
# *3rd Annual white paper on the structured dialogue*

***Experiments (EXP)***

3rd Annual white paper on the structured dialogue
Edited by SSSA.
1st Edition, October 2017
ISBN: pending
Funding Project Code: FP7-ICT-2012-601116

# Contents

**Summary**

Focus on application-oriented research and development, ECHORD++ (E++) is been funded by the FP7 for five years to improve and increase the innovation in robotic technology through small-scale projects and a “structured dialogue” incorporating public entities and citizens to the conventional platforms of industry and academia. Three instruments and processes are being developed under the ECHORD++ project: experiments (EXP), research innovation facilities (RIF) and public end-users driving technological innovation (PDTI), all of them improving and increasing the innovation in robotic technology of SMEs companies and addressing answers to societal and industrial needs in different scenarios. E++ will elaborate four Annual White Papers describing the outcomes and results of the project, the tasks of communication and dissemination and the structured dialogue between all the involved stakeholders.
The third Annual White Paper is focused on the EXP process and the lessons learned during the first 36 months of E++. The aim of this white paper is to introduce the experiments instruments that was intended to boost the innovative research in robotic technology thus fostering the collaboration between academia and industries. The experiments aim at developing robotic solutions that could be brought to the market in a short-term prevision.

## 1. Objective and scope

As new branches of robot automation emerge, such as small, lot-size production of variants in SMEs, including such areas as (factory) logistics, recycling, human-care, security, home appliances, edutainment, personal robot companions, etc., radically new designs of robot systems are needed.
With the competition in robotics ever increasing, (especially between Japan and Europe), cutting-edge technology will be the decisive factor which determines success. We believe Europe can achieve the “cutting-edge” advantage through a very close collaboration of robot manufacturers and research institutes.
Thus, the E++ experiments overall objective is to encourage and support Europe’s robot industry to bring technology forward and to build up excellence in well-defined areas.
Whitin the experiments instrument, incentives are provided to encourage European robot manufacturers and research institutes to work together on an operational level, with tangible and measurable results to accelerate the development of technologies and their deployment into new application scenarios.
It is worth saying that the experiments instrument is a well-proven backbone of the ECHORD project and it has been revised and improved in the ECHORD++ project.
The aim of the White Paper is to present the methods through which E++ implemented the instrument of Experiments.
An experiment is a small to medium sized scientific research and/or technology development project carried out by a team of one or more research institutions and robot manufacturers, which typically lasts 18 months. They have clearly defined goals in terms of quantifiable technological advancement in the areas described in the research focus.
Two or more partners collaborate within each experiment. These small projects are expected to result in both tangible and measurable outcomes in terms of the accelerated development of technologies, as well as the deployment of robotics technology into new scenarios for the direct application of the research results.
Each experiment has a funding of 300.000€ given by the ECHORD++ Consortium as a cascade funding structure.

## 2. Experiments process

Different phases have been developed in order to successfully coach, evaluate, select and monitor the 31 funded experiments. The phases are six and are the following (see Figure 1):

- Phase I: Preparatory Activities
- Phase II: Consultation and coaching of experimenting partners
- Phase III: Call Issue
- Phase IV: Evaluation and Selection
- Phase V: Monitoring and Review
- Phase VI: Results Extraction and Exploitation

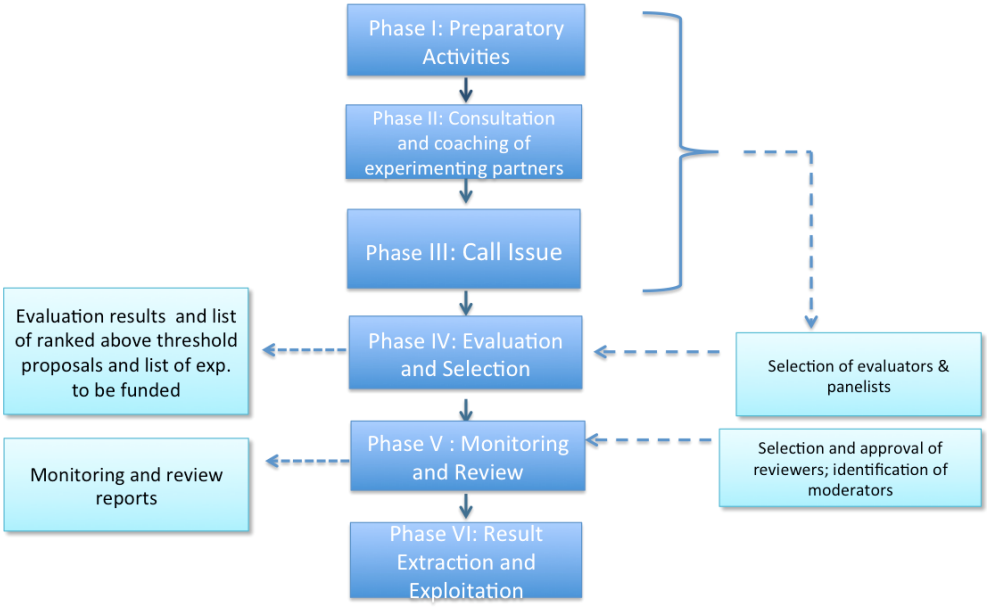


*Figure 1. Experiment Phases*

In the following paragraph the deepen description of each phase.
Two have been the Calls executed in order to fund 31 experiments. Such phases have been executed for each call.

## 3. Phase I: preparatory activities

The preparatory activites aim at improving and optimizing the application and the management processes of the experiments.

### Templates and guidelines

Guidelines and the templates for pre-proposal, proposal, evaluation and correct delivery of the experiment were prepared and delivered (see Figure 2).

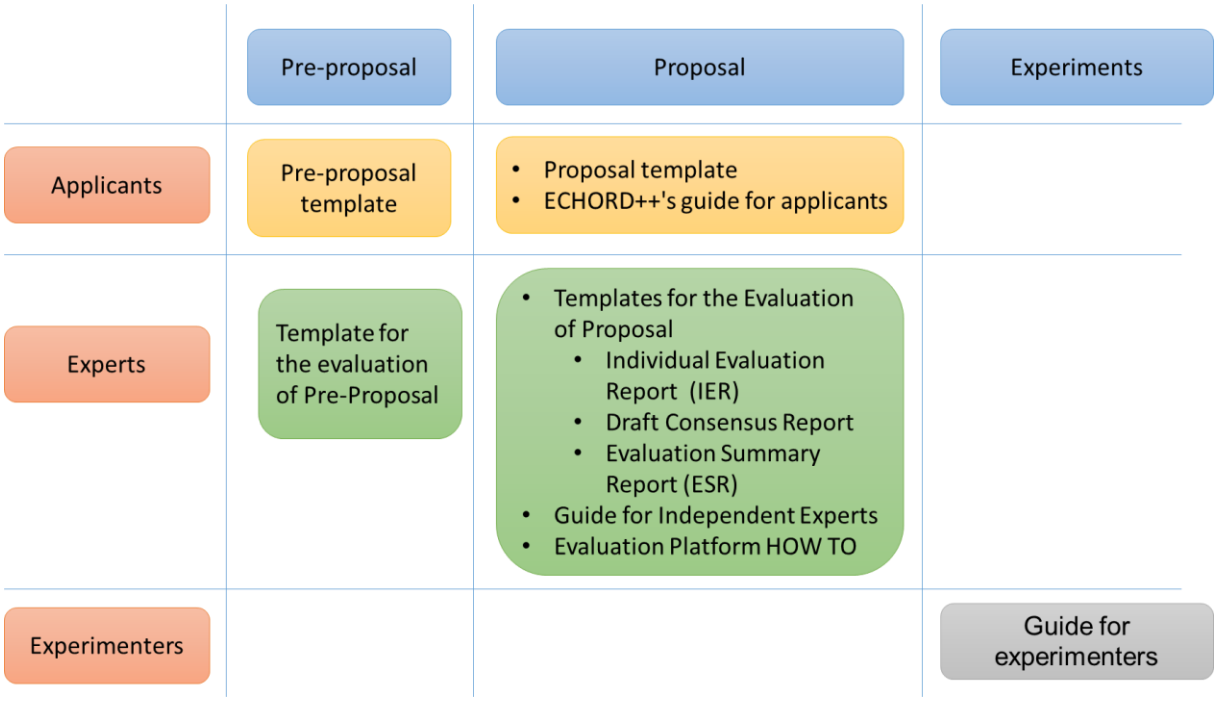


*Figure 2: templates and guidelines prepared*

*Pre-proposal template*

The pre-proposal template is structured as follows:

1. proposal title,
2. choice on scenario/research foci,
3. general description of the objective,
4. description of the consortium,
5. type of experiment chosen,
6. technical/scientific work information,
7. commercialization plan,
8. expected impact,
9. dissemination activities.

