ECHORD++

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Robotics Innovation Facilities. RIFs

4th Annual white paper on the structured dialogue

Robotics Innovation Facilities. RIFs

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1   Summary

With a focus on application-oriented research and development, ECHORD++ (E++) has been funded by the FP7 for five years to improve and increase the innovation in robotic technology through small-scale projects and a "structured dialogue" incorporating public entities and citizens to the conventional platforms of industry and academia.

Three instruments and processes are being developed under the ECHORD++ project: Experiments (EXP), Robotics Innovation Facilities (RIF) and Public end-users Driving Techno-logical Innovation (PDTI), all of them improving and increasing the innovation in robotic technology of SME companies and addressing answers to societal and industrial needs in different scenarios. E++ will elaborate four Annual White Papers describing the outcomes and results of the project, the tasks of communication and dissemination and the structured dialogue between all the involved stakeholders.

The fourth Annual White Paper is focused on the Robotics Innovation Facilities (RIF) process and the lessons learned during the first 48 months of E++. The aim of this white paper is to introduce the RIF instrument that was intended to boost the innovative research in robotic technology thus fostering the collaboration between academia and industries.

2   Objectives and scope

In addition to call-based experiments, small, focused research projects, ECHORD++ introduces a new concept to allow for light-weight access to research infrastructure and expertise. In three European countries, so-called RIFs (Robotics Innovation Facilities) are set up. RIFs are physical infrastructures in these countries.

A RIF is a "living lab" with close ties to the (academic) host institution and industry, and at the same time, it is a test bed for new robotics technology. Robotics Innovation Facilities will allow new robot customers and users to collaborate with roboticists with no entrance barrier, and at very low cost – so that new communities can form.

Operationally, the RIFs are open "experimental facilities", physically located at a university or research organisation. They provide equipment, services and personnel for anyone and everyone interested in robotics. ECHORD++ piloted this concept by establishing three RIFs and studied how they can work in an optimal way to attract researchers from other fields, robot users and customers, so as to generate new start-ups and support SMEs. Moreover, RIFs are an excellent opportunity to test new markets for manufacturers and start-ups at different stages, and this market analysis comes at no extra charge for them.

SMEs and start-ups are the main focus group to participate in these activities – RIFs are by their definition an ideal environment for developing and fostering new opportunities for commercialisation.

RIF access is without the need to formally become a new member of the ECHORD++ consortium (in contrast to the Experiment), and has a quick and regular decision procedure to evaluate light-weight application documents and to schedule stays in an interactive way. There are no fixed deadlines, the assessment of the applications are done approx. every two months.

Facts in brief:

- Three physical facilities providing infrastructure and services
- Stay duration approx. 6 weeks, re-application after a successful stay possible
- No application deadlines
- No need to become a member of the ECHORD++ consortium
- Evaluation panel every 2 months
- Acceptance and scheduling horizon: 6 months

3   Overview of the RIF instrument

A Robotics Innovation Facility (RIF) is a location where a single individual, a group of individuals or organisations can explore application of robots and automation to a variety of problems and challenges.

The ECHORD++ project has funded three RIFs. The three RIFs aim to assist participants in demonstrating robotics and automation solutions to problems that may be outside the capability or resources of a participant. The availability of hardware, software and expertise facilitates a quick examination of potential solutions and show if a proposed approach to solve the challenge is feasible or not.

Using a RIF to explore new product ideas or processes will enable the user to test various robots and interact with robotics and automation suppliers in a neutral environment. Moreover by streamlining the application process and lowering the engagement barrier it is anticipated that many participant outside of the normal robotics community will be able to participate in this enterprise.

In addition, the RIFs will strengthen and streamline the outreach to new constituencies by stimulating personnel exchange and more structured dialogue between all stakeholders. For example, workshops and information days are planned at the RIFs.

The RIFs are located in Bristol, UK, Peccioli (near Pisa), Italy and Paris, France.

4   The RIF process

A detailed description of the RIF Engagement Process is presented in the RIF Handbook.

A brief description of the stages is shown below.

The RIF instrument life cycle was split into six different stages of development

- Phase I: Definition phase for the RIFs and evaluation of proposals for structure and operation
- Phase II: Set-up phase for the RIFs (identical for each RIF with the same set of deliverables)
- Phase III: Handling of applications, selection, prioritisation, and scheduling
- Phase IV: Operation of the RIFs with user access
- Phase V: RIF process adjustment
- Phase VI: Result extraction, and follow-up
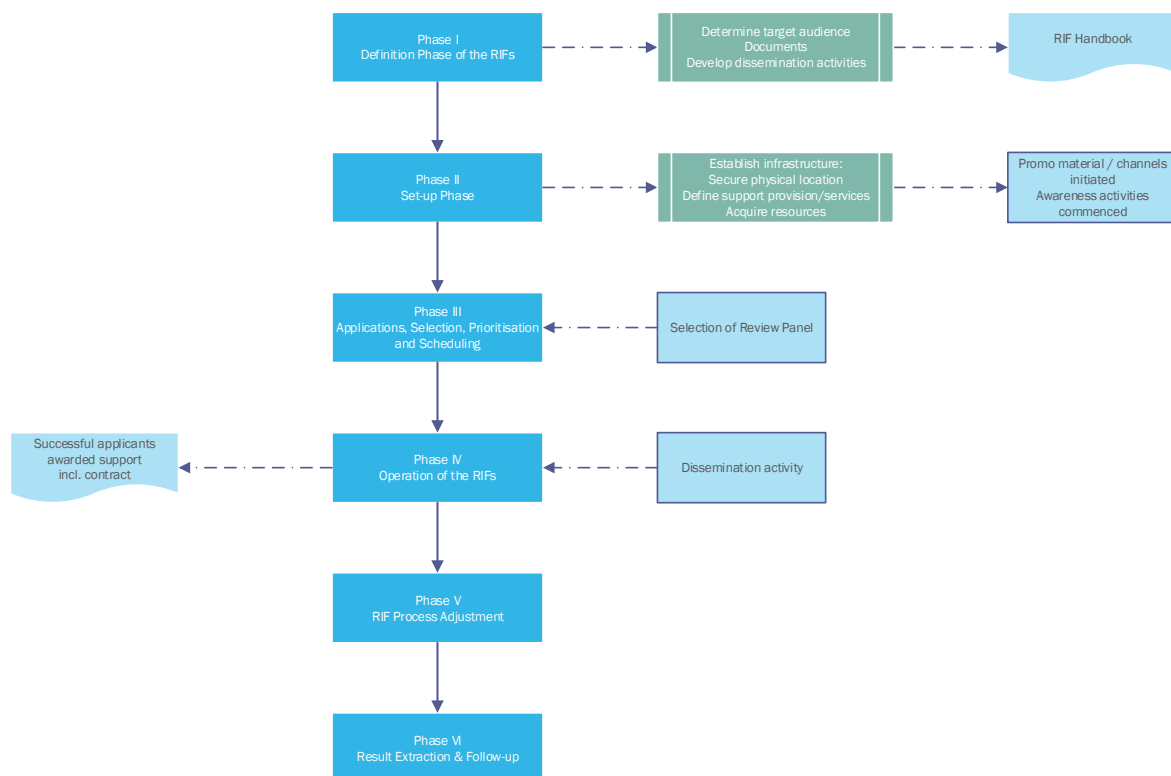
5   Phase I: Definition phase for the RIFs and evaluation of proposals for structure and operation

The RIF Operation Handbook was developed to define and convey the RIF concept to all key stakeholders and act as a Standard Operating Procedure for each of the three physical centres. The document included RIF infrastructure, technical and human resources, work plans, a marketing plan, operational processes and procedures including guidelines, templates and forms. As the RIF instrument evolved throughout its life, processes and procedures were modified and communicated through progressive adaptations of the RIF Handbook.

