EIT ICT Labs

BLENDED LIFE IN A CONNECTED WORLD

European Leadership in ICT Innovation

Strategic Innovation Agenda
2014-2016

Knowledge &
Innovation
Community

EIT ICT Labs

Content

Management Summary

BLENDED LIFE IN A CONNECTED WORLD

Today, we live a blended life. We experience a world where physical and virtual encounters seamlessly merge. We blend our private and professional lives due to the flexibility to work at any time from different locations. We see industry disruptions as a result of flexible production as well as personalised service and product offerings. We see a blending of work and education in life-long learning amongst others facilitated by distance learning platforms offering us ways to a personalised approach in fulfilling our life and career goals. This blended life is a direct consequence of the deep penetration of ICT into our society through ubiquitous connectivity and information access and enables disruptive innovative solutions to address societal megatrends like demographic changes, urbanisation, increased mobility and scarcity of natural resources.

EIT ICT Labs is at the heart of these developments and is committed to bring the best of blended life to European citizens and industries. Building on European strengths and values, EIT ICT Labs drives the opportunities of a blended life via a pan-European ecosystem that brings together key players from education, research and business to create a true open innovation environment. Mobility of talents, ideas, technologies and investments drives the necessary sharing of know-how in order to create a European network of vibrant ICT hotspots. With this network involving more than 120 leading European ICT companies, universities, research institutes, local innovation clusters and incubators, EIT ICT Labs drives European ICT innovation for economic growth and quality of life by: 1) accelerating the

market introduction of research-based innovations, and 2) educating highly talented students in top class ICT programmes with a strong focus on entrepreneurial skills. Halfway through its first term, EIT ICT Labs has undertaken a major strategic review of the achievements to date and identified the next steps to ensure EIT ICT Labs' high impact at the desired ambition level.

DRIVE ACCELERATION OF RESEARCH-BASED INNOVATION BY ENFORCING FOCUS AND IMPACT OF INVESTMENTS

In order to have sufficient critical mass behind its innovation actions, EIT ICT Labs has decided to focus on a limited number of areas. These areas have been selected based on a careful SWOT analysis of the European ICT position in a global perspective.

When it comes to core ICT developments, the areas that have been selected to focus the efforts on are: Future Networking, Future Cloud, and Privacy-Security-Trust. This selection is motivated by the fact that Blended Life is driven by the efficient handling of big and real-time data volumes and therefore needs a future generation of secure and trusted network and Cloud infrastructures. Since these technologies are key it is of vital European interest to have a strong position.

When it comes to ICT-enabled developments, five areas have been selected: Health & Wellbeing, Energy, Urban Life and Mobility, Smart Manufacturing and Critical Infrastructures, and Smart Spaces. These areas offer clear opportunities for Europe due to the combination

of European strengths and values when it comes to healthcare, sustainable energy production, manufacturing of high quality products, and quality of life in our cities and environment. Towards 2016 we expect major breakthroughs in *Trusted multi-Cloud Infrastructures and Services, Cyber-Physical Systems for Production Systems, Preventive Healthcare solutions based on the Quantified Self,* and *Smart Grids,* to name a few.

DRIVE ENTREPRENEURIAL EDUCATION VIA BLENDED EDUCATION AND MOBILITY

The EIT ICT Labs education adheres to a systematic "Schools & Tools" approach providing blended programmes that deliver T-shaped talents who are able to combine deep technical ICT knowledge with broad entrepreneurial skills. The "T-shaped" metaphor refers to professionals with deep skills and expertise in a single technical field as well as a set of broadly applicable non-technical abilities, e.g. related to innovation and entrepreneurship or to collaboration and communication. The Master-, Doctoral- and Professional Schools build their programmes on Tools, such as the EIT ICT Labs partner university education programmes, Co-location Centres and online learning platforms. The ambition is to set a strong example for Europe by demonstrating excellence and by operating lighthouse initiatives that stimulate entrepreneurship and mobility, thereby inspiring a structural change in the European education landscape. Towards 2016 the Master- and Doctoral School will be upgraded in scale, the Professional School will be established and blended education will be

fully integrated in all programmes. Integration of education activities within the Action Lines will be strengthened via thematic Summer Schools and Master and doctoral student participation in Action Line activities. By 2016 EIT ICT Labs will be a recognised brand for ICT education leading to privileged access to top ICT talent for employers and a wave of new entrepreneurs creating successful ICT ventures.

DEVELOP THE EIT ICT LABS ECOSYSTEM AND ITS IMPACT

The current EIT ICT Labs ecosystem consists of seven core Nodes and two Associate Partnerships. During 2014-2016 London will be maturing as a full Node and the profiles of both Associate Partnerships (Madrid and Budapest) will be strengthened. EIT ICT Labs will engage and share with the EU-28 via its X-Europe Outreach programme and it will establish a bi-directional link with Silicon Valley. Opportunities within the BRIC countries will be explored towards 2016. Various initiatives will be taken to further stimulate the flourishing community of researchers, students, business developers, researchers, teachers and entrepreneurs in the EIT ICT Labs Co-locations.

This Strategic Innovation Agenda (SIA) describes the essential strategic steps to be taken by EIT ICT Labs to enhance effectiveness and increase global impact for Europe. By 2016 the European ICT innovation culture will have further shifted towards "value creation" witnessed by new services and products, innovative solutions and future ICT entrepreneurs driving new start-ups and growth of companies towards European and global excellence.

1 Blended Life in a Connected World

BLENDED LIFE

The deep penetration of ICT into the veins of our society has provided ubiquitous communication and information access resulting in a blended life. A blended life in the sense that the physical and virtual world are merging into one where physical encounters with friends and family are seamlessly integrated with virtual encounters on social networks. A blended life in the sense that it allows us to combine work and private life in a way that offers the flexibility to work at any time from different locations. A blended life for our industries that see ICT deeply embedded into their products and services, allowing them to deliver flexible services and products tailored to specific customer needs. A blended life for our industries that use ICT for cost-effective production at many locations leading to situations where producers are consumers and turn into 'prosumers'.