*Proposal template*

The proposal template is obtained through a more structured division and adding sub-paragraph such as "Concept, methodology and associated work plan", "Expected results" and "Exploitation plan of experiments results and management of knowledge and of intellectual property", with requirements as "Proofs-of-concept, prototypes, products" and "Dissemination plan of experiment results".

With respect to ECHORD project, more attention is given to define the key parameters to select most successful proposals.

In addition, the instrument of RIF is defined as one indicator to assess the impact and the feasibility of the experiments.

Videos and any multimedia material are required as mandatory proof of "transfer output".

As a consequence, the templates are modified accordingly in order to include a plan for dissemination and outreach activities and description of impact and bring-to-market process.

Finally, the proposal template is structured as follows:

1. Scientific and technological quality (limit: 8 pages):
    a. Experiment objective,
    b. Progress beyond the current state of the technology,

    c. Concept, methodology, and associated workplan,
        i. Task list,
        ii. Description of individual tasks,
        iii. List of deliverables,
        iv. Summary of experiment effort,
        v. List of milestones.
2. Impact (limit: 4 pages):
    a. Expected results,
    b. Proofs-of-concept, prototypes, products,
    c. Exploitation plan of experiment results and management of knowledge and of IP,
    d. Dissemination plan of experiment results.
3. Implementation (limit 3 pages):
    a. Individual participants,
    b. Description of the consortium,
    c. Overall experiment resources- costs and funding.

*Guide for applicants*

The development of ECHORD++'s guide for applicants has seen different steps:

1. The addition of a Glossary of Terms at the beginning of the document, to help applicants to go through the text and to fix the main concepts,
2. A general update of the information (new scenarios and research foci and evaluation criteria) and the addition of the new ECHORD++ instruments (i.e.: RIFs),
3. A shorter background description through the differentiation in different paragraphs on: General information, Types of Experiment, Scenarios and Research Foci,
4. The description of Scenarios, Research Foci and RIFs is just briefly reported in the main contents since wider information are provided in three different Annexes,
5. The addition of the description of the link between Experiments and RIFs to help the comprehension of the RIFs' scope in the experiment process.

The final aim was to provide a clear set of instructions in order to receive optimal proposals.

Three documents were developed to support Phase IV (selection and evaluation):

1. the template for the evaluation of Pre-Proposal,
2. the templates for the Evaluation of Proposal,
3. the Guide for Independent Experts.

*Pre-proposal evaluation template*

In order to facilitate a correct and effective evaluation of pre-proposals, the template to be fulfilled by the evaluators is structured with specific questions that matched the ones asked to applicants in the pre-proposal form. In order to help evaluators to give a clear, strict and homogeneous feedback, suggested answers are provided too.

Once collected the answers, the evaluator is required to submit the feedback (within 5 business days) following a suggested template form:

*Dear*
*Please find below the comments of the ECHORD++ team on your pre-proposal*
*Please note that this is a feedback service to check whether the idea and the concept fit into ECHORD++'s scope. It is not a first application stage nor has the handing in of a pre-proposal any influence on the actual evaluation, the full proposals will be evaluated by independent experts.*
*XYZ: *collect the answers reported in red*

*Kind regards,*
*The ECHORD++ Team*

*Proposal evaluation templates*
The templates for the evaluation of proposals are divided in three: an Individual Evaluation Report (IER), who is developed by answering to five questions for each Section (Scientific and/or technological Excellence, Impact and Implementation); a Draft Consensus Report, which is a document filled by the rapporteur as summary of the result of the individual evaluations (IER) and it is structured as the summary of the arguments of each evaluator for each section and the Evaluation Summary Report (ESR), which is developed by the rapporteur, summarizing the views of the evaluators.

The Individual Evaluation Report (IER) is obtained by answering the following questions for each section:

1. **Scientific and/or technological excellence**, relevant to the scenario and research focus. This is intended to measure the degree of innovation. The guiding questions for this criterion are:
   - Are the **objectives** of the proposal **stated in a clear way**?
   - Will there be **progress beyond the state of the art** with respect to already existing products? Is the expected outcome of the experiment innovative?
   - Will this research **improve the quality, functionality or performance of the products** already available in such a way that the proposed effort can be justified or can it – finally – lead to new types of products?
   - Does the description of the project **fit with one of the given scenarios** as in the Guide for Applicants? If another scenario is closer to the proposed work, the most suitable one should be used as a basis and this should not influence the score.
   - Does the description of the project fit one of the **research foci** as outlined in the Guide for Applicants?
2. **Quality and efficiency of the implementation and the management**. This is intended to measure the appropriate allocation of budget and resources. The guiding questions for this criterion are:
   - Are the **proposers qualified** by their past experience and/or reputation to carry out the proposed work?
   - Are the roles of the partners clearly defined, given their individual competences?
   - Is the **promised outcome realistic** with respect to the effort and money to be spent ("value for money"), and with respect to the proposed experiment duration?
   - Are there **risks in the proposed work** that the proposers may not be aware of and that may compromise the success of the experiment?

- Is the indicated **budget reasonable**? Is the project plan clear, are resources clearly allocated and are milestones and deliverables clearly defined?

3. **Potential impact through the development, dissemination and use of project results**. This is intended to measure the effectiveness of the technological transfer and the impact on the market created by the experiment when successful. The guiding questions for this criterion are:

- Do experimenters have a plausible a way to **measure impact and success**? Are **specific Key Performance Indicators** proposed that will enable this to be assessed? Is the experiment target coherent with (known) roadmaps of robot manufacturers and/or the EU's strategic agenda? Will this impact be sustainable, given the reputation of the proposers and their "market power"? Indicators could be: Expected impact on the market created by the experiment when successful, demonstrated by means of market screening, competitive position, etc. including description of measures of impact and success.
- Will the experiment lead to a **bi-directional technology exchange** between manufacturers and research organizations? What is the quality of the exploitation plan with economic potential?
- Is the **work-plan of the proposal appropriate** with respect to timing, distribution of work between the partners, tasks, milestones and deliverables?
- What is the **quality of the dissemination plan** describing measures and target audiences, e.g. presence at fairs, association meetings, creation of multimedia material, scientific papers, articles in industrial magazines? How widely and openly will the research results be disseminated? Are the foreseen dissemination channels (journal publications, workshops, etc.) adequate to promote the expected results of the research among the target groups (robot manufacturers, system integrators end customers, research organizations)? Measures should address the full range of potential users and uses, including research, commercial, social, environmental, contribution to standards. Examples are publication of research papers, commitment of a robot manufacturer to use the work in their future product program.
- RIF[1] planning: The realistic outcome can be proven by a visit to a RIF (or by another demonstration). It states that:
    - the proposal fits in one or more RIFs and the proposer is willing to use one of them;
    - the proposal fits in one or more RIFs but the proposer is not willing to use any. In this case the proposer should indicate in which way same level of impact will be reached;
      the proposal does not fit in any of E++'s RIFs. In this case, it has to be stated that there is no possibility to use a RIF – and why. If RIF use is not intended the proposer should state how the same impact as with RIF usage can be reached.

*Guide for Independent Experts*

The development of ECHORD++'s Guide for Independent Experts has seen different steps:

1. The addition of a Glossary of Terms at the beginning of the document, to help evaluators to go through the text and to fix the main concepts
2. A general update of the information (new scenarios and research foci, timeline and evaluation criteria)

[1] RIF descriptions can be found at http://echord.eu/index.php?id=6

3. A review of the Evaluation process workflow and the following evaluation documents (Individual Evaluation Report; Draft Consensus Report; Evaluation Summary Report)
4. An explosion of sub paragraph to describe singularly the different aspects and procedures such as: "Direction for Comments", "Direction for Scores" (in ECHORD under the paragraph "Direction for Evaluations of Individual Criteria"), "Conditions to involve a third Evaluator" (in ECHORD under the paragraph "Obtaining the scores"), "Rules for Conflict of Interest" (in ECHORD under a separate Annex)

Finally, the guide for independent experts is structured as follows:

1. An initial glossary of terms
2. An introduction on the project and the final aim of the call
3. Description of the evaluation process
    a. Evaluation steps
    b. Evaluation criteria
    c. How to score
    d. Directions for rapporteurs
    e. Obtain the final scores
    f. Conditions to involve a third evaluator
    g. Rules for Conflicts of Interest
    h. Evaluation timing

*Evaluation platform: HOW TO (for experts)*

The experts are provided also of a guide to correctly use the web-based evaluation platform. The guide describes the web platform functionality in order to implement the evaluation of proposals. It is structured as follows:

1. An initial summary of the evaluation process and deadlines
2. Instructions on how to access the proposals
3. Description of the independent evaluation
    a. Evaluator role
    b. Rapporteur role
4. Description on how obtain consensus
5. Description on how accept consensus

Screenshots of the web platform functionalities are provided in order to support the description.