5.1   Marketing Plan

The key to the definition phase of the RIFs was to understand who its target audience is, the type of client they would attract, the type of support it can offer in consideration of the technical resources available and the human expertise at hand and the nature of work expected to be undertaken. The Marketing Plan was devised, with the input from each of the three RIFs, external business consultants, marketing professionals and the ECHORD++ programme lead institution, as follows:

5.1.1   Introduction

- To raise awareness of the ECHORD++ programme with a strong focus on promoting the activities and opportunities available through each RIF
- To reach potential clients through the use of digital platforms, incl. social media channels
- To enhance communication and understanding through the use of visual materials
- To add credibility to the programme utilising available endorsements from third parties
- To support the other E++ instruments and its key stakeholders

5.1.2   Understanding the market

Target audience / RIF clients

- SMEs, start-up companies & entrepreneurs (Local / National / Europe)
- Large business
- Not-for-profit organisations
- Researchers
- Industrial networks
- Academic networks
- Local authorities
- National governmental departments
- Educational institutions (secondary, FE & HEI)
- Fund agencies

RIF competitors

- Existing robotics and automation solution providers
- Business support programmes & consultancies (free or fee-based)
- Other universities and research centres

Affiliated marketing activity

- Host institution events, seminars and workshops
- Local business support initiatives
- Robotics conferences (local & national)
- Business & Innovation conferences (local & national)

- Editorials in industrial publications
- Sponsorship e.g. competitions

5.1.3 Identifying opportunities

Strengths of the RIFs

- Physical space
- Access to a broad range of robotics expertise & consultation
- Equipped with various robotics hardware & software
- Ability to conduct feasibility studies and carry out prototyping
- IP protection; ownership resides with client
- Permanent technical & business support personnel
- Located at established centres of excellence in Europe e.g. the BRL
- Access to business engagement initiatives
- Full range of skills development workshops on offer
- Established industrial and academic contacts
- Support (and funding) from European Commission
- Growing brand recognition
- Disposal of a broad network of local institutes and SMEs to create partnerships
- Diversity of competences & expertise

Weaknesses

- Limited capacity to accommodate resident engagements
- Online skills development courses for "non-local" clients
- Inflexibility to award start-up companies monetary support
- Increase range of workshop topics

Opportunities

- Progressive skills development from basic entry level to advanced level
- Distance learning courses
- Increase exposure at regional business events
- To address the growing need to develop business "Robotics Officers"
- Develop partnerships with business & public sector support programmes to complement offerings, increase awareness & reduce costs
- Sharing of expertise from the BRL and ECHORD++

Obstacles

- Insufficient labour resources
- Lack of marketing funds
- Potential business support partners may feel we are a threat to their objectives and possibly that we are encroaching on their territory
- Research being ring-fenced

5.1.4 Objectives

- To create a demand for the support offered each RIF
- To develop a rich pipeline of potential clients
- 60% of all engagements to comprise of SMEs and start-up businesses
- 25% of the RIF client base to be based outside the South West of England
- To create a demand for the RIF programme to justify the continuation of the initiative beyond its initial funding
- To build and enhance the reputations of the RIF, BRL, CEA and SSSA
- To have over 250 followers on Twitter

5.2 Users of RIFs

RIFs are addressing different user groups and provide specific benefits for them. The four user groups we envisage are as follows:

- **SMEs and start-ups**: to test products, prototypes and ideas, carry out feasibility studies, market analyses and acceptance studies. The RIFs will also encourage SMEs and (potential) spin-offs to intensively exchange knowledge with the host institution and other researchers and to use the equipment in the RIF. Depending on the SME this can go as far as "re-emulating" the conditions under which cooperations have become success stories. Accessing robotics and automation platforms free of charge, for a number of weeks with support from in-house expertise enables the participant to interact with the latest robotics and automation equipment. Participants will be gaining competitive advantage by use of robotics and automation in developing new products and processes. It is possible to obtain project funding to explore new products and processes by using the RIF engagement as part of a feasibility investigation and strengthening any further application for funded work. For any participant the use of RIF and its expertise will shorten development time and enables faster to market approach. Using a RIF to explore new product ideas or processes will enable the user to test various robots and interact with robotics and automation suppliers in a neutral environment.

- **Students**: students from different departments (CS, EE and ME – but also psychology, medicine and other disciplines) from different universities can apply for access to the RIF facilities and write their theses in close cooperation with users present in the RIF. This offer will be free, but students (or their home departments) will have to pay for their living expenses. Application will be simple: a one-sheet description of the work to be carried out will suffice.

- **New user groups**: outside the traditional robotics community, other researchers such as psychologists interested in e.g. human-machine interaction, usability and acceptance studies can make use of the RIF's services, infrastructure and equipment. They will have to apply for RIF time by submitting a short description of the planned work; their work will have to be synchronized with the other users far in advance on a best-match basis. For academics and individuals, RIF offers an opportunity for familiarisation and experimentation with robotics and automation for dissemination across society at large, schools, colleges, universities and other interested groups or to explore new ideas and applications.

- **E++ Experiments**: each experiment funded will be asked to spend a short time on one of the RIFs. More details can be found in the "ECHORD++ - Overview of the Experiments" brochure.

- **Workshop Attendees:** regular workshops are offered as part of the structured dialogue in a number of areas related to robotics, autonomous systems and automation. These workshops are open to all. In general these are introductory sessions targeting SMEs and delivered via a mix of lectures and hands-on sessions and delivered over two days over two consecutive weeks.

There is an additional benefit for robotics and automation suppliers and system integrators. They have opportunities for showcasing their products in a neutral environment and allow potential users to experiment and trial such offerings without the usual immediacy of commercial focus.

5.3   Scope and specialization of the RIFs
Within the general thematic context of ECHORD, each of the RIFs has its specialisations:

5.3.1   Bristol

- RIF @ Bristol Robotics Laboratory (RIF@Bristol), Bristol, UK, provides assistance in areas related to Cognitive Workers for new Applications:

  - Manufacturing
  - Assisted Living
  - Medical engineering
  - Food and Agriculture
  - Edutainment
  - General robotics, automation, sensors and actuators

5.3.2   Peccioli

- RIF@ Scuola Superiore Sant'Anna (RIF@SSSA), Peccioli (near Pisa), Italy, will provide assistance in areas related to Outdoor Logistics, Agricultural Robotics, Rehabilitation Robotics and Service Robotics:

  - Robotic co-worker (potential different applications that can be customized on the user's need)
  - Logistics robots (autonomous transport of goods and autonomous transport of people, in urban area)
  - Robot co-worker in domestic environment (robot companion, in the domotic house and in the nursing home in Peccioli)
  - Edutainment robot (robot guide and robot companion, in museums and in the domotic house)
  - Agricultural robotics (vineyards and biofarms as real environment test beds)
  - Disassembly in Circular Economy (dual arm robot provided with vision sensors and precision/power grasps grippers).

5.3.3   Paris Saclay

- RIF@CEA (Commissariat à l'énergie atomique et aux énergies alternatives), Paris, France, will provide assistance mainly related to Medical and Health Robotics, cobotics and collaborative robots:

- Tele-operated surgical robots
- multi-modal sensing of the operation site, cognitive interface between the surgeon and the robot system, smart instruments for minimally invasive surgery
- Rehabilitation robotics
- Teleoperation among other in medicine
- Human gesture assistance to reduce Muskulo Skeletal Disorders

5.4   Stay duration and users working in parallel

The allocation of time slots at the RIFs will be carried out on six monthly time horizons. Currently a full engagement is nominally six weeks duration. Depending on the available resources a minimum of four of engagements during a six-month period will be available. In some locations this may be more. But given this minimum and the three RIF locations, there will be approx. twelve engagements that occur every six months after which a new group will be invited.

5.5   RIF Work Packages
Four RIF specific Work Plans were developed to aid the set-up of the three RIFs as follows:

5.5.1   RWP1: Project Management

Objectives

- Efficient coordination of the integration of work packages using an up-to-date communication infrastructure in a collaborative environment
- Establishment of the management infrastructure for the efficient operation of a project comprising three geographical locations across Europe
- Timely communication with ECHORD++ programme leaders at TUM
- Quality assurance of the technologies employed and the services offered to RIF clients;
- Efficient control of each RIFs budget
- Efficient scheduling of client engagement with RIF technical support and equipment; within facility and via remote support

5.5.2   RWP2: Communications

Objectives

- 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.)
- Each RIF to communicate with the general public, comprising policy-makers, as well as stakeholder groups represented within the project
- Establish consistent and efficient communications between internal and external parties
- 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 represent RIFs at relevant, selected events.

