PROJECT PERIODIC REPORT

Grant Agreement number: 601116

Project acronym: ECHORD Plus Plus

Project title: European Clearing House for Open Robotics Development Plus Plus

Funding Scheme: ICT-2011.2.1

Date of latest version of Annex I against which the assessment will be made:

Periodic report: 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th **X**

Period covered: from **01/12/2017 – 31/01/2019**

Name, title and organisation of the scientific

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Declaration by the scientific representative of the project coordinator

I, as scientific representative of the coordinator of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;

- The project (tick as appropriate) [3]:

    ☐   has fully achieved its objectives and technical goals for the period;

    X   has achieved most of its objectives and technical goals for the period with relatively minor deviations.

    ☐ has failed to achieve critical objectives and/or is not at all on schedule.

- The public website, if applicable

    X   is up to date

    ☐ is not up to date

- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 3.4) and if applicable with the certificate on financial statement.

- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 3.2.3 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name of scientific representative of the Coordinator: Prof. Dr. habil. Alois Knoll

Date: March, 14th 2019

Signature of scientific representative of the Coordinator

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3 If either of these boxes below is ticked, the report should reflect these and any remedial actions taken.

Contents

1 Publishable summary

For over five years, ECHORD++ has worked hard to bridge the gap between academia and industry to the lasting benefit of European robotics. With its clear mission of bringing robotics technology from the lab to the market, ECHORD++ turned out to be most probably the most application-oriented EU-funded robotics research project ever attempted, and this happened already during its runtime. Bearing this responsibility in mind, the fifth reporting period saw expanded activities towards exploitation and commercialization in all work packages.

Concerning the experiments, one of the main publicly visible goals during the reporting period was the review of the second set of experiments and the extraction of experiment results in terms of quality, innovation aspects and pathway to the market. The management and monitoring processes have been further improved in Call 2 compared to Call 1, thanks to the presence of two moderators (technical and managerial) improving the monitoring of technical aspects and route to market / commercialization aspects. Analyzing the innovation triggered by the experiments, we conclude that the development of new products was the most prominent method of innovation in ECHORD++ (with 58% of the experiments), followed by improving already existing products (16%), the implementation of new processes (also 16%) and the improvement of existing processes which happened in 10% of the experiments. Surveys conducted among the beneficiaries suggest that more than 50 % of them have already started to commercialize and generate income or are expected to commercialize their innovation within the next 1-3 years. A commercialization strategy which is very prominent in ECHORD++ is to start with the commercial exploitation of smaller sub-products to generate the funds to finance the development of the full-fledged technology within a second step.

With the end of ECHORD++ funding at hand the Robotics Innovation Facilities (RIFs) have entered a transition period during which they need to turn from facilities with initial public funding into a self-sustainable collaborative network. In order to support the RIFs to get through this period, ECHORD++ has started a RIF Booster Program using professional business and organizational development consultants with expertise in robotics to work with the RIFs. Besides outlining a development plan for the three RIFs the consultants provided a deep analysis of the status quo at each of the RIFs and the RIF network as a whole including analysis of hitherto existing RIF collaborations. During the last reporting period all three RIFs have taken major steps forward since they now all have viable continuation strategies in place. The RIFs have managed to finance a continuation of their operations and they all have secured privately funded projects. Furthermore, they acquired a deeper knowledge of the dynamics of tech transfer activities, which has been exploited in their subsequent operations. The RIF instrument has resulted in an improved regional and national visibility. All three RIFs will therefore continue to use the brand "RIF". The key improvements to the RIFs in the continued operations are more efficient interaction with potential customers, improved internal processes to deliver results, and improved internal and external communication processes.

Within the two application areas of the PDTI instrument, Healthcare (Comprehensive Geriatric Assessment) and Urban Robotics (Sewer Inspection), the activities performed during Phase III directly build on the prototypes and feasibility studies developed within Phase II. All four development teams worked on improving their prototypes in quality and reliability. As a result, three out of the four teams would need about two additional years to fully commercialize their solutions (the gap and the route to market being

different for all three of them). The fourth team has a longer route to market as their hardware still requires more improvement but has generated scientific knowledge which is very valuable for the community in terms of education and research. Additional third-party funding already secured will ensure continuity of work on the prototype. All four teams will have to adopt different commercialization strategies, but these have been clearly identified and underpinned with business plans. All four teams benefited from the competitive product development process in PDTI, with clearly identified synergies which – by co-creation – can now be exploited and will facilitate the route to market for all four teams. Coaching provided by one technical expert from the ECHORD++ core team in conjunction with a member with a track record in business development and commercialization was appreciated by all four teams.

While the activities of all four teams as well as their monitoring by members of the ECHORD++ core consortium mainly concentrated on the technical side during the first two phases of PDTI, the focus in Phase III shifted from technology to commercialization and business development. This was also reflected by the expertise of the coaches assigned to all four teams for monitoring: in this last phase the coaching was done by experts of the ECHORD++ core consortium who had both a technical as well as a commercial background.

Outreach and dissemination efforts continued to result in high recognition of the project among the relevant target audiences, paving the way to market for the research and development teams and their products. A very notable item here is the so-called success booklet "ECHORD: the secret of our success" which was finalized with the help of a professional writer. The success booklet is a high-level publication presenting stories about the research areas of ECHORD++, the prototypes developed, and their possible application in a low-threshold manner, making the topics accessible for a broad audience. Also, we continued to present the project at major fairs and events, displaying not only the products developed under the umbrella of ECHORD++ but also the project's methodology. Again, many partners exhibiting showed commitment even beyond the runtime of their respective experiments, highlighting the added value of the strong common brand ECHORD++. Regarding scientific publications, the 267-page scientific book on ECHORD++ has been finalized and sent to the editors of Springer Science+Business Media where it will be published.

2 Project objectives, work progress and achievement, project management

The fifth and final Reporting Period of ECHORD++ is naturally geared towards exploitation and phasing out of the project. During these last 14 months, 13 out of the 16 originally funded experiments (WP3) were still active, those six which were granted an extension have been active for 7 months. PDTI sewer inspection had their final on-site review in December 2018, PDTI healthcare in January 2019. The RIF activities funded under the umbrella of ECHORD++ ended in September 2018. Based on the recommendations of the last review meeting, a RIF Booster Program was implemented. At the end of this booster program, the three RIFs decided to continue the activities of their DIHs under the brand name "RIF".

2.1.1 Project objectives for the period

Now we will discuss the specific objectives for the project's different work packages, both for the duration of the entire project, but also specifically for the Reporting Period 5.

Overall Objectives WP1:

WP1 covers the project management, the financial management, as well as the quality management of E++ and, importantly, the management of Amendments. More precisely this means:

- Efficient coordination of the integration of all the work packages using an up-to-date communication infrastructure in a collaborative environment;
- Establishment of the management infrastructure for the efficient operation of a complex project comprising a variety of different instruments;
- Efficient collaboration within the consortium, especially between the project committees;
- Timely communication with the European Commission;
- Quality assurance of the technologies employed and the services offered, and a proper implementation of the work packages, including the timely delivery of deliverables;
- Efficient control of the budget.

Fifth and final reporting period:

The project management team at TUM processed a total of 3 amendments to the Grant Agreement with a forth one pending at the moment of submission of this Periodic Report. The Cost Claim for RP4 was submitted. The financial data of core consortium partners were provided first off-line, as part of the periodic report. Afterwards, when the session on the EC Participant portal was available, the financial statements of all beneficiaries were submitted online and discussed in an updated version of the periodic report. The major achievement of this last reporting period was to identify and implement the additional activities, based on the recommendations received in the last review meeting, to increase the impact of ECHORD++ RTD instruments by re-investing the budget which was not used by the experiments. These activities included an Experiment Booster Programme, just like the dedicated RIF Booster Programme. Tight financial controlling, based on costs projection, was performed to ensure compliance with the budget.

Overall Objectives WP2:

WP2 encompasses the external and internal communication of ECHORD++ as a whole and provides services and material for scientific work packages (WP3, WP4 and WP5). It supports the preparation of high-quality information material (e.g. templates, pictures, graphs, and statistics) for WP6. The objectives of WP2 can be described as follows:

- To ensure effective support of all stakeholders involved (or interested) in the project;
- To realize effective external communication with representatives of the media (professional press, daily press, TV channels etc.);
- To communicate with the general public, comprising policy makers, as well as the stakeholder groups represented within the project (RoM, ReIO, public bodies, students, decision-makers in politics, trade associations etc.).

Fifth and final reporting period:

The objectives for the fifth reporting period were strongly influenced by the recommendations given in the fourth review report. In particular, it was our goal to:

- Execute an aggressive marketing strategy
- Make an attempt to secure pieces in quality business press in relevant countries

- Communicate the results of ECHORD++ regarding the technology developed but also the project's methodology
- Finalise the Success Booklet.

Overall Objectives WP3:

This work package covers the management of the experiments: from the inception (the management of the Open Calls and selection of the experiments), via the life time (monitoring of their activities based on Performance Indicators), throughout to the end (measurement of impact directly after the runtime and for a certain time after their official end for the sake of sustainability). The DOW describes the objectives as follows:

- To evolve the regulatory framework governing the experiments;

- To implement and continuously improve the processes for the experiments in close cooperation with Quality Management based on the experiences of ECHORD.

Fifth and final reporting period:

The activities in the last reporting period focused on finalizing the Call 2 experiments as well as on assessment and maximization of the impact of individual experiments. Monitoring teleconferences were regularly held with the experiments to ensure smooth implementation of the projects in their final stages. As many experiments of the project (6 experiments in total) were granted cost-neutral extensions, in some cases monitoring activities lasted until June 2018. Similarly, the final reviews of the experiments were scheduled throughout the whole period. Each of the reviews involved both an external reviewer with expertise in the field of the experiments and a representative of the ECHORD core consortium, usually a member of the monitoring team. A TRL workshop was organized in order to quantify the developments of the Call 1 experiments on the 30.01.2018 in Munich. Three external experts (Dr. Alexander Müller, Dr. Patrick van der Smagt and Mr. Thilo Zimmerman) accompanied by two representatives of ECHORD++ consortium (Dr. Yannick Morel and Ms. Marie-Luise Neitz) re-evaluated the reports and final reviews of the Call 1 experiments to establish the starting and the final TRL of their developments. The third main activity of the period revolved around the Experiment Booster instrument successfully launched in the 4th period. Four experiments (Linarm++, EXOtrainer, MODUL and SAGA) benefited from this opportunity. As part of this programme, they received additional training and support allowing them to bridge the gap between lab and market, thus bringing their products or services closer to commercialization.

Overall Objectives WP4:

The activities within WP4 were geared to the development of the entire management process for the RIFs (Robotics Innovation Facilities). This process covers the purchase of equipment (to complement the in-kind contribution hardware-wise provided by all three RIF owners), the application and selection process for potential RIF users, the definition of Performance Indicators to track the success of the stay during and after the use time, the remuneration procedures, etc. In detail:

- Define all the processes needed for RIF set-up, operation and evaluation;
- Provide networking opportunities to partners undertaking E++ Experiments;
- Provide opportunities to educate and support a new generation of entrepreneurs in robotics;
- Make available the physical and human resources to support commercial exploitation, especially for SMEs and startups.

Fifth and final reporting period:

During this last reporting period of ECHORD++ all three RIFs have managed to finance a continuation of their operations beyond the funded runtime of ECHORD++ and to prepare for self-sustainability as a DIH. The program, which was carried out by a management consultant experienced in robotics, started with teleconferences (TCs) held with each RIF between 25-27 June 2018. The aim of these TCs was to introduce the consultant and the RIFs to each other and to discuss the RIF Booster Program, as well as to initiate work on a preliminary Business Model Canvas (BMC). These interviews were followed by individual workshops on each of the RIFs and a consolidated one to work on synergies to exploit beyond ECHORD++. Interviews between the consultant and the three RIFs between 25-31 January 2019 concluded the program and provided final insight in the status of each RIF and the path they have adopted following the closure of the RIF project. The major achievement and support provided by the project to the three RIFs by running this RIF Booster Program can be summarized as follows (taken from the final report of the booster): "During the RIF project, all the RIFs acquired a deeper knowledge of the dynamics of tech transfer activities, which has been exploited in their subsequent operations. Models for alternative 'tech-transfer' career paths have been developed, particularly in the university environments. The RIF project has resulted in an improved regional and national visibility. All three RIFs will therefore continue to use the brand 'RIF'. The key improvements to the RIF project in the continued operations are more efficient interaction with potential customers, improved internal processes to deliver results, and improved internal and external communication processes."

Overall Objectives WP5:

WP5 is dedicated to the development of robotics technology for public service in two pre-defined application domains: *Urban robotics* and *Healthcare*. Subsequent to the definition of the overall scenarios, the concrete challenges (one per scenario) are identified via an Open Call addressed to public authorities (hospitals, municipalities etc.). These two challenges build the basis for an Open Call to which RTD consortia can apply in order to develop the technologies in a competitive approach (three teams per scenario in Phase I, two out of these three teams competing with each other in Phase II and Phase III). This technology development is guided by the public authorities which have submitted the successful PDTI challenges.

The overall objectives of WP5 can thus be described as follows:

- To define concrete potential application areas for pre-commercial procurement (PCP) in robotics in the public sector, geared to the societal challenges identified for HORIZON 2020
- To establish, prototype (PCP pilots), evaluate and document a process to identify innovation gaps for the public sector based on an active search for public bodies to join the project
- To push the development of specific products for the public sector in a competitive way and to cooperate with the Quality Management
- To showcase the benefit of robot technology in selected applications with real installations in target environments
- To develop robotic solutions that meet the end-user requirements

Fifth and final reporting period:

PDTI sewer inspection had their final on-site review in December 2018, PDTI healthcare in January 2019. The external experts in PDTI sewer inspection decided to have an in-person feedback with the two development teams providing recommendations on commercialization paths and exploitation of synergies. All four PDTI development teams have developed business plans. Three out of the four teams – ASSESSTRONIC, SIAR and ARSI – are very close to commercialization and would need approximately two additional years to fully commercialize their solutions (the gap and the route to market being different for all three of them). CLARC has generated new third-party funded projects to further develop the technology and to exploit their scientific findings in education and research. In both applications – "Comprehensive Geriatric Assessment" and "Sewer Inspection" – the experiments would find high market potential. Especially through PDTI Urban Robotics, ECHORD++ – motivated and driven by the core partner UPC – has shown the potential impact of robotic solutions in the area of city infrastructure by demonstrating the added-value of using robots during sewer inspection (verified during multiple tests in the field).

Overall Objectives WP6:

WP6 is dedicated to increasing the visibility of ECHORD++ via conferences and fairs and to disseminating the scientific results of the project. To achieve these goals ECHORD++ can rely on a speaker group set up to present E++ at various events.

The goals are:

- To increase the visibility of ECHORD++
- To organise the structured dialogue
- To develop and sustain external relations with all stakeholders involved: public bodies, partners, science communities and the general public, comprising policy makers, trade organizations and public users
- To present ECHORD++ at relevant, selected events
- To support the instruments experiments (WP3), RIFs (WP4) and PDTI (WP5) in attracting users/customers and in delivering the results to relevant stakeholders

Fifth and final reporting period:

During the fifth reporting period the focus of WP 6 was shifted even more from the mere display of prototypes towards events with a higher political impact, combining the display of the project's results regarding the technology developed with a wider dissemination of the project's methodology. Also, with two White Papers and a scientific book pending publications, scientific dissemination had to be stepped up. As before, the PR and scientific team at TUM strongly supported the colleagues at UPC to ensure that the objectives are met.