Blended life is a reality and as such it brings both opportunities and challenges. On the one hand it allows us to maintain better contact with people we care about and at the same time it brings us a level of transparency that raises concerns about the ability to keep information in the privacy of our own life. The blending of private life and work brings clear advantages of combining private and professional obligations and at the same time brings the challenge of keeping the right balance between private and professional life. The blending of products and services leads to personalisation of offerings, and at the same time leads to consumers that are confused about the huge variety of offerings. Blended production leads

to shorter supply chains and cost-effective production and at the same time disrupts existing business models.
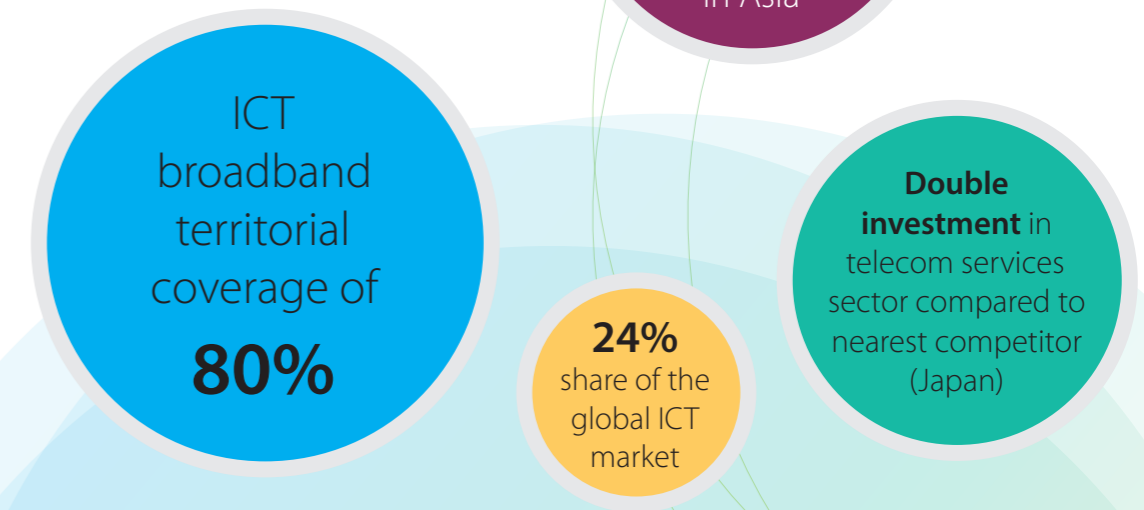
BUILD UPON EUROPEAN STRENGTHS

Europe has an excellent ICT infrastructure, a highly skilled and trained population and advanced know-how in key areas of ICT. World leadership in enterprise software applications, embedded systems, access networks and several industry sectors like health and energy puts Europe in a favourable position in these areas. The strong historic and cultural links of the 28 sovereign EU member states contribute the multilingual and multicultural skills necessary to succeed in the global market place. Moreover, European industry, traditionally strong in manufacturing innovation, will be able to profit from the early adoption of digital intelligence in existing industrial manufacturing facilities.

UNLOCK THE POTENTIAL OF BLENDED LIFE IN A CONNECTED WORLD

A high level of agility is needed to cope with the fast pace of change in ICT itself and in many of the ICT application areas. Barriers to entry are highly dynamic and may suddenly disappear. Newcomers leveraging a disruptive innovation can quickly overrun companies that are successful today. EIT ICT Labs is at the heart of these developments and is committed to bring the best of blended life to

European citizens and industries. Building on the European strengths as well as the European values on quality of life, equal opportunities and economic prosperity, EIT ICT Labs will in a responsible way select and deploy its education and innovation efforts to drive the opportunities of a blended life. EIT ICT Labs does this by creating a pan-European ecosystem that brings together key players from education, research and business to create a true open innovation and education environment. Mobility of talents, ideas, technologies and investments drives the necessary sharing of know-how in order to create a European network of vibrant hotspots that drive ICT innovation focusing on European needs and strengths in order to drive leadership.

Mobile penetration of **1.2 contracts per capita** vs. 0.9 in the US and 0.8 in Asia

ICT broadband territorial coverage of **80%**

24% share of the global ICT market

Double investment in telecom services sector compared to nearest competitor (Japan)

✔ Some key facts on Europe

2 EIT ICT Labs: A Pan-European Innovation and Education Ecosystem

EIT ICT Labs has been established in 2010 to drive European leadership in ICT innovation and education. The creation of EIT ICT Labs is motivated by the fact that, although Europe has world-class ICT research and education, the societal and economic impact needs to be improved in order to guarantee European competitiveness in the global economy.

EIT ICT Labs' mission is to drive European leadership in ICT-related innovation to foster economic growth and enhance the quality of life of European citizens. The objective is to accelerate innovation by:

– Inspiring the innovation spirit and renewing innovation processes within the existing ICT industry,
– Accelerating the transformation of innovations into marketable products, services and businesses,
– Educating a new breed of entrepreneurial ICT engineers,
– Catalysing the development of potential SMEs into future global ICT leaders,
– Strengthening the European ICT ecosystem with a sustainable network built on world-class reputation.

2.1 | BLENDED LIFE IN A CONNECTED WORLD: EUROPE'S NEEDS AND OPPORTUNITIES

EIT ICT Labs is committed to bring the best of blended life to European citizens and industries and to drive European leadership. This requires a careful selection of areas to target. Building on Europe's

strengths as well as recognising Europe's vital interest guides the selection of areas where EIT ICT Labs invests in order to create maximum impact.

The ICT industry itself has seen enormous growth and huge disruptions over the past decades. Next to that ICT has penetrated almost all aspects of society and has drastically impacted people's lives as well as heavily impacted or even disrupted all kinds of industries. In order to have sufficient critical mass behind its innovation actions EIT ICT Labs has decided to focus on a limited number of areas. These areas have been selected based on a careful SWOT analysis of the European ICT position in a global perspective.

When it comes to core ICT developments, the areas that have been selected to focus the efforts are: Future Networking, Future Cloud, and Privacy-Security-Trust. This selection is motivated by the fact that Blended Life is driven by the efficient handling of big and real-time data volumes and therefore needs a future generation of secure and trusted network and Cloud infrastructures. Since these technologies are key it is of vital European interest to have a strong position.