*Guide for Experimenters*

The experimenters, once funded, receive a Guide for Experimenters to explain the experiment monitoring and reporting activities required by the project. The guide also contains the description of the experiments web platform and information on how to use it correctly.

The guide is structured as follows:

1. Description of the scope of the guide
2. Description of the monitoring and reporting activities
3. Technical HOW TO use the web platform
    a. How to log in
    b. How to select the experiment section
    c. Description of the experiment dashboard
    d. How to enter data for a monitoring period
    e. How to fill in the report

**Database**
Three databases were set up to disseminate the opportunity of E++ project: one for potential applicants (1386 contacts), one for manufacturers (136 contacts) and one for independent experts (366 contacts). A big effort was due to create a solid evaluators' list. Starting from ECHORD's one, in the first Call 43 industrial and 11 research experts have been contacted while in the second Call other 7 industrial and 3 research experts have been added.

**Manufacturer list**
As in ECHORD, manufacturers were asked to offer hardware at special prices for E++ activities. This list was published, but there has not been systematic handling of hardware purchase. The reasons are the huge amount of issues with depreciation and the relative high volume of non-list-equipment that ECHORD experienced. But in order to facilitate the purchase of standardized hardware, the product "catalogue" has been uploaded and updated in E++'s website just for registered users.
The total number of offers received was 76 in categories such as: robotic arms with different payload, mobile platforms, parallel kinematics, controller hardware (if not included in robot), sensor equipment and software.

**Evaluators contract**
For each evaluator, a web based expertise profile has been developed in order to facilitate the matching with the proposals and obtain an appropriate assignment. The expertise profile has been obtained from keywords provided by each of them when registering on the evaluator's portal.
Once the assignment is completed, an email is sent to all evaluators acting as a contract request with the following attachments:

- Guide for Independent Experts: guidelines to be followed in order to develop a proper evaluation,
- Conditions of Appointment: information about Conflict of Interest and Code of Conduct for Independent Experts,
- Reply form of acceptance: form to be signed by each expert in order to be legally authorized to develop the assigned evaluations,
- Appointment Letter: letter signed by the WP leader (Prof. Paolo Dario) attesting the request to act as evaluator for the reported proposals assigned to each expert.

Only once received the signed reply form and downloaded both the "Guide for Experts" and the "How to" guidance to use the website, the expert had the access to the proposals assigned to him.

## 3. Phase II: Consultation and coaching of experimenting partners

In the second phase, contacts collected in the database were contacted through emails in order to first present ECHORD++ and then ask for their participation/contribution.
A team of customer service was developed with the aim to answer potential applicants' questions through phone and email.
In addition, in order to help potential applicants, common raised questions were collected and whose answers published on the web site in the "Frequently Asked Questions" section.

## 4. Phase III: Call issue

Phase III concerns the call issue.
In E++ the call text provides information about the opening and the deadline of the call, the definition of experiment, the scope, the list of scenarios and the website link in which find more information.
The Call 1 was opened on the 3.3.2014 and the deadline was on the 14.4.2014, 17:00 Brussels time and it was published in the following newspapers:

- Gazeta Wyborcza (Poland), 3rd March 2014
- EXPANSION (Spain), 3rd March 2014
- Les Echos (France), 4th March 2014.

It was also published in the magazine "the Engineer" (UK) on March 10th, 2014.
The Call 2 was opened on the 4.5.2015 and the deadline was on the 23.6.2015, 17:00 Brussels time. The call was published in the following media:

- Lietuvos Rytas (Lithuania) 12.05.2015
- Pravda (Slovakia) 12.05.2015
- Novi List (Croatia) 12.05.2015

It was also published in the magazine "EE times" (UK) in the May 15 issue as well as trough the typical mailing lists such as eurobotics-dist, social networks, especially LinkedIn, and through the ECHORD++ web site.
Call 1 resulted in 137 eligible proposals, while Call 2 in 114.

## 5. Phase IV: Evaluation and selection

The evaluation of Pre-Proposal is developed internally among the Core Consortium based on the competence of each member.
Each pre-proposal is evaluated by one member through the template developed in Phase I. A formal response has been provided within 5 business days.
The chance to submit the pre-proposal was given just in the first 3 weeks of the call and it was not mandatory but a service to support applicants and improve their proposals.

The workflow of the Evaluation of Pre-Proposal is shown in Figure 3

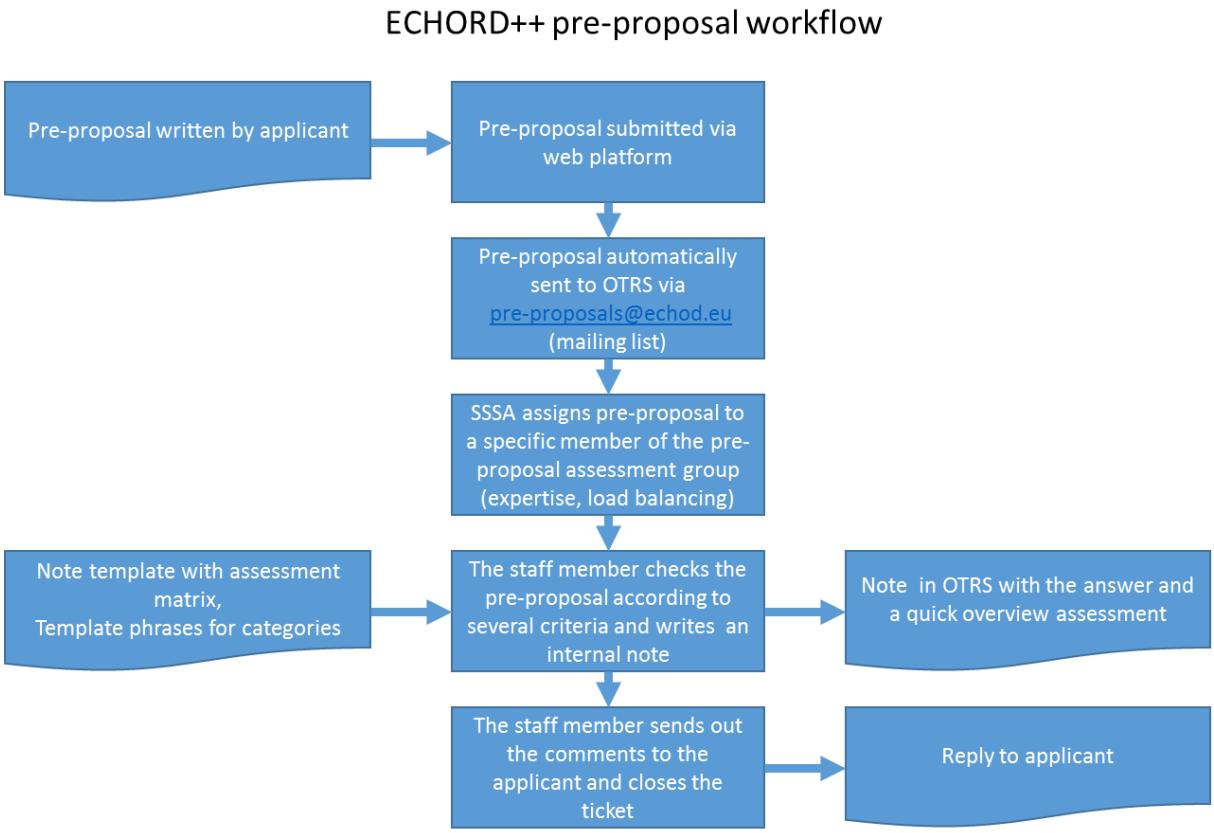


*Figure 3: Pre-Proposal Workflow*

The evaluation of proposals is composed by different steps, see Figure 4. For each proposal, two evaluators and one moderator (called “rapporteur”) are assigned, starting from the database of experts developed in Phase II. The assignment is based on the evaluators' expertise profile that had to match with the scenario and application of the proposal.