2.1.2 Follow-up of previous review

The consortium gratefully acknowledges the help and support offered by the reviewers. Insights provided have been invaluable to us in our work. Here we will discuss how the reviewers' recommendations, as formulated in the Technical Review Report for Period 4, have been addressed.

Recommendation R1: *Make concrete suggestion for the use of excess funds from the ROAR project based on a cost-benefit analysis and act on these in time for the next review.*

After the reimbursement of RP 3, leftover budget was forecast as follows:

		Funding Request	Funding Approved	Leftover Budget
Experiments Call I, including ROAR		4,752,677 €	4,075,676 €	677,001 €
of which already reserved for Experiments Booster Programme	*EXOtrainer, MODUL, SAGA (Amendment No. VI)*			*248,912 €*
	LINarm++ (estimate for (Amendment No. VII)			*64,680 €*
Total Call I				**363,410 €**
PDTI beneficiaries terminated after Phase I		90,479 €	75,798 €	**14,681 €**
		4,843,156 €	4,151,474 €	**378,091 €**

Table 1 - leftover budget forecast

The ECHORD++ core team developed a cost-benefit analysis of additional activities to be performed to further strengthen the impact of ECHORD++ in strategically relevant areas (see Table 3). Of the activities listed, the following action items have been selected by the external reviewers and integrated into the portfolio of ECHORD++ activities via Amendment Request 7:

Activity financed	EU contribution	Status
RIF Booster	40.360 €	finalized
Healthcare Booster	10.100 €	Scheduled for 13th March '19
Video Automatica	4.165 €	(https://www.youtube.com/watch?v=W5NeN1e2Ko8
Medica 2018	48.000 €	http://echord.eu/medica2018/
Booklet Success stories	30.000	Finalized, copies distributed to reviewers
Event at EU Parliament	94.000 €	Scheduled for 2nd April 2019

Table 2 - overview of financed activities

Measure	Estimated Costs	Target Group	Resources needed	Schedule	Potential Impact	Our recommendation
RIF Booster 1 **Workshop** organised at one of the RIF premises	8k €	RIFs	Financial support for travel and subsistence expenses for 30 participants from various stakeholders groups, including industry and venture capitalists, together with the consultancy firm selected for the RIF Booster Programme (2)	Planning 2-3 months in advance (directly correlated with the RIF Booster 2)	Discuss current practices in the strategic development of a network of research facilities and the possible paths towards its self-sustainability. The desired impact is for both RIFs and stakeholders to get to know each other better, and gain a better understanding of their mutual needs and potential RIFs' marketable services.	**Impact: High** High impact particularly high if used as kick-off for RIF Booster 2 since this would provide the external consultants of the RIF Booster 2 with a good opportunity to gather a significant volume of information relevant for the planned booster activities. Not doable to prepare RIF Booster 2. **Risk: High** Reluctance of the RIFs to commit effort into this activity, in particular in motivating the participation of

						external relevant stakeholders.
RIF Booster 2 **Programme** tailored and managed by external Consultancy Firm	40,360 € + VAT (Cost of subcontracting selected provider WIDE Idea Development AB)	RIFs	Support from external consultancy firm in analysing the RIFs local ecosystems (stakeholders' analysis and mapping), shaping of development plan (portfolio of services, business model, business plan), and building a strategy towards self-sustainability ("road to market"); follow-up performance assessment 1yr post E++	4 months + final assessment	Better knowledge of challenges and opportunities for the RIFs and greater likelihood of achieving self-sustainability	**Impact: High** High impact on the future of the RIFs strategical development towards self-sustainability Risk: High Outcome highly contingent on the willingness to the RIFs to openly cooperate and engage in the Programme
Lab Tour **Tour in China + Book**	110k €	4 selected representatives from industry and 200+ people receiving the book	7 members of Core Consortium for 2 weeks of travelling, organised by WP6 organisation team	Organizing appointments at Labs, inviting guests, booking flights, shuttles	4 very good industry contacts and a book documenting the Lab Tour The books of the LabTour	**Impact: low** **Risk: High** High costs, long duration approx. 8 months, not do-able

				and accommodation, organizing Visas:	should be distributed at the ECHORD++ Final Event during IROS in October in Madrid (not do-able within project's remaining runtime).	in the given timeframe anymore.
+ Video documentary	+ 20k €	video documentation on You Tube		6 months + 2 weeks of travelling time for 7 members of the consortium + 6 weeks putting together the documentation of the Lab Tour		The visibility with video would be higher, but still this project is not do-able in the remaining time frame.
					More interactive and reaching out to a broader audience: a video documenting the Lab Tour, which can be published on YouTube	
Road Show	200k €	General public	Organisation-team + truck driver + promoters + scientists	Organizing permits for exhibition space in cities, printing truck, booking hotels for staff: 6 months + 2-3 weeks of travel	Promotion of a selected application area of ECHORD++ For general public we recommend something interactive	**Impact: Low** unless planned in cooperation with technical museums **Risk: High** High costs, long planning time required, not do-able in the remaining runtime

Event at EU Parliament and Committee of Regions *during European Robotics Week (Nov 2018)*	80k €	Representatives from regional and national authorities, other EU projects	Organisation of booth, transport of robots and convincing 10 experiments to participate	3-4 months for organization + 1 week setting up and presence at the booth	Informing representatives from regional and national authorities, in particular about PDTIs and inspiring other EU projects	**Impact:** Medium Impact could be high if combined with future European DIHs to be used as starting point for future DIH. **Risk:** Low
Success stories **Booklet "Magazine"**	20k €	Visitors at IROS (E++ final event)	WP 2 team collecting information, briefing Adriana Hamacher (award-winning writer, blogger, tech-journalist and robot evangelist).	2 months	Booklet in attractive style (visually and language) to be distributed at IROS and other future EC events.	**Impact:** High **Risk:** Low Low costs, long duration, something nice to have and keep for long time, <u>do-able in the remaining time before IROS</u>
+ 3-minute video	+ 5k €	Visitors at IROS (E++ final event) and broad audience on YouTube	Script for video must be developed by WP2. Video to be shot during automatica18 (12 exhibits and	2 months (can be done in parallel to booklet)	The video can be seen by the general public all over the world on YouTube and can quickly be distributed via email.	**Impact:** High **Risk:** Low Low costs, attractive to younger target group, can be easily distributed, <u>do-able in</u>

			presence of Core Consortium members) + Best Picture/ Video Award ceremony on June 19, 2018.			the remaining time before IROS
Press Kit	20-25k €	Press	Gathering information from 10 prototypes. Photos or video material for press. Offer information on USB sticks to selected press.	2 months (depending on response of experiments)	If the press takes on the information, the impact can be large	**Impact:** High **Risk:** High Low costs, do-able in the remaining runtime, but we cannot force the press to use the material if press is not interested.

Table 3 - measures with evaluation of costs & impact

Recommendation R2: *RIFs: The project is requested to clearly report using measures common to all 3 RIFs and plot this by time, and across the 3 sites to allow comparison and additional insights. The progress report mentioned charts and tables but in fact only shows one table which aggregates the figures for all time points and all RIFs. This makes it hard to see trends, progress and to compare the three at equivalent stages of development.*

*As part of this, the project is also requested to assess the level of development of the 3 RIFS (perhaps using the capability maturity model **CMM** or similar) using expertise available within the organisation (UWE) and/or the project (BOR) and to use this to plan out the evolution towards a more mature state, and what outcomes would be expected and what actions and resources would be required to move to the next stages, both within the rest of the project, and beyond it.*

As part of mapping out this evolutionary journey, further strategy development activities should be conducted. In order to secure a market oriented approach to this kind of "RIF booster", external business consultancy experts should act as moderators and coaches for the process. If fully or partly conducted together, these sessions could also act as a medium for further knowledge sharing between the 3 RIFs.

For the past three years, three Robotics Innovation Facilities (RIFs) have received funding from the ECHORD++ project to serve as collaborative test beds for exploring how academia can successfully interact with small, medium and large enterprises to drive robotic development and economic growth in Europe. The ECHORD++ consortium acknowledges that with the end of funding, the RIFs have entered a crucial

phase in which they need to prepare for self-sustainability and for establishing a collaborative network. In order to support the RIFs throughout this transition period, ECHORD++ has engaged a professional business and organizational development consultancy with expertise in robotics to work with the RIFs. The scope of the RIF Booster Programme was as follows:

- Provide a local assessment of the three RIFs covering staff, structure and capacity, current network, and former engagements.
- Conduct a stakeholder analysis and mapping of the local RIF ecosystems in order to make a comparison of RIF stakeholder maps. This will result in the first deliverable: a Stakeholder Analysis and Mapping Report. It is important that this short report identify any missing or complementary skills and assets.
- Establish a development plan for the three RIFs (portfolio of services to be offered, business models and business plan) based on a common base model, resulting in the second deliverable: A Development Plan Report, to include services, business models, and business plans.
- Investigate the possibility of increasing the impact of the RIF instrument, by considering options for the 'Road to Market'. This will result in the third deliverable: A Road to Market Report, which will include recommendations for increasing the overall effectiveness of the existing RIFs, a market strategy for sustainability, and a strategy for expansion of the concept.
- Make an assessment of the progress made by the three RIFs, to be delivered in January 2019, following the completion of the first analysis in September 2018.

The **RIF Booster Programme** was initiated by teleconferences (TCs) held with each RIF (25-27 June 2018). Apart from introducing the consultant and the RIFs to each other, the TCs initiated work on a preliminary Business Model Canvas (BMC). Each RIF was expected (and agreed) to prepare this BMC before the next meeting with the consultant (July and August 2018). These meetings comprised a three-day visit by the consultant to each RIF. The meeting with RIF Paris took place 18-20 July, with RIF Peccioli on 25-27 July, and with RIF Bristol on 20-22 August.

The first day of each visit involved meetings with at least five key customers of each RIF. The aim of these meetings was to understand how the RIF had provided value to these stakeholders, how they had experienced the RIF service and what recommendations these customers have in terms of the operation of the future RIF Robotic Competence Centers (RCCs). The customer meetings were followed by a two-day creative workshop, which involved key employees at each RIF. The goal of these workshops was to identify the opportunities and challenges presented by the current RIF organizations, and to explore ways in which to optimize and further develop the RIF concept for the future. The take-aways from each RIF were summarized using the Business Model Canvas.

The detailed results of the RIF Booster Program can be found in the extensive reports provided by WIDE Idea Development AB. All three RIFs share the same goals as those presented in the RIF project description, but with differing maturity levels and with a focus on different customer types, based on their distinct business ecosystems. This has resulted in variation in terms of how the RIFs have each prioritized their activities to achieve the goals of the RIFs within ECHORD++.

Nevertheless, all three RIFs have managed to finance the continuation of their operation. During the runtime of ECHORD++, all the RIFs acquired a deeper knowledge of the dynamics of tech transfer activities, which has been exploited in their subsequent operations. Models for alternative "tech-transfer" career paths have been developed, particularly in the university environments.

Furthermore, the RIF project has resulted in improved regional and national visibility. All three RIFs will continue to use the brand "RIF". The key improvements to the RIF instrument in the continued operations are more efficient interaction with potential customers, improved internal processes to deliver results, and improved internal and external communication processes.

Recommendation R3: *Marketing and branding. The consortium is encouraged to continue to take seriously all efforts to brand the partner activities (experiments, RIF clients, PDTI clients etc) via the product, website etc. The review team especially recognises the marketing and branding potential of the PDTI activities and encourages the acceleration of the marketing activities.*

As in the previous reporting periods, the consortium strategically selected events at which the results from the project were presented to the appropriate target audiences. These results naturally included showcasing the outstanding technology development facilitated by ECHORD++ as well as the "ECHORD++ methodology", meaning the countless lessons learned concerning the set-up and promotion of a network of Robotic Competence Centers, the involvement of the public sector in technology development processes, insights on the management of large-network projects and many more. Events where ECHORD++ as a brand was promoted included, but were not limited to, the following
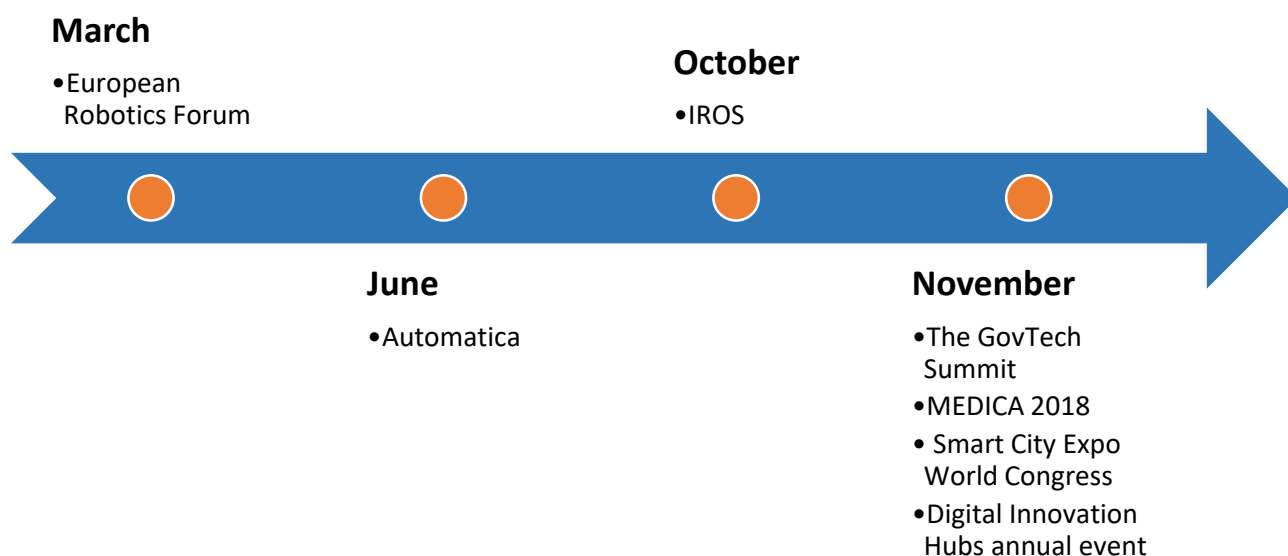
March
- European Robotics Forum

October
- IROS

June
- Automatica

November
- The GovTech Summit
- MEDICA 2018
- Smart City Expo World Congress
- Digital Innovation Hubs annual event

Figure 1 - events in RP5 where ECHORD++ was promoted

European Robotics Forum 2018

On March 15th the ECHORD++ workshop "Encouraging Regions and Cities to Innovate through Robotics" took place. The participation of regional public entities as end-users and procurers and the industrial and academic consortia as suppliers, gave us the opportunity to develop this workshop under the structure of an Open Consultation to link real needs with technological solutions looking to rise new robotic products closer to the market.