5.5.3   RWP3: Marketing

Objectives

- To increase the visibility of the RIFs, capitalising on the visibility of ECHORD++
- To generate interest in RIF activities and initiatives and promote knowledge exchange and interaction with the RIFs
- To establish a universal brand with local identity for each RIF, representative of the ECHORD++ programme

5.5.4   RWP4: RIF Support Services

Objectives

- To identify and address RIF User support needs
- To provide access to industry specific research, findings, discoveries and developments
- To determine specific client needs and provide necessary assistance through direct support, including technical expertise, knowledge transfer and access to technical equipment, or referral to external support services if available
- To manage effectively User engagement with RIF(s)
- To ensure operational activity is documented, application & review procedures are adhered to, NDAs, Engagement Agreements and local facility enrolment & induction is fulfilled according to the RIF Handbook, and contributes towards evidencing & achievement of KPIs

6   Phase II: Set-up phase for the RIFs

All three RIFs have successfully formed RIF support teams, incorporating technical, administrative and managerial personnel and developed physical environments including hardware and software. Due to the potential demand for support across robotics themes, and from varying industrial sectors, each RIF has identified areas of technical and research based support within the host institutions and external partners providing specialist knowledge and support.

6.1   Human resources
Permanent staff

All RIFs have core personnel that are funded by the ECHORD++ project. Depending on the contracts of employment such personnel adhere to the local institute and EU employment regulations. In all cases it is of paramount importance that time spent by permanent staff on ECHORD++ related activities are collected via time sheets.

Visiting scholars

It is likely that RIFs will provide opportunities for scholars from many institutes to have access to the equipment to pursue areas of research that may benefit from the resources available in a RIF. Such visitors will be covered by those rules that govern the normal workplace requirements in terms of insurance, accidents and liabilities. Moreover, such personnel have also no claim to IP if they are working with a third party unless that agreement has been arrived at outside the remits of RIF and ECHORD.

Non-permanent staff

A RIF may access, depending on the availability of funds, personnel from the host institute or in some cases from outside suppliers. There is no vetting process other than those required by local regulations of the host institutes.

The full list of technical resources including hardware and software available to the RIF client at each of the three RIFs is detailed below:

6.1.1 RIF@Bristol: General information

RIF@Bristol is located at the Bristol Robotics Laboratory (BRL) in Bristol, UK and is the largest multi-disciplinary robotics facility in the country. It has an international reputation as a leading research centre in advanced robotics research. Professor Melhuish with Dr. Pipe as Deputy Director leads BRL. BRL is a partnership between the University of Bristol and the University of the West of England and with over 60 researchers it has a broad portfolio. BRL infrastructure includes workshops, rapid prototyping facilities, wet labs, 2,400m2 of project laboratories and two arenas with motion capture systems. BRL has many collaboration partnerships, both national and international and is experienced in managing large multi-site projects. Two experienced units specializing in business and enterprise serve BRL.

General profile. The University of the West of England (UWE) is a modern, growing university in the thriving harbour side city of Bristol. UWE Bristol is one of Britain's most popular universities, with around 30,000 students and 3,000 staff and is the largest provider of Higher Education in the South West of England. UWE is one of the fastest growing research institutions in the UK.

The University of Bristol (UNIVBRIS) is consistently ranked among the leaders in UK higher education. Ac- cording to The Times Higher Education World University Rankings 2009, it is among the top 35 universities in the world. Research-intensive and with an international reputation for quality and innovation, the University has 17,000 students from over 100 countries, together with more than 5,500 staff. In terms of the number of applications per undergraduate place, Bristol is arguably the most popular university in the country. The University is also recognised as a leading centre for the exploitation of knowledge through partnership with industry and the creation of spinout companies, and for imaginative engagement with the public.

6.1.2 Technical Resources

The facility will provide the following hardware and software:

<u>Hardware</u>
- 1 x IRB 120 ABB industrial robot (3 kg payload),
  mounted in a bespoke safety cage for use with classic industrial research and development.
- 1 x Staubli RX 120 6 axis industrial robot arm with force feedback (22kg payload)
  mounted in a bespoke safety cage for use with classic industrial research and development.
- 1 x Kuka LBR iiwa Lightweight arm (5kg payload)
  mounted in a bespoke safety cage for use with classic industrial research and development.
- 1 x Kuka KR60-3 (30 – 60kg payload)
  mounted in a bespoke safety cage for use with classic industrial research and development.
- 1 x Kuka LBR 14 R820 iiwa (14kg payload)
- 1 x ABB YuMi (0.5kg payload)

- 1 x Universal Robots UR5 (5kg payload)
- 1 x Rethink Robotics Baxter Robot (4kg payload)
- 1 x Aldebaran Pepper Robot (humanoid robot)
- A fully operational work station for production of prototypes featuring: Emco lathe & Milling machine with digital readouts
- Vicon vision system
- 2 Neobotix MPO-700 mobile platform, fully sensored robots for industrial, medical and assisted living applications.
- A Schunk SVH advanced humanoid robotic hand.
- Conveyor belt with embedded microcontroller.
- National Instrument data logging and instrumentation equipment
- A variety of hand and power tools.
- A Pace soldering station with Bofa extraction units.
- A power supply unit.
- An oscilloscope.
- An Assisted Living testing arena. A structure which imitates that of a typical bungalow for assisted living investigations.

Software
- Solid Works Computer aided design and analysis software
- Robot simulation software
- Data logging and statistical analysis software
- Modelling software for control
- Automation40 Schematic software

Services
- Market analysis
- Rapid prototyping
- Prototype design and production
- Experimenting and testing
- Knowledge exchange workshops in:
  - Introduction to mechatronics
  - Microcontrollers and embedded systems
  - Introduction to Robotics
  - Sensors and interfacing
  - Systems integration
  - Automation 4.0
  - Business Start-up
  - Intellectual Property & Finance
- Concept proofing
- Error recovery
- Internet of things

6.1.3   Examples of work undertaken:

- Development of robotic assembly cells
- Advisory service on application of robots in machining

- Development of robots for education and entertainment
- Robots in assisted living
- Use of robots in food and agriculture
- Design of automated materials handling systems
- Development of sensors and actuators

6.2 RIF@SSSA: General information

The Scuola Superiore Sant'Anna (SSSA) www.santannapisa.it/en is one of the five Italian special status university institutions, also called "Scuole Universitarie Superiori", which provides an education of excellence. It is a public university in its own right, which comprehends 6 research institutes, 1.800 students and 100 academic staff and holds over 100 patents and has spun off 43 companies since 1991, 20 by the BioRobotics Institute alone. The latter, located at the "Polo Sant'AnnaValdera" in Pontedera, Pisa, wants to act as a linking bridge to international centres of knowledge and to create a new concept of engineers that are scientists, inventors, entrepreneurs, able to invent and solve problems, and to create new companies in high technology sectors (biomedical engineering, micro-engineering, robotics and mechatronics). The BioRobotics Institute is composed of about 150 persons (more than 90 are PhD students). The average age is 31.5 years with a percentage of foreign students of 10%. The women are 31%.

The BioRobotics Institute offers a wide spectrum of state-of-the-art **research facilities and workshops** on campus and owns a **business incubator**, as well as seven additional laboratories and research centres located in Tuscany, among them the **Assistive Robotics lab (Service Robotics and Ambient Assisted Living Lab)**, Peccioli, Pisa. The Assistive Robotics lab has been collaborating with the **Municipality of Peccioli** (a small town close to Pisa) since 1995, on the topics of Services to elderly citizens through the design of service centres, the set-up of a domotic apartment for experimental research, the experimental application of rehabilitation technologies. This solid experience brought to identify the lab in Peccioli as a "**Robotics Innovation Facility**" (RIF) within the ECHORD++ project.

The Peccioli RIF www.pecciolirif.com consists of outdoor and indoor settings, where different scenarios could be developed, tested and evaluated, such as (i) Robotic co-worker (different potential applications), (ii) logistics robots (autonomous transport of goods and autonomous transport of people, in urban area), (iii) robot co-worker in domestic environment (robot companion, in the domotic house and in a nursing home), (iv) edutainment robot (robot guide and robot companion, in museum and in the domotic house) (v) medical robotics (hospital and rehabilitation centre), (vi) agricultural robotics (bio farms and vineyards in Peccioli area) (vii) and disassembly robotics for circular economy.

The BioRobotics Institute also provides: The Advanced Robotics Technology and Systems Laboratory (ARTS Lab), the Centre of Research In Micro-engineering (CRIM), the Centre for Research on the technology and support services for the Longevity (EZ-Lab), the joint lab of rehabilitation at Auxilium Vitae (Volterra), the centre of excellence on computer assisted surgery (Pisa) and the new Research Centre on Sea Technologies and Marine Robotics (Livorno).

