



The European Coordination Hub for Open Robotics Development

E++ 5th Review Meeting

WP3 - Experiments

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Barcelona, March 27, 2019



Objectives of WP3 - Experiments



Experiments

- **Regulatory framework** governing the experiments based on ECHORD
- **Implementation and improvement** of the process
- Close **cooperation with Quality Management (WP1)**

Objectives of WP3 - Experiments



Ranking



Six Monthly Report



Outcome

Selection

Monitoring

Evaluation

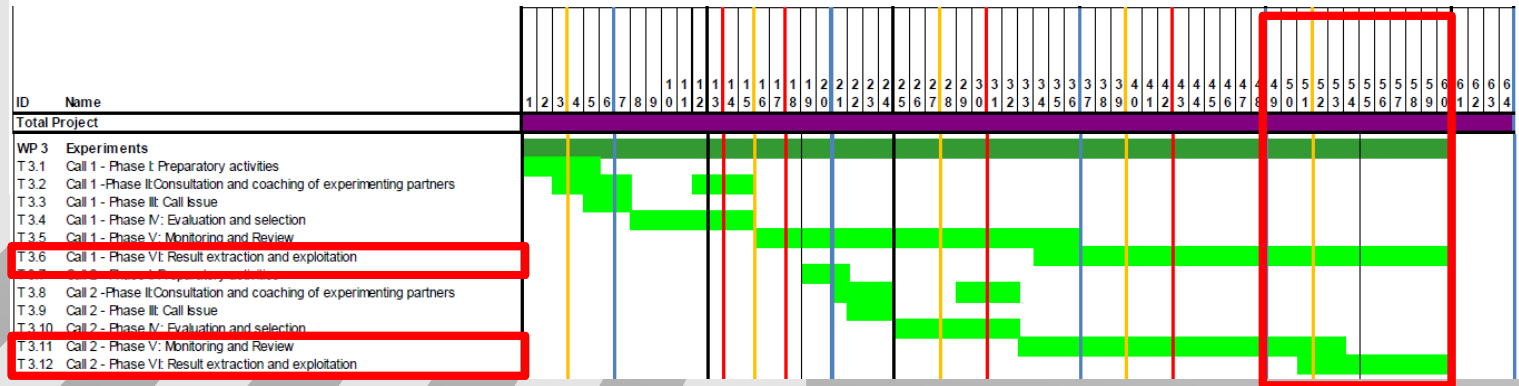
Summary WP3 - Experiments



Experiments

Person-Months per Participant		
Participant number ¹⁰	Participant short name ¹¹	Person-months per participant
1	TUM	27.00
2	SSSA	45.00
3	UWE	0.50
4	UNIVERSITAT POLITECN	10.50
5	CEA	0.00
Total		83.00

1.3.3 Timing of work packages and their components



M51-M64

Main achievements during the 5th period (WP3)



Experiments

Monitoring of Call 2:

- Thanks also to several extensions, all experiments came to a conclusion by the end of November 2018
- Management of final review on site (selection of reviewers and collection of evaluations)
- TRL evaluation performed by external reviewers (follow-up of Recommendation R4 of RP4)

Outcome of Call 2:

- Reviewers evaluation very positive overall (with few exceptions)
- Improvement of Monitoring process
- Some products already emerging
- Some excellent examples of technology transfer between Academia and Industry (Saga, SAFERUN)
- Steps to the market are well identified and for the 34% of experiments the expected time to market is 1-3 years

Deliverables of the reporting Period

- **D 3.5.6** 6th six-monthly report on experiment progress and on reviews
- **D 3.6.2** Final report on the outcome of the experiments

Milestones of the reporting Period

- No milestones planned

Follow-up of previous Review

- No Recommendation related to WP3



Experiments

Overview of tasks for WP3



Experiments

SECOND CALL

- Task 3.11: Call 2- Phase V: Monitoring and review
- Task 3.12: Call 2- Phase VI: Result extraction and exploitation