Also during ERF 2018 TUM employee Sebastian Weisenburger conducted video interviews with different EU-funded projects on behalf of euRobotics and the EC. One of these interviews featured Cécile Huet on

the topic of how ECHORD++ contributed to the EC's support of research and innovation and how the project can be seen as a predecessor of the Digital Innovation Hub idea.[4]

Automatica fair 2018

From 19-22 June 2018 more than 46,000 visitors and 890 exhibitors participated in automatica, the leading trade fair for intelligent automation and robotics in Munich. 11 prototypes and components were showcased: AAWSBE1, MODUL (ANYbotics), CLARC, CATCH, FlexSight, HyQReal, iSybot, LINarm++, SAGA, SIAR and WIRES. The 150 square meter booth was perfectly positioned in the middle of hall B4. Hall B4 was also the hall recommended by the Bavarian Minister for Economic Affairs in his opening speech for being „the most innovative hall ". After four days, all ECHORD participants were extremely satisfied by the number of visitors and the interesting contacts they could make.

IROS Madrid 2018

During the first week of October over 3000 attendees from across the world gathered in Madrid for the IEEE/RSJ *International Conference on Intelligent Robots and Systems* (IROS).

The ECHORD++ booth was situated in the EU Exhibition Area presenting four prototypes: CLARC, EX-OTRAINER, LINarm++ and SIAR. ANYmal, which started as the ECHORD++ Experiment MODUL, had its own booth in the main exhibition area. All the exhibits found lots of interest and some were even featured on Spanish television.[5]

Furthermore, on October 3rd the ECHORD++ Forum "Advances in Robotic Science Supporting Innovation" took place. The aim of the forum was to share the results of 35 robotic experiments, PDTIs and Robotic Innovation Facilities financed under the ECHORD++ European Project and the lessons learned in the innovative procedures developed during the past five years.

The GovTech Summit

This event which was held in Paris on 12th November 2018 featuring the motto "Connecting Europe – Bringing together Citizens, Businesses and Government" highlighted how EU projects develop technology and digital solutions to make public administration more effective and efficient and to bring citizens, businesses and government closer together. Marie-Luise Neitz from TUM presented how ECHORD++ contributed to technology transfer for the public sector.

MEDICA 2018

At MEDICA, the world's leading trade fair for the healthcare sector (12 – 15 November, 2018, Düsseldorf), ECHORD++ showcased four of the healthcare projects conducted under its umbrella: CLARC, Assesstronic, EXOtrainer and LINarm++.

Furthermore, Juan Pedro Bandera Rubio from Universidad de Malaga presented the PDTI project CLARC at the MEDICA TECH FORUM.

Smart City Expo World Congress

At this annual event which took place from 19 – 21 November 2018 in Barcelona ECHORD++ exhibited the robotic solutions for Sewer Inspection SIAR and ARSI.

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[4] https://www.youtube.com/watch?v=rEWHBhHKoAI

[5] http://rtve.es/v/4777498?t=25m13s (IROS report from minute 25)

Digital Innovation Hubs annual event in Warsaw

The aim of this event was to reinforce the capacity of Digital Innovation Hubs (DIHs) to support European companies in their digital transformation. On 27 November Marie-Luise Neitz from TUM presented lessons learned from the ECHORD++ Robotic Innovation Facilities (RIFs) at the DIH annual event in Warsaw during the session on "DIHs to deploy AI and robotics across Europe."

2.2 Work progress and achievement during the period

The following section gives an overview of the progress achieved by the core consortium in the different Work Packages. WP 1 is identical with the Project Management and is therefore dealt with under section 2.3. of this report. The progress achieved by the partners selected under the second call for RTD experiments is provided in Annex I.

2.2.1 Work progress and achievement during the period

During the fifth reporting period, the Service Center invested the major part of its resources in promoting the project and its results among the relevant target audiences. The main achievements in WP 2 during the fifth reporting period were:

- Expanded presence in the media
- Automatica fair in Munich
- Active "selling" of the ECHORD++ methodology (branding)
- Finalizing the Success Booklet
- Production of video material
- Comprehensive support for events (WP6)

Task 2.1 Everyday work

As during the last reporting period the everyday work consisted of assisting experiment and PDTI partners via email and telephone, providing mostly specific information about the project and the different applications to interested stakeholders and enabling communication among the core consortium partners. Compared to times with open calls the work load in this task has been significantly lower during the fith reporting period.

Moreover, the Service Center has processed requests from journalists interested in covering the project in the media. Furthermore, enquiries from external organisations have been forwarded to the appropriate contact persons at the core consortium partners and the beneficiaries, e.g. a request from a Brasilian company interested in the technology developed in the ARSI and SIAR PDTI projects. Another example is the request for presenting ANYMAL at a show in the Netherlands. After some discussions, they agreed and were able to pay the price that Anybotics charged for a two-day show although it was far beyond their budget.

Task 2.2 Provider of the IT-infrastructure

In this last period of ECHORD++'s runtime not only the website was regularly updated with news and events, but also the social media accounts on twitter, LinkedIn as well as the YouTube channel, which now shows even more very interesting and informative videos. The number of visitors on our webpage has increased again by 36% up to 73,726 (February 28, 2019), ECHORD++'s LinkedIn group has grown to over 389 members (January 2019) and thus gained 20 members during this last reporting period. For the

ECHORD++ Twitter account, we were able to grow the number of followers to 1318 (February 2019), which means an increase of +32%. Very good figures can also again be reported for the Twitter accounts of the RIFs in Bristol (2,415 followers, +48%), whereas the twitter community of the RIF in Pisa-Peccioli remained relatively stable with 452 followers.

Furthermore, we added a new subpage to the website to provide the possibility to download all brochures and flyers. This is especially important to generate a kind of sustainability after the end of ECHORD++ for customers and interested future research partners.

Task 2.3 Planning of communication measures for all WPs

The communication strategy and plan has been updated to match the challenges of the fifth reporting period and to act according to the reviewers' recommendations.

All of the proposed events and fairs in 2017 and 2018 were successfully attended. In this part of the report we will focus on WP-2 related activities with regard to events, for details on the events, visitor numbers, etc. see WP6. Concerning the follow-up on generated leads, during the events where prototypes have been exhibited, visitors mainly talked to the exhibitors directly, therefore further interactions beyond the fairs were handled by the respective experiment or PDTI partners.

Selling the methodology of ECHORD++ also continued and was intensified. The approach was to go to politically relevant high level events on top of dedicated fairs. Highlights to be mentioned are the GovTech Summit 2018 in Paris chaired by the French President Emanuel Macron and the annual DIH event in Warsaw with participation in an expert panel on the future roadmap of DIH in Europe. Emanuel Macron had to refuse but the Canadian Prime Minister Justin Trudeau showed up at the GovTech Summit. In this session ECHORD++ was referenced several times by Khalil Rouhana as the European-funded project used by the European Commission as reference to "learn from" at DIH. More details are given in WP6.

We have successfully continued ECHORD++'s vast presence in media relevant to our target audiences. In the meantime, a total of 394 references in different media show a convincing success in the effort to disseminate the project, its different prototypes and their specific applications, and last but not least the tremendous funding by the European Commission. Most of the articles, TV reports, etc. on ECHORD++ were perceived by the core consortium to be of high quality, in total length as well as in content. The figure above shows an increase of 16% compared to the last reporting period, although we expected hardly any new media references to be created by the experiment partners beyond the runtime of their funding. Another noteworthy figure the core consortium has gained from surveys conducted by experiment partners is, that only one third of the experiment partners have involved a communication/media professional in the experiment, highlighting the potential for improvement, especially when considering more than half of the media references of ECHORD++ were triggered by experiments partners. A good example is CATCH: The Fraunhofer Institute published a press release on February 5, 2018. This caused 24 references within the next 3 weeks! To tap the full potential of future technology transfer projects' outreach activities the core consortium therefore suggests involving local (meaning: none-core consortium) PR/marketing professionals either in every project team or via being part of a larger organization with a dedicated PR department or via involving an external agency. This suggestion also coincides with another insight gained from the surveys which is that three quarters of the experiment partners have published information about the experiment in another language than English, stressing the importance of communication on local, regional and national level in the respective languages, a task which can only to a limited extent be assumed by any core consortium.

In total, the figures on media references show the direct success of our strategy to enable the beneficiaries of the cascading funding to build fruitful media relations, turning them not only into spokespersons of their own projects but also of ECHORD++ as a whole. This relates to the second recommendation received at the last review meeting, i.e. to build an "ECHORD++" brand.

Press releases, invitations to the booth, new target group oriented flyers and roll-ups were produced for events. Both, the press releases and the invitations were sent to specialized press to attract their interest in the prototypes. Some journalists from different European countries demonstrated their interest by requests for providing conversational experts. These journalists then created long articles about the prototypes shown at automatica, especially about the agricultural robots, whereas other prototypes attracted interest mainly by photos published after the fair. The rental of a press box during the fair was not useful (the material provided there was not touched), but the direct address by distributing invitations during relevant forum talks attracted many additional visitors before and to the award-winning ceremony on the first evening.

Task 2.4 Maintenance of target-group specific data

The consortium is constantly expanding its network and establishing new contacts with relevant stakeholders in all fields covered by the project. Contact data bases are being updated as appropriate. As mentioned above a major part of the interaction with the stakeholders interested in the technology has been processed by ECHORD++'s beneficiaries. The core consortium supported the interaction with these stakeholders with its newsletters which have been distributed to an impressive number of 4252 followers.

The press release distribution list built up in the first reporting period is also kept up-to-date and expanded as new contacts with the media are established. Additionally, new specified contact lists were set up, e.g. for healthcare and agricultural magazines. By a structured search, additional 200 contacts from national and international special interest magazines could be added. We sent press information about the prototypes shown at automatica and MEDICA to all these contacts. 15 contributions in magazines from Poland to Spain resulted until February 2019. At Medica a film team of the fair Duesseldorf made several videos during the fair, one of them contained mostly an interview about EXOTRAINER and many sequences about CLARC.

Task 2.5 Generation of PR-related material

The existing design templates (PowerPoint, Word, flyer, roll-ups, poster) have been widely used at various occasions. A short description of all prototypes showcased at automatica 2018, was compiled and distributed to the press visiting automatica fair.

The experiment brochure featuring all experiments was revised, updated and re-printed before automatica fair, and almost completely distributed. The remaining copies were sent to Madrid for the IROS in October.

Like at the previous automatica in 2016, the ECHORD++ PR Team invited all Experiments – and this time also the PDTIs – to send us their best picture (Call 2 and PDTI) and for the first time also their video material featuring their prototypes (Call 1, Call 2 and PDTI). All the submissions were shortly presented during the event in the evening and the winners of all three categories (best picture Call 2, best picture PDTI, best video – all) were awarded an "Oscar", a certificate and also received a beam+ telepresence robot. The award ceremony with approximately 100 guests, was moderated by Reinhard Lafrenz, Secretary General of euRobotics. A questionnaire distributed among the participants revealed that they were mostly very

satisfied with the results of the fair participation: 6 of 10 reached their target group and were happy with the number and quality of the visitors, all could find interesting contacts (between 3 and 15), some of them even found marketing partners which they originally did not look for. We also could attract a guided tour of the automatica fair for company representatives, who were very interested and spent more time as planned at our booth.

A film team, hired by the PR team recorded many sequences and interviews at the ECHORD++ booth at automatica, and put it together to create a new image film for ECHORD++. The film also contains scenes of the award show at the booth for the best photo and the best video made by the experiments and PDTIs. The image film is available on the ECHORD++ YouTube channel.

Additionally to the eleven ECHORD++ prototypes, we also announced other European funded projects with open calls at the ECHORD++ booth.

Figure 2 - automatica impressions   *Figure 3 - automatica impressions*

Due to the short notice of confirmation of Medica fair and no availability of resources at UPC, the PR team of TUM took over the organization of the booth at Medica 2018. All experiments and PDTIs in the healthcare sector were invited to participate in our booth. Specialized flyers were produced for MEDICA fair describing all the prototypes at the booth. The content of the flyers was uploaded to the Medica Fair's webpage weeks before, which was much more successful than booking a press box at the fair and cheaper, too. Two talks at the forums during MEDICA could be organized and both scientists used the ECHORD++ PowerPoint template.

Another invitation on very short notice arrived for the GovTech Summit in Paris. Marie-Luise Neitz was invited to give a talk on Public end-user driven technical innovation procurement PDTI and to share her lessons learned from ECHORD++. Additionally, we were asked to set up a small booth (see WP6). As we were encountering a completely different target group than at automatica or MEDICA with this event, we created a new flyer describing the selection process of our PDTIs, the Open Call management and included short descriptions of all four running PDTIs. We also produced a roll up and poster asking visitors to vote for one of our suggested new robotic solutions or to propose other useful robotic challenges.

The so-called success booklet "ECHORD: the secret of our success" was finalised with the help of a professional writer, Adriana Hamacher. She is an award-winning writer specialised in emerging technologies and working for BBC, and, apart from that, a first-class researcher in human-computer interaction. This glossy and very attractive magazine presents stories about the research areas of ECHORD++, the prototypes developed, and their possible application on 39 pages. Apart from stories and facts, the magazine contains many photographs and has an ISBN, which means it can be ordered via the regular bookselling trade. It will be distributed at the European Robotics Forum in Bucharest in March

Figure 2 - success booklet

and at the final event at the European Parliament in Brussels in April. Furthermore, copies of the brochure will be sent to all partners involved in ECHORD++ and to selected journalists.

Adriana Hamacher has very good contacts to BBC and other publications she works with and will certainly get back to us or refer to ECHORD++ in future productions. A teaser leaflet announcing the ECHORD++ success stories was distributed during IROS in Madrid, making people aware of the success stories, of the ECHORD++ booth at IROS, and giving them the opportunity to pre-order a copy.

All the new flyers, brochures and the success booklet can be downloaded in the new ECHORD++ download area.

2.2.2 Work Package 3: Experiments

WP3 includes all activities related to experiments' lifecycle. The objective of WP3 is to develop the regulatory framework governing the experiments, implement and continuously improve the process for the experiments in close cooperation with Quality Management based on the successful experiences of ECHORD. The rest of this section is structured according to the tasks.

In the fourth Periodic Report will be reported the main activity developed in the following tasks:

- Task 3.6: Call 1 - Phase VI: Results extraction and exploitation
- Task 3.11: Call 2- Phase V: Monitoring and Review
- Task 3.12: Call 2 - Phase VI: Results extraction and exploitation

Task 3.11 Phase V – Monitoring and Review

Final monitoring activities

The 15 selected experiments were offered the choice to choose between start date 1.6.2016 and 1.9.2016. In this Reporting Period, all the Experiments were concluded, included those that requested an extension of few months, and the final review took place.

Each experiment was overseen by a team of two dedicated Moderators, a Technical Moderator, comfortable with the technical content of the work done, and a Management Moderator, whose role consists in facilitating the monitoring process (scheduling Monitoring calls, taking minutes, etc.). Interactions between monitoring team and experimenters was performed through regular, two-monthly Skype monitoring calls, and follow-up question/answers through emails or infrequently over the phone.

Monitoring activities were structured around a Key Performance Indicator (KPI) roadmap. For each Experiment, Core Partners have negotiated with experimenters one set of KPIs per experiment. These KPIs are such that, their achievement by Experimenters guarantees completion of the experiment's objectives, as originally described in the experiment's proposal. The set of performance metrics is recorded in an official, agreed-upon by experimenters document, referred to as KPI document.