6.3.1   Technical Resources

<u>Hardware</u>

- a Dual Arm robot from COMAU
- an Universal Robot arm, UR5
- Two Robotiq grippers
- Two Festo grippers
- Two ATI Load cells
- TwoScitos G5 equipped with:
- A Laser scanner SICK
- A Laser scanner Hokuyo
- One Asus xtion pro
- One Pan-tilt unit
- A Kinova jaco arm
- Two Kinect v2
- Two Kinect v1
- A Stargazer
- Two Segway rpm200
- An outdoor wifi network
- An outdoor surveillance monitoring system
- A NAO Next Gen Humanoid Robotic Platform *(new)*
- One KUKA youBot omni-directional mobile platform *(new)*

<u>Sensor Network</u>

- Wireless sensor network for smart environments
- ZigBee based home automation system
- Wearable sensor for physiological parameters
- Personal localization system (GSM/GPRS/GPS)
- Posture assessment (Inertial Sensors)
- Pir Sensor, Temperature Sensor, Humidity Sensor, Light Sensor, Door Sensor

<u>Services</u>

- Acceptability, usability and dependability assessment
- Benchmarking analysis
- Legal insurance, ethical, safety & economic issues
- Knowledge exchange workshops

Facilities

- A Landfill
- A Kitchens Warehouse
- The Domotic Home
- A Museum
- A Nursing Home
- Several Local Industries
- A Research Centre on Sea Technologies and Marine Robotics
- The Peccioli town
- The Laboratory of Rehabilitation Bioengineering at the Auxilium Vitae Rehabilitation Center
- The Locomotion Disorders Laboratory
- The Neuro-Developmental Engineering Laboratory
- The Centre for Micro-BioRobotics
- Three Biofarms
- Two vineyards
- A Breeding farm

6.3.2 Examples of work undertaken:

- Development of a sensored smart fridge
- Definition of the characteristics of an indoor portable seismic sensor
- Development of a mobile robot that check the soil condition in footballs arena
- Development of a vending machine that sells fresh cut fruit
- Development of a smart mobile warehouse
- Development of a smart refrigerator for blood and plasma

6.4.1 RIF@CEA: General information

RIF@CEA is located within the premises of CEA, LIST, Interactive Robotics Laboratory in Saclay, about 20km south west from Paris. It can be easily accessed from Paris and its two international airports using RATP and SNCF train services.

CEA (Atomic Energy Commission) is a French government-funded scientific and technological research organisation. CEA is active in three main fields: energy, information and health technologies, and defence and national security.

CEA LIST is a Research Institute inside CEA. Located at the heart of Saclay area (Paris region), the CEA LIST Institute focuses its research activities on developing innovative technologies for smart and complex systems. Its R&D programmes, with potentially major economic and social implications, centre on interactive systems (ambient intelligence), embedded systems (architecture, software and systems engineering), sensors and signal processing (industrial control systems, health, security and metrology). Dedicated to technological research, CEA LIST's more than 700 researchers and technicians strive to encourage innovation and technology transfer through long-term industrial partnerships. The dynamism of the Institute's teams, their project-based culture and their consistently high standard of scientific excellence underpin this objective. CEA LIST is a natural partner for industry seeking breakthrough technology, from the initial concept down to working demonstrators.

The Interactive Robotics Laboratory of CEA LIST includes 45 researchers and PhD students. Its research activities focus on service robotics, remote handling and collaborative robotics, with

applications in the fields of energy (nuclear, oil & gas), industry and health (surgery and rehabilitation).

Robotics research at CEA initially started in the 60s and 70s to address the need of remote manipulation of nuclear material in environments non accessible to humans. Force feedback tele-robotics is now also used in other hazardous environments like tunnel boring, space or offshore. In the industrial context, the research performed at CEA anticipates and accompanies the current evolution of production from large scale manufacturing of standard items to customized and individualized products. This evolution requires the development of more dextrous and easily programmable robots which can be used as versatile, reconfigurable and intelligent means of production. On the other hand, collaborative robotics in permanent interaction with humans offers another solution. By providing a force and gesture assistance to the operators, collaborative robots allow to minimize musculoskeletal disorders caused by manual tasks while maintaining human flexibility and adaptability. The Interactive Robotics Laboratory also works on future service robotics, with focus on personal assistance requiring more dexterity, mobility and autonomy (intelligent systems). Finally, the force feedback, haptics and cobotics technologies developed in the laboratory are applied in surgery and rehabilitation.

The laboratory is structured to provide technological innovation integrated into industrial prototypes. Core technologies are new robotic architectures, high performance actuation, force and supervised control, method and software tools. Research activity is organised in 3 main applicative themes: remote handling, collaborative robotics and autonomous dextrous manipulation.

6.4.2 Technical Resources

<u>Hardware</u>

- Tele and co-robotics surgical platform for MIS, open surgery and surgeons training
- High performance bi-manual master station for tele-surgery and virtual surgery training (integrated platform with two 6 DOFs hybrid haptic interfaces, among which one with active prop allowing realistic simulation of active tools, audio and visual feedback)
- Rehabilitation robotics or human assistance for industrial application platform
- Two 7 DOFs high performance ABLE arm exoskeletons.
- Assistive robotics platform for disabled people
- One Kinova 6 DOF Jaco robot equipped with a 3 fingers gripper and mounted on a Robosoft Robulab 10 mobile platform
- A fully equipped 200 m2 apartment representative of future living environments of disabled people: MobileMII (MobileMii contains home domain and video surveillance equipment usable for technical validation)
- Collaborative robotics and tele-robotics platform for industrial applications
- One A6.15 RB3D 7 DOFs collaborative robot
- One COBOMANIP from Sarrazin technology – collaborative robot for assistance to load handling
- Staubli RX90L and TX90XLTX90 6-axis industrial robot for tele-operation or hybrid command (force and position control)
- Artemis AGV (automated driverless vehicles) from BA system
- VR platform for virtual prototyping and training for industrial applications
- One 3D TV equipped with a real time simulation environment for physical interactions.
- One collaborative robot dedicated for SME logistic and industries *(To be operational in 2015)*

- Two advanced high transparency 6 DOF robots usable as collaborative robots or tele-robotic slave robots *(availability to be confirmed in 2015)*.
- Representative surgical environment composed of an adjustable operating table, a patient mock-up *(availability to be confirmed in 2015)*.
- An endoscopic trainer (pelvitrainer, e.g. a Laprotrain) and an endoscope (and a Viky EP motorized endoscope positioner if the pelvi-trainer is not equipped with a camera) *(availability to be confirmed in 2015)*.
- Other Robots focused on cobotics and collaborative robotics needs could be added in the future

Software

- Access to XDE interactive mutli-physics simulation software runtime licences. XDE is a software suite developed at CEA since more than 12 years and featuring interactive multi-physics simulation of multibody systems, rigid and (simply) deformable objects and contacts as well as a biomechanical digital human able to interact with its environment. Composed of different modules (XDE Physics, X-Fitting, X-Robotics, X-Ergonomics), XDE has applications in Virtual Prototyping, ergonomic studies, maintenance in virtual and mixed reality, training to dexterous gestures, robotics and cobotics simulation

- Access to TAO (Computer Assisted Tele-robotics) runtime licences. TAO is a tele-robotics controller developed at CEA since more than 20 years and featuring force feedback master/slave control, robotics trajectory control, Cartesian/joint position control, virtual Mechanisms, position/force homothetic setting, gripper pursuit with camera, 3D graphical supervisor.
- Access to SCORE 3D supervisor runtime licences
- Access to the AVISO assistive robotics programming environment Entail

Services

- Advices on the management of intellectual property rights
- Assistance to technology transfer
- Advices on how to deal with ethical, legal and societal issues in robotics
- Knowledge exchange workshops
- Experimenting and testing
- Concept proofing

6.4.3   Examples of work undertaken:

- Development and test of novel sensors for surgery
- Development and test of novel intra-corporeal dexterous surgical tools
- Test of rehabilitation cursus
- Test of new application in cobotics