When it comes to ICT-enabled developments, five areas have been selected: Health & Wellbeing, Energy, Urban Life and Mobility, Smart Manufacturing and Critical Infrastructures, and Smart Spaces. By addressing these areas, new innovative solutions will be enabled for societal megatrends like drastic demographic changes, urbanisation, increased mobility and scarcity of natural resources.
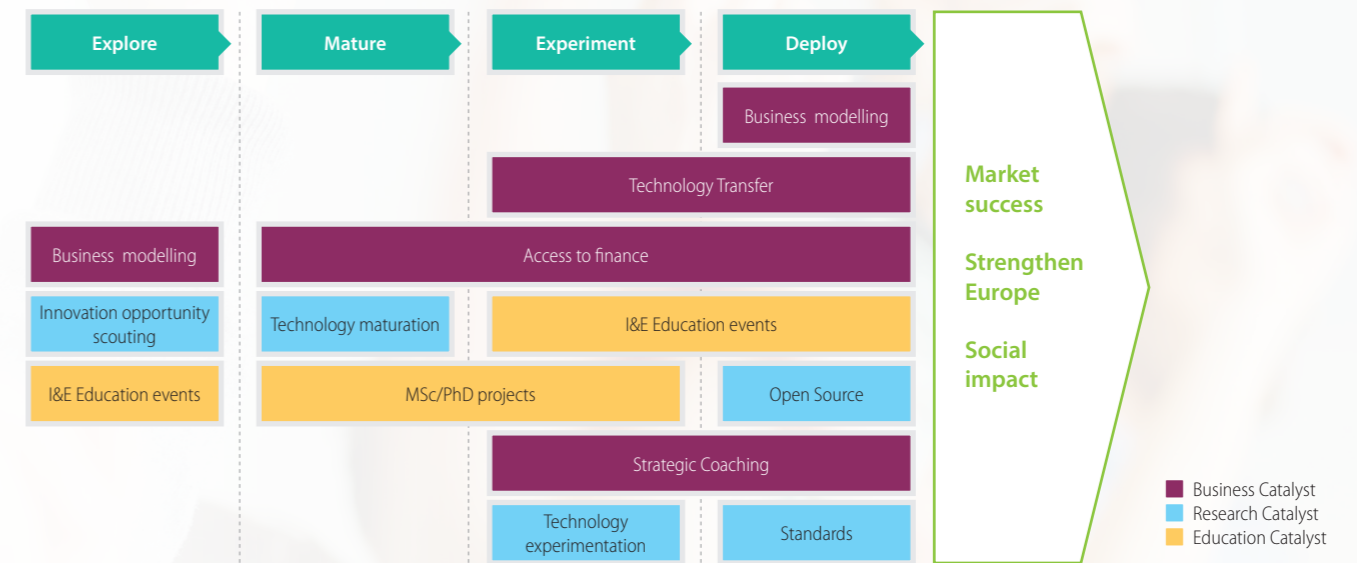
Figure 2.1 Innovation funnel mapping EIT ICT Labs Catalysts

2.2 | EIT ICT LABS: BUILDING THE PILLARS

The mission is implemented via an integral strategy that builds on three core pillars:

– Research-based Innovation and Entrepreneurship
– Entrepreneurial Education
– A pan-European ecosystem of innovation hotspots

Bringing education, research and business actors together creates a vibrant innovation and education ecosystem where the flow of talents, ideas, technologies, and investments is driving economic and societal impact. The crucial element of the strategy to blend Research, Business and Education in a pan-European ecosystem has meanwhile resulted in a partner network consisting of more than 120 leading European ICT companies, universities, research institutes and local innovation networks and incubators.

Acting as a Catalyst through focused Action Lines

EIT ICT Labs' approach is to act as a catalyst, in the sense that it builds on the existing strengths of its partners in the ecosystem and accelerates the development of talents and technologies via targeted investments and intelligent creation of value-chains in the ecosystem. This is done via application of acceleration instruments called Catalysts. These Catalysts are applied to existing partner activities that are called Carriers. Carriers can be education programmes of the EIT ICT Labs university partners that are augmented with Catalysts which focus on entrepreneurial skills. The combined Carrier-Catalyst actions lead to the development of the so-called T-shaped talents. Carriers can also be technologies that have been developed by the research partners. In order to accelerate the route to market, Catalysts are added for maturation, access to finance and business development. The Catalysts are shown in Figure 2.1, where they are mapped onto the phases of the EIT ICT Labs innovation funnel to illustrate how they facilitate transitions "from idea to product", "from lab to market", and "from student to entrepreneur".

Carrier-Catalyst activities are carried out in so-called Action Lines. Action Lines are the EIT ICT Labs approach to drive innovations to the market and education of entrepreneurial talents. EIT ICT Labs makes strategic choices with respect to the most attractive areas for driving European ICT innovation and education leadership and selects its Action Lines accordingly. Action Lines themselves are portfolios of Carrier-Catalyst activities. These activities are carefully selected during the annual business plan development.

The key criteria for selecting the research-based innovation Action Line activities are: 1) strategic fit with the strategic Action Line priorities, 2) potential in terms of societal and economic impact, and 3) ability for the EIT ICT Labs ecosystem to successfully execute both in terms of technological strength as well as ability to create access to the market.

Value extraction and access to market is realised in a variety of ways, such as catalysing new ventures, growing existing SMEs to European level and world-class scale and facilitating the strategic development of established large industries.

The present Action Lines are expected to remain in place for the mid-term future. New Action Lines may be incubated on the basis of societal needs, European strengths, partner interests and/or technology and business foresight.

Education Action Lines implement the entrepreneurial education in EIT ICT Labs. Here we find three Action Lines that drive the Master, doctoral and professional education. Education Action Lines combine Education, Research and Business activities to deliver the T-shaped students that combine deep technical knowledge with entrepreneurial skills.

Figure 2.2 shows the deep integration of Education, Research and Business in both the research-based innovation and the education Action Lines.
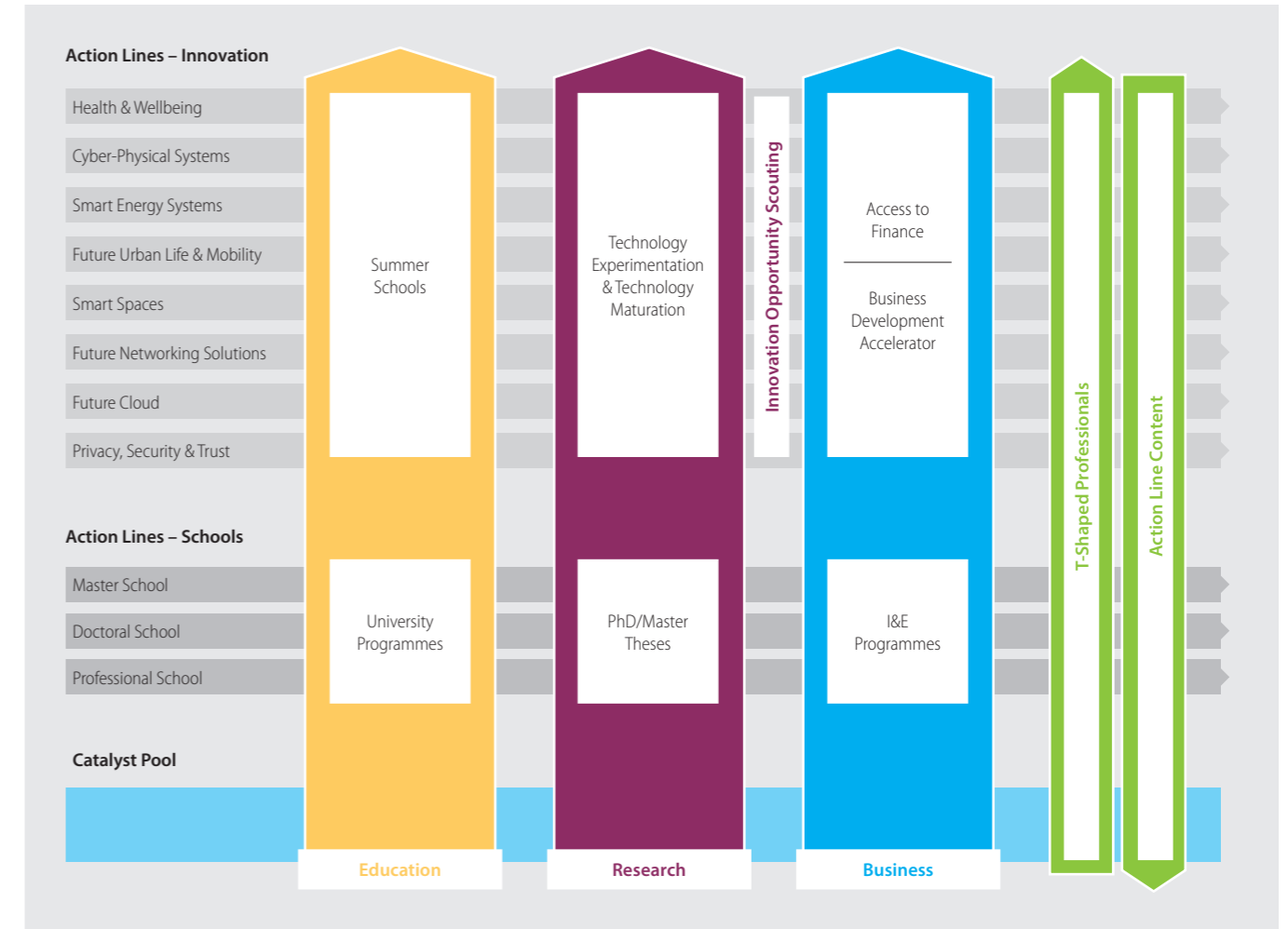

