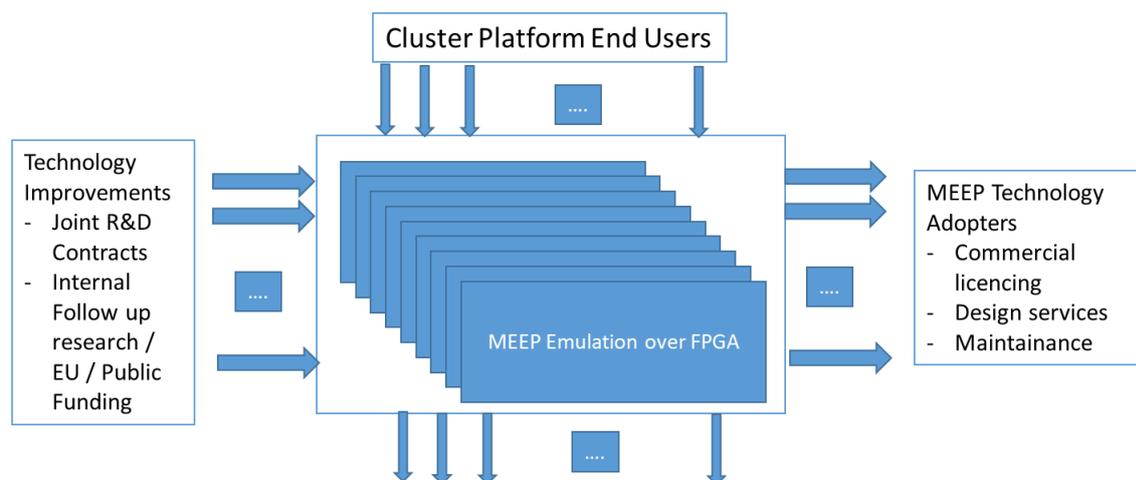


Figure 4: Main exploitation paths for MEEP

The exploitation plan will also address therefore the sustainability of how the results will be used or further develop after the end of the project. It will entail the evaluation of project achievements including their acceptance by the business world. It will address: (1) IPR management issues, (2) leveraging open source communities for project promotion, (3) the definition of any necessary exploitation agreements, etc. Thereby given the hybrid approach with open source and proprietary

technologies different approaches will need to be studied including how to facilitate sharing openly for academic and research purposes without compromising or jeopardizing future commercialization

## 7 Conclusion and next steps

The exploitation strategy and how this will be implemented has been outlined. The main processes are established, including IP management, market and technology watch that help to define exploitation strategy

The activities will be followed, further developed, and progress will be reported in the corresponding Exploitation progress deliverables. This document will examine and assess a potential plan or plans for the exploitation of the final project result.

- D3.2 Exploitation progress report (M18): Presenting the progress of the exploitation activities including IPR management, initial market analysis and exploitation plan.
- D3.3 Final exploitation plan (M36): Final report on exploitation activities

## 8 Annex 1: Exploitation Plan Template

<b>Name of the Organization:</b>						
<b>Brief description of your role in the project:</b>						
<b>BACKGROUND</b>						
<i>(Please provide detail information if previous own technology will be used by you or any other partner for the development of the project or if any previous IP is going to be further developed e.g. OmpSs for BSC)</i>						
<b>Exploitable Assets &amp; IP Management (individual and/or collective)</b>						
<i>Please provide the information on exploitable assets, type of results (whether it is SW or HW or services). How you aim to protect it, e.g. license agreement: Open source (please provide type), close/ proprietary, patent, trademark, industrial secret, etc. Also, please mention the TRL level of your assets.</i>						
<b>Exploitable Assets</b>	Type of Results (SW/HW/Service)	Protection Type	License Type	TRL Level*		
<b>Exploitation Plan</b>						
<i>Please specify the plan for exploitation activities. For example: further internal research, collaborative research, internal product development, internal service creation, licensing, joint venture, spin-off, Standardization activities, etc.</i>						
<b>Exploitable Assets</b>	Type of Results (SW/HW/Service)	Expected Exploitation Activities				
<b>Market and Target Audience</b>						
<i>Please specify the target industrial sector with size of the market the project can make an impact on. Also, please include the potential users, customers and competitors.</i>						
<b>Type</b>	<b>Exploitable Assets</b>	<b>Target Industrial Sector</b>	<b>Market Size</b>	<b>Potential Customers</b>	<b>Competitors</b>	<b>End Users</b>
SW						
HW						
Service						
Others						
<b>Value Proposition</b>						
<i>Please indicate the values that would be offered to our target customers</i>						

What benefits the customers expect to gain?

What obstacles/ problems the customers expect to avoid?

**Key Partners**

Please indicate who are the potential partners, which key activities the partners can perform and which key target resources can be acquired from the partners.

Type	Potential Partners	Key Activities Partners Perform	Key Target Resources Acquired from Partners
SW			
HW			
Service			
Others			

**Expected Benefit for Society:**

**Follow-Up of the project? If yes, how and what will you need?**

\* Technology readiness level