7 Phase III: Handling of applications, selection, prioritisation, and scheduling

7.1 Application Process
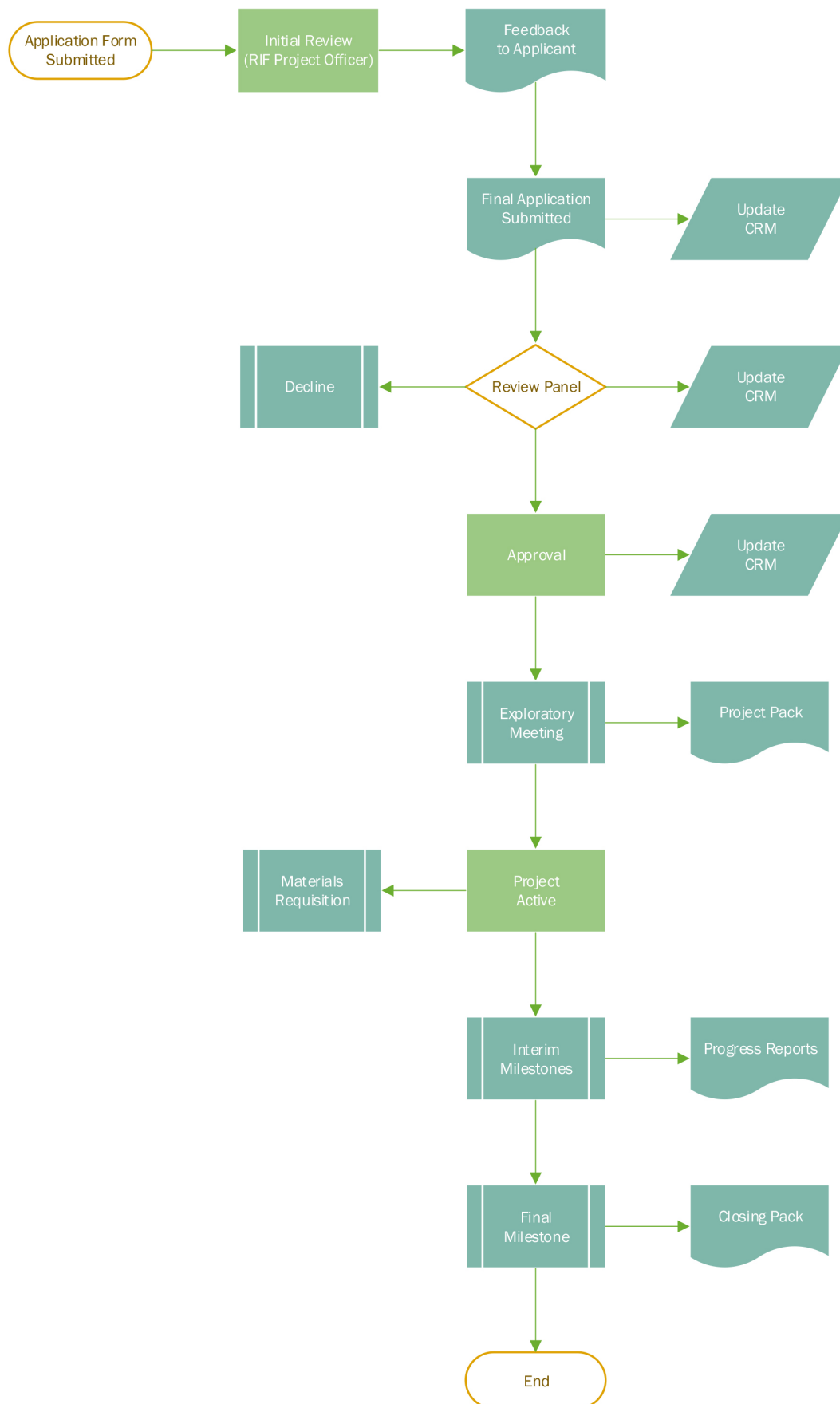
7.1.1 Initial Application:

The engagement process starts with completing the 'RIF Project Proposal Form' available online via the Echord++ website (www.echord.eu) and direct from the RIFs. On completion, the application form is submitted to the designated RIF for assessment.

In cases where the RIF submission is very close to an acceptable standard, but would benefit from some additions or modification to improve the submission, the respected RIF will provide a short and focused assistance to the applicant so that submission can be improved, increasing the likelihood of success. This, however, does not mean that the consultation will guarantee the success of the application or it can be carried out for an extended length.

Key Steps

− All formal applications are controlled directly by the local RIF.
− Proposal received and notification message sent to applicant.
− Each application is reviewed to ensure all information has been included.

The first review will be concerned with the following points only:

- Have all sections of the form been completed?
  ⇨ An example of lack of compliance would be unfilled sections.

- Is the information provided appropriate?
  ⇨ An example of lack of compliance would be unreachable URL or a web address.

- Is there a clear focus for the proposed request?
  ⇨ An example of lack of compliance would be omission of a clear statement that informs the reviewers in determining if the applicant has considered the usefulness of a RIF stay and the type of equipment that may be used.

- Is it feasible for the RIF to accomplish to the request received by the applicant?
  ⇨ Are the resources available?
  ⇨ Are the competences adequate to succeed in providing the expected results?

− Feedback & refinement of application and clarification of details requested if applicable.

7.1.2   Selection stage:

On receipt, all final applications will be reviewed by the local RIF Review Panel to be scored in accordance with pre-defined criteria including assessing the feasibility of the requested project and availability of competences required to undertake the proposal.

The membership of the review panel will be drawn from within the local RIF staff and can be tailored in accordance with the nature of the proposal, e.g. the inclusion of an expert in the respective robotic theme.

On completion of the review process of each application, the local RIF Review Panel will complete the 'Scoring form'. Those applications that score a total of less than 40% will be rejected outright. The remainder will be allocated slots for the forthcoming six months depending on their score and RIF capacity. If the six monthly period is filled, the unallocated applicants may be taken forward to the next six month period, however, this is at the discretion of the review panel and is not automatic. Those applicants that are not allocated slots may elect to resubmit their proposal for future consideration.

Key Steps

- Each application is reviewed by a local RIF panel
- Bristol RIF adhere to a scoring methodology (as per RIF Handbook)
- Applications for travel support will be assessed
- The outcome of the review to be communicated directly to the applicant by the local RIF
- Unsuccessful applicants will be provided feedback on request and given the opportunity to re-submit a revised application
- Successful applicants are invited to attend an internal exploratory meeting to assess and refine project needs and to determine the terms & conditions of the engagement, including resources, staffing, procurement & timeline.

7.1.3   Review / Evaluation criteria

The following are guidelines for the application review panel to assess and score an application. For each of the eight criteria a score out ten will be awarded based on its appropriate alignment with a descriptor for that criterion. The sum of the eight scores will be used for ranking of the applications.

Alignment with Robotics and Automation

Project's aim is to use/develop or design a system that include robotics and an integrated system and is directly related to ECHORD++ research foci and scenarios

Clarity and Focus of Proposed Work

There is a clear focus with well-defined time lines and deliverables and specific equipment requirements. The software required for modelling for example, and expertise needed from the RIF is detailed. The test protocols are clearly defined. The focus is stated in a clear sentence as "The focus of this engagement is to ……………."

The applicant has examined the details of facilities as described on the RIF web sites and is fully conversant with RIF capabilities.

Evidence of Commitment

The applicant is fully committed to the engagement with a request to participate in any work carried out in the RIF. This is manifested by the request to visit the RIF throughout the duration of the work. The applicant has already carried out some preliminary work before visiting the RIF. The applicant has produced hardware and software that may be used during the stay in RIF. This may be evidence by the purchase or acquisition of items currently not available in the RIF to use during the practical sessions in the RIF. There are computer models and CAD drawings of various elements that may be used during the engagement. The applicant has included sessions to be conducted in their place of work to supplement the stay in RIF. The work requested is a significant part of a larger project and the applicant has expressed and demonstrated the strategic nature of this engagement in their overall long-term plans.

Potential Impact

The application details the financial, technological and societal impact of the results of the engagement. The potential impact based on forecasted outcome from the engagement is realistic as agreed by both the applicant and the RIF review team. There is a clear focus, an agreed timeline and deliverables and the deliverable dates for the post engagement phase where the results will be exploited. The financial return from the outcome is clearly outlined, as are the technological and societal impacts. There is a clear description of the extent and depth of effects of the engagements after the completion of the engagement. These might describe the mechanism for obtaining financial return for example by the sale of products or expertise resulting from the engagement. The description may detail the extent to which the technology developed, as the results of the engagement will be implemented in relevant areas. The societal impact may be in the form devices, techniques, implements that may help the aged or improve the living environment.