FIRST CALL

- Task 3.6: Call 1- Phase VI: Result extraction and exploitation

Monitoring and Review

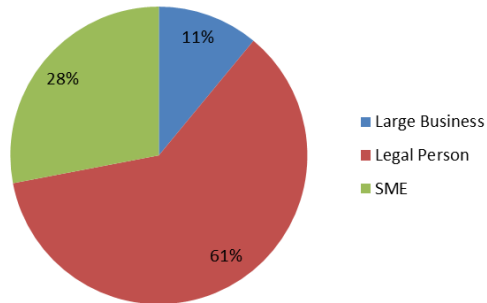
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Call II Experiments

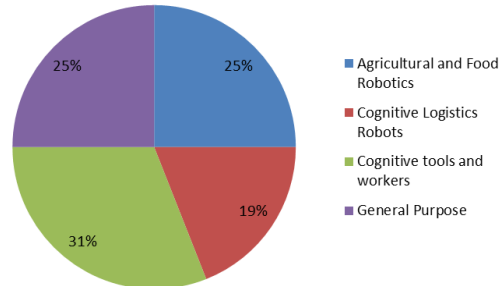
- 16 running Experiments
- 47 funded organizations
- Starting date: June 2016 or September 2016
- Expected end: November 2017 or February 2018

1	INJEROBOT	Agricultural and Food robotics
2	FlexSight	Cognitive Logistics Robots
3	SAGA	Agricultural and Food robotics
4	MAX ES	Cognitive Logistics Robots
5	AAWSBE1	Cognitive tools and workers
6	WIRES	Cognitive tools and workers
7	Keraal	General Purpose
8	SAFERUN	Cognitive tools and workers
9	DUALARMWORKER	Cognitive tools and workers
10	RadioRoSo	Cognitive tools and workers
11	HOMEREHAB	General Purpose
12	FASTKIT	Cognitive Logistics Robots
13	CoCoMaps	General Purpose
14	GRAPE	Agricultural and Food robotics
15	CATCH	Agricultural and Food robotics
16	HyQ-REAL	General Purpose

Organisation Distribution



Scenario Distribution



Monitoring and Review

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General Monitoring Activities

- Each Experiment was overseen by a team of **two dedicated Moderators**

SSSA

TUM

UPC

Experiment	Technical Moderator	Management Moderator
AAWSBE1	SSSA - Manuele Bonaccorsi	SSSA - Manuele Bonaccorsi
CATCH	UPC - Herminio Martínez-García	SSSA - Raffaele Esposito
CoCoMaps	TUM - Adam Schmidt	TUM - Adam Schmidt
DUALARMWORKER	SSSA - Annagiulia Morachioli	UPC - Ana Maria Puig Pey Claveria
FASTKIT	TUM - Yannick Morel	TUM - Yannick Morel
FlexSight	SSSA - Raffaele Limosani	UPC - Ana Maria Puig Pey Claveria
GRAPE	UPC - Antoni Grau	SSSA - Stefano Betti
HOMEREHAB	TUM - Adam Schmidt	TUM - Adam Schmidt
HyQ-REAL	TUM - Yannick Morel	SSSA - Laura Fiorini
INJEROBOT	UPC - Antoni Grau	SSSA - Alessandra Moschetti
Keraal	SSSA - Abdul Butt	SSSA - Abdul Butt
MAX-ES	TUM - Adam Schmidt	UPC - Ana Maria Puig Pey Claveria
RadioRoSo	TUM - Y. Morel, UPC – A. Grau	SSSA - Clementina Cruceli
SAFERUN	TUM - Yannick Morel	UPC - Ana Maria Puig Pey Claveria
SAGA	SSSA - Alessandro Manzi	TUM - Yannick Morel
WIRES	SSSA - Ilaria Strazzulla	TUM - Adam Schmidt



Task 3.5: Call 2- Phase V - Monitoring and Review MONTH 51-64

Contributors:
TUM, SSSA, UPC

General Monitoring Activities

General overview (D356)