Figure 2.2 EIT ICT Labs Value Creation Engine

2.3 | 2009 – 2013: ACCOMPLISHMENTS SO FAR

Since its conception in 2009 and its start in 2010, EIT ICT Labs has consistently built its pillars as can be seen from Figure 2.3 that shows EIT ICT Labs' evolution together with its most significant achievements.

EIT ICT Labs started out based on the original Knowledge and Innovation Community (KIC) proposal outlining the overall vision and strategy, which included as key elements the intention to invigorate the innovative spirit within the existing European ICT industry, to create a new generation of entrepreneurial engineers, and to catalyse new ventures that can grow to become future world leaders.

By now, EIT ICT Labs has firmly established itself and several core elements of its innovation engine are fully operational. The pan-European ecosystem of ICT innovation Co-location Centres stimulates the mobility of talents, ideas, technologies and investments. The

Education
Outline of Master School and I&E embedding

Business & Entrepreneurship
Outline of Business & Entrepreneurship support infrastructure

Co-location & Ecosystem
Preparation and launch of formal structure of the KIC

Education
Preparation and launch of Master School, agreement with 19 universities

Research-based Innovation
Launch of Action Lines structure and Catalyst-Carrier model

Business & Entrepreneurship
Entrepreneurship support system, first start-ups supported

Co-location & Ecosystem
CLCs operational, legal framework structure for affiliates. Key operational principals (Action Lines, Carrier/Catalysts). Launch of public website, intranet portal and ICT support

Education
Master School operational, Doctoral School agreement, 6 DTCs established

Research-based Innovation
Action Lines implement focus on impact, signing MoC with Future Internet-PPP, Innovation Radar foresight reports

Business & Entrepreneurship
Pan-European Business Development Accelerator

Co-location & Ecosystem
Trento established as the sixth full Node

Education
3 new DTCs, doubling number of students

Research-based Innovation
Scaling-up and streamlining Action Lines. Increasing market uptake and adaptation

Business & Entrepreneurship
Expanding impact of Business Development Accelerator. Co-operation agreement with European Investment Fund on start-up/SME support

Co-location & Ecosystem
Madrid established as a new Associate Partner group

2009	2010	2011	2012	2013	2014
Proposal	Launch	Get Organized, Get Recognized	Invest for Impact	Target & Focus	Create for Value

Figure 2.3 Evolution of EIT ICT Labs between 2009 and 2014

pan-European Master and Doctoral Schools are set up in a scalable way and focus on excellence, on systemic change through technical programmes with deep embedding of innovation and entrepreneurship, and on delivering T-shaped talents with a passion for innovation. The EIT ICT Labs Action Lines integrate education, research and business and drive research-based innovations to the market. Several Action Lines provide leading examples for setting up business-oriented Summer Schools and postmaster education programmes. The pan-European Business Development Accelerator drives value extraction and entrepreneurship. Strategic collaborations with established players such as the European Investment Fund, Future Internet PPP, ITEA, and the European CIO Association are in place and can be leveraged. Outreach activities have begun to set up new connections across Europe and to Silicon Valley.
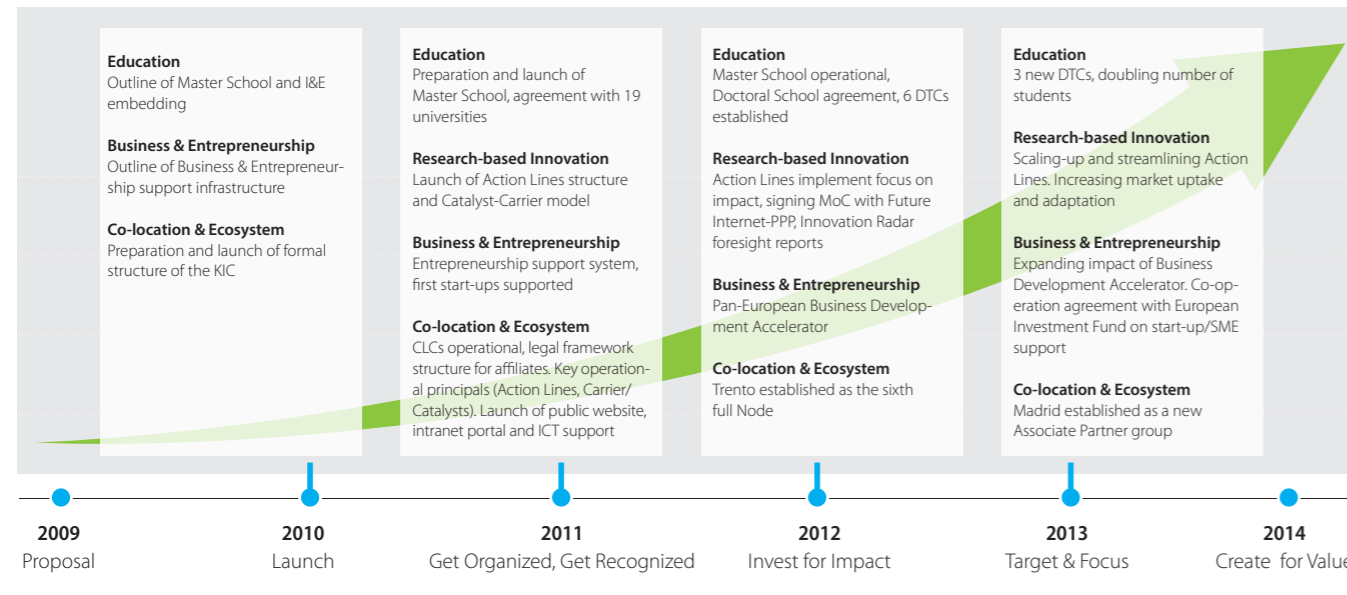
2.4 | 2014 – 2016: THE WAY AHEAD

Lessons that have been learnt during the process lead to further improvements towards the coming years. The leading role of the Action Lines as the main value creation mechanism as well as for the integration of Education, Research and Business is further emphasised. Based on experiences in the Action Lines, the research activities will be further aligned with the EIT ICT Labs innovation funnel with more emphasis on technology maturation and technology experimentation. Targeted High Impact Initiatives are being defined to further focus efforts and maximise impact. The Outreach ambition is embedded within the management agenda for the Action Lines. The role

of the physical Co-location Centres is strengthened and emphasised further.