Novelty of Proposed Work

The proposed RIF engagement will seek and demonstrate a novel and innovative solution to the problem posed and presents a new solution method using new software, hardware or integration. The result of the engagement is a new marketable product or methodology that has not been available in this form. The projected effect is *'transformational'* resulting in a product that does not currently exist. An example of this type of innovation is the personal computer and the creation of a new industry. In the context of RIF engagement the aim would be to **demonstrate either a software or hardware version of the *real* product.**

The following table summarizes the point scheme for novelty aspect:

	Demonstrated on a real product	Demonstrated on a key element of the product	Demonstrated on a simulated version of the product
Transformational effect	10	9	8
Incremental effect	7	6	5
Marginal effect	4	3	2

Size of Organisation

Organisation with up to 2 people is awarded a score of 10

Clarity of Continuation Strategy

Post engagement with the RIF, a proposal for 'Experiment' by full set of partners has been agreed and a declaration made that the proposal is available for the RIF review panel if required. There is a clear, logical and realistic project plan with identifiable deliverable due dates for post RIF period.

Presence of an Exploitation Strategy

A potential test product is likely and a **budget has been allocated** to develop a product based on the results of RIF engagement and market analysis has been carried out indicating a sizable market, marketable products are planned and beta test sites identified. A business plan has been drawn up and a number of potential clients have been identified and engaged

Re-application or extension of a stay

In the event of an unsuccessful initial application an opportunity to reapply will be granted.

Fair treatment of all applicants

All applications for RIF engagement will be assessed by a local RIF Review Team on each proposal's individual merits.

Results notification

Results are communicated to the applicants shortly after application review. An appeal process is not offered although feedback is available on request.

Table 1: Project scoring table

Client									
Reviewers									
Date									

					SCORING CRITERIA FOR RIF APPLICATIONS				
ALIGNMENT WITH ROBOTICS AND AUTOMATION	VERY LITTLE ALIGNMENT								HIGHLY ALIGNED WITH AUTOMATION AND ROBOTICS
	1	2	3	4	5	6	7	8	9	10
COMMENTS									
CLARITY AND FOCUS OF PROPOSED WORK	NOT CLEAR AND NO FOCUS								VERY CLEAR AND HIGHLY FOCUSED
	1	2	3	4	5	6	7	8	9	10
COMMENTS									
EVIDENCE OF COMMITMENT	NO REQUEST FOR STAY OR REGULAR VISIT TO LAB								REQUST FOR STAY IN THE LAB FOR THE DURATION
	1	2	3	4	5	6	7	8	9	10
COMMENTS									
POTENTIAL IMPACT	THERE IS NO POTENTIAL FOR IMPACT								A CLEAR IMPACT IS INDICATED
	1	2	3	4	5	6	7	8	9	10
COMMENTS									
NOVELTY OF PROPOSED WORK	THE WORK HAS NO NOVELTY								THE WORK IS VERY NOVEL
	1	2	3	4	5	6	7	8	9	10
COMMENT									
SIZE OF ORGANISATION	VERY LARGE ORGANISATION								MICRO OR VERY SMALL
	1	2	3	4	5	6	7	8	9	10
COMMENTS									
CLARITY OF CONTINUATION STRATEGY	NO EVIDENCE OF POSSIBLE CONTIUATION								THERE IS A CLEAR EVIDENCE OF ROUTE FORWARD
	1	2	3	4	5	6	7	8	9	10
COMMENTS									
PRESENCE OF AN EXPLOITATION STRATEGY	NO EVIDENCE OF EXPLOITATION OF POTENTIAL OUTCOME								VERY CLEAR ROUTE TO EXPLOITATION
	1	2	3	4	5	6	7	8	9	10
COMMENTS									

8 Phase IV: Operation of the RIFs with user access

Once operational, the RIFs scheduled for the different types and priorities of user groups to be catered for. This will involve balancing the relative importance and temporal priorities of the three types of user groups to be supported.

Every RIF will have to undertake the dissemination and awareness plan that they created in T4.1 and organised in T4.2 . The information days and events for SMEs and start-ups will be organised and carried out. Local SMEs and start-ups will be invited to participate.

Organisation of media events and press coverage, help in market studies, and with specific dissemination activities, coaching (especially for start-ups), and accompanying users in the further steps towards exploitation are also part of this task. Where appropriate, special initiatives will be organised to support technical transfer between selected user groups. The RIFs are monitored in context of the QM, but involvement of external experts may also take place, if helpful. Like the E++ Experiments, RIFs will be monitored for their performance, using an electronic infrastructure. There will be a limited travel support to RIF users in order to allow for access even if there is no RIF geographically close to the user's location. The rules for granting travel support will be defined

during the set-up phase (task T4.1) and will be published together with documents such as access criteria.

The three RIFs have been actively developing support initiatives for their clients with a strong emphasis on assisting start-up companies; identifying the general needs of new businesses including product prototyping, IP policy and protection guidance, financial assistance, personnel skills development and market research & assessment. Each RIF has established a support programme to offer RIF clients:

Service Provision	Bristol	Paris-Saclay	Peccioli
Stage 1 Engagement (free access)	6 weeks	6 weeks	6 weeks
Stage 2 Engagement (fee-based)	Referral to BRL Solutions for follow-on R&D	-	-
Experimenting and testing	Yes	Yes	Yes
Assisted living test area	Yes	-	Yes
External test sites	No	-	Yes
Prototype design and production	Yes	-	Yes
Rapid prototyping	Yes (BRL)	-	Yes
Workshop facilities	Yes (BRL)	-	Yes
Concept proofing	Yes	Yes	Yes
Skills development workshops	Yes	Yes	Yes
IP (Intellectual Property) guidance	Via UWE Bristol & Wynne-Jones LLP	-	Yes
Funding opportunities	Via UWE Bristol	-	Yes
Marketing support	In-house & UWE Bristol	-	Yes
Business support	In-house & UWE Bristol	-	Yes
Market analysis	In-house & UWE Bristol	-	Yes
Legal analysis	-	-	In-House & DIRPOLIS institute of SSSA

Insurance support	-	-	Yes
Usability, acceptability, dependability and benchmark analysis	Yes	-	Yes

8.1   Scheduling and possible re-assignment of location

The scheduling of engagements and resource management are controlled locally by each RIF. If it is determined that an alternative RIF may be more suitable / appropriate to fulfil an approved engagement, a dialogue between the two RIFs will be undertaken to explore a re-assignment of location. A final decision will be made between the two RIFs and the client.

8.2   RIF's risks and mitigation strategies

Reasonable effort has been made to ensure the availability of all the required resources to carry out the work outlined in the agreement between a RIF and a visitor at the time of the visit. The RIFs will display the current working status of all equipment on their respective websites and it is the responsibility of the applicants to ensure that they consult the appropriate website prior to their visit to a given RIF.

In common with all other complex and multifaceted endeavours there are potential likelihoods for aspects of delivery from the RIFs that may not emerge. These may be caused by the operational procedures of a RIF; for example a robot breaking down and hence preventing the performance of a certain crucial task. Or the operational schedule may be interrupted due to absence of key personnel and thus preventing the occurrence of certain activities. It may also be that the participants whether on the short engagement or the longer Experiment may not be ready with their input and hence prevent the delivery of an output. For all these cases a risk register is created and mitigation strategies are identified from the outset to ensure the smooth running of RIFs as far as possible.

8.3   Access to equipment

Where the competence in the safe use of equipment can be assured it would be possible for an applicant to request the use of equipment in a RIF without necessarily any involvement from the RIF personnel. Again the limits for this will be in respect of the duration of the RIF engagement. Applicants are encouraged to carry out as much work as possible at their own facility or using simulation software where available at any of the RIFs before occupying hardware time at a given RIF.
Each RIF is responsible for providing a central scheduling of its resources.

8.4   Travel Support

There will be a limited travel support to RIF users in order to allow for access even if there is no RIF geographically close to the user's location. The travel grants will be used to enable users to participate in and with the RIFs rather than perceiving distance as a barrier to engagement.

The terms for applying to access travel support are provided below:
- The grant will be available on a "match-funding" basis.
- Eligibility criteria of applicant:
    o Registered within the European Union
    o An SME, SME-like non-profit organisations
    o Submitted RIF proposal been approved
    Allocation of assistance will be based on the location of the applicant from the allocated RIF:

- o   Over 500 km 50% match funding up to a maximum of €500 reimbursed, this shall include subsistence
  - o   The maximum that can be reimbursed for flights of over 500 km will be 1000€, this shall include subsistence.
- Grants will be awarded based on the cheapest reasonable travel costs not more than actual costs for the stay; they are meant per RIF engagement not per person.
- ECHORD++ Experimenters are not eligible to access travel grants.