High-level overview– Low level of details

Every
Six
months

	Self-Assessment	Milestone	Deliverable	Technical KPIs	Impact KPIs	Dissemination KPIs
DUALARMWORKER	●	●	●	●	●	●
Injerobot	●	●	●	●	●	●
SAGA	●	●	●	●	●	●
Flexsight	●	●	●	●	●	●
Max Es	●	●	●	●	●	●
AAWSBE1	●	●	●	●	●	●
Wires	●	●	●	●	●	●
Keraal	●	●	●	●	●	●
Saferun	●	●	●	●	●	●
Radioroso	●	●	●	●	●	●
Homerehab	●	●	●	●	●	●
Fastkit	●	●	●	●	●	●
Cocomaps	●	●	●	●	●	●
Grape	●	●	●	●	●	●
Catch	●	●	●	●	●	●
Hyq-Real	●	●	●	●	●	●

Detailed traffic lights (QM reports)

Low-level overview– High level of details

tkPIs	#1 Time to plan a dual arm trajectory	#2 Trials to obtain a suitable solution	#3 Deviation with the respect to ideal trajectory	#4 Weight carrying capability
	●	●	●	●

Milestones	#1 Dual-arm closed kinematics chain planning algorithm selected	#2 First prototype implemented	#3 final prototype implemented
	●	●	●

Deliverables	#D4.1 Story Board	#D1.1 Pilot case scenario definition	#D2.1 Intermediate report on dual arm motion planning algorithm	#D2.2 Library for dual arm closed kinematics chain motion planning	#D3.1 Prototype of the first demonstrator
	●	●	●	●	●
	#D2.3 Library of dual arm constrained automatic programming	#D2.4 Library of dual arm online collision detection and avoidance	#D3.2 Prototype of the second demonstrator	#D4.2 Multi-media Report	
	●	●	●	●	

- One or more activities planned in the period resulted in positive outcome
- One or more activities planned in the period resulted slightly under expectation
- One or more activities planned in the period resulted significantly below expectations
- No action foreseen in the selected period

Monitoring and Review

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Each Experiment has been concluded with a final review:

- **Reviewers** (External expert, Technical Moderator)
- **Demonstration of the technology developed**
- **Discussion** about Experiment achievement with the Experimenters

Collected documents

Experimenters

1. KPI Summary
2. Innovation questionnaire

Reviewers

1. Comments and recommendations
2. On site Evaluation Template
3. Innovation questionnaire



Monitoring and Review

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Final Reviews on site

Highly qualified evaluators,
real expert in the field

Added value to E++

Acronym	End Experiment	Review Dates	Location	External Evaluator	Internal Evaluator
AAWSBE1	feb-18	5 June	Odense	Nicola Pedrocchi	Manuele Bonaccorsi
CATCH	apr-18	4 May	Berlin	Jordi Palacin (Skype Call)	Herminio Martínez García
CoCoMaps	mar-18	3 May	Reykjavik	Patrick van der Smagt	Adam Schmidt
DUALARMWORKER	nov-17	6 February	San Sebastian	Stefania Pellegrinelli	Fabio Bonsignorio
FASTKIT	feb-18	28 March	Bouguenais	Andreas Pott	Yannick Morel
FlexSight	jun-18	18 October	Padova	Lorenzo Marconi	Raffaele Limosani/Giovanni Lacava
GRAPE	feb-18	21 March	Barcelona	Prof Jordi Palacin/David Bisset	Antoni Grau
HOMEREHAB	feb-18	22 June	Elche	Keller, Thierry	Adam Schmidt
HyQ-REAL	jun-18	28 June	Alessandria	Alexander Sprowitz	Yannick Morel
INJEROBOT	nov-17	12 February	Almería	Jordi Palacin	Antoni Grau
Keraal	jun-18	19 July	Brest	Domenico Formica/Malcom Fis	Yannick Morel
MAX ES	jun-18	14 November	Toulon	Maximo Roa	Adam Schmidt
RadioRoSo	feb-18	20 April	Prague	Sotiris Makris	Yannick Morel/Antoni Grau
SAFERUN	nov-17	16 May	Reggio Emilia	Lorenzo Marconi	Yannick Morel
SAGA	mar-18	27 July	Eindhoven	Andreas Muller	Yannick Morel
WIRES	jun-18	26 October	Bologna	Nicola Pedrocchi	Adam Schmidt