Handling Review procedures

For each Review, two experts evaluated the project: 1 Internal Expert from the E++ Core Partners (usually the technical moderator of the experiment) and 1 External evaluator, expert in the field of the experiment. For the external experts, contracts have been developed as the ones used for the experts that evaluated the proposals in Call 1 and Call 2.

As the monitoring process was structured around timely achievement of the KPIs, also the review process was built around that. Prior the onsite review, every experiment had to prepare a final report called "KPI Summary", improved with respect to Call 1 templates and built around KPIs, structured as follows:

- Section 1: Executive summary
- Section 2: Deliverables
- Section 3: Milestones
- Section 4: Technical KPIs
- Section 5: Impact KPIs
- Section 6: Dissemination Milestones
- Section 7: Concluding Remarks

In Table 4 the list of experiment with the assigned External evaluator, the chosen Visiting Site, the internal evaluator and the date of the review.

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	giu-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	giu-18	26 October	Bologna	Nicola Pedrocchi	Adam Schmidt

Table 4 - List of Experiments and relative information on the review onsite. The Table reports the assigned External, the chosen Visiting Site, the internal evaluator and the date of the review

A six-monthly overview of the current status of the Experiments was reported in D356 while D362 gave an overview of the final outcome of the experiments. As in the previous RP, both technical and managerial moderators reported the status of project outcomes (KPIs). The outcome of the final evaluation process is provided in the form of traffic-light overview. Each tracked category (Technical KPIs, Impact KPIs, deliverables, etc.) was assigned a traffic light value descriptive of status (good, acceptable, poor).

In Table 5 it is possible to have a clear picture on the final evaluation provided for each experiment by the evaluators.

Call 2 Experiments	Milestone	Deliverable	Technical KPIs	Impact KPIs	Dissemination KPIS
DUALARMWORKER	🟩	🟩	🟩	🟩	🟩
INJEROBOT	🟩	🟩	🟩	🟩	🟩
SAGA	🟧	🟩	🟧	🟧	🟩
FlexSight	🟩	🟩	🟩	🟩	🟩
MAX ES	🟩	🟩	🟩	🟩	🟩
AAWSBE1	🟩	🟧	🟩	🟧	🟩
WIRES	🟩	🟩	🟩	🟩	🟩
Keraal	🟩	🟩	🟧	🟧	🟩
SAFERUN	🟩	🟩	🟩	🟩	🟩
RadioRoSo	🟩	🟩	🟧	🟧	🟩
HOMEREHAB	🟩	🟩	🟩	🟩	🟩
FASTKIT	🟩	🟩	🟧	🟩	🟩
CoCoMaps	🟧	🟧	🟥	🟧	🟧
GRAPE	🟧	🟧	🟥	🟧	🟧
CATCH	🟧	🟩	🟥	🟧	🟧

Table 5 - Global picture on the outcome from the experiments. Green light means a successful evaluation, a orange traffic light refers to an outcome slightly under the expectations and a red light is for results significantly under the expectations.

Generally looking at the quality distribution across Experiments, results confirm the quality assessed during the monitoring process with no major surprises happened during the final review onsite. As had already happened in Call 1, also in Call 2 the Experiments quality distribution highlighted a small numbers of excellent Experiments, an equally small number of bad ones, and the remainder in-between these two extremes. Four Experiments (Dualarmworker, Saferum, Homerehab and Hyq-Real) were in a very good status and three Experiments had very negative results.

Management of underperforming Experiments

In this reporting period, additional management of a Call 1 Experiments was performed. LA ROSES has undergone an additional mid-term review which took place in July 16. As a result of this early review they were granted a three months extension. This extension was geared to a list of objectives to be met by the LA ROSES experiment. The final review then took place in January 2017. They received a very detailed feedback by an external expert both after the mid-term review as well as the final review which revealed the shortcomings of the work performed by LA ROSES. This brought to a possible decision of a cost cut of the experiment. To avoid this, the Experimenters decided to prepare additional technical reports on the activities of the Experiment carried out after the review. Furthermore, a new review was organized for

February to evaluate the results of the Experiment. The evaluation showed that the issues raised during the original review – mainly the overheating and missing experiments on porcine eyes were successfully addressed by the experimenters. DexBuddy was another experiment considered to be underperforming. To avoid the cut of costs, an additional review was planned for 7th of January 2019 in order to give DexBuddy an opportunity to present the activities aimed at solving issues identified during the original review. The evaluation showed that despite not reaching some of the original KPIs (e.g. related to dissemination of the results) the experiments had significant impact and was one of the cornerstones of the success and growth of the Artiminds company. The technological achievements of the project have been further developed and are now commercially exploited.

Task 3.6 Call I - Phase VI – Result extraction and exploitation

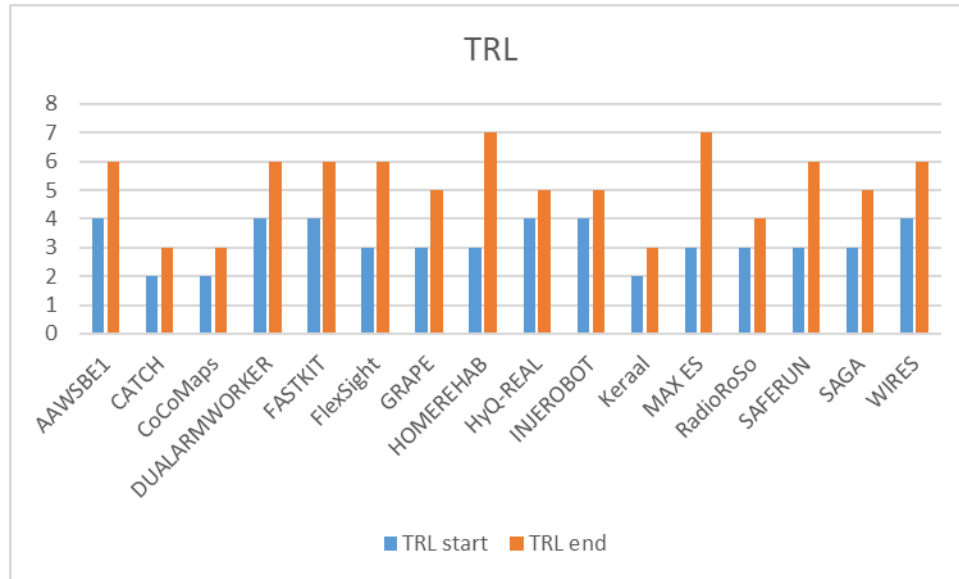| Acronym	TRL start	TRL end
AAWSBE1	4	6
CATCH	2	3
CoCoMaps	2	3
DUALARMWORKER	4	6
FASTKIT	4	6
FlexSight	3	6
GRAPE	3	5
HOMEREHAB	3	7
HyQ-REAL	4	5
INJEROBOT	4	5
Keraal	2	3
MAX ES	3	7
RadioRoSo	3	4
SAFERUN	3	6
SAGA	3	5
WIRES	4	6

Table 6 - TRL overview

Figure 3 - TRL Start & End

For improving the collection of the Experiments outcome, online surveys were purposively 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 (33 answers for Call 1 Experiments and 46 answers for Call 2). Detailed results are reported in D3.6.2.

The goals of the surveys were to collect data about the lesson learned about Experiment instrument methods and the innovation aspects. According to Experimenters, both budget and duration were appropriate, while the use of RIFs could be better exploited.

With respect to the lessons learned about the procedure settled during the Project, results showed that Call 2 Experimenters were more satisfied about the management and monitoring process as the proof that the following modification brought in Call 2 monitoring were successful:

- the presence of two moderators (technical and managerial) for improving the monitoring of technical aspects and reporting aspects,
- frequent Skype calls for Experiments status updates,
- internal call among moderator for making evaluation aspects uniform.

Results showed that the Project raised awareness about similar cascade funding projects, and especially Call 2 Experiments have applied in similar initiatives such as RobMoSys, ESMERA, Human Brain Project and HORSE. About the 30% of both Call 1 and Call 2 Experiments gave continuity to their work with follow-up projects. Less successful was the search to secure funding from private or public investors.
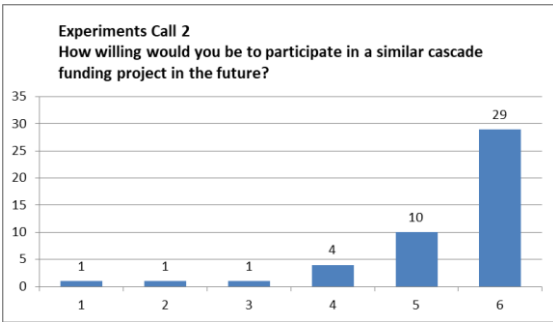
Figure 4 - Call 2 Experiments willingness to participate in similar cascade funding projects
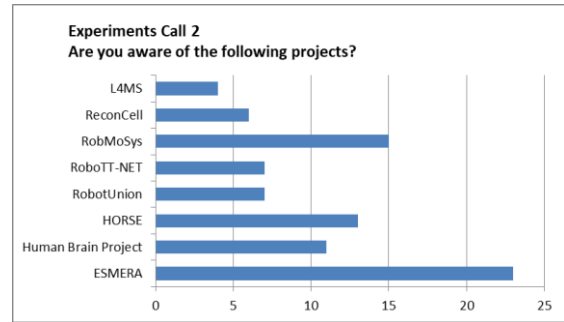

Figure 5- Involvement of Call 2 Experiments in similar cascade funding projects

The core ambition of the Experiments Instrument is to bring robotics innovation From Lab to Market. Therefore, one of the main metric to evaluate the E++ instruments success is the identification of the type of innovation creating thanks to the experiments outcome and the relative time to market of this innovation. Both Call 1 and Call 2 Experiments main outcomes were:

- the development of a new product,
- the improvement of an already existing product,
- the improvement of a process.

A final analysis was devoted to the market analysis, in particular the pathway to the market and the market identification and competitors.

Results showed that while Call 2 Experiments have still to exploit their innovation and are still involved in technology transfer aspects while the 25% of Call 1 Experiments are focusing on aspects closer to the market such as certification and standardization or search for investors.

Looking at the market, the majority of the products have not a well-established market and 52% of Experimenters declared that their market size is lower than 25M€ with the presence of some competitors but value proposition is clear and could be easily appreciated by the potential customers. Finally, the expected time to market is between 1 and 5 years from now.
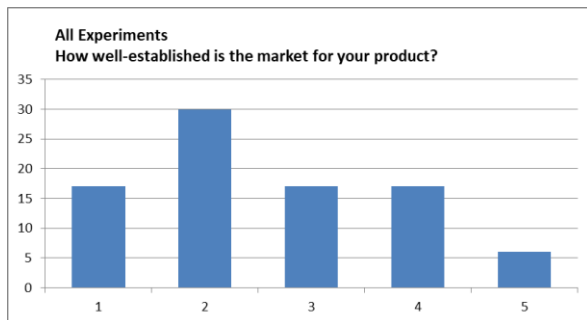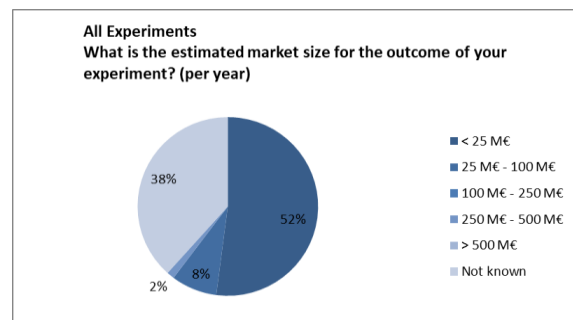

Figure 8 - market establishment
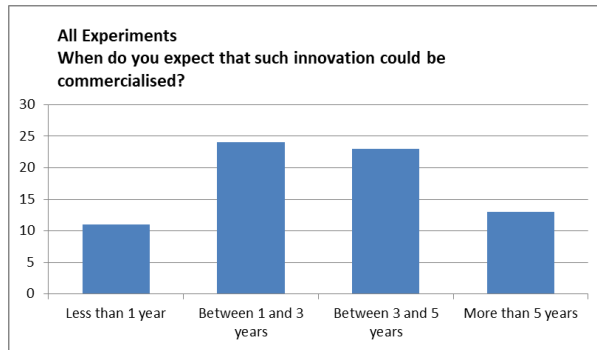

Figure 9 - estimated market size

Figure 6 - expected commercialisation

Experiment Booster Programme

The Experiment Booster Programme (EBP) is a new instrument established in ECHORD++ with the goal of supporting entities previously involved in the ECHORD++ Experiments in bringing their solutions to the market. The concept for the new instrument was driven by realization, that although many of the experiments developed innovative and relevant technological solutions, they still needed the final push to transform those into successful products. EBP consisted of two complementary segments – coaching and incubation programme delivered by external institutions and consideration for the third, TechFounders, accelerator programme bringing together the participant with potential industrial partners.

To provide flexibility to the beneficiaries and insure their needs are addressed as well as possible, the process also allows interested experimenters to formulate their own support programme. Applications from seven experiments were received, out of which four were selected for funding: SAGA, ExoTrainer, LINarm++ and MODUL. Each of the selected projects had different expectations and needs, which were addressed via individualized coaching and incubation approaches.

Avular had been facing difficulties in the highly competitive drone market. During the implementation of the SAGA project, they realized, that the newly designed navigation and on-board computer module can be a product on its own. With the support from EBP Avular underwent a radical change in the vision and strategy of the company and developed a new business model centered around the new product – Curiosity Core. The programme also allowed them the partner with a new investor – Lumipol Holding B.V. and to engage new customers – e.g. Vanderlande.

Similarly, the participants of the LINarm++ experiment realized that one of the building blocks of their rehabilitation device, namely the Series Elastic Actuator (SEA), could be commercialized on its own and thus support the further development of the medical device. With the support of the UnternehmerTUM's Makerspace they managed to manufacture and evaluate a new, more mature and market-ready prototype of the actuator. Participation in the coaching programme allowed the team, comprised of researchers, to define the value proposition and business model for their future venture. Additionally, a patent application protecting the results of the project has been submitted.

The ANYbotics company, a spin-off of ETH focusing on commercialization of the outcomes of the MODUL experiment, had been successfully selling both the SEAs and the quadruped robot developed during the project. However, both were sold without qualification or guarantee. Moreover, lifetime test showed that the actuators had rather limited lifetime, which was a significant obstacle in upscaling the production. Participation in EBP focused on redesigning the actuator in order to increase its robustness and reduce production costs. Both those goals were achieved – with 10-fold increased durability (from 100k to 1M

load cycles) and manufacturing costs reduced by at least 40%. The resulting new product is now being produced in a zero series and is expected to undergo rigorous testing and certification in order to be ready for customer deliveries in late 2019.

The exoskeleton developed within the EXOTrainer experiment had been already industrialized by Marsi Bionics and had been undergoing CE qualification. EBP provided support in shaping a targeted business strategy facilitating penetration of the German market, which is crucial for securing the financial success of Marsi Bioinics. The coaching activities provided support in understanding the reimbursement system of the German health, defining approach strategy and shaping targeted business plan. All those activities were in line with the strategy of Marsi Bionics, which is planning to address Germany as the first market and is preparing for clinical trials in Germany at the moment.

EBP has proved to be highly successful and helped the selected companies in getting closer to commercialization of the results of their projects and crossing the infamous "valley of death". The key factor of the success is the tailored approach to each of the cases and their needs – be it reshaping the strategy, reengineering the solution, adjusting to local regulations or finding an investor. Besides having a tremendous impact on the involved companies, the programme provided valuable experience in shaping the non-research related support for the participants of the future *financial support of third party* (FSTP) programmes.