These rules are a first attempt and will be revised after the first 3 months of fully operational RIFs. In this phase, all decisions have to be approved by the evaluation board (see 3.5).

8.5   IP regulations, use of results, acknowledgement of E++ support (public)

RIF collaborators will own the IP developed during the RIF engagement. RIFs do not claim any rights to any of the IPs developed during the engagement. Where more than one collaborator participates in the same RIF engagement it is incumbent on the collaborating parties to agree on an IP sharing process. The RIFs do not participate in this process but require to see the agreement before they start of the work. All results obtained during a RIF engagement belong to the visiting parties and RIF makes no claim to this. All visiting parties must ensure that appropriate statements that acknowledge the support provided by RIFs are transmitted to the respective RIFs as evidence for later reporting to the Commission.

8.6   Contract, Service limitations, liability,

Terms and conditions of engagement vary locally, and are available on request from the respective RIF.

8.7   Reporting duties

The successful applicant must undertake to provide a short report concerning the application of the results obtained from the engagement six months, one year and eighteen months after the completion of the project. It is important to ensure that the dialogue between ECHORD++ and the applicants is maintained after the completion of the RIF stay.

9   Phase V: RIF process adjustment

After the first experiences in the operational phase, a critical internal review of the procedures will take place and, if needed, the procedures and modes of operation will be adapted. The redefined processes will be communicated and used for the next application rounds.

Contributions of UWE:

UWE will collect the recommendation on process adaptations of SSSA and CEA and update the operational handbook accordingly.

Contributions of TUM, SSSA and CEA:

Will actively contribute to the process adaptation, make recommendations and review the handbook.

These adjustments will be implemented by UWE personnel visiting SSSA and CEA and implementing the data collection environment that is developed by RIF@Bristol for the purposes of RIF data collection and analysis. This information will then form the bases of data presented at the review meetings that detail the types of entities that have engaged with the three RIFs.

10 Phase VI: Result extraction, and follow-up

The main goal of this task is to extract the results of the work done and to support the users in a structured way to take the next steps. An example is the organisation of workshops with venture capitalists in case of start-ups, but also the analysis of data to be used for certification or standardisation efforts are possible. Another goal of this task is to extract the results of the different users and use this as an input for the identification of the weaknesses and strengths of the RIF concept, should they be evolved into a new funding scheme, etc.

Contributions of UWE:

UWE has the lead and is the driving force behind the dissemination activities and result extraction in close cooperation with the other two RIFs. UWE will analyse the result of the different RIFs including their marketing activities and contribute to the final report that identifies the route to marke.

Contributions of TUM, SSSA and CEA:

Will actively contribute to the final report, provide statistical data and required analysis, write parts of the report, provide picture etc. The data required will be defined in task 4.1

10.1 Marketing Strategy (Review)

The three ECHORD++ RIFs were launched and operational by Spring 2014. Its customers are already benefiting from their RIF-engagements. Numerous events created awareness for all of the RIFs, multi-channel communication supports the promotion of the RIF services.

The "RIF" brand has not yet been fully established. All three RIFs have experienced a majority take up of support from parties located in close proximities to the respective facilities. However, the lack of engagement from outside the local & regional areas may be down to the fact that awareness generation exercises have taken place locally.

The challenge to achieving sustainable RIFs lies in understanding & meeting the needs of our clients, building upon the expertise and developmental opportunities from within the ECHORD++ initiative and its partners to provide niche robotics and automative solutions currently not being offered.

The ECHORD++ consortium regards the marketing activities for the RIF as crucial for achieving a sustainable success of the RIF concept. Since the RIFs are currently the only remaining instrument for new persons and organisations to join ECHORD++, this offers room and need for support for the RIF marketing from the consortium, especially from the communication / marketing specialists.

10.1.1 Analysis of the current situation

SWOT analysis

A profound SWOT analysis helped us to identify helpful and potentially harmful parts of the RIF concept / RIF marketing. The table below provides valuable input for the development of the RIF marketing strategy:

	Helpful	Harmful
Internal	**Strengths** 1. Zero-risk concept (financial, IP) – USP! 2. Access to high-tech robotic equipment **and** services (expertise) 3. Low-engagement barrier 4. NDAs are available 5. RIF operators are strong organizations (strong and enduring reputation) 6. RIFs fill a gap on the market 7. Strong local base 8. EC (esp. robotics units) uses RIFs and E++ as role model 9. Variety of platforms offered to users 10. Networking effects 11. Clients are reducing their risk when implementing robotics technology with help from the RIFs	**Weaknesses** 1. Need to implement measures to ensure confidentiality (NDAs) 2. Unclear branding of RIF concept 3. Lack of network in different countries 4. Missing visualization (esp. on the website) 5. Bad internal communications 6. Lack of case-studies 7. Lack of resources (personnel, budget) 8. Vulnerability of the equipment 9. Lack of transition plan for going to a stage of sustainability
External	**Opportunities** 1. Links to incubators 2. Increasing interest in robotics 3. RIFs will be recognized as a centre of excellence 4. Expanding RIF concept (e.g. through franchising) 5. Increased interest by the EC for innovation on hubs 6. Development of links with actual robot manufacturers (RIFs as showroom for their products) 7. Dissemination of RIF model beyond robotics community 8. Potential commercial application 9. RIF could leverage the industrial potential in Europe 10. The ECHORD++ RIF is a unique robotic support concept	**Threats** 1. "Paperwork"/Bureaucracy might scare potential users off 2. Confidentiality issues might scare potential users off 3. Incubators in some areas (healthcare) are competitors 4. Language issues (potential users don't speak English respectively Italian or French). 5. Accidents with injuries to persons at the RIFs 6. Poor engagements 7. Lack of ability to meet demand / long waiting time 8. Lack of financial & labour resources to meet demands of clients 9. Rise in demand for robotics support will potentially see similar support initiatives introduced that will challenge / threaten the RIFs, whether they are or not fee based. 10. Similar, fee paying, models that may introduce "free" support.

SWOT strategies

Strategies for dealing with the outcome of the SWOT analysis are mentioned below. These strategies will lead to actions by the consortium / be integrated in the overall marketing strategy.

Opportunity-strength strategies	Opportunity-weakness strategies
Use strengths to take advantage of opportunities 1. Use our network to benefit from increasing demand in robotics 2. Easy access to RIF helps to benefit from high demand	*Overcome weaknesses by taking advantage of opportunities*
Threat-strength strategies *Use strengths to avoid threats* 1. Use existing experience in dealing with NDAs and IP rights of the users (make sure it's easy to engage with RIFs) 2. For marketing outside the "RIF countries" try one country that is advanced in robotics and also widely English-speaking first (e.g. Denmark)	**Threat-weakness strategies** *Minimize weaknesses and avoid threats* 1. Identify how to improve internal communication (BRL); maybe blog system 2. RIF-specific website or new echord.eu website; dialogue platform 3. Produce footage (photo/video) in required quality 4. Make the application as easy as it can be (see above) 5. Target the market in the "RIF countries" first before trying to cover all of Europe

10.2 Marketing objectives

Marketing objectives are split in short and mid-term (i.e. during the runtime of ECHORD++) and in long-term (i.e. after ECHORD++) objectives. While the project is still running, the main objectives are to raise the profile of the RIFs and to demonstrate the RIF success, meaning giving evidence of the value added by the RIFs: directly to the RIF users, indirectly to European industry, the job market, the EC's efforts in pushing technology development and more. Concerning the number of applications the goal is to have a 100% utilization of the RIFs capacities with a moderate oversubscription.

One objective of a 'RIF focused' marketing campaign is to address the challenge in offering free services. A common reaction from potential clients is that "nothing is for free" and "you get what you pay for". This could potentially be the biggest challenge to overcome in encouraging businesses to engage with the RIFs.

Consumers have differing expectations regarding the "value" of services & products if a monetary value is not attached to them, e.g. paid for (robotics consultation, R&D) services are of a higher standard / quality utilizing "best for purpose" components, mandatory legal rights & IP protection in place, skilled personnel assigned to projects and equal time & resources allocated to the project portfolio to ensure agreed timelines & delivery dates are met.

It is a challenge of the marketing strategy to convince potential clients that these qualities are not just aspired to but will be met by the RIFs, irrespective of a no-fee policy. This will instil a confidence in potential clients that the RIF model is capable of enabling robotic solutions at the highest standard. Building upon this success will afford an opportunity for the RIFs to become self-sustaining through the delivery of a secondary, "fee paying" support mechanism.