The evaluation process has been developed in 3 steps:

1. Step1: a remote evaluation, in which the full proposal is evaluated by two anonymous independent experts who have to provide two individual evaluation reports (IER). The two IER's arguments have then to be converted into Individual Provisional Marks and compared. In contentious evaluations, with remarkable differences between experts’ opinions, the rapporteur has to develop a third evaluation, compiling his own IER. In the end, the arguments of all three evaluators have to be combined.

2. Step 2: the provisional marks are computed by the rapporteur as a result of argument counts of the 2 (or 3) IERs, and reported in a Consensus Draft. Consequentially, there is a Consensus Blog discussion between the rapporteur and the evaluators in which the provisional marks are turned into a final score. The final marking is based too on the comments of the evaluators made on the appropriate *Consensus Blog* via web platform and not on the arithmetical mean of the argument counts. The evaluators explicitly agree on the final mark for each criterion and consensus report. This report is then sent to the proposers after the evaluation phase. The rapporteur is in charge of writing a consensus report (Evaluation Summary Report, ESR), summarizing the views of the evaluators.
3. Step 3: once all the evaluations are completed and the ESRs ready, an on-site panel meeting has to take place, where a ranking of the proposals is established and the scores of the proposals calibrated. The panel meeting is held with a subset of experts who have acted as evaluators and/or rapporteurs. The final ranking has to be approved by the European Commission.

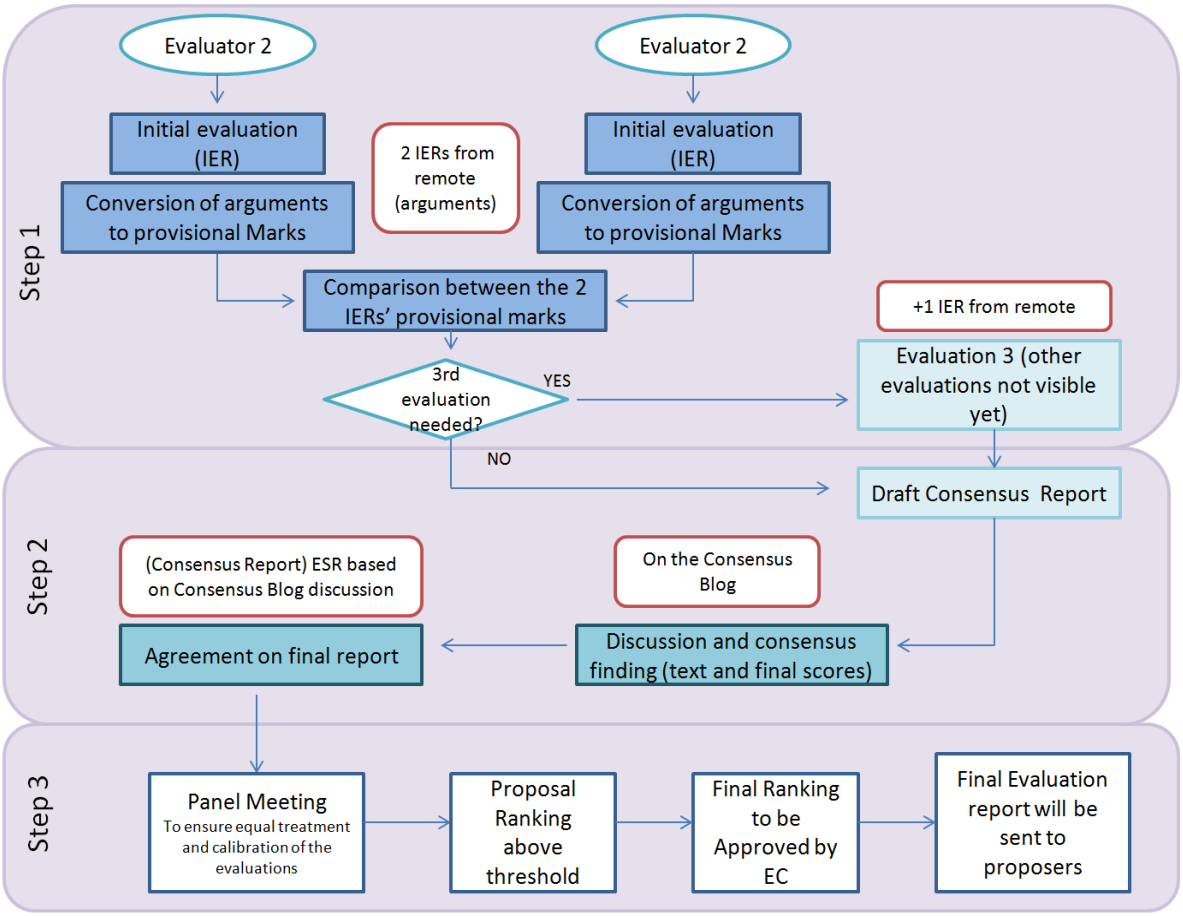


*Figure 4. ECHORD++ Evaluation Process Workflow*

The proposals are evaluated by experts on the basis of three criteria:

1. Scientific and/or technological excellence relevant to the scenario and research focus.
2. Quality and efficiency of the implementation and the management.
3. Potential impact through the development, dissemination and use of project results.

For each criterion, a score from 0 (lowest) to 5 (highest) is assigned, half points are also allowed. The threshold for possible funding is 3 in each criterion, with the sum of all three marks not being less than 10.
The panel decides to use the following rules in the prioritizing procedure of the proposals:

(a) Proposals are ranked by higher total score.
(b) When there are an equal total score, groups of proposals with the same total scores are to be formed.
(c) Within each group, the proposals are ranked by higher score for criterion 3, i.e. impact. As this issue is especially important in the ECHORD++ experiment scheme, the experts are asked to have a very close look at the expected exploitation, which includes the “transfer excellence” and a potential route to the market.
(d) When, within a batch, there is an equal score for criterion 3 between the proposals, the proposals are ranked by higher score for criterion 1, i.e. scientific and/or technological excellence.
(e) For proposals in the same group and with equal scores on all criteria, the panel decides in a comparative manner, based on the nature of the proposals’ topics. The main aspects of the proposals are carefully analyzed to assess the match of the proposal’s goals with the ECHORD overall goals and the panel agreed on their relative order in a consensual way.

These rules are applied in consecutive order until the final prioritization is achieved. This procedure is usually only applied to proposals that scored above thresholds. In the following, proposals with 10.0 or more points, but with one or more criterion failing the individual threshold of 3.0 are not listed.
A proposal will only be considered eligible if it meets all of the following conditions: (i) it is received before the deadline given in the call text, (ii) template and web forms (all sections!) are completed. The proposal must be submitted by legal entities which have been established in one of the member states of the EU or in an associated country.

## 6. Phase V: Monitoring and review

The monitoring of the experiments is developed by two moderators that belong to the Core Consortium: one technical and one managerial for each experiment. The technical moderator has to check the technical progress of the experiment, ensure the correct adherence to the agreed activity plan and support the experimenters when technical issues arise. The managerial moderator has to keep track of the deadline in providing deliverables, bi-monthly self-assessments and KPIs.
One of the lessons learned from the previous ECHORD project was the importance of impact creation that can be significantly improved by a structured approach. Therefore, the monitoring procedure was revised and improved by adding technical and impact-related Performance indicators (KPIs), which were jointly defined within ECHORD++ core staff and the experiment partners for each single experiment.
Additionally, ECHORD++ core staff has been supporting the experiments selecting the right communication channels and events with a special focus on the expected impact for each single experiment.
Every two months, the experimenters are asked to report about the recent progress, through the monitoring platform. This is not intended to be in the form of lengthy reports, but rather in form of images, videos, drawings, etc. The experiments are also asked to provide:

1. Deliverables
2. Justifications to the completed milestones
3. Justifications to the completed technical, dissemination or impact related KPI

The experimenters are strongly encouraged to provide videos and any multimedia material.
After each bimonthly self-assessment a telco is usually set for each experiment in order to discuss with the two assigned moderators the progresses, the criticality and clarify the use of the portal.
The progress of each experiment is then mapped through bimonthly traffic lights that set their developments in the different areas, see Figure 5.