2.2.3 Work Package 4: Robotics Innovation Facilities (RIFs)

The main objective of the fifth and final period of ECHORD++ for the Robotics Innovation Facilities (WP4) was to explore mechanisms to continue the RIFs beyond ECHORD++ funding. In all cases the three RIFs have secured funding and put in place mechanisms to ensure their sustainability for future years.

The full list of local personnel and available resources, including hardware and software available to the RIF client at each of the three RIFs is detailed within the RIF Handbook. Listed below in this Periodic Report are the new resources acquired during the current reporting period, 1st March 2018 to 31 September 2018 (end of the funded runtime of RIF operations).

Glossary of Terms

Engagement / Activities: An interaction with an organization or individual. Includes face to face, digital enquiries, dissemination events, workshops, pipeline and collaborations.

Collaboration: A successful application for an in-depth R&D collaboration, nominally 6 weeks, that has commenced.

Task 4.1 Definition phase for the RIFs

Not active during the reporting period. Corresponding sections of the RIF handbook have been continuously updated, though.

Task 4.2 Set-up phase for the RIFs

Not active any more during the final reporting period. As part of the continuation strategy, each RIF has been seeking funding from collaborative research projects that are supported by local, national or European funding sources. All three RIFs have been successful in seeking additional funding which has been invested in the acquisition of additional personnel and hardware (as detailed out in the RIF Handbook).

Task 4.3 Handling of applications, selection, prioritization and scheduling

Within this timeframe the RIFs approved 22 new applications, as presented in D4.3.5. The detailed distribution of those applications between the individual RIFs and different sizes of the applicants is given in Table 7. The differences in the nature of the stakeholders collaborating with the different RIFs show (as also highlighted in the reports of the RIF Booster Program), that all three of them are embedded in already existing and completely different local industrial ecosystems.

RIF	Start-up	SME	Large business	Total
Paris	0	1	3	4
Bristol	2	2	2	6
Peccioli	1	8	1	10
Total	3	11	6	20

Table 7 - distribution of new applications among RIFs

Task 4.4 Operation of the RIFs with user access

All the RIFs continued to offer access to their facilities and services in the final reporting period of ECHORD++. Between September 2017 and September 2018 the RIFs were engaged in 20 new collaborations. Within this period 113 RIF clients engaged with the RIF offering. For instance in Bristol the ratio of activities conducted with SMEs increased from 58% to 72% in this period, showing that the RIFs' offer became even more accessible and adjusted to the needs of SMEs. Table 8 presents detailed distribution of those among the individual RIFs.

RIF	New collaborations	New engagements	Total SME share (previous period)
Paris	7	91	53% (44%)
Bristol	3	17	72% (63%)
Peccioli	10	5	89% (59%)
Total	20	113	

Table 8 - distribution of new collaborations and customer engagements among RIFs

The key achievements of the RIFs, and thus the RIF instrument as a whole, in the reported period include:

- Registering all three RIFs as fully functional DIHs http://europa.eu/digital-innovation-hubs-tool
- Development of individual business strategies with the assistance of independent consultants provided via the RIF Booster Program
- Securing funds for continued operation beyond the runtime of ECHORD++

The main achievements of the **RIF@BRISTOL** include:

- Six new collaborations in this period (1st March 2018 to 31 September 2018)
- 100% funding secured (circa £1m) from ERDF to continue RIF@Bristol for further three years

- ERDF project commenced August 2018 and new staff (technical & administrative) employed, please see below.
- RIF@Bristol recognized & registered as European Digital Innovation Hub (DIH) Ref. http://europa.eu/digital-innovation-hubs-tool
- Partnership in TERRINet Project, duration 48 months; this is a joint activity with a number of European institutes and organizations including five members of the ECHORD++ consortium. BRL's budget is circa EUR 384,859.
- The RIF@Bristol has secured £3600 training fee to provide introductory training for six trainees over a period of two days; funded by Somerset Energy Innovation Center
- Agreement to continue support to NatWest bank to provide consultation and offer technical development support to its clients post ECHORD++ funding from Framework 7 programme.
- Early stage negotiations with Barclays bank to replicate NatWest bank support program to its clients, commencing Spring 2019
- RIF@BRISTOL has been in very promising discussions with a major aerospace company to secure a yearlong R&D project at circa £60k funding
- An Automation Systems supplier has approached the RIF@Bristol with a proposal for sending their clients who are considering early stage investigation of robotics. This is likely to be a new income generating stream.
- The Innovate UK funded project that resulted in the installation of an automated assembly system at Numatic International, a vacuum cleaner manufacturer has been awarded a rating of 'Outstanding' by the funder (source: https://info.uwe.ac.uk/news)

The **RIF@Peccioli** reported the following key achievements:

- 10 new collaborations with companies in this period;
- 8 new contracts which will be concluded in 2019;
- The National Competence Center (CC) on Industry 4.0 proposal named ARTES 4.0 "*Advanced Robotics and enabling digital Technologies and Systems 4.0*", coordinated by SSSA, successfully passed the negotiation phase and the project was financed by Ministry of Economic Development. On December 10, 2018 the Recognized Non-Profit Association ARTES 4.0, the organizing body of the CC in Industry 4.0, was set up.
- SSSA is partner of the DIH-HERO project (Digital Innovation Hubs in Healthcare Robotics) under the Horizon 2020 Grant Agreement No. 825003. The DIH will develop a broad-based pan-European network of Digital Innovation Hubs specialising in Healthcare Robotics.
- Involvement in the International Robotics Festival on October 2018 in Pisa;

The main achievements of the **RIF@Paris-Saclay** in the last period involved:

- Creation of iSYBOT company, incarnating the support from Echord++ in the conception of a new type of collaborative robot
- CEA obtained the support of the Ile-de France region to create the DIGIHALL Digital Innovation Hub1 Founding members of DIGIHALL are (CEA, IRT SystemX, Systematic cluster, Inria, Télécom ParisTech and Télécom SudParis).

- Start in January 2018 of the three Competence Center projects TERRINET (with BRL and SSSA) COVR (regulation in robotics) and ESMERA (Industrial challenges) to extend the scope of the RIF@Paris-Saclay
- Involvement in three DIH network projects RIMA (Robotics for Inspection and Maintenance, leader CEA) DIH-HERO (robotics for Healthcare, leader University of Twente), AGROROBFOOD (robotics for agrifood, leader U Wageningen).
- RIF@Paris-Saclay becomes an iCenter or the EIT Digital
- Interaction with the team of the H2020 SCALING project[67] about use of co-creation practices across Europe.

Task 4.5 RIF Process Adjustment

The RIFs continued to operate using the well-tested and already established procedures. Therefore, neither local nor global application processes were changed in the last period of RIFs operation. Analogously, no amendments were made to the scheduling of RIF clients.

Task 4.6 Result extraction and follow-up

The main results of the RIF instrument introduced in the ECHORD++ project and the lessons learned during the runtime of the project have been gathered and presented in the 4th Annual White Paper. In the last period special focus was put on ensuring the follow-up of the concept and ensuring sustainability of the RIFs beyond the runtime of the project.

An additional instrument, the RIF Booster, has been developed to support the individual RIFs in shaping their business and sustainability in accordance with the regional specificities and constraints (which are visible for example in the structure of collaborations reported by the RIFs). The program involved workshops and meetings with independent consultants, who analyzed the history of RIFs operation, the structure of their teams and the ecosystems, in which they are embedded. As a result, individualized reports summarizing the strengths and weaknesses of RIFs and outlining the direction of future development have been created.

Those strategies, together with the independent efforts of the RIF teams, allowed all three RIFs to secure funding for continued operation in the following years.

The **RIF@Bristol** has been successfully seeking funding on regional, national and European levels.

It is a part of the TERRINet Project, which is a joint activity with a number of European institutes and organizations including five members of the ECHORD++ consortium. BRL's budget is 385k€. The role of RIF@Bristol shall be the organization and scheduling of training and summer school sessions for training of personnel across from Europe.

An application for funding for circa £1m over three years – the RE project - has been secured from ERDF to develop a program to assist around fifteen organizations in Bristol area. The new programme is named SABRE and is delivered from within the existing RIF@Bristol to support SMEs in the West of England. The

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[6] https://www.mcts.tum.de/en/research/scalings-scaling-up-co-creation-avenues-and-limits-for-integrating-society-in-science-and-innovation/

[7] http://www.scalings.eu/

assistance will take the form of a three-months collaborative project in providing robotics and automation solutions to the SMEs in this area.

A new project is in the final stages of discussion with a major aerospace company to secure a yearlong R&D project at circa £60k funding.

The **RIF@Peccioli** used the RIF concept to model National CC ARTES 4.0 - a network structure of 13 universities and 115 companies with a total budget of 36 million Euro covering 7 Italian regions (Tuscany, Marche, Umbria, Lazio, Sardinia, Sicily, Liguria). ARTES 4.0 will be coordinated from the new RIF location in Pontedera - BioRobotics Institute of SSSA. The CC ARTES 4.0 is expected to be self-financing within three to five years.

Additionally, the SSSA is coordinating the aforementioned TERRINet project it is also a part of the HERO Pan-European DIH network focusing on the healthcare robotics.

The **RIF@Paris** secured its continuity by being the kernel and one of the founding members of the DIGIHALL Digital Innovation Hub of the Ile-de-France region. The hub covers four main development axes: Artificial Intelligence, Factory of the Future, Cyber-Physical Systems and Digital Trust. The operation of DIGIHALL draws from the experiences of the RIF instrument.

Moreover, the RIF@Paris is a leader of a Pan-European DIH networks focusing on robotics in inspection and maintenance (RIMA) and member of two others – DIH-HERO and AGROBFOOD. It is also providing access to its facilities within the TERRINet project.

2.2.4 Work Package 5: Public end-user Driven Technological Innovation (PDTI)

Objectives of reporting period

The goal for this reporting period of Public end-user Driven Technological Innovation (PDTI) was to develop the prototypes from Phase II further to achieve a TRL of 7-8 (Urban Robotics) and 6-7 (Healthcare Robotics), to improve the characteristics of the prototypes evaluated in Phase I and II, and to incorporate the technological improvements into the prototype that are needed to perform the challenges set out in the Challenge Brief. At the same time this last phase of PDTI also aimed at increasing the marketability of the developed robotic solutions, preparing for commercialization in order to take the products to the market.

Major achievements

Task 5.8 – Development of prototypes, scientific monitoring and feasibility studies

As PDTI healthcare is delayed according to the original timeline, the following reports on the final evaluation of Phase II. The major achievements of the Phase II before the evaluation can be found in the last periodic report. The final evaluation of Phase II took place on February 28th, 2018 at the public body, hospital Sant'Antoni Abat. In the first part of the final evaluation, the solutions were tested with two real patients selected by Dr. Galvez from the public body. In the second part, the consortia presented their progress and results of Phase II, focusing on the KPIs for this phase. The panel meeting took place the day after the evaluation. The final evaluation of Phase II showed that the technology is promising and that there is a market for it. However, there was still a lot of remaining work Phase III and beyond.
For CLARC, the TRL was not as expected with a TRL of 4. To increase the TRL, the reviewers recommended to reduce the complexity of the system and to consult with clinicians, health practitioners and wider range of users. The TRL of ASSESTRONIC was rated to be higher (TRL5). TRL 7 would be possible to achieve with moderate effort. Reviewers recommended to keep the portable concept, make it robust and open for

additional functional and maybe some activity tests (not in Phase 3 but during the product development phase afterwards). The submitted business plan was built around a software licensing model that seemed very unrealistic when contrasted with existing big software platforms and ecosystems for mobile/tablet healthcare applications.

This was a challenge to tackle within a relatively short period of time. At the same time, there needed to be a stronger focus on commercialization and customer involvement in Phase III. Thus, preparing for commercialization and engagement with the market was part of the objectives for Phase III.

One major outcome of the panel meeting and a strong recommendation of the external evaluators for both RTD consortia was to reduce the scope of the technology development during Phase III in order to bring the technology with this restricted scope to a high TRL level. As a result of this recommendation, the European Commission requested to get the clear feedback of the public stakeholders involved that the technology – even with the restricted scope - was still of interest to them. All public stakeholders directly involved in PDTI healthcare sent their statement of interest and committed (particularly the medical team) to support the evaluation of the technology development during Phase III with the monitoring team. Thus, Phase III started with a focus on a reduced technical scope, a targeted TRL of 6-7 and the development of a realistic business plan for both teams.

Task 5.9 Pre-Commercial small scale test-series / service development (task description here as in the DOW on the NEF portal)

PDTI Sewer Phase III had a duration of 12 months. It started on December 15th, 2017 and ended on December 14th, 2018. PDTI healthcare Phase III started on 1st of June 2018 and ended on 31st of January 2019.

During the last Phase of PDTI, all four development teams worked on improving their prototypes in quality and reliability. As a result, SIAR presented a very advanced prototype, while ARSI significantly improved their software (data collection and image processing) in terms of speed, quality and reliability, but with less focus on the drone. In PDTI healthcare, CLARC put a lot of effort into their prototype and tested it with around 400 patients (an impressive sample, but not all of them showing geriatric deficiencies), while ASSESSTRONIC put fewer effort into developing the hardware (which is not the core part of their product) but focused very much on the business side of their development. ASSESSTRONIC collected feedback from a lower number of patients, but their sample was more adequate.

While the activities of all four teams as well as their monitoring by members of the ECHORD++ core consortium, mainly concentrated on the technical side during the first two phases of PDTI, the focus in Phase III shifted from technology to commercialization and business development. This was also reflected by the expertise of the coaches assigned to all four teams for monitoring: In this last Phase the coaching was done by experts of the E++ core consortium with both a technical as well as a commercial background.

With their solid prototype, SIAR generated interest beyond just sewer-monitoring applications. SIAR is in contact with potential customers interested in their hardware, but also with customer groups all over the world not necessarily interested in taking their hardware or software solution, but in contracting SIAR as a service provider on their own account. SIAR seems to have a very broad exploitation potential. ARSI - in contrast- can commercialize their solution only in conjunction with a service provider. Their software solution offers an immediate path to commercialization: Integrating data generation and image processing into a sensor which human workers carry while inspecting the sewer would immediately increase the quality of information for the service provider at low costs.

In PDTI healthcare, ASSESSTRONIC has managed to develop a modular, highly flexible solution which is scalable in price, depending on the set-up (full scope including Get-up-and-Go test or just completing questionnaires electronically via a tablet). As in ARSI, the strong side of the CLARC solution is the software development, especially the interface for the healthcare professional. The reliability of the software used during the geriatric assessment still requires more improvement to become reliable in the real world.

All four development teams have developed business plans. ASSESSTRONIC needs to further finetune the costs in their plan. Three out of the four teams – ASSESSTRONIC, SIAR and ARSI – would need approximately two additional years to fully commercialize their solutions (the gap and the route to market being different for all three of them). CLARC has generated new third-party funded projects to further develop the technology and to exploit their scientific findings in education and research. In both applications – "Comprehensive Geriatric Assessment" and "Sewer Inspection" – the experiments would meet a high market potential. Especially through PDTI urban Robotics, ECHORD++ – motivated and driven by the core partner UPC – has shown the potential impact of robotic solutions in the area of city infrastructure by demonstrating the added-value of using robots during sewer inspection (verified during multiple test in the field).