Monitoring and Review

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• Call 2 Experiments final outcome

	Milestone	Deliverable	Technical KPIs	Impact KPIs	Dissemination KPIs
DUALARMWORKER	●	●	●	●	●
INJEROBOT	●	●	●	●	●
SAGA	●	●	●	●	●
FlexSight	●	●	●	●	●
MAX ES	●	●	●	●	●
AAWSBE1	●	●	●	●	●
WIRES	●	●	●	●	●
Keraal	●	●	●	●	●
SAFERUN	●	●	●	●	●
RadioRoSo	●	●	●	●	●
HOMEREHAB	●	●	●	●	●
FASTKIT	●	●	●	●	●
CoCoMaps	●	●	●	●	●
GRAPE	●	●	●	●	●
CATCH	●	●	●	●	●
HyQ-REAL	●	●	●	●	●

The **quality** is reflected in the monitoring tools showed in the table:

- Green light means **successful evaluation**
- Orange means an **outcome slightly under the expectations**
- Red light is for results **significantly below the expectations**

TRL evaluation

Each external expert acting as a reviewer was expected to evaluate TRL

Experiment start	Experiment end
Initial TRL from: <ul style="list-style-type: none">• Deliverables• Experiment Proposal• Experiment's KPI document	Final TRL from: <ul style="list-style-type: none">• Final report (Experimenters declare the gained TRL)• Direct access to live demo of the prototype developed

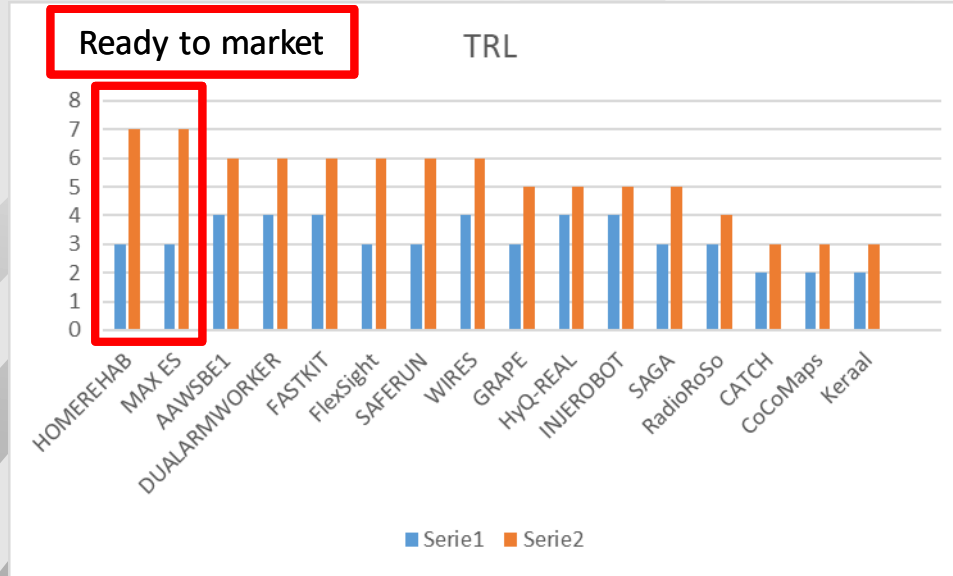
Monitoring and Review

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TRL evaluation

Each external expert acting as a reviewer was expected to evaluate TRL

Acronym	TRL start	TRL end
HOMEREHAB	3	7
MAX ES	3	7
AAWSBE1	4	6
DUALARMWORKER	4	6
FASTKIT	4	6
FlexSight	3	6
SAFERUN	3	6
WIRES	4	6
GRAPE	3	5
HyQ-REAL	4	5
INJEROBOT	4	5
SAGA	3	5
RadioRoSo	3	4
CATCH	2	3
CoCoMaps	2	3
Keraal	2	3



Call II Experiments increased their TRL of an average of 2 levels

Result extraction and exploitation (Call 1 and Call 2) MONTH 51-64

Data collection

- In order to improve the collection of the Experiments outcome, **online surveys were purposely developed and filled in by the involved Experimenters** during the final year of the Echord++ Project.
- **Almost all partners involved in each Experiment answered the surveys**