EIT ICT Labs will further increase its effectiveness by moving towards a more output-oriented organisation focused on deliverables and

The unique qualities of EIT ICT Labs for Europe:

Agility: From opportunity spotting to execution across the network in vibrant Co-location Centres, efficient and effectively, with the right and motivated partners, accountable on impact and results.

Capacity: Logical and coherent approach in providing key players both within and outside the ecosystem access to promising technologies, pan-European facilities and expertise of EIT ICT Labs partners.

Quality: Top talent with entrepreneurial spirit through innovative blended learning programmes on Master, doctoral and professional level.

Coverage: Policy makers, entrepreneurs and investors gain privileged access to best players, technologies and services in Europe.

Focus: Investments and activities targeted towards innovation areas that have high impact on European economic growth and quality of life.

meaningful results. Towards 2016, EIT ICT Labs strives for an appropriate balance between top-down and bottom-up management driving European innovation leadership by facilitating partners and creating new leaders. To further increase the value of the network, EIT ICT Labs will actively invest in:

1. Boosting research-based innovation by focusing on High Impact Initiatives within the priority areas of the Action Lines,

2. Driving entrepreneurship and mobility by establishing a recognised EIT ICT Labs education brand based on blended learning,

3. Creating a high impact ecosystem by further strengthening the delivery of the EIT ICT Labs network.

A summary of the main strategic targets within these domains is seen in Figure 2.4 and will be detailed in the following Chapter.
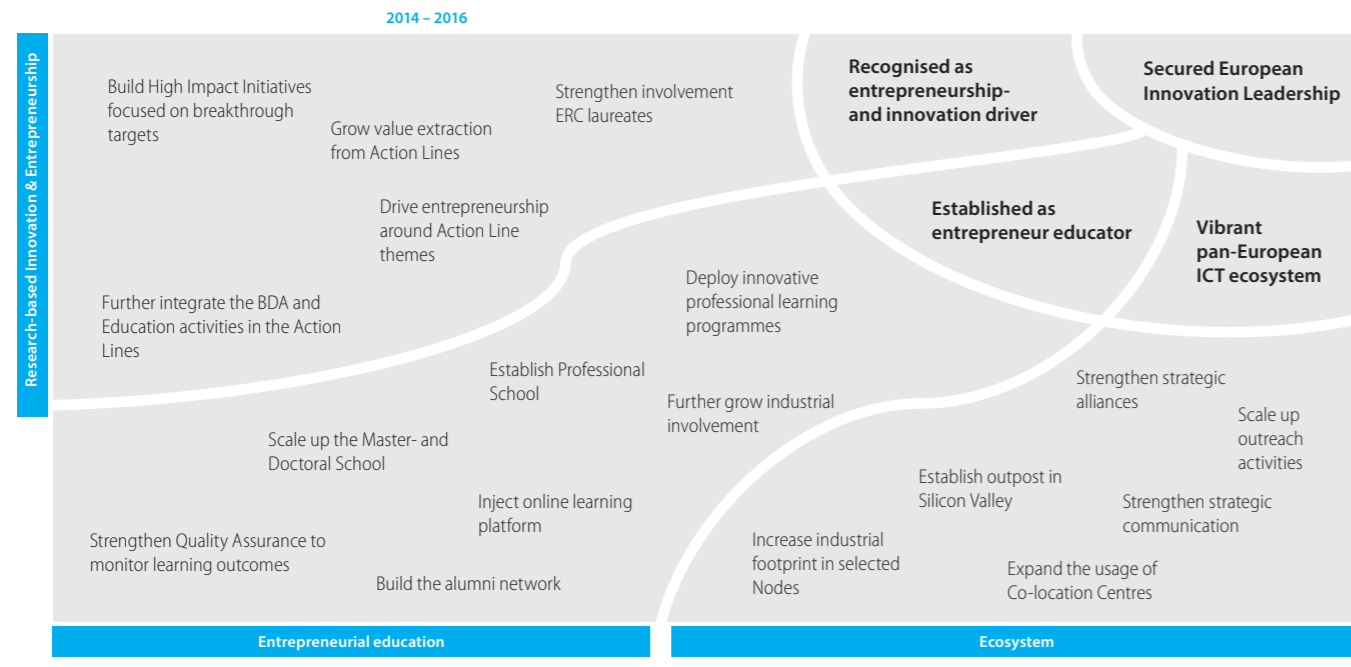
2014 – 2016

- Build High Impact Initiatives focused on breakthrough targets
- Grow value extraction from Action Lines
- Strengthen involvement ERC laureates
- Recognised as entrepreneurship- and innovation driver
- Secured European Innovation Leadership
- Drive entrepreneurship around Action Line themes
- Further integrate the BDA and Education activities in the Action Lines
- Deploy innovative professional learning programmes
- Established as entrepreneur educator
- Vibrant pan-European ICT ecosystem
- Establish Professional School
- Further grow industrial involvement
- Strengthen strategic alliances
- Scale up the Master- and Doctoral School
- Scale up outreach activities
- Inject online learning platform
- Establish outpost in Silicon Valley
- Strengthen strategic communication
- Strengthen Quality Assurance to monitor learning outcomes
- Increase industrial footprint in selected Nodes
- Build the alumni network
- Expand the usage of Co-location Centres

Research-based Innovation & Entrepreneurship

Entrepreneurial education

Ecosystem

Figure 2.4 Main strategic targets towards 2016

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3 EIT ICT Labs: Drive European ICT Innovation Leadership

3.1 | RESEARCH-BASED INNOVATION: DRIVE INNOVATION LEADERSHIP

Focused on major breakthroughs with high impact on European Competitiveness

As explained in the previous Chapter EIT ICT Labs focused its investments on a limited number of innovation areas. These have been selected with respect to European relevance and leadership potential. The activities in these domains have been grouped into eight research-based innovation Action Lines that are described in more detail below. For each Action Line two or three priority areas have been identified that will determine the selection of the Action Line activity portfolios for the 2014-2016 timeframe.