PDTI Urban Robotics: Progress Phase III

The kick off telco for Phase III took place on December 19th, 2017. Here, the consortia received explanations on the monitoring process and the evaluation criteria for the Phase III. Proposals of the required deliverables were discussed, and the consortia were informed about the dissemination and communication activities offered by ECHORD++ and the actions proposed to improve marketability. The monitoring periods and activities in Phase III are described in detail in D5.7. The evaluation during the test series were focused on the functions required by the end-user and how well the new robotic technology would solve them. It is clear that the **ARSI** UAV is an early prototype which was completely redesigned from previous solutions. The reviewers doubt whether the chosen approach to develop a new platform is appropriate given commercial availability of COTS (Commercial off-the-shelf) solutions. In addition, a fully commercial solution may require a range of platforms depending on sewer dimensions, with modular payload to accommodate different situations. The strength of the ARSI solution lies in the data handling. The matching process in real time and post processing is excellent. Classification using multiple methods (heat maps, interpretation by masking surfaces from real pictures) is well developed.
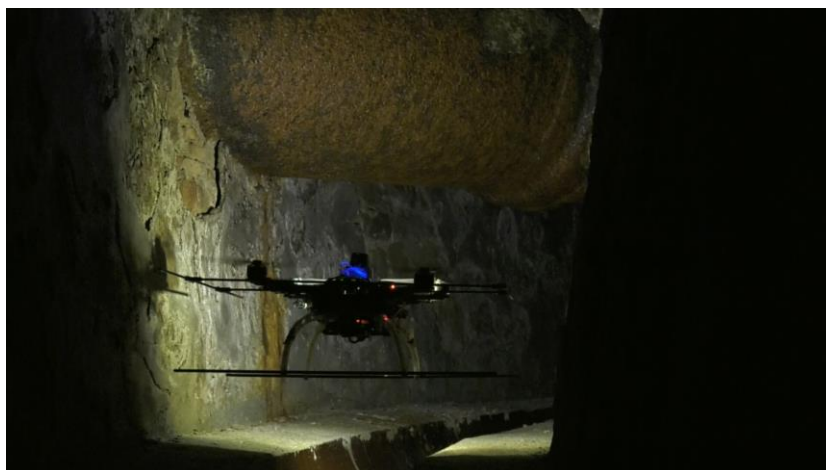

Figure 7 - ARSI final prototype

The **SIAR** team has made commendable progress since the last review at the end of Phase II. It is clear from the improvements implemented that they have taken many of the comments from the previous review on board. They have succeeded to develop a prototype which shows a lot of potential for commercialization and is already quite close to a market ready solution.

Figure 8 - SIAR final prototype

In general terms both consortia are strongly advised to get connected to the international market sooner rather than later, as the international market will be needed to make the commercialization viable and sustainable. The experts recommended to split the technology in individual units, considering bringing different partial solutions to the market and do not concentrate on the robotics technology alone.

PDTI Healthcare Robotics: Progress Phase III

Instead of a kick-off meeting, a midterm testing was organized, which took place in Vilanova i la Geltru, Barcelona Spain, at Hospital Sant'Antoni Abat from 17th to 19th of October 2018. The midterm testing gave the opportunity for the public body and the monitoring team to get a live update on the development progress, give them feedback on their first new prototype of Phase III, discuss the KPIs (see D5.7) for the final evaluation and the next steps until the end of the phase (monitoring deliverables, due dates, etc.). In this regard, the midterm testing was also used to organize two workshops in order to go into detail on how to write a business plan and what matters when developing a product.

Specific focus was placed on the business workshop as the final evaluation of Phase II showed a critical lack in this area, specifically on the business plan. At the workshop, the plan and guidelines for the business monitoring were presented. The agenda for the workshop included providing a typical business plan structure incl. an example of a business plan; going through the defined business KPIs, plan for the upcoming monitoring and deliverables. In the following months of Phase III, the consortia and the monitoring team had weekly monitoring calls, technical as well as business calls.

Both consortia participated in ECHORD++'s booth at the MEDICA fair 2018 and the monitoring team used this opportunity to inspect the updated prototypes and have a physical meeting to discuss the product development progress. Dr. Galvez Barron, healthcare professional from the public body, was in contact

with the consortia before they focused on their small-scale tests and visited both teams at the beginning of their test series.

The final evaluation of Phase III took place on 25th of January 2019 in Brussels followed by a panel meeting the next day. Both teams presented their progress during Phase III in form of presentations and demonstrations of their new prototypes, outlining their achievements according to the KPIs set-out for Phase III.
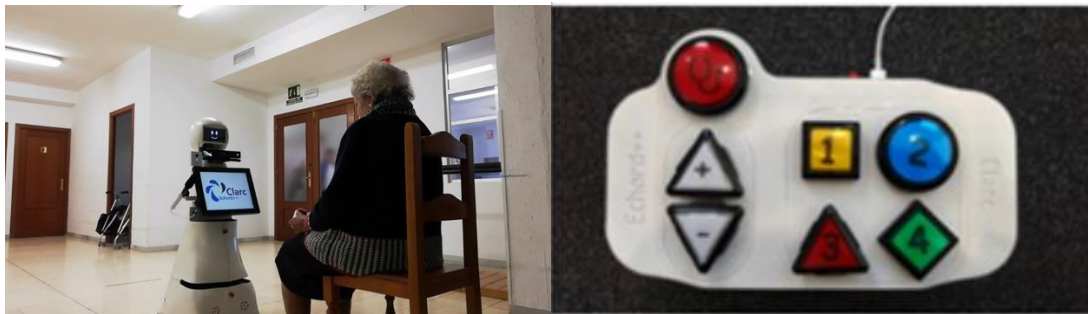
Figure 9 - CLARC user testing and new prototype, including new remote control (right)

CLARC was again highly motivated in Phase III and have carried out tests with a large number of patients (more than 400 patients so far), which helped to collect feedback on the new prototype design developed towards the end of Phase II. They have also attended all dissemination events that ECHORD++ invited them to such as Automatica, IROS and Medica Fair. The user studies have been carefully planned by the CLARC team, including well-known work such as the USUS framework[8] for evaluating human-robot interactions. In view of the novel uses of robots that are likely to emerge, this may prove a useful addition to knowledge in the field. A number of scientific results have been disseminated in this connection. Even though these rather build scientific impact than actual innovation, they contribute to a user-friendly development within this field that all developers of social robots can make use of. CLARC has been dedicated to creating a thorough business plan with the business monitoring team. The presented business plan has been well developed and can be feasible when the technology works.

ASSESSTRONIC has again demonstrated an organized approach to their work, with a clear focus on product development and delivering a prototype that is close to market at the end of Phase III. The ASSESSTRONIC team made significant progress since Phase 2. The system is convincingly simple and thus does not represent a high level of risk. The external reviewers evaluated the solution as TRL 6, on its way to a market ready solution. The final business plan is solid in the perspective of market expectations, the market approach, and foreseen sales estimates. Especially the involvement of Acetiam as a company who could commercialize the solution, is promising. Acetiam possesses all infrastructure and knowledge to successfully exploit the results and access the market without need of venture capital. ASSESSTRONIC independently organized user studies, which had no major technical issues or delays. They planned their study with a smaller sample size but focusing on a more appropriate end-user. Still, the number of patients on which the solution was tested is too few. Further trials are needed to ensure validation, which is essential if a final product is to be marketed successfully.

Figure 10 - ASSESSTRONIC final prototype

In Phase III, both teams have clearly benefitted from the PDTI structure, especially the monitoring input from multidisciplinary experts and the definition of clear KPIs. They successfully created prototypes for the user studies and developed a final improved prototype by the end of Phase III. ASSESSTRONIC focused on delivering a solution that works for the end-user and is robust enough to be used within the next couple of years. Both teams have delivered a business plan that is feasible and which they can continue to work with in their future activities. It is the monitoring team's belief that the PDTI experience will prove beneficial to both teams, in particular in fostering a product- and innovation- technology-development mind-set that will support them in introducing the product to the market according to the time frame that is appropriate for their individual solutions.

Task 5.10. Result extraction and PDTI manual generation.

Having performed also Phase III of PDTI, the core consortium of ECHORD++ is now able to fully assess the achievements and commercial potential of the different solutions. Concrete results and lessons learned from the PDTI process are summarized in the PDTI Manual (D5.8). ECHORD's recommendations to the EC and the stakeholders involved in developing robotics technology for and with the public sector in the future can be summarized as follows:

- If the technology development in a PDTI-like activity is from the beginning restricted to a specific technology (in our case robotics) it is vital to make sure that the challenge allows for such a restriction.
- It is important to make sure that all stakeholder groups are identified and actively involved in the process.
- When collaborating with the public sector it is important to understand that user and purchaser of the technology are not necessarily the same entity and that the interests of these two can be very different from each other. So, it is necessary at the beginning to clarify the role and decision-taking power of each stakeholder. It is also vital to understand the criteria, which the procurer implements to motivate the purchase decision.

- When dealing with hardware it is important for the development teams to have a proper mock-up in their labs. SIAR did this successfully and benefitted from this step.
- The coaching by the tandems business-technical from the core teams was tremendously important to achieve the results outlined in this deliverable. Coaching needs to include technical as well as business competence. At the end of ECHORD++, there are three prototypes, which will make their way to market within maximum two years if they are able to generate the funds and continue to get the support needed to make this happen. CLARC's way to market is longer, but this team has generated very valuable scientific knowledge and has already managed to acquire additional funds to continue their development. CLARC is probably the team which shifted their mind-set most: They have learned to adopt the agile project management approach, have learned how to integrate user perspective in their healthcare development and have forged a lot of new contacts (including hospitals with patients for testing) which will help them a lot to be successful in the future.

Having an additional in-person review meeting between the development teams and the external experts was particularly helpful. Done is sewer inspection, this helped to identify opportunities in commercialization as well as in the collaboration between the two teams, which started as competing organizations, but now benefit a lot from collaborating with each other.

2.2.5 Work Package 6: Structured Dialogue and Outreach Centre

WP6 is dedicated to increase the visibility of ECHORD++ via conferences and fairs and to disseminate the scientific results of the project. To achieve these goals ECHORD++ can rely on a speaker group set up to present E++ at different events.

The work progress and achievements during the period/highlights are:

- Exhibitions of prototypes at various major trade fairs and conferences, e.g. 150 sqm ECHORD++ booth at Automatica
- Participation in events related to "methodology selling", e.g. the GovTech Summit 2018, the annual DIH event, etc.
- Two white papers and a scientific book have been finalized

During the fifth reporting period ECHORD++ participated in numerous international fairs, showing the results of the robotic prototypes and the methodology developed, spreading the knowledge gained in the ECHORD++ instruments and the project management. Specific audiences have been reached for each one of the specific scenarios proposed by ECHORD++: MEDICA 2018 for healthcare robotics; Smart City World Expo and Congress 2018 for urban scenarios; IROS 2018 for the robotic scientific community and the European Robotics Forum for the European robotics ecosystem. Task 6.1 Overall outreach and communication planning

The action plan for outreach and communication was updated during the reporting period. The consortium paid special attention to communicate the methodology of the project and the products that have been developed, with an emphasis on attending events with a high political impact. Furthermore, as recommended by the reviewers, at these events we spared no efforts to brand the activities of our beneficiaries.

Task 6.2 Representation ECHORD++ at workshops, conferences, etc. and Task 6.3 Organisation of major fairs and events

As in the previous reporting periods, the consortium strategically selected events at which the results from the project were presented to the appropriate target audiences. The table below shows a summary of the activities in WP6 during the fifth reporting period and some images of the mentioned events. A further event already scheduled is the session "EC Success Stories" planned on March 22nd at the European Robotics Forum this year[9] where ECHORD++ will be presented upon invitation of the European Commission. The motivation of the session is to demonstrate how the European Union investment through its

programme contributes to the field of robotics and to foster the exploitation and re-use of the projects results. This process of inviting projects was very selective, therefore, we see this as a huge opportunity to again give high visibility to our project, demonstrate its contribution, how our results will be exploited and possibly how the audience can build on them.

For the future we see a high demand to share the results of ECHORD++ with interested stakeholders even beyond the runtime of the project. The core consortium is more than willing to continue communicating the success stories of ECHORD++ and its enduring legacy provided the availability of funds, of course.

Figure 11 - ECHORD++ Automatica booth

EVENT	VENUE – DATE INSTITUTION	DETAILS - PARTICIPANTS
EuRobotics Forum 2018	Tampere, Finland March 13 -15, 2018	**Workshop:** **"Encouraging cities to innovate through Robotics"** The main objective of the workshop presented under the ECHORD++ project was to identify the potential of robotics applications for regional and cities' challenges. The participation of the regional public entities as end-users and procurers and the industrial and academic consortia as suppliers, give us the opportunity to develop this workshop under the structure of an Open Consultation to link real needs with technological solutions looking to rise new robotic products closer to the market. **Participants:** **ALBERTO SANFELIU**. **FARID DAILAMI** **PAOLO DARIO** **CHRISTOPHE LEROUX**

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[9] https://www.eu-robotics.net/robotics_forum/press/erf2019-programme.html?changelang=3

		FRANZISKA KIRSTEIN
		ANTONIO BANDERA
		CARLOS RIZZO
		PAULO ALVITO
		CECILE HUET
		PÄIVI HAHO
		ANDRE MARTINS
		Audience: 30 people
		Organizers
		Prof. Dr. Alberto Sanfeliu, Dr. Ana Puig-Pey
Automatica 2018	Munich, Germany June 19 -22, 2018	**Echord++ Stand:** The main objective of the Echord++ participation in Automatica Fair, is to show to the industrial sector the results and pre commercial robotics products developed under Echord++. The 150 square meters of the stand allowed to show 12 prototypes and most of the cases to experiment with them. **Prototypes:** **ANYmal** **ANYdrive** **LINarm++** **FlexSight** **CATCH** **CLARC** **SIAR** **HyQ-Real** **SAGA** **AAWSBE1** **WIRES** **ISYBOT** **Organizers** Dr. Ana Puig-Pey, UPC and Anna Principato, TUM

IROS 2018	Madrid, Spain October 1-5, 2018	**Workshop:** **"ECHORD++: Advances in Robotic Science Supporting Innovation"** The main objective of the forum is to disseminate the innovative results of the more than 35 robotic experiments financed under the ECHORD++ European Project and the lessons learned in the innovative procedures developed during these five years looking to boost the project slogan "From LAB to MARKET". **Participants:** **CECILE HUET** **ALOIS KNOLL** **CHRIS MELHUIS** **ALBERTO SANFELIU** **PAOLO DARIO** **ELENA GARCIA** **PAULO ALVITO** **17:50-18:00.** **GEOFF PEGMAN** **Echord++ Stand:** The main objective of the Echord++ participation in IROS 2018 Expo, was to show some of the results and findings of E++ prototypes to the scientific robotic community. Four prototypes were exhibited in an area of 12 square meters. **Prototypes:** **EXOTrainer** **LINarm++** **SIAR** **CLARC** **Organizers** Prof. Dr. Alberto Sanfeliu, Dr. Ana Puig-Pey
GovTech Summit 2018	Paris, France November 12-13	**Echord++ Stand and Pitch** The main objective was to sell the methology of the open-call-management and the concept and success of healthcare and urban robotic PDTIs. An attempt was made to generate new challenges, especially in urban robotics for public bodies. **Information about:**