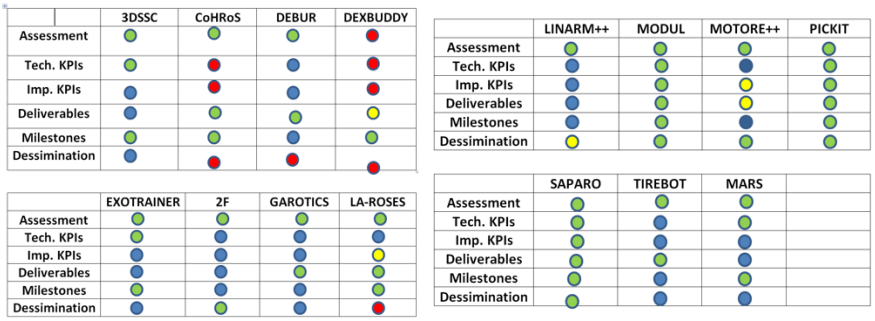


*Figure 5. One of the 11 bimonthly tables that collect the information of each experiment on different fields: self assessment, technical KPIs, Impact KPIs, Deliverables, Milestones and Dissemination KPIs.*

The “one page overview” sheet immediately delivers a top view of all experiments and “red”, “yellow” and “green” areas of all the experiments are easily identified.
For the underperforming experiments different actions were taken such increase the number of teleconference calls or set a Mid Term Review with external experts.

## 7. Phase VI: Results extraction and exploitation

Each experiment ends with a Final Review Onsite.
For each Review two experts has to evaluate the project: one external and one internal of the Consortium of E++. Prior the onsite review, every experiment has to develop a Final Report and a questionnaire in order to provide information on the value chain developed, as requested by the reviewer, and having the following information: TRL, number of patents, number of jobs created, turn over from the experiment, applications in number of other areas.
The evaluators, prior the onsite review, must have studied the project and all the material produced by the experimenters. During the review, they have to actively participate and provide two evaluation documents: one specific on the quality of deliverables, milestone, KPIs; one general recommendation of the project.

## 8. Numbers of Call I and Call II

### Proposal

In Call 1 137 proposals have been received, while in Call 2 114.
In Call 1 31% of organizations that have been funded were SMEs, whose number increased in Call 2 up to 38% (see Figure 6).

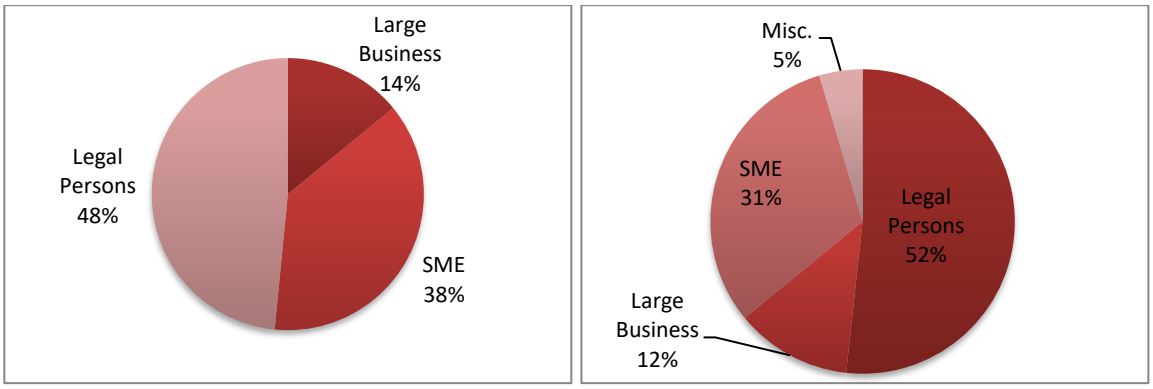


*Figure 6: Organizations distribution of proposal received: Call 1 (on the left) and Call 2 (on the right).*

In Call 1 the countries that applied most were Italy, Germany and Spain while in Call 2 Italy, France, Spain and UK (see Figure 7).

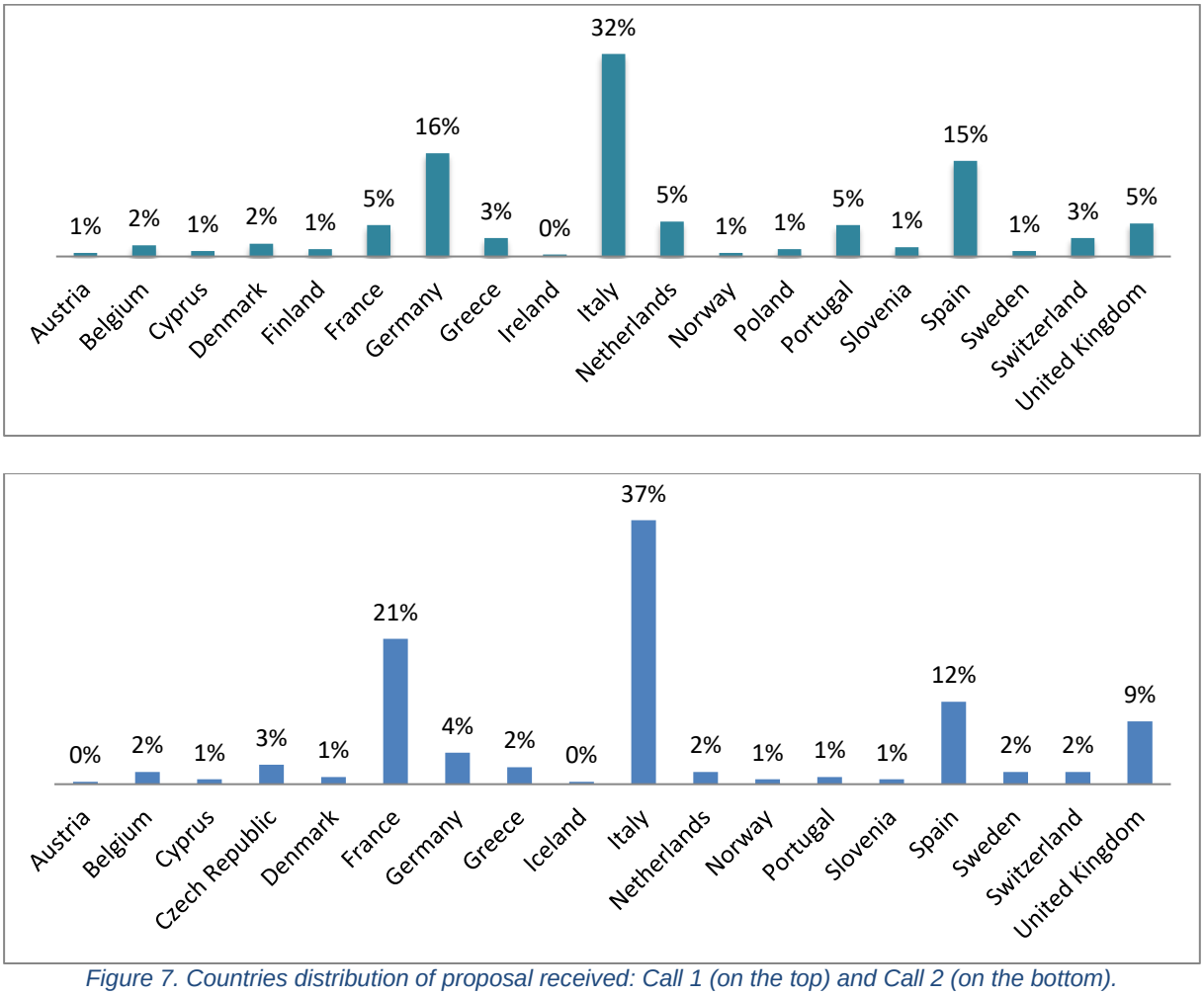


*Figure 7. Countries distribution of proposal received: Call 1 (on the top) and Call 2 (on the bottom).*

**Evaluators**

Of the almost 400 experts contacted, in 54 acted as experts in Call 1, while in 37 in Call 2.

The background distribution of the evaluators is reported in Figure 8, increasing the percentage of Industry background of 10% compared to the First Call. Note that some of the experts from academia had an industry-related background.