	Number of Experiments	Number of answers	Total
Call 1	15	33	79
Call 2	16	46	

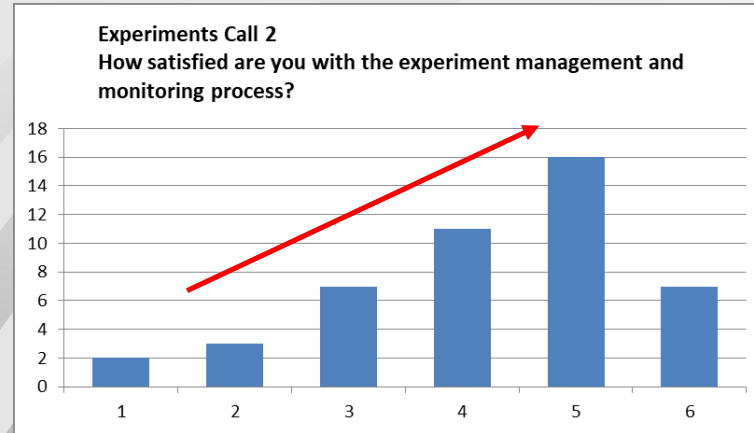
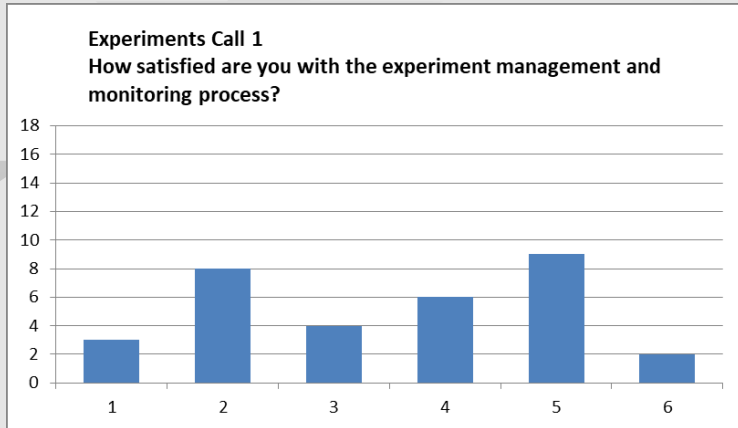
- **Results about:**
 1. Lesson learned about Experiment instrument methods
 2. Funding and Follow-up research
 3. Innovation aspects



Result extraction and exploitation (Call 1 and Call 2) MONTH 51-64

1. Lessons learned about the Experiment instrument methods

Management and monitoring process



*1 not satisfied –
6 very satisfied*

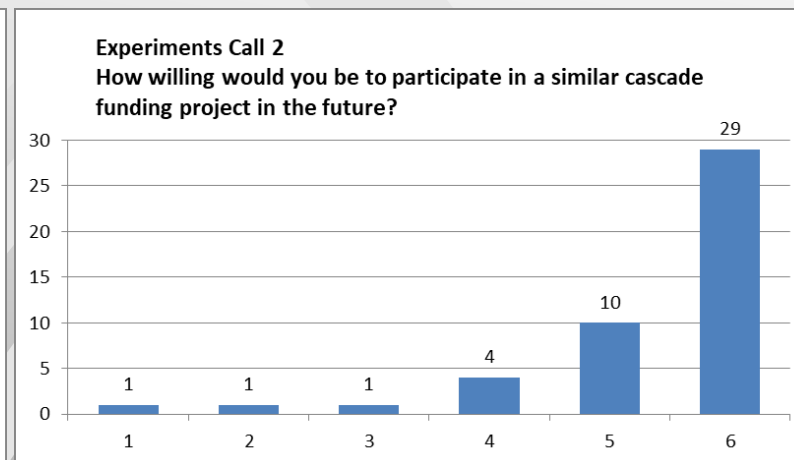
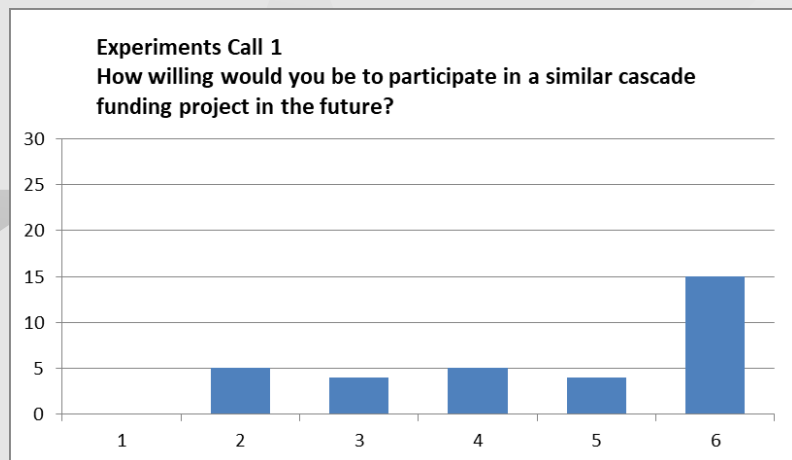
The **process has been improved in Call 2** by the following tools:

- two moderators (technical and managerial) in order to improve the monitoring of technical aspects and reporting aspects
- frequent Skype calls for Experiments status updates
- internal calls between the moderators to level out the evaluation

Result extraction and exploitation (Call 1 and Call 2) MONTH 51-64

1. Lessons learned about Experiment instrument methods

Awareness of new cascade funding projects



1 unwilling to participate; 6 very interested

- Both Call 1 and Call 2 E++ Experiments are **very interested in cascade funding projects**
- **Call 2 Experiments were more involved** in similar initiatives

2. Funding and Follow-up

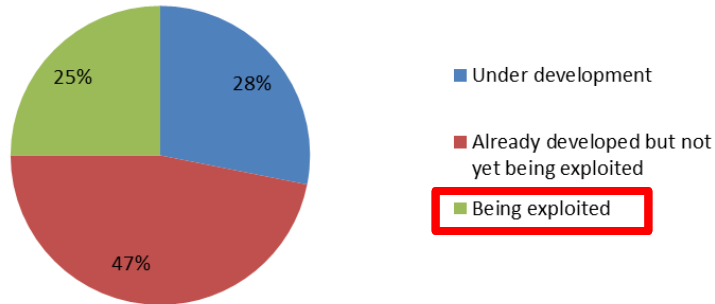
- **Call 2 Experiments have achieved better results** in terms of new funding and of new research projects
 - **44% of Call 2 Experiments secured funding** to implement results or to bring them to the market through:
 - public funding
 - private investors
 - internal resources
 - **43% of Call 2 Experiments have implemented follow-up projects**
 - **14% of Call 2 Experiments plan** follow-up projects

Result extraction and exploitation (Call 1 and Call 2) MONTH 51-64

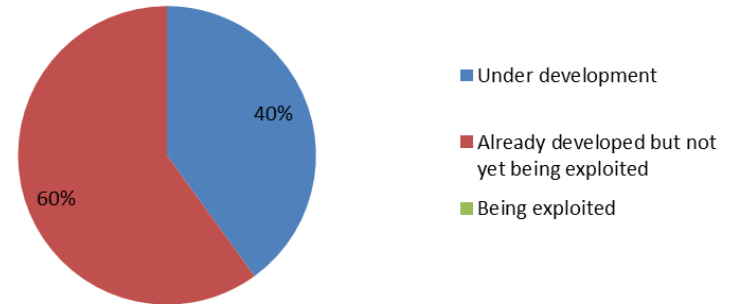
3. Innovation

Level of exploitation of the innovation developed

Experiments Call 1
Is the innovation developed within the project?



Experiments Call 2
Is the innovation developed within the project?