		Healthcare and urban robotics, open-call management
		Organizers
		Marie-Luise Neitz, Anna Principato, Christine Kortenbruck
MEDICA 2018	Düsseldorf, Germany November 12-15, 2018	**Echord++ Stand:** The main objective of the Echord++ participation in the MEDICA fair was to present the pre-commercial healthcare robotics developed in Echord++ and to closely connect to distributors and decision-makers in hospitals. On only 36 square meters we could present four prototypes, which attracted a lot of interest. Most of them could forge a huge number of promising links. **Prototypes:** **CLARC** **EXOTRAINER** **ASSESSTRONIC** **LINARM++** **Organizer** Christine Kortenbruck (TUM)
Smart City World Congress and Expo 2018	Barcelona, Spain November 13-15, 2018	**Echord++ Stand:** Echord++ has participated at the Smart City World Congress and Expo during the last four years. The main objective of this participation was to disseminate the procedures developed under the PDTI instrument between the cities' representatives and to show the results of the urban robotic challenge in sewer inspection and clearance. A floor of 50 square meters were shared between Echord++ and UPC/CIT (UPC Research Transfer Center **Prototypes:** **ARSI** **SIAR** **Information about:** **Architectonic Heritage Inspection with Robotics as SIAR and ARSI** **TERRINet Call** **TERRINet network infrastructure Barcelona Robot Lab.** **Organizers**

		Prof. Dr. Alberto Sanfeliu, Dr. Ana Puig-Pey
DIH annual event 2018	Warsaw, Poland November 27-28, 2018	The aim of this event was to reinforce the capacity of Digital Innovation Hubs (DIHs) to support European companies in their digital transformation. SMEs, start-ups, research and technology organisations, DIHs and policy-makers from all around Europe were invited to participate. **Information about:** Marie-Luise Neitz gave a talk at the DIHs to deploy AI and robotics across Europe. The session presented how the collaboration between the DIHs on AI and robotics can be further enhanced across the EU and in particular discuss how the link between them and other DIHs can be facilitated in future, also under the Digital Europe Programme. The panel also discussed how to optimise synergies and collaboration between the AI-on-Demand platform, the "toolbox for AI" and the DIHs network, "distribution channel for AI". **Organizers** Marie-Luise Neitz

Table 9 - Events, Venue & Details

Task 6.4 R&D publications and project outcome announcements

During the fifth reporting period the beneficiaries of ECHORD[++] triggered 22 scientific publications in journals and conference proceedings, highlighting both, the potential and the need for technical publications emerging from ECHORD[++]. Although the beneficiaries were expected to focus on communicating their results to non-scientific media, it should not be forgotten that a large part of the beneficiaries' staff indeed consists of researchers on postgraduate or post-doc level for whom scientific publications are an indispensable part of their job. Therefore, the ECHORD[++] core consortium also actively supported the experiment and PDTI partners in disseminating their scientific results by editing a 267-page scientific book on ECHORD[++] which has already been finalized and sent to the editors of Springer Science+Business Media where it will be published in the "Springer Tracts in Advanced Robotics" edition. This book named "ECHORD[++]: Innovation from lab to market. Robotic science supporting innovation" is structured in two parts. Part I presents an overview of the ECHORD[++] project instruments - Experiments, Robotic Innovation Facilities and Public end-user Driven Technology Innovation PDTI - and its specifics procedures and tasks from a "lessons learned" point of view. Part II presents a selection of 10 scientific and technological articles of the findings and results from ECHORD[++] Experiments and PDTIs. Finally, the public entity involved in PDTI urban, BCASA from Barcelona City Council, signs an article based on its participation in this innovative instrument.

During the fifth reporting period, ECHORD[++] presented two more White Papers. The first one named "Whitepaper on the financial support of third parties: what we have learned," elaborated by the TUM team, includes contributions from Cristina Lobbi, Marie-Luise Neitz, Adam Schmidt and Geoff Pegman. The second paper, named "Robotics Innovation Facilities," elaborated by the BRL Team, includes contributions from Farid Dailami and Chris Melhuish.

2.3 Project management during the period

The project management in ECHORD++ is covered by Work Package 1, which is dedicated to the coordination of the whole project, the integration of all the work packages (WP), the establishment of efficient management and collaboration infrastructure, the quality assurance, as well as the control of budget and spending.

During the fifth reporting period, the project management team has:

- submitted the periodic and financial reporting for period 4 (1/12/16 – 30/11/17);
- guaranteed the continuation of the PDTI instrument into Phase III for both Challenges, by negotiating and transferring the necessary financial resources to all four consortia involved (ARSI and SIAR for Urban Robotics, ASSESSTRONIC and CLARC for Healthcare);
- monitored the financial resources spent by all beneficiaries, discussed and approved a more strategic allocation of the unused budget with the aim of maximizing the impact of the RTD instruments;
- successfully launched the Experiment Booster Programme and the RIF Booster Programme;
- formally requested the extension of the project until 30/04/19 to allow the completion of the dissemination events introduced in the Annex 1 of the GA with the 7th request of amendment.

Despite some minor delays, mainly due to the difficulties experienced with the use of the EC Participant Portal and promptly notified to the Project Officer, the project has ensured the contractual and financial stability of its beneficiaries, as shown by the strategic KPIs (Annex 1) concerning contractual and financial security and further explained under Task 1.3.

In addition, the response was again strong in traditionally performing disciplines like networking and SMEs attraction. The Service Center has successfully supported all beneficiaries in building and expanding their own network of relevant stakeholders, contributing in this way also in strengthening the ECHORD++ brand. At the same time, the RIFs were able to implement an appealing offer for SMEs and start-ups.

Task 1.1 Overall Project Management

Coordination at PI level worked well thanks to informal meetings between the coordinator and members of the **Coordination Committee** throughout the reporting period. A final **Advisory Board Meeting** will likely be organized in Brussels, in conjunction with the event at the EU Parliament that is currently under organization.

Periodic conference calls - between TUM and the WP leader (WP3), the RIF owners (Bristol, CEA and SSSA) and the external consultant for the RIF Booster, as well as in WP 5 BOR (Healthcare) and UPC (Urban robotics) - ensured a very close and intensive collaboration between the members of the core-consortium. As in the previous period, great effort has been devoted in the area of experiment monitoring both for the experiments of call 2, as well as for Phase III of PDTI.

Task 1.2 Quality Management

An assessment of the project's performance against pre-defined targets is given in the Annex 1 to this report. During the period, the project was able to meet most of the assessable KPIs for the period. When unforeseen challenges emerged, we capitalized on the lessons learned so far and the processes improved during period 4 (e.g. flexibility in PDTI process), aiming to achieve reasonable levels of performance. Fol-

lowing reviewers' recommendations, the monitoring of **Experiments** has used a traffic light format to represent each Experiment's status (see Section 2.2.2). In complement, a more detailed traffic-light document was produced, describing with the same traffic-light representation the status of all KPIs, Deliverables and Milestones of each Experiment (see D1.2.7 and D.1.2.8). Yellow traffic lights in experiments were mainly caused by delays, while the general outlook for the majority of the experiments is fairly positive.

The monitoring of performance indicators for the **RIFs** was carried out, as in the previous period, in a more operational day-to-day fashion. A more systematic review and quality assessment of the instrument has been provided by the RIF Booster Programme (see Section 2.2.3).

During the reporting period, both **PDTI** Challenges (Healthcare and Urban Robotics) have gone through Phase III in which solutions with high market potential were achieved. Great attention was paid during this Phase to further support the teams in showcasing and commercially exploiting their results. In particular, the two consortia involved in the Sewer Inspection challenge (ARSI and SIAR) attended a follow-up meeting after the review of Phase III, in which the E++ management team joined the external experts to advise the teams on how to pave their way to the market (see Section 2.2.4).

Overall, the **dissemination and outreach activities** of ECHORD[++] were very successful and resulted in a high visibility of the project, as shown by the positive data on website and social media traffic and the several enquiries received by our Service Center from external organisation interested in the technology developed by Experiments and PDTI consortia (further details provided in Section 2.2.1). As detailed in Section 2.2.5 of this report, the project participated to and organized several outreach events that attracted not only members of the European robotic scientific community and ecosystem in general, but also specific audience interested in healthcare and urban robotics.

The quality assessment of all deliverables of the core consortium due during this reporting period was done as a team effort by the core partners involved in the different activity lines (Experiments, PDTI and RIFs).

Task 1.3 Financial Management

The total grant of ECHORD[++] amounts to 19.750.000 €. A pre-funding of 8.920.000 € was granted to the project. Retaining 5% of the maximum total grant for the security fund, the pre-funding physically transferred to the coordinator's account amounted to 7.932.500 €. After **pre-funding** the core consortium (1.957.109 €), Call I Experiments (2.375.159 €), Call II Experiments (2.456.351 €), the public bodies involved in PDTI (total 169.252), and the PDTI consortia for Phase I (143.390 €) and Phase II (439.659 €), the coordinator used part of its own pre-financing (217.191 €) to complete the pre-funding of PDTI Phase III (608.771 €); thus distributing a total of pre-financing equal to 8.149.691 €.

The financial statements for **RP IV** were submitted in the NEF on 16/01/19 and was approved by the European Commission on 13/03/19. The interim payment process based on the financial statement acceptance forms is currently under preparation.

During this reporting period the expenses claimed for **RP III** were also timely reimbursed as accepted by the EC. However, part of the personnel costs claimed by some beneficiaries involved in Call 1 (from the experiments DexBuddy and LA-ROSES) were rejected by the Commission on the basis of the on-site review performed after the end of the experiments. Following an open and more conducive approach, in agreement with the Project Officer and the monitoring team, the results of these experiments were re-evaluated during a second on-site review, meant to assess the progress achieved by some of the beneficiaries

after the official end of their experiments. Given the positive results confirmed by the external experts involved in these reviews (see Section 2.2.2), the possibility for the engaged beneficiaries to submit adjustments during the final cost claim is encouraged by the project management team and will be discussed with the reviewers during the upcoming review meeting.

Task 1.4 Management of Amendments

Three official requests to amend the gran agreement were submitted by the Consortium during the fifth reporting period.

The **sixth request of amendment (D1.4.6)** covered the following topics:

- Funding of Phase III of the PDTI Urban Challenge (Sewer Inspection, see Section 2.2.4): a total of 528.202 € (funding request) was transferred from TUM's Coordination Budget to the beneficiaries involved in the ARSI and SIAR consortia to finance the third Phase of PDTI. Phase III included: (i) the performance of further tests to advance the TRL of the prototypes developed by the competing consortia; (ii) the development of a data management plan; (iii) the preparation of an exploitation plan that includes a concrete commercialization strategy. The results of these tasks are included in the deliverables (ARSI D26.9 - D26.15; SIAR D28.9 - D28.15) that were added to the updated Part B of the Annex I to the grant agreement (DoW).
- Funding and implementation of the Experiment Booster Programme (see Section 2.2.2): three programmes were approved involving the experiments ExoTrainer, MODUL, and SAGA. As explained in the updated Annex I, the proponent beneficiaries (Marsi Bionics, ETH Zürich, and Avular respectively) received up to 15.000 € in sub-contracting and 60.000 € direct costs to take part in specific programmes aimed at tackling some prominent challenges for the commercialization of their prototypes. These include, for examples, (i) the introduction of ExoTrainer in the German healthcare market, (ii) studies to decrease the manufacturing costs of MODUL, and (iii) the development of a new business plan due to a shift of SAGA' target market from drones to mobile computing/sensing. Further details can be found in deliverables D12.10, D17.10, and D32.10.

The **seventh request of amendment (D1.4.7)** covered the following topics:

- Funding of Phase III of the PDTI Healthcare Challenge (Comprehensive Geriatric Assessment, see Section 2.2.4): a total of 692.129 € (funding request) was transferred from TUM's Coordination Budget to the beneficiaries involved in the ASSESSTRONIC and CLARC initiatives to finance the third Phase of PDTI. Phase III included: (i) further development of the technology and of a marketable product and its demonstration; (ii) the development and performance of user and acceptance studies; (iii) the preparation of a concrete and viable business plan and commercialization strategy. The results of these tasks are included in the deliverables (ASSESSTRONIC D24.9 - D24.13; CLARC D25.7 - D25.11) that were added in the updated Part B of the Annex I to the grant agreement (DoW).
- Funding and implementation of one additional Experiment Booster Programme involving the experiment LinArm++: as explained in the updated Annex I, the proponent beneficiary (Consiglio Nazionale delle Ricerche) received 57.303 € to (i) manufacture a more advanced prototype embedding the new variable stiffness actuator developed during the experiment, and (ii) participate into an incubation programme to develop a business plan and a commercialization strategy to bring the new actuator to the market. Further details can be found in deliverable D15.10.

- Introduction, funding, and implementation of the RIF Booster Programme: following up on the comments received during the last review meeting, the management team has implemented a diverse approach to further support the RIF instrument during this period of transition, and has selected a suitable provider (WIDE Idea Development AB) to carry out the planned activities.
- Implementation and funding of additional activities, such as the booklet on the success stories or the video filmed at automatica18 (see Section 2.2.1).

The **eight request of amendment (D1.4.8)** concerns the request to extend the ECHORD++ project: after the initial extension of the project's runtime until M 64 (January 2019), included in the fifth request to amend the grant agreement (RP 4, D1.4.5) and granted by the Commission, an additional request to extend the duration until M 67 (April 2019) was submitted on 29/01/19 and is currently waiting for the Commission's approval.

One additional amendment (D1.4.9, currently in preparation) is foreseen to request (i) the inclusion of FISEVI as third party linked to the beneficiary SERVICIO ANDALUZ DE SALUD (partner of the CLARC consortium, PDTI Healthcare), and (ii) the partial transfer of rights and obligations between the beneficiary FUNDACIO PRIVADA SANT ANTONI ABAT (public body responsible for the Healthcare challenge in PDTI) and CONSORCI SANITARI DEL GARRAF. The approval of these two requests is essential to enable the aforementioned beneficiaries to submit their financial statements for the current reporting period.