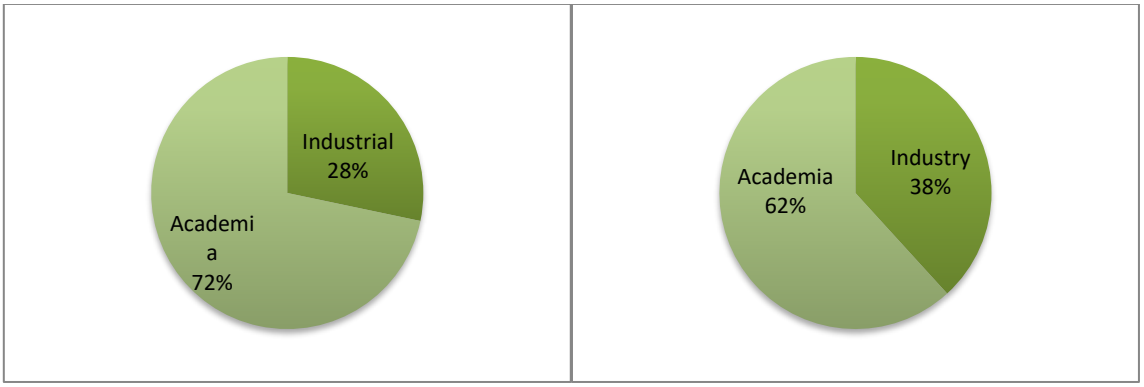


*Figure 8. Background distribution of evaluators: Call 1 (on the left) and Call 2 (on the right).*

In call 1 the assignment of mixed experts (meaning at least one industrial and two academics) was of 66% and increased to 87% in Call 2. The other 13% was assigned to academic experts in which at least one of the three experts had industrial competences (see Figure 9).

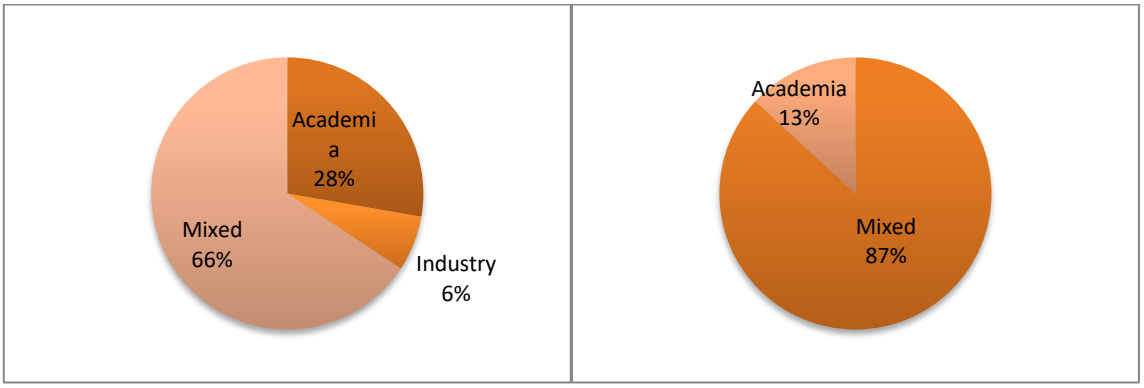


*Figure 9. Proposal assignment distribution of evaluators: Call 1 (on the left) and Call 2 (on the right).*

**Experiments selected/founded**

In Call 1, 16 proposals were selected for funding. 8 out of the 16 selected proposals addressed the General Purpose Robotic co-workers, 3 proposals the Medical Robotics scenario, 3 proposals the Agricultural and Food robotics scenario, and 2 the Cognitive Tools and workers for Cognitive Factories scenario (Figure 10, left). In Call 2, 16 proposals were selected for funding where 4 addressed the General Purpose Robotic co-workers, 4 proposals the Agricultural and Food robotics scenario, 5 the Cognitive Tools and workers for Cognitive Factories scenario and 3 Cognitive Logistics Robots, demonstrating a more balanced results compared to Call 1 (where General purpose had 50%, Agricultural and Food robotics had 19%, Cognitive Tools and workers 13% and nobody chose Cognitive Logistics Robots). No experiments address the Medical Scenario, either the Urban Scenario (Figure 10, right).

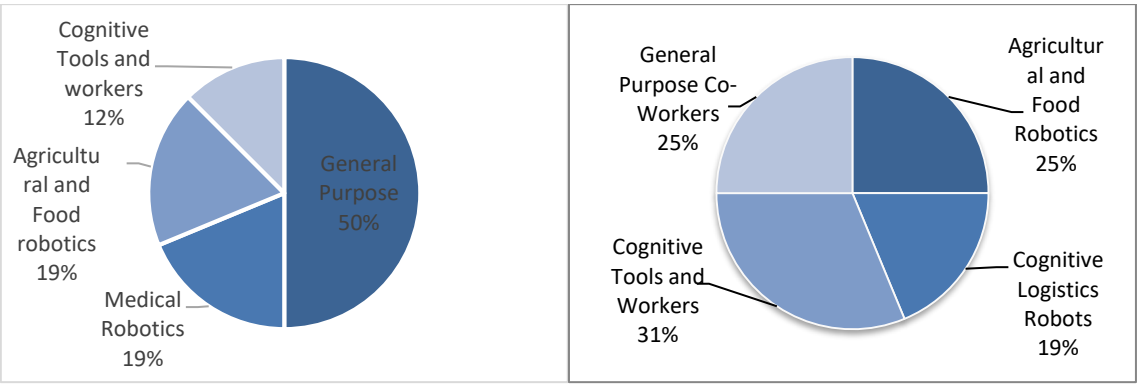


*Figure 10. Scenarios distribution of selected experiments: Call 1 (on the left) and Call 2 (on the right).*

While in Call 1 SMEs represented the category most selected (43%) in Call 2 Legal person (meaning research institutes, foundations, etc..) resulted to be the most prominent presence (Figure 11).

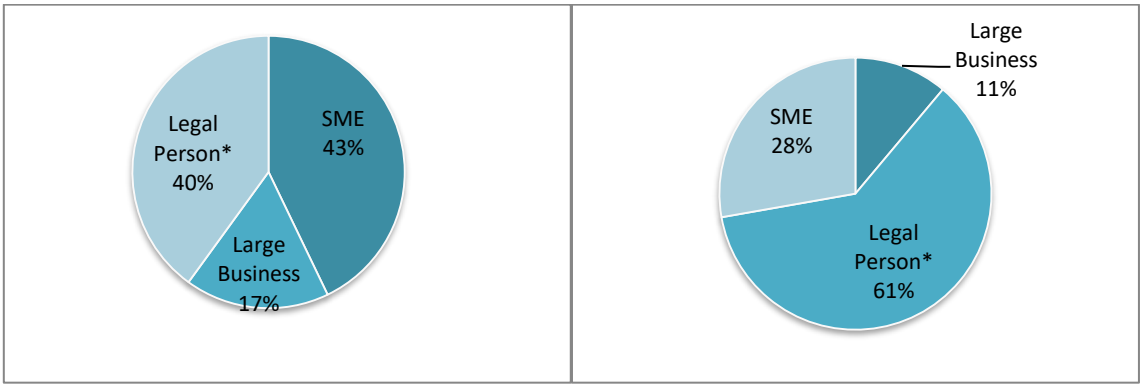


*Figure 11. Organizations distribution of selected experiments: Call 1 (on the left) and Call 2 (on the right).*

The selected proposals of Call 1 are presented in Table 1 (in alphabetical order).