- Call 2 Experiments have still to exploit their innovation
- **25% of Call 1 Experimenters** are a step forward in this process and this result is consistent with the timeline of the E++ calls

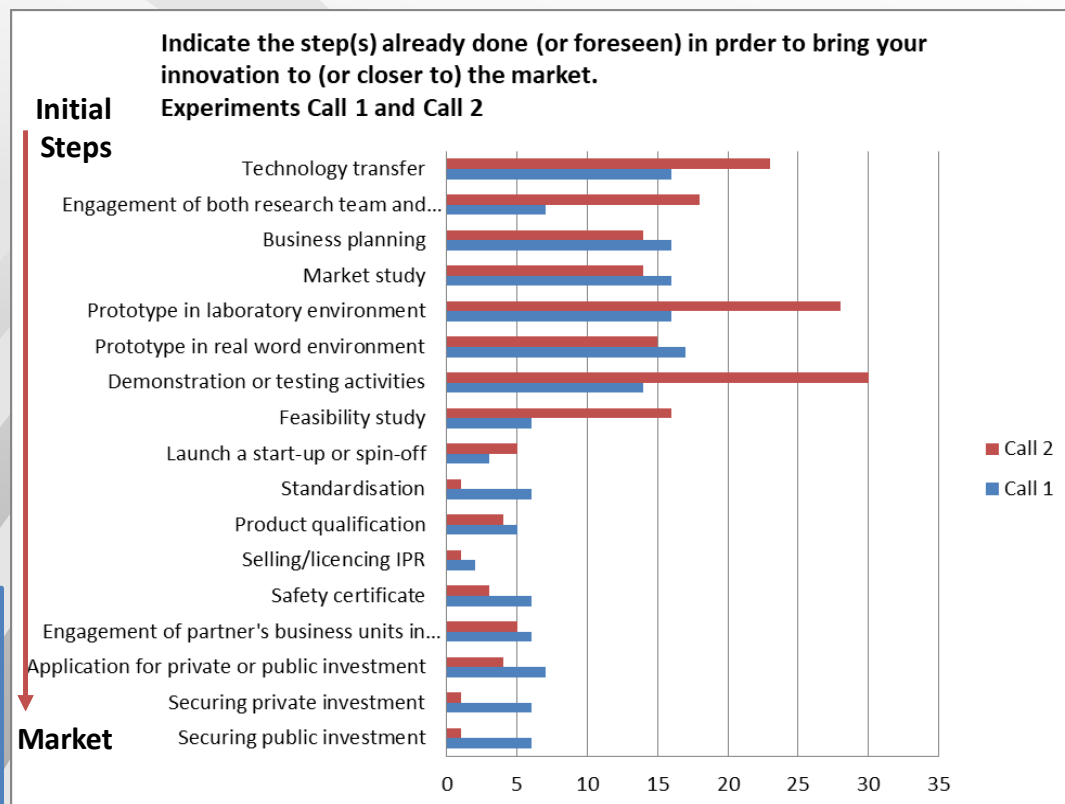
Result extraction and exploitation (Call 1 and Call 2) MONTH 51-64

3. Innovation

Level of exploitation of the innovation developed

- **Call 2** Experiments are still involved in **technology transfer**
- **Call 1** Experiments are focusing on aspects closer to the market, such as **certification and standardization or search for investors**

Call 2 Experiments are achieving more steps so it is expected that at the end they will achieve better results with respect to Call 1



3. Innovation

Creation of a Start-up

- **4 spin-off companies**
- **3 new spin-off created:** ANYbotics AG (MODUL), IDRhA, FlexSight Srl
- The **Booster Programme** assisted **Marsi Bionics** in their efforts to secure venture capital investments to support their expansion strategy

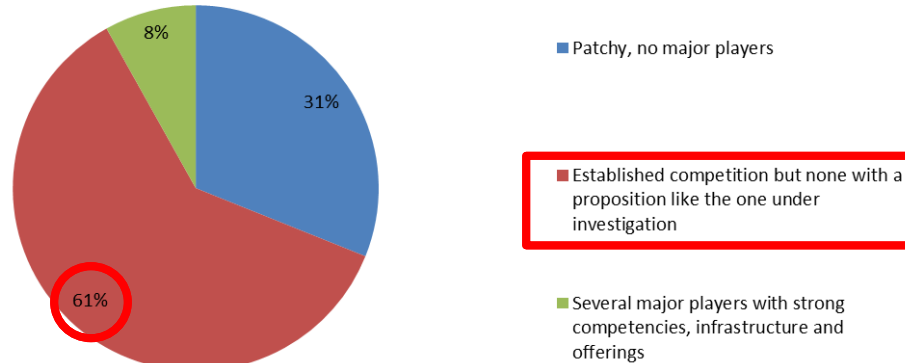


3. Innovation

Market analysis

All Experiments

How strong is competition in the target market?