▸ **Health & Wellbeing – Prevention through the Quantified Self**

Mission: Reduce the demand for expensive healthcare by detecting small physical and mental health issues early and avoiding larger health problems by suitable lifestyle interventions.

Motivation: EIT ICT Labs partners own "quantified self" and "activity of daily life sensing" technology and especially the large core industrial partners have access to the world market.

Achievements 2016

Physical Wellbeing / Cardio Vascular: Productisation and commercialisation of a B2C Cardio Fitness solution via start-ups and transfer of sensors, smart algorithms and applications to existing companies; Evidence for effectiveness of solution; At least three solutions (e.g. for lifestyle / health, sports and high risk jobs) introduced.

Mental Deterioration: Stress / Burn-out: Solutions commercialised in B2C and B2B markets (initial annual revenue plan of €6M), Dementia: Solutions commercialised in B2C and B2B market; In total at least three solutions introduced, via start-ups and transfer of activity of daily life sensing, smart algorithms, (big) data mining and applications to existing companies.

Societal Impact: Improve quality of life through early treatments and by avoiding life-threatening health issues as well as through early treatments and extended labour participation & independent living due to reduction of burnout & early development of dementia.

Economic Impact: Lower healthcare costs due to less hospitalisation and due to less residential care. The combined markets are estimated at ~1 B€ in 2020 and EIT ICT Labs partners will gain a significant share.

▸ **Cyber-Physical Systems – European Leadership in Production and Infrastructures**

Mission: Increase the efficiency and reliability of industrial production systems and critical infrastructures by combining embedded systems, sensors, control systems, and data aggregation and analysis technology into smart systems-of-systems.

Motivation: Improved efficiency and robustness (through the deployment of Cyber-Physical Systems) assures European industrial competitiveness at the global level. In addition, European industry vitally depends on good functioning critical infrastructures. EIT ICT Labs core industrial partners are well positioned and EIT ICT Labs can link technology providers with system integrators to realise most effective solutions.

Achievements 2016

Production Systems: Feasibility study demonstrating economic value of augmenting existing production processes with Cyber-Physical Systems (CPS) technology; Reference architecture with harmonised process and data interfaces; An integrated engineering environment covering the complete product life-cycle: design, simulation, production, operation, maintenance, evolution; New start-ups and new business within existing companies implementing new business models.

Critical Infrastructures: Matured and validated technology components for communication and information aggregation; Larger-scale demonstration of the federated deployment and management of heterogeneous CPS infrastructures; At least four companies (start-ups, SMEs) exploiting new market opportunities as component/system suppliers or providers of (Cloud-based) information and management services.

Societal Impact: Competitive and expanding manufacturing industry in Europe providing a broad range of leading edge employment opportunities; Enhanced quality of life as well as excellent preconditions for industry due to high quality critical infrastructures.

Economic Impact: Competitive, cost-effective manufacturing; Accelerated market growth for providers of core CPS technologies and derivative solutions by common data formats; Emerging European CPS ecosystem boosting business creation along complete value chain: large manufacturing industries, SME tool providers, system integrators, and service providers; De-facto CPS engineering standards.

▸ **Smart Energy Systems – Defining Europe's Future Energy Market**

Mission: Contribute to the creation of an open European energy market by testing and deploying ICT solutions for decentralised power generation infrastructures and user-centric services for smart energy systems.

Motivation: EIT ICT Labs partners combine their strengths in energy and infrastructure to meet the needs of decentralised network elements (generation & storage), to support European consumers in optimising their energy usage and to create exportable concepts.

Achievements 2016

Infrastructure: At least one new technical high capacity virtual power plant set up; Creation of start-ups (e.g. derived from new regulated market roles) and support of SMEs which fulfil key roles in the Virtual Power Plant ecosystem; Relevant standards defined and adopted.

User-centric Services: Planning and simulation tools for user-centric infrastructures; SMEs supported and start-ups created; Test beds and living labs infrastructure usable by third parties; ICT solutions proven as a key building block to achieve the EU 2020 climate change objectives.

Societal Impact: Reduced environmental impact by reduced need for traditional power plants; More efficient use of renewables; Reduced consumer energy bills; User awareness on energy efficiency and measurable improvement in energy consumption behaviour.

Economic Impact: Reduced business risk; Business models for sustainable economic success; Thriving ecosystem for ongoing innovation; Virtual power plant export business opportunity; Acceleration of market development via large scale pilots.

▸ **Future Urban Life & Mobility – Informed Citizens and Revolutionised Urban Mobility**

Mission: Turn ICT breakthroughs into new up-scaled urban services to develop new mobility behaviours as well as citizen empowerment via the validation of new business models in the context of Smart Cities.

Motivation: European technology and service companies are at the forefront of creating multi-modal solutions addressing the mobility challenges of European urban environments; Strong democratic traditions in many European countries are a catalyst for crowdsourcing initiatives and citizen engagement.

Achievements 2016

Mobility Paradigm Shift: Mobility marketplace application allowing stakeholders (citizens/users, urban service providers, governance bodies) to propose and access new mobility services and develop

new mobility behaviours; Urban services and mobility applications and services based on collaborative citizens generated data; Mobility marketplace platform that can be duplicated for dissemination in other urban areas.

Citizen Engagement and Empowerment: A trusted Big/Open Data platform in place for the development and deployment of collaborative services; Big/Open Data based products and services released on the market by new start-ups; Emergence of local communities and empowerment of cities' governance bodies.

Societal Impact: Modal transfer increase; Reduction of CO2 emission from personal transport; Reduction of transport fatalities in European cities; Improved relation between citizens and governance bodies; More options for urban planning authorities; Open access to data and information as an emerging right for citizens.

Economic Impact: Reduced costs related to traffic congestion, pollution and accidents (~ 502 B€ per year in Europe); Innovation ecosystem around Big/Open Data platform; Reduced costs due to value created by engaged citizens.

▶ **Smart Spaces – Blending the Physical World and the Virtual World**

Mission: Create comfortable experiences for users and efficient resource optimisation solutions for businesses via applying advanced ICT to everyday working and living environments.

Motivation: EIT ICT Labs partners own a variety of advanced interaction and blending technologies as well as market channels (e.g. large industrial companies, SMEs, start-ups) that are capable of installing and managing complex systems and can act as solution or component providers.

Achievements 2016

Smart Retail Experience: One or few SSP initiated companies offer analytics services globally to retail industry; A number of SSP originating SMEs provide smart retail services to consumers globally and to major retail brands.

Smart Urban Experience: Public interactive screens used by advertisers to reach customers, starting from malls and busy public areas; Content creation and user experience for augmented reality solutions proven and first commercial services starting; Outdoor gaming companies have launched their first games.

Smart Buildings: New SMEs or large system integrators providing ICT-based indoor analytics solutions and flexible asset management for facility operators and large corporations; SMEs with co-working tools for office workers.