3 Deliverables and milestones tables

3.1 Deliverables table

No.	Name	WP No.	Nature	Delivery date from Annex I	Actual/ Forecast delivery date	Planned effort (from Annex I)	Comments
D1.1	Project Plan	1	0	31.10.13	Version 1: 30.09.13 Version 2: 18.06.15	17	Delivered during an earlier reporting period.
D1.2.1	1st six- Monthly QM Report	1	R	31.03.14	29.05.14	1.5	Delivered during an earlier reporting period.
D1.2.2	2nd six- Monthly QM Report	1	R	30.09.14	30.09.14	1.5	Delivered during an earlier reporting period.
D1.2.3	3rd six- Monthly QM Report	1	R	31.03.15	30.06.15	1.5	Delivered during an earlier reporting period.
D1.2.4	4th six-Monthly QM Report	1	R	30.09.15	30.09.15	1,5	Delivered during an earlier reporting period.
D.1.2.5	5th six-Monthly QM Report	1	R	31.03.16	31.03.16	1,5	Delivered during an earlier reporting period.
D1.2.6	6th six-Monthly QM Report	1	R	30.09.16	07.10.16	1,5	Delivered during an earlier reporting period.
D1.2.7	7th six-Monthly QM Report	1	R	31.03.2017	31.03.17	1,5	Delivered during an earlier reporting period.
D1.2.8	8th six-Monthly QM Report	1	R	30.09.2017	24.01.18	1,5	The report was submitted with a slight delay and then updated to include an overview of the experiment extensions.
D1.2.9	9th six-Monthly QM Report	1	R	31.03.2018	15.03.19	2	In preparation
D1.3.1	1st Periodic Report	1	R	31.05.14	02.06.14	2	Delivered during an earlier reporting period.
D1.3.2	2nd Periodic Report	1	R	30.07.15	30.07.15	3	Delivered during an earlier reporting period.
D1.3.3	3rd Periodic Report	1	R	29.01.17	30.01.17	3	Delivered during an earlier reporting period.
D1.3.4	4th Periodic Report	1	R	29.01.2017	29.01.17	3	An updated version of the report was submitted on the EC Participant Portal, together with the form C of all the beneficiaries, as soon as the reporting session was available (16/01/19).
D1.3.5	5th Periodic Report	1	R	31.03.2019	12.03.19	5	The report is submitted on time for the review meeting. It will be updated and submitted on the EC Participant Portal, together with the form C of all the beneficiaries, once the Commission has decided on the 8th request to amend the GA (project extension) and the reporting session is available on the portal.
D1.4.1	Amendment request 1	1	O	Unplanned	18.06.15	Unplanned	Delivered during an earlier reporting period.
D1.4.2	Amendment Request 2	1	O	30.10.14	30.06.15	2	Delivered during an earlier reporting period.
D1.4.3	Amendment Request 3	1	O	Unplanned	26.01.16	Unplanned	Delivered during an earlier reporting period.
D1.4.4	Amendment Request 4	1	O	30.03.16	28.11.16	3	Delivered during an earlier reporting period.

D1.4.5	Amendment Request 5	1	O	31.03.2017	22.05.17	3	Delivered during an earlier reporting period.
D1.4.6	Amendment Request 6	1	O	Unplanned	18.05.18	Unplanned	The approved request includes the financing and implementation of the 3rd phase of PDTI Urban Robotics and of the Experiment Booster Programme for ExoTrainer, MODUL, and SAGA.
D1.4.7	Amendment Request 7	1	O	Unplanned	10.09.18	Unplanned	The approved request includes the financing and implementation of the 3rd phase of PDTI Healthcare, of the Experiment Booster Programme for LinArm++, and of the RIF Booster Programme.
D1.4.8	Amendment Request 8	1	O	Unplanned	29.01.19	Unplanned	The pending request includes the extension of the project from M64 to M67 and the consequent modification of the final reporting period.
D1.4.9	Amendment Request 9	1	O	Unplanned	As soon as the Commission provides feedback on AR 8.	Unplanned	Includes a request for a partial transfer of rights and obligations and the inclusion of a third party to allow two beneficiaries, which underwent changes in their organizational structure, to claim costs for the 4th and 5th reporting periods.
D2.1.1	1st Customer Satisfaction Survey	2	R	30.09.14	30.09.14	16.20	Delivered during an earlier reporting period.
D2.1.2	2nd Customer Satisfaction Survey	2	R	30.09.15	30.09.15	16.20	Delivered during an earlier reporting period.
D.2.1.3	3rd Customer Satisfaction Survey	2	R	30.09.16	30.01.17	16.30	Delivered during an earlier reporting period.
D2.1.4	4th Customer Satisfaction Survey	2	R	30.09.2017	30.09.17	16.30	Delivered during an earlier reporting period.
D2.2	Project Website	2	O	30.11.13	31.10.13	9.5	Delivered during an earlier reporting period.
D2.3	Communication Plan	2	R	31.12.13	21.02.14	4	Delivered during an earlier reporting period.
D2.4	Contact data base	2	R	30.11.13	08.05.14	4	Delivered during an earlier reporting period.
D2.5	First set of PR-related material including presentations	2	R	31.12.13	28.02.14	8	Delivered during an earlier reporting period.
D3.1	Collection of guidelines, templates, and supporting documents	2	R	28.2.14	04.04.14	3	Delivered during an earlier reporting period.
D3.2	Report on information events and coaching activities	2	R	31.3.14	31.3.14	9	Delivered during an earlier reporting period.
D3.3.1	Call texts	2	O	28.2.14	10.03.14	2	Delivered during an earlier reporting period.
D3.3.2	Call texts	3	O	31.07.15	07.05.15	2	Delivered during an earlier reporting period.

D3.4.1	Collection of documents with final ranking, evaluation reports, statistics, and funding suggestion	3	R	31.07.14	14.08.14	4	Delivered during an earlier reporting period.
D3.4.2	Collection of documents with final ranking, evaluation reports, statistics, and funding suggestion.	3	R	31.12.15	05.02.16	4	Delivered during an earlier reporting period.
D3.5.1	1st six-monthly report on experiment progress and reviews	3	R	30.06.15	30.06.15	6	Delivered during an earlier reporting period.
D3.5.2	2nd six-monthly report on experiment progress and reviews	3	R	31.12.15	31.08.16	6	Delivered during an earlier reporting period.
D3.5.3	3rd six-monthly report on experiment progress and reviews	3	R	31.08.16	31.08.16	6	Delivered during an earlier reporting period.
D3.5.4	4th six-monthly report on experiment progress and reviews	3	R	30.04.17	26.05.17	6	Delivered during an earlier reporting period.
D3.5.5	5th six-monthly report on experiment progress and reviews	3	R	30.10.17	31.10.17	6	Delivered during an earlier reporting period.
D3.5.6	6th six-monthly report on experiment progress and on reviews	3	R	30.09.18	Upcoming	8	In preparation
D3.6.1	Final report on the outcome of the experiments Call I	3	R	30.11.16	27.01.17	10	Delivered during an earlier reporting period.
D3.6.2	Final report on the outcome of the experiments Call II	3	R	30.09.18	Upcoming	11	In preparation
D4.1	Operational Handbook	4	R	28.2.14	28.2.14 Version 14: 26.08.15	5.5	Delivered during an earlier reporting period.
D4.2	Report on set-up phase	4	R	30.09.14	10.12.14	5.5	Delivered during an earlier reporting period.
D4.3.1	Report 1 on selection /prioritisation and user schedules	4	R	30.09.14	30.06.15	0.9	Delivered during an earlier reporting period.

D4.3.2	Report 2 on selection/ pri-oritisation and user sched-ules	4	R	30.09.16	24.11.15	0.9	Delivered during an earlier reporting period.
D4.3.3	Report 3 on selection /pri-oritisation meeting and user schedules	4	R	30.09.16	31.01.17	0.9	Delivered during an earlier reporting period.
D4.3.4	Report 4 on selection /pri-oritisation meeting and user schedules	4	R	30.09.2017	30.09.17	0.9	Delivered during an earlier reporting period.
D4.3.5	Report 5 on selection /pri-oritisation meeting and user schedules	4	R	31.05.18	14.09.18	7.3	This report was submitted with a 4 month delay as a cause of the participation to the RIF Booster Programme.
D4.4.1	Report 1 on the outcome of the individual RIFs	4	R	30.09.15	24.11.15	63.75	Delivered during an earlier reporting period.
D4.4.2	Report 2 on the outcome of the individual RIFs	4	R	30.09.16	31.01.17	63.75	Delivered during an earlier reporting period.
D4.4.3	Report 3 on the outcome of the individual RIFs	4	R	30.09.2017	30.09.17	63.75	Delivered during an earlier reporting period.
D4.4.4	Report 4 on the outcome of the individual RIFs	4	R	30.09.18	Upcoming	63.75	In preparation (Delayed as a consequence of the extension of the project to M64 and the participation to the RIF Booster Pro-gramme.)
D4.5	Revised operational hand-book	4	R	30.09.2015	31.01.17	4	Delivered during an earlier reporting period.
D4.6	Final Report in RIF Concept	4	R	31.01.19	Upcoming	16	In preparation
D5.1	Operational Handbook	5	R	28.02.14	Version 1: 28.01.14 Version 5: 25.08.15	7	Delivered during an earlier reporting period.
D5.2	List with the public bodies interested in participating and their proposals as input for the evaluation	5	R	31.07.2014	Version 1: 31.05.14 Version 2: 30.09.14	7	Delivered during an earlier reporting period.
D5.3	PDTI: Open Call and selec-tion of RTD consortia	5	R	30.09.2015	30.09.16	23.5	Delivered during an earlier reporting period.
D5.4	Open Call and selection of the RTD consortia	5	R	30.09.15	30.09.15	8	Delivered during an earlier reporting period.
D5.5	Phase I - Design Phase: Se-lection of the two winning teams for Phase II	5	R	31.03.2016	31.03.16	7.75	Delivered during an earlier reporting period.
D5.6	Phase II – Feasibility Studies	5	R	31.01.18	31.01.18	22.1	Submitted on time. It corresponds to former D5.7 and was up-dated under amendment V.

D5.7	Phase III – Small Scale test series, user acceptance	5	R	31.01.19	12.03.19	46.0	Slightly delayed as a consequence of the late end of the 3rd phase of PDTI Healthcare (review and panel meeting on 25-26/01/19). It corresponds to former D5.8 and was updated under amendment V.
D5.8	PDTI Manual	5	R	31.01.19	15.03.19	35.25	Slightly delayed as a consequence of the late end of the 3rd phase of PDTI Healthcare (review and panel meeting on 25-26/01/19). It corresponds to former D5.9 and was updated under amendment V.
D6.1	Action plan for communication / PR measures	6	R	31.12.13	Version 1: 31.12.13 Version 2: 08.05.14	4	Delivered during an earlier reporting period.
D6.2.1	1st Annual White paper on the structured dialogue	6	R	30.09.15	31.12.16	9	Delivered during an earlier reporting period.
D6.2.2	2nd Annual White Paper	6	R	30.09.16	12.03.19	9	The previous deliverable (Proposal for Elsevier S&T Book on "Robotics for the elderly") is substituted in RP5 by the white paper on the financial support of third parties.
D6.2.3	3rd Annual White Paper	6	R	30.09.2017	October 2017	9	Delivered during an earlier reporting period.
D6.2.4	4th Annual White Paper	6	O	30.11.2018	Upcoming	9	In preparation
D6.3	Final R&D Publication	6	O	30.11.2018	12.03.19	23	Submitted with a delay as a consequence of the complexity of the publication process at Springer Science+Business Media

Table 10 - Deliverables Overview

3.2 Milestones table

No.	Name	Means of verification (from Annex I)	Delivery date from Annex I	Achieved Yes/No	Actual/Forecast achievement date	Comments
MS1	Project Kick-off	Agenda and minutes of this Kick-Off meeting	M1 31.10.13	Yes	Done	Kick-Off Meeting in Paris, mid-October 2013
MS2	Definition Phase for RIFs, PCP Pilots completed	Definition of the flowcharts for both instruments: RIFs (in deliverable D4.1), and the PCP Pilots (in deliverable D5.1)	M6 31.3.2014	Yes	Done	The Operational handbook for both instruments include a flowchart to manage both instruments. For the PCP Pilots the flowchart illustrates the activities geared to the active search for public bodies and the definition of the challenges for both scenarios. After this, the management of the RTD proposals / experiments will be very similar to the experiments (WP 3). The only difference will be that the products /services will be developed in a competitive approach and that it must be possible to compare the progress within the "competition" at any time (so fix common performance indicators for all RTD consortia working on the same scenario).
MS3	First bunch of experiments, RIF users and public bodes for PDTI selected	Experiments: Mail with evaluation results sent out to the applicants PDTI: Mail with evaluation results sent out to the public bodies who submitted a challenge RIF users: First engagement mails sent to RIF users	M13 31.10.2014	Yes	As planned	Experiments: The mail with the outcome of the evaluations was sent to the applicants on 14.08.2014. PDTI – selection of public bodies: The mail to inform the public bodies (who had submitted challenges) about the outcome of the evaluations was set out on 10.10.2014. RIFs: The first RIF users (to carry out the beta test) were attracted to the RIFs on 01.11.2014 (CEA), 27.02.2014 (SSSA) and 31.01.2014 (BRL)
MS4	First bunch of experiments, RIF operational phase start and R&D specification for PDTI finished	Experiments: Start date of first bunch of experiments according to contacts RIFs. First user engagements signed PDTI: technical details for Challenge brief fixed for both scenarios.	M16 01.01.2015	Yes	As planned	Experiments: The first bunch of experiments started on 01.01.2015 (those accepting to start without the signed contract /Amendment) RIFs: the beta test phase was fully running; before the official launch of the RIFs. RIFs: The first RIF users (to carry out the beta test) were attracted to the RIFs on 01.11.2014 (CEA), 27.02.2014 (SSSA) and 31.01.2014 (BRL). This was to gain first experiences. The RIFs were officially launched for unlimited public access on: November 26, 2014 (Bristol); January 14, 2015 (CEA) and February 9, 2015 (SSSA)

						The specifications for both PDTI scenarios were fixed after the selection of the public bodies in November / December 2014. But a fine-granular specification was developed for the Challenge Briefs prior to the Open Call (launched on 15.01.2015)
MS5	Second bunch of experiments and R&D partners for PDTI activities Pilots selected	Panel meetings	M30 31.03.16	Yes	Experiments: as planned PDTI Urban: slightly delayed (19.5.15) Healthcare 1: 16.4.15 Healthcare 2: delayed by 3,5 months	The panel meeting for Call II experiments took place on 7.10.2015. The panel meeting on urban robotics (sewer) took place on 19.05.15 The first panel meeting on healthcare took place on 16.04.2015, the second panel meeting after the re-launch of the call on 13.07.015.
MS6	Prototypes for small-scale test series in PDTI Pilots selected	Review and Panel Meeting with external evaluators and public bodies.	M42	Yes	Both slightly delayed Urban Robotics: 16-17.10.17 Healthcare: 28.02.18	The 2nd phase of the Urban Robotics challenge had a runtime of 12 months, from 01.09.15 to 01.09.16. The 2nd phase of the Healthcare challenge had a runtime of 10 months, from 01.06.17 to 01.03.18. This delay was caused by the redress case submitted by the ARNICA consortium at the end of phase I.
MS7	All experiments finished	On-site reviews with external and internal evaluators	M53	Yes	M62	The last experiment of Call 2 ended in June 2018 (M57) and the last on-site review took place in November 2018 (M62).
MS8	Closing Event		M64	Yes	M61 in Madrid	Workshop and at IROS 2018, "ECHORD++: Advances in Robotic Science Supporting Innovation": exhibition, presentation of the success stories from the RTD instruments financed by ECHORD++, and social event.
					Planned in M67 in Brussels	Breakfast at the EU Parliament in Brussels scheduled on April 2, 2019.
MS5	Second bunch of experiments and R&D partners for PDTI activities Pilots selected	Panel meetings	M30 31.03.16	Yes	Experiments: as planned PDTI Urban: slightly delayed (19.5.15) Healthcare 1: 16.4.15 Healthcare 2: delayed by 3,5 months	The panel meeting for Call II experiments took place on 7.10.2015. The panel meeting on urban robotics (sewer) took place on 19.05.15 The first panel meeting on healthcare took place on 16.04.2015, the second panel meeting after the re-launch of the call on 13.07.015.

Table 11 - Milestones Overview