Offer a free high quality short-term solution in a professional capacity at industrial standards that will lead to fee paying, long term collaborations. Creating a sustainable demand for the RIFs already in operation and maybe also for new RIFs, as well as securing a lasting funding for the RIFs are therefore the key objectives of the strategy.

Short + Mid-term objectives in detail:

- Spread the word about RIF success
- Understand needs of SMEs
- Ensure that people are aware of RIF existence beyond region where RIF is located
- Attract broader applications (Different SMEs)
- Raise profile
- Encourage use of robotics
- Communicate 'no risk engagement'; IP is protected
- Documentation for SMEs → Simplify usage of RIF promote
- Promote our offerings
- RIF branding
- Visualize what a RIF is
- Better channels of communication & promotional material
- Clear focus: target audiences → Global vs. Local
- Find out: Is there a demand we can't meet (market research)

Long-term objectives in detail:

- Create a demand for RIFs: for more RIFs and the ones already existing
- Expand within Europe
- Keep RIFs going after ECHORD++ (Self-sustainability)
- Have more people working at RIFs
- Have more equipment in RIFs
- Offer products that companies/institutions will pay for (not necessary?)
- Extend the RIF concept throughout Europe
- RIF as model for innovation lab
- Simplify usage of RIF
- Generate funding
- Enlarge RIF beyond robotics
- Make the RIF support SPARC activity

10.3 Target audiences

There are various target groups for the RIF marketing which include (industrial) solution-providers and solution-demanders, government agencies, the EC and politicians. In general, RIFs are for people with ideas, the RIFs help them to develop these ideas.

Below are the target audiences BRL is currently addressing:

- SMEs, start-up companies & entrepreneurs
- Large business
- Not-for-profit organisations
- Researchers
- Industrial networks
- Academic networks

- Local authorities
- National governmental departments
- Educational institutions
- Fund agencies
- Other European funded programmes

10.4 Message

Strong messages must be sent to potential RIF users, the stakeholders and potential financiers to ensure the future of the RIFs. The following messages will be used for the RIF marketing, emphasized depending on the target audience:

- The RIFs offer access to high-tech robotic equipment and expertise at zero risk (i.e. free of charge with guaranteed IP protection)
- The benefits for corporate users include: The ability to improve processes (efficiency), the ability to investigate new products and services and the ability to improve the skills of the employees
- Research institutions can investigate new, smart solutions at the RIFs
- The RIFs generate additional service beyond the engagement with RIF users, e.g. through trials, tests and benchmarking
- The RIFs accelerate innovations to the marketplace
- The RIFs protect and enhance the intellectual property of their users
- The RIFs offer their users the opportunity to realize their potential
- The RIFs promote the actions of the European Commission regarding robotics, they offer a value for the taxpayers (and thereby justify the strategy of the EC)
- The RIFs promote standards for safety in human-robot interaction (this is a message for the later stage of the project)
- The RIFs meet high industrial standards, without compromise
- The RIFs are two way engagement; the success of the RIFs is dependent on the success of its Users

10.5 Action Plan

The action plan below lists tasks for the ECHORD++ core consortium members, grouped by digital (blue) and non-digital channels (green). Please note: This list is neither exhaustive (further ideas can of course be incorporated), nor does it cover the complete runtime of the project.

Digital Channel	Task	Responsible partner	Deadline	Budget needed
Website	Relaunch echord.eu in a contemporary design	TUM	15. December 2015	None (will be part of the general relaunch of E++ IT systems)
Website	Make password-protected pages on echord.eu possible	TUM	15. December 2015	None (will be part of the general relaunch of E++ IT systems)
Website	Improve RIF-specific Q&A section on echord.eu	TUM	15. November 2015	None
Website	Create a set of RIF-specific keywords and hashtags for Search Engine Optimization (SEO)	TUM	15. December 2015	None
Website	Rephrase texts on website, implement graphics (info-graphics)	TUM	30. November 2015	None
Website	Contribute high-quality pictures of the RIFs	BRL/CEA/SSSA	15. December 2015	None if done with in-house resources (otherwise: ask for quotations)
Application form	Add a disclaimer to the form, stating that completing the form is not legally binding but just to register interest.	BRL	15. November 2015	None
Third parties' websites	Persuade RIF users to report on their RIF stay and to set link to our website	BRL/CEA/SSSA	With every successful RIF stay	None
Third parties' blogs	Make a list of third parties' blogs for sending them information on the RIFs	TUM	31. January 2015	None

Social media	Make an umbrella channel for all the RIFs out of BRL's YouTube and Twitter channel	BRL	15. November 2015	None
Social media	Conduct some market research on which further channels potential RIF users would use	TUM	15. December 2015	None
Social media	Collect ideas for social media campaigning	TUM	15. December 2015	None
Webinars/online courses	Collect ideas for webinars and online courses	BRL/CEA/SSSA	31. January 2015	None
YouTube	Film statements of RIF users to put them on YouTube/echord.eu	BRL/CEA/SSSA	With every successful RIF stay	None if done with in-house resources (otherwise: ask for quotations)
YouTube	RIF Video: Draft storyboard, estimate costs	TUM/BRL	31. January 2015	Tbd
PowerPoint/InDesign	Create CI guidelines based on the current design	TUM/BRL	31. December 2015	None

Non-digital Channel	Task	Responsible partner	Deadline	Budget needed
Market research on proximity/language issues	Conduct market research to see if geographic proximity/language is really an issue	TUM	31. January 2015	None
Breakfast/Lunch at the European Parliament	Get an MEP to sponsor the event, check whether such an event would be possible under the current standards for security	TUM	31. December 2015	5,000 € (travel expenses + catering) for the actual event
System integrators	Collect ideas on how system integrators could interact with the RIFs for mutual benefit	RUR	31. December 2015	None
Events	Clarify with Ana at which events we should emphasize the RIF marketing	TUM	31. November 2015	None
Robobusiness Europe 2016 (Denmark)	Clarify with Claus how much a remarkable presentation of the	TUM	31. October 2015	Rough estimate for the event:

	RIFs at Robobusiness Europe would probably cost; Get in touch with the conference's organisers			10,000 – 15,000 € for the booth (UPC will finance a part of it) + 5,000 € travel costs + 2,000 € shipping of demonstrators
Events for media	Collect ideas for events at the RIFs that will attract media (maybe an event on women in robotics?)	BRL/CEA/SSSA/TUM	31. December 2015	None
EC channels	Ask Cécile Huet which EC events we could be attending	TUM	30. November 2015	None
Exhibition stand	Design and buy an exhibition stand for each of the RIFs	TUM (Design) BRL/CEA/SSSA (purchasing)	29. February 2015	3,000 €
Showroom at RIF for manufacturers	Contact manufacturers if they are interested in having their newest equipment at the RIFs for showcasing it to potential users and buyers.	BRL(coordinate the action with CEA/SSSA)	31. December 2015	None
Trade organisations	Make a list of suitable trade organizations for each of the RIF countries and in Denmark/Germany/the European level; ask them to spread the word about RIFs	BRL/CEA/SSSA/RUR (for their countries); TUM (for the rest)	31. January 2015	None
Enterprise Europe network	Ask them to spread the word about the RIFs	TUM	31. January 2015	None
Research & Technology organizations, chambers of commerce, syndicates of industries and further networks	See trade organisations			
Existing research infrastructures	Target key individuals, check which infrastructures would	BRL/CEA/SSSA/ RUR/TUM	31. January 2015	None

	be favourable to contact			
Speaker group briefing	Create briefing for ECHORD++'s speaker group (see DOW for definition) to facilitate their communication on the RIFs	TUM	31. January 2015	None
Radio interviews	Ask key personnel of successful RIF stays if they are willing to give radio interviews about their experiences at the RIFs	BRL/CEA/SSSA/	31. January 2015	None
Research white paper	Write general pieces about how the RIFs helped companies for the 2016 ECHORD++ white paper	BRL/CEA/SSSA/	30. September 2016	None

11   Conclusions

Handling of applications, selection, prioritisation, and scheduling

The global application process was replaced by a locally managed process adhering to the application procedure defined within the RIF Handbook; the adaption reflects the strength in understanding and addressing the local needs of prospective clients and the availability of local resources.

12   Contributors

Mark Haley
Farid Dailami
Paolo Dario
Christophe Leroux

13   Acknowledgements

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