Societal Impact: Mainstream solutions and services for multi / Omni-channel retail, open street spaces and private as well as public buildings; New, virtually enhanced experiences of interacting with physical environments; Revitalisation of public spaces; Healthier and more comfortable work and living environments; Productivity gains.

Economic Impact: European companies gain market share in the addressed areas; Differentiation opportunities for innovative companies (new entrants possible, growth takes place via new business creation and via additional transactions stimulated by the new solutions); Improved asset utilisation (e.g. work productivity in smart offices, resources in office spaces, etc.).

▶ **Future Networking Solutions – Building Europe's Communication Infrastructure of Tomorrow**

Mission: Help to ensure the European lead in solutions and standards based on cost-effective as well as energy-efficient networking technology, which supports the traffic demands resulting from an ever increasing and variable set of applications.

Motivation: Establish global leadership of EIT ICT Labs partners and secure participation in high growth (40% annually) market for network infrastructure. EIT ICT Labs partners can utilise Software Defined Networks to disrupt the market, reduce overseas dominance and enable European stakeholders to benefit from a horizontal approach to Internet of Things technology to efficiently address diverse societal challenges.

Achievements 2016

Green Mobile Access Networks: Demonstrated capability to manage 1000-fold traffic increase by 2020 in an energy-efficient way; Successful standardisation initiatives, incl. energy metrics standards adopted by regulatory agencies; Simulation tools for energy metrics; Substantial technology transfer and knowledge adoption.

Software Defined Networks (SDN): Successful feasibility demonstrations; Initial market introductions of technology components; Portfolio of created and/or coached start-up companies; Deployment of SDN and virtualised networks prepared for 2018.

Internet of Things (IoT): Demonstration of generic IoT communications platform and its use in key application areas; Readiness for

broad deployment by 2018; Active start-up network "surrounding" the platform; Standardisation to achieve M2M support in networks.

Societal Impact: High quality communication infrastructures such as green high bandwidth mobile services are crucial for a good functioning of society as a whole; Services demanded by users for a "Digital Europe" provided at affordable network costs; Potential of IoT unleashed for widespread deployment, addressing societal challenges and user demands.

Economic Impact: Global lead of European network system vendors secured; Head start of 1-2 years for European players for "5G"; Successful standardisation as a market creating activity, potential for significant licensing income; Increased market share for the European SDN vendors, e.g. due to evidence for decreased CAPEX and reduced OPEX for operators and due to improved support for novel services and applications; EIT ICT Labs IoT communications platform recognised as leading (easy-to-adopt, attractive functionality, fast development for users), with a long list of active partners from several vertical segments.

▸ **Future Cloud – A Secure Data and Service Infrastructure for Europe**

Mission: Drive European competitiveness in the area of Cloud services and Big Data via the deployment of trusted Cloud technologies and Big Data Analytics Cloud infrastructures.

Motivation: Europe's companies can benefit from a robust and efficient mission-critical Europe-based Cloud computing infrastructure that is established by leveraging Europe's strong position as trusted Cloud service provider as exemplified by European solutions such as unique Stratosphere platform. This infrastructure requires real-time performance with the guarantee of the highest level of security and privacy and includes the establishment of a European value-driven ecosystem and a user community for Big Data in the Cloud.

Achievements 2016

Trusted Clouds: European multi-Cloud platform over Telco network; New innovative trusted real-time Cloud services are validated and several market introductions are under preparation.

Big Data Analytics in the Cloud: Ecosystem and user community for Big Data and Cloud is established; Start-up with 3-5 M€ sales; Number of successful Big Data / Cloud solution transformations in businesses across Europe.

Societal Impact: Solutions are trusted by businesses and end-users; Security, privacy and persistence of European citizen and business data will be preserved; Enhanced access to and value generation on Big Data results in better services for public sector, healthcare, traffic, etc. used by the European citizens.

Economic Impact: New profitable innovative European businesses have been built around trusted multi-Cloud platforms and Big Data analytics services in the Cloud and are recognised, trusted and deployed in global markets.

▸ **Privacy, Security & Trust – A Protected Blended Life**

Mission: Support users and businesses in protecting their digital assets and transactions, promoting robust and safe products and services that realise data privacy and security.

Motivation: Strong need (with continuously rising awareness) for cyber-security solutions currently not met by existing market offers, often due to fragmentation of solutions and

regulations or due to lack of trust of current (e.g. US-based) providers. A perceived lack of safety slows down business operations and requires extensive and expensive risk management. EIT ICT Labs' partnership (e.g. with mobile operators, technology providers) has suitable expertise and can place service offerings on the market and the European providers have trust advantage over US-based providers.

Achievements 2016

Digital Identity Management: Europe-wide federated identity platform; Privacy-aware and cost-effective EIT-ICT-Labs-endorsed e-authentication and identity management services and products to be commercialised; Real-world testing in selected application scenarios, including e-payment, e-government, e-health, and smart spaces.

Data Privacy: Creative Commons licenses incorporating data privacy; Concrete technical solutions, in terms of software & hardware security tokens, for data privacy in selected application scenarios, including user profiling, e-voting, smart energy, and Cloud computing; Feasibility studies of end-to-end protection in data
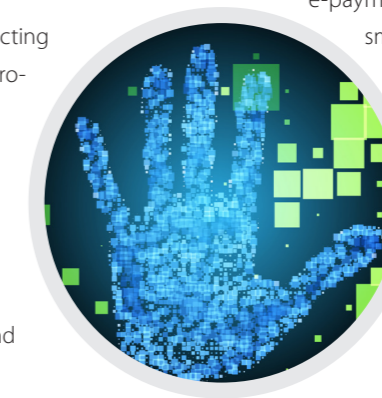
communications; market preparation and first commercially successful products and services.

Mobile Cyber-Security, addressing malicious software in mobile and online applications: Demonstrate problems with existing solutions; Innovative and cost-effective solutions for anti-malware protection, especially for mobile devices, e.g. by combining efficient client agents and Cloud-based services; Feasibility study of massive and privacy-aware anti-malware scanning of devices connected to the Internet.

Societal Impact: European citizens protected via authentic and more trustworthy mobile services and products; Less abuse of sensitive data; Less cyber-crimes; More trust among people and organisations in Europe; More trust in digital technology, applications and services; Raised social awareness.

Economic Impact: Successful (European) businesses with significant market share (digital identity management, online and mobile privacy solutions, anti-malware products and services); Less economic damage due to cyber-crimes (online identity theft, fraud, fake services and products); Lower costs for effective protection compared to proprietary protection solutions; Lowered obstacles

catalyse business transactions; Safer environment supports growth of European mobile operators.

Deep integration of Education, Research and Business is key in the Action Lines. The specific aspects that Education, Research and Business bring to the Action Lines above are outlined below.