| **Name of the Experiment** | **Organizations** | **Country** | **Scenario** |
|---|---|---|---|
| 2F | IMER INTERNATIONAL SPA<br>RoboTech srl | Italy<br>Italy | General Purpose Robotic co-workers |
| 3D Smart Sense and control | Flexible Robotic Solutions<br>KU Leuven | Belgium Belgium | Agricultural and Food robotics |
| CoHRoS | Bielefeld University<br>Carl Cloos Schweißtechnik GmbH | Germany<br>Germany | General Purpose Robotic co-workers |
| DEBUR | Aluminio Inyectado ALIASA S.L.<br>Organization of Alberto Tellaeche | Spain<br>Spain | Cognitive Tools and workers for Cognitive Factories |
| DEXBUDDY | AEA srl – Loccioni<br>ArtiMinds Robotics GmbH<br>KIT - Humanoids and Intelligence Systems Lab<br>Shadow Robot Company | Italy<br>Germany<br>Germany<br>United Kingdom | General Purpose Robotic co-workers |
| EXOTrainer | Agencia Estatal Consejo Superior de Investigaciones Cientificas<br>Hospital Sant Joan de Deu (HSJD) | <br>Spain<br>Spain | Medical Robotics |

| | | | |
|---|---|---|---|
| | Marsi Bionics | Spain | |
| GAROTICS | C.WRIGHT & SON GEDNEY LTD<br>Organization of Jörn Strauß<br>Universität Bremen | United Kingdom<br>Germany<br>Germany | Agricultural and Food robotics |
| LA-ROSES | CNR - Istituto di Fisica Applicata "Nello Carrara"<br>Ekymed Spa<br>Fastenica Srl | Italy<br>Italy<br>Italy | Medical Robotics |
| LINArm++ | Ecole Polytechnique Federale de Lausanne<br>Idrogenet Srl<br>National Research Council of Italy<br>University of Ljubljana | Switzerland<br>Italy<br>Italy<br>Slovenia | General Purpose Robotic co-workers |
| MARS | AGCO GmbH<br>Hochschule Ulm | Germany<br>Germany | Agricultural and Food robotics |
| MODUL | CDD M.E.P.E.<br>ETH Zurich | Greece<br>Switzerland | General Purpose Robotic co-workers |
| MOTORE++ | FABRICA 136<br>Humanware Srl<br>RoboTech srl | Italy<br>Italy<br>Italy | Medical Robotics |
| pickit | FhG - Fraunhofer IFF<br>Scape Technologies A/S | Germany<br>Denmark | Cognitive Tools and workers for Cognitive Factories |
| ROAR | ETH Zurich<br>Skybotix AG | Switzerland<br>Switzerland | General Purpose Robotic co-workers |
| SAPARO | FhG - Fraunhofer IFF<br>Pilz GmbH & Co. KG | Germany<br>Germany | General Purpose Robotic co-workers |
| TIREBOT | CORGHI S.P.A.<br>UNIVERSITA DEGLI STUDI DI MODENA E REGGIO EMILIA | Italy<br>Italy | General Purpose Robotic co-workers |

*Table 1. Selected proposals Call 1 ECHORD++ experiments*

In Call 2 the majority of the proposals showed a good scientific and/or technological quality (average 4,47/5, compared to 4,2/5 of Call 1), and even the average scores for the other criteria shows a high-quality level (4,25/5 for the Quality score, compared to 4,167/5 of Call1 and 4,44/5 for Impact score compared to 4,067/5 of Call 1). This proves that the chosen format of proposals allows for a lean and precise description of experiments, and the impact end exploitation descriptions have improved compared to the first call.

The selected proposals with the partners, the chosen scenario and country of provenience are shown in the Table2:

| **Name of the Experiment** | **Organizations** | **Country** | **Scenario** |
|---|---|---|---|
| INJEROBOT | Ingro maquinara SL<br>Robotnik Automation S.L.L.<br>Foundation for Agricultural Auxiliary Technologies | Spain<br>Spain<br>Spain | Agricultural and Food robotics |
| FlexSight | IT+ROBOTICS SRL<br>ROBOX S.P.A.<br>Sapienza Università di Roma | Italy<br>Italy<br>Italy | Cognitive Logistics Robots |
| SAGA | Consiglio Nazionale delle Ricerche<br>Avular<br>Wageningen University | Netherlands<br>Italy<br>Netherlands | Agricultural and Food robotics |

| | | | |
|---|---|---|---|
| MAX ES | INSTITUT DE RECHERCHE TECHNOLOGIQUE SYSTEMX<br>ECA ROBOTICS<br>Aluminium Pechiney | <br>France<br>France<br>France | Cognitive Logistics Robots |
| AAWSBE1 | Organization of Bridget Hallam<br>Refind Technologies<br>Averhoff A/S | Denmark<br>Sweden<br>Denmark | Cognitive tools and workers |
| WIRES | I.E.M.A. s.r.l.<br>DEI - Università di Bologna<br>Second University of Naples (SUN) | Italy<br>Italy<br>Italy | Cognitive tools and workers |
| Keraal | CENTRE HOSPITALIER REGIONAL ET UNIVERSITAIRE DE BREST<br>Telecom Bretagne<br>Generation Robot | <br>France<br>France<br><br>France | General Purpose |
| SAFERUN | PREGEL SPA<br>Elettric 80 S.p.a.<br>Università degli Studi di Parma | Italy<br>Italy<br>Italy | Cognitive tools and workers |
| DUALARM-WORKER | AIRBUS OPERATIONS SL<br>TECNALIA RESEARCH and INNOVATION<br>CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE | Spain<br><br>France<br><br>Spain | Cognitive tools and workers |
| RadioRoSo | Universita Degli Studi Di Genova<br>Centre for Research and Technology Hellas<br>National Radiation Protection Institute<br>Ansaldo Nuclear Engineering Services Limited<br>Ceske vysoke uceni technicke v Praze | Greece<br>Czech Republic<br>Italy<br>United Kingdom<br>Czech Republic | Cognitive tools and workers |
| HOMEREHAB | Instead Technologies for Helping People<br>CENTRO DE ESTUDIOS E INVESTIGACIONES TECNICAS<br>MIGUEL HERNANDEZ UNIVERSITY OF ELCHE | Spain<br>Spain<br>Spain | General Purpose |
| FASTKIT | CENTRE NATIONAL DE LA RECHERCHE SCIENITIFIQUE<br>INSTITUT DE RECHERCHE TECHNOLOGIQUE JULES VERNE | France<br>France | Cognitive Logistics Robots |
| CoCoMaps | Icelandic Institute for Intelligent Machines<br>Communicative Machines | United Kingdom<br>Iceland | General Purpose |
| GRAPE | Politecnico di Milano<br>FUNDACIAO PRIVADA ALIRA<br>VITIROVER | Italy<br>Spain<br>France | Agricultural and Food robotics |
| CATCH | Fraunhofer Institute IPK-Berlin<br>Leibnitz-Institut ATB Potsdam-Bornim<br>AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÃƒÂ• FICAS | Germany<br>Germany<br>Spain | Agricultural and Food robotics |
| HyQ-REAL | Fondazione Istituto Italiano di Tecnologia<br>MOOG Controls | Italy<br>United Kingdom | General Purpose |

*Table 2 Selected proposals Call 2 ECHORD++ experiments*

**Results extraction**

This paragraph relates to Call 1 results only since Call 2 is still in progress.
In Table 3 is reported a clear picture on the final evaluation provided by the evaluators for each experiments of Call 1.

| | Milestone | Deliverable | Technical KPIs | Impact KPIs | Dissemination KPIs |
|---|---|---|---|---|---|
| TIREBOT | | | | | |
| MOTORE++ | | | | | |
| LINARM++ | | | | | |
| LA ROSES | | | | | |
| GAROTICS | | | | | |
| MARS | | | | | |
| PICKIT | | | | | |
| SAPARO | | | | | |
| 3DSSC | | | | | |
| 2F | | | | | |
| DEBUR | | | | | |
| COHROS | | | | | |
| DEXBUDDY | | | | | |
| EXOTRAINER | | | | | |
| MODUL | | | | | |

*Table 3. Global picture on the final outcome from the experiments. Green light means a successful evaluation, a yellow traffic light refers to an outcome slightly under the expectations and a red light is for results significantly under the expectations. The evaluation of each parameter is based on the average of each item, so that a green is obtained when the majority of the evaluation of each parameter is green, thus a yellow and a red light (i.e.: if 6 deliverables out of 10 have been evaluated green, the final evaluation of the voice "Deliverables" is green). Exceptions are the following: even though the majority of the lights were green, a final yellow light has been assigned in these two conditions: if there is at least one red light; for dissemination KPIs, if no website has been developed (since it was mandatory).*

The final outcome shows that 12 experiments out of 15 (one experiment withdraw the fundings because of internal issue) were successful while La Roses, Cohros and Dexbuddy performed significantly under the expectations.
The majority of the experiments (39%) claimed to have reached a TRL7, while the 25% reached TRL 5, and 19% TRL 6, see Figure 12.