- **Market competitors:** even if there is an established competition, no major players are present in the specific field of interest
- **Potential opportunity to exploit the market for E++ Experiments**

Result extraction and exploitation (Call 1 and Call 2) MONTH 51-64

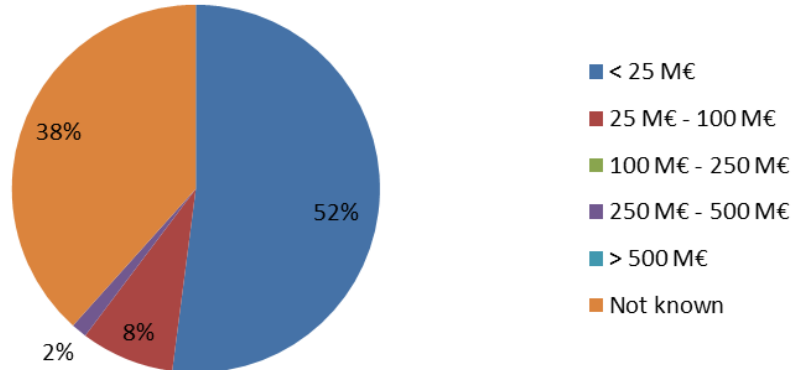
3. Innovation

Market analysis

Market size and time to market

All Experiments

What is the estimated market size for the outcome of your experiment? (per year)



- **52% of the Experiments** has a market size lower than 25M€
- **34% of the experiments** is expected to be commercialized **between 1 and 3 years**
- **15%** of the experiments is expected to be commercialized in **less than 1 year**

Conclusions

Results showed two important aspects:

- **IMPROVEMENT OF THE EXPERIMENTS MANAGEMENT AND MONITORING PROCESS**
 - The management and monitoring processes have been improved in Call 2 as compared to Call 1:
 - two moderators (technical and managerial) improving the monitoring of technical aspects and reporting aspects
- **INNOVATION**
 - E++ Experiments **foster the development of a new product, the improvement of an already existing product or the improvement of a process**
 - Some **products already emerging** and ready to market
 - Some excellent examples of technology transfer between Academia and Industry
 - **52% of the Experiments** has a **market size between 25M€ and 100 M€** with the presence of some competitors, **but value proposition is clear** and could be easily appreciated by the potential customers
 - **Steps to the market are well identified** and for the **34% of experiments the expected time to market is 1-3 years**



Experiments

Impact of Experiments in a nutshell

Technology push concept has been replaced by clear technology pull: development of market-oriented solutions

- almost **27%** experiments from the 1st Call commercially exploited
- **58%** developed a new product
- **16%** developed a new service
- **42%** plan to bring solutions directly to the market
- around **20%** have already secured funding for further exploitation
- **4 spin-off companies created:** ANYbotics AG (MODUL), IDRhA, FlexSight Srl and Marsi Bionics

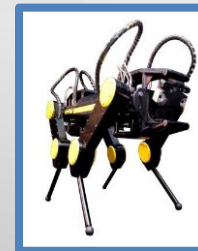
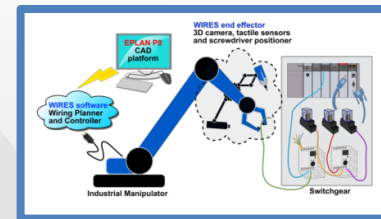


Overview of tasks for WP3

Experiments Outcome
and Perspectives



WIRES
HQ-REAL



MOOG



SUN
SECONDA UNIVERSITÀ DEGLI STUDI DI NAPOLI

IEMA
Impianti Elettrici Macchine Automatiche

Experiment Booster



Adam Schmidt