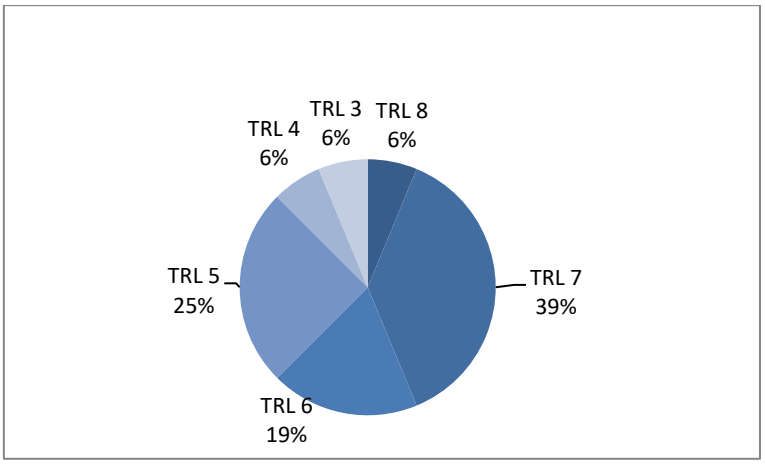


*Figure 12. Distribution of TRL at the end of Call 1 experiments.*

The 87% of the experiments will increase the TRL in two Years. Among them 31% will arrive at TRL 9 and the 31% at TRL 8. An overview of the TRL status (at the beginning of each project, at the end and in the next 2 years) is provided in Figure 13.

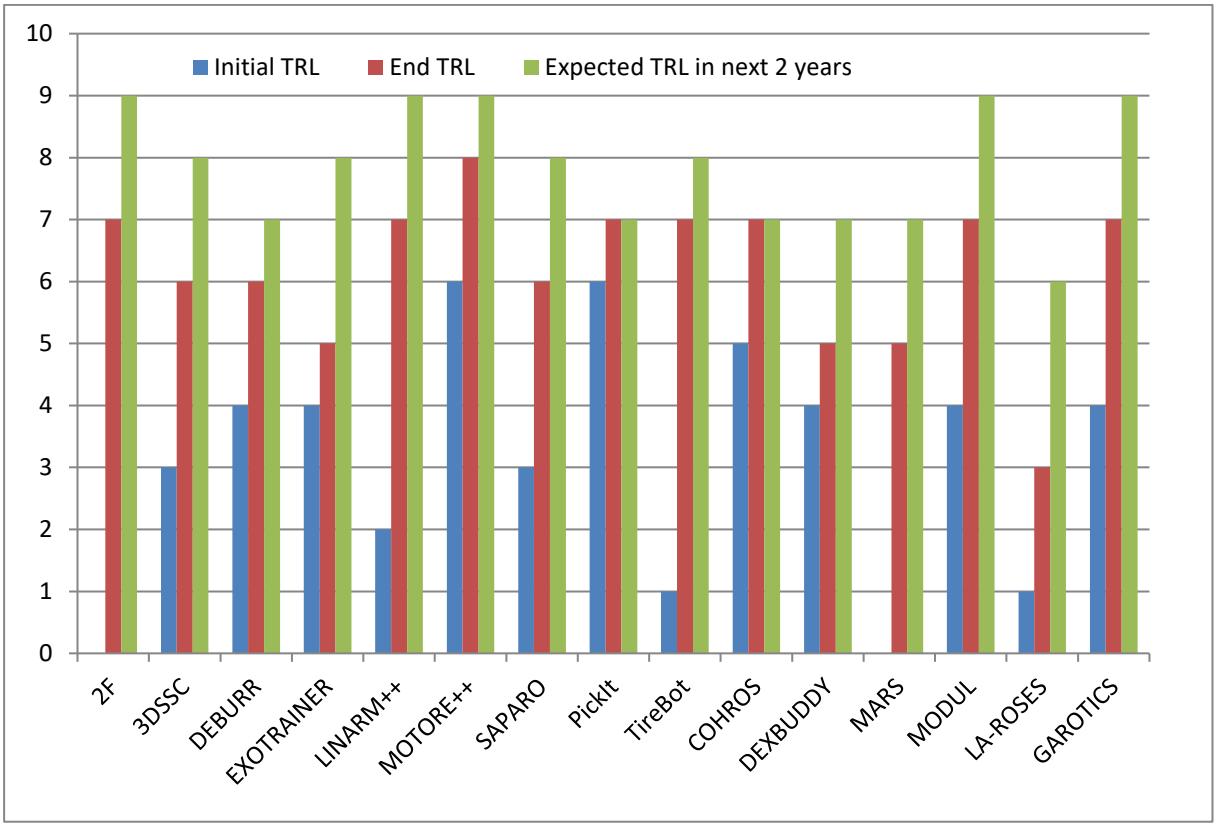


*Figure 13. Overview of TRL status of each experiment.*

Nine experiments out of fifteen actually created at least one new job position during the development of the experiments. Ten experiments will create new jobs in two years, as shown in Figure 14.

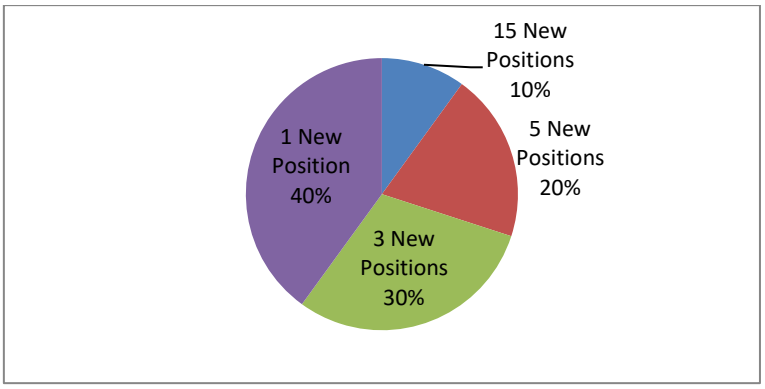


*Figure 14. Distribution number of positions that will be created in two years*

Two experiments created a Spin Off and the five produced at least one patent.
Three experiments provided information of the turn over during the development of the project, but six more will have a significant turn over in the next 2 years:

- MOTORE++ will have 200k euros turnover
- GAROTICS and DEXBUDDY will have 450k euros turnover
- MODUL and EXOTRAINER will have >1.5 mio euros turnover
- 3DSSC will have a turnover among 400k and 1.2 mio euros

In Table 4 a general overview of the outcome of each experiment in terms of patents, jobs created and turnover both at the end of the experiments and in two years.

| | **At the end of the experiment** | | | **Expected in the next 2 years** | | |
|---|---|---|---|---|---|---|
| **Experiment** | **# Patents** | **# Jobs** | **Turnover €** | **# Patents** | **# Jobs** | **Turnover €** |
| 2F | 0 | 0 | 0 | 1 | 0 | NA |
| 3DSSC | 1 | 2 | 0 | 2 | 6 | 400K - 1.2M |
| DEBURR | 0 | 0 | 0 | 0 | 2 | 150K |
| EX-OTRAINER | 0 | 1 | 0 | 0 | 5 | 1.5M |
| LINARM++ | 0 | 0 | 0 | 1 | 1 | NA |
| MOTORE++ | 0 | 2 | 120K | 0 | 1 | 200K |
| SAPARO | 0 | 0 | NA | 1 | 2 | NA |
| PickIt | 0 | 0 | 0 | 1 | 1 | NA |
| TireBot | 0 | 1 | NA | 1 | 1 | NA |
| COHROS | 0 | 1 | 0 | 0 | 0 | NA |
| DEXBUDDY | 0 | 1 | 0 | 1 | 5 | 450K |
| MARS | 0 | 1 | NA | 5 | 1 | NA |
| MODUL | 1 | 4 | 0 | 1 | 15 | 2M |
| LA-ROSES | 0 | 1 | NA | 1 | 2 | NA |
| GAROTICS | 0 | 0 | 0 | 1 | 3 | 500K |

*Table 4 General overview on the outcome of experiments in terms of patents, jobs created and turnover.*

## 9. Conclusions

E++ furtherly improved the methodology to implement the instrument of Experiments by optmizing the process, the supporting documents, the selection of successful experiments and the monitoring of correct activities in the development of them.
Results of Call 1 and preliminary outcomes of Call 2 show that the majority of selected experiments achieved the expected goals developing robotic platforms with a relevant TRL and foreseen impact significantly increased in the next two years. The collaboration between academia and industry proved to be beneficial from both sides having final products to be close to the market in just 18 months. The two calls of E++ allowed to 74 new organizations to be involved in the european funding scheme for the first time, 67 only in the first call. The involvement of SMEs and Large Enterprises has been unexpectedly successfull.
Thanks to the effort spent in ECHORD and ECHORD++ the Experiments instrument is now solid and ready to be seen as an example of good practice in cascade fundings and collaboration between academia and industry.

## 10 Contributors

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## 11 Acknowledgments

This work has been funded with "ECHORD++ EU Project FP7-ICT-2012-601116".