Engage Talents

Ambition 2009 ▸ current status ❖ target 2016

Master School ▸ Students participate in selected activities ❖ Full engagement via internships, idea competitions, and start-ups
Summer Schools ▸ Summer School pilots in selected Action Lines ❖ High quality recognised Summer Schools in all Action Lines
Doctoral School ▸ Selected participation in activities ❖ deep embedding in Action Line activities amongst others in Doctoral Training Centres

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3.1.1 | Education: Feed the Action Lines with Talents

Master School Talents bring entrepreneurship

In the EIT ICT Labs philosophy education and innovation go hand in hand. Master School students are exposed to the most recent innovations via participation in Action Line activities via internships, idea competitions and start-up creation. At the same time, Action Line activities benefit from the ideas and skills Master School talents bring to the Action Line activities.

Summer Schools drive innovation uptake

As part of the dissemination strategy, Action Lines organise Summer Schools to educate students, researchers, and practitioners on the most recent innovations in the priority areas of the Action Lines.

Doctoral School Talents bring cutting edge technology

Doctoral students participate in Action Line activities by bringing results from their research to the Action Lines as well as getting inspired by Action Line challenges to pursue their research in specific directions. The Doctoral Training Centres play a specific role in bringing together doctoral students, teachers and business developers to target the research at the most promising opportunities in terms of impact.

3.1.2 | Research: Feed the Action Lines with Technology Insights and Opportunities

Underpin strategy planning of Action Lines

EIT ICT Labs' ambition is to fulfil a meaningful role in accelerating time-to-market of innovations with tangible and relevant results. Towards 2016 the focus will be on underpinning the Action Line strategies with insights in mid-term techno-trends as well as through systematic consultation with Core Partners. In close collaboration with Core Partners the strategic plan and one or two (long-term) High Impact Initiatives will be defined.

Scout promising technologies early

EIT ICT Labs accelerates innovations based on research performed by its partners. To attract more researchers with promising projects, EIT ICT Labs will encourage and support partners' consortia in relevant Horizon 2020 projects. Furthermore, the mechanism for scouting technologies will be improved. Evidence-based maturity evaluation criteria are to be integrated in the mechanism to assess opportunities and timely detect technologies that are ready to be pushed to the market. Additionally, the monitoring process of application & implementation of the Research Catalysts will be strengthened.

Drive utilisation of the Experience & Living Labs and testing infrastructures

Experience & Living Labs will play a major role in recruiting and involving stakeholders and end-user communities, executing experimentations and analysing data and results. EIT ICT Labs' role here is to validate the user-related added value of new services and business models.

The main goal towards 2016 is to strengthen the existing infrastructures with focus on user-oriented Experience & Living Labs. By 2016, EIT ICT Labs will launch a brokering platform for partners to access and select the Experience & Living Labs and/or testing-related services that suit their needs. The brokering platform and the brokering approach will more generally also play an important role in EIT ICT Labs sustainability strategy.

Create innovation nucleus

Ambition 2009 ▸ current status ❖ target 2016

Innovation Radar ▸ Established and operational ❖ Reports contributing to EIT ICT Labs thought leadership, recognised also outside of EIT ICT Labs

Living Lab ▸ Results from first pilot Experience & Living Labs available ❖ Brokerage platform for users available

Breakthrough innovation ▸ Five Action Lines on application areas of ICT and three on Core ICT established ❖ Working towards breakthroughs in priority areas

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3.1.3 | Business: Extract Value from the Action Lines & the Ecosystem

Drive value extraction through business development

A key initiative in 2012 was the launch of the EIT ICT Labs Business Development Accelerator (BDA) as a tool to integrate Action Lines, local ecosystems and the large corporates. The Business Developers act as spiders in the web and leverage the full partner network. Concerning the local ecosystem until now, out of the 750 screened start-ups and SMEs, 70 were selected and have been actively supported. Towards 2016, the BDA aims to scale up and increase the

number of selected start-ups and SMEs to 200, while turning 25% into concrete success stories, meaning establishment of new ventures, market introductions of new business and growth towards European scale.

Enhance Action Line investments

Currently BDA activities are mostly directed to the local ecosystem around the Nodes. The main BDA goal towards 2016 is to align with EIT ICT Labs investments in innovation activities in the Action Lines supporting the commercialisation of the Action Line results. Scouted start-ups and SMEs will be clustered in business communities per Action Line. Additionally, the BDA will expose students from the EIT ICT Labs schools to Action Line-related business opportunities and support them with tools to create their own relevant start-ups.

Attract potential ideas and companies for Action Line activities and ecosystem

EIT ICT Labs will start in 2014 to execute an "EIT ICT Labs Idea Challenge" for each Action Line. The main aim is to enrich the Action Line portfolios with new complementary partners and ideas and to establish contact to entrepreneurs and innovators in their domain. Towards 2016, EIT ICT Labs will strengthen the entrepreneurial community and significantly improve the entrepreneurial spirit within the Action Lines as well as the Key Performance Indicators on new business creation. Crucial success factors are ensuring proper follow-up of the challenge, integrating received ideas and connecting companies to Action Lines activities and the partner ecosystem.

Ensure access to finance through portfolio of attractive contacts

To be able to quickly scale beyond national markets and compete against global players, it is essential to have access to specialised loans and investment capital. The main aim towards 2016 is to utilise

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Establish entrepreneurial ecosystem

Ambition 2009 ▸ current status ❖ target 2016

Incubation Centre ▸ Co-Location Centres (CLCs) host several start-ups and SMEs ❖ Hosting capacity fully used in all CLCs

Entrepreneurs Club ▸ Dynamic network is growing around CLCs ❖ Pan-European start-up and SME communities established for each Action Line enabling exchange & promotion

Seed/Angel Investors & Venture Capitalists ▸ Network of business developers established; external contacts established and first investments confirmed; signed MoC with EIF ❖ Privileged access for entrepreneurs to best practices and investment capital

Large Core Partners ▸ Collaboration with research departments established ❖ Collaboration with scouting and M&A departments

the opportunities offered by the collaboration agreement signed with the European Investment Fund (EIF) in 2013. Additionally, EIT ICT Labs will extend its strategic relations with the investor community inside and outside the ecosystem.

In 2013, the BDA started a series of Investors' Dinners in several Nodes to enable European ventures to pitch in front of Venture Capitalists and Business Angels. Towards 2016, a strategic collaboration with the European Business Angel Network (EBAN) should be established and more US-based Venture Capitalists and Business Angels should take part in these activities. To this end an outpost will be established in Silicon Valley (see Paragraph 3.3.2).

Strengthen the innovation possibilities of established large ICT corporates

It is vital for Europe that the established ICT companies change their innovation strategies towards a more open innovation approach. Towards 2016, EIT ICT Labs will support its large corporate partners in this transition by systematically connecting them to the European start-up and entrepreneurial scene and developing methodologies and tools to quickly integrate start-up and entrepreneurial teams into their business models. It is crucial for the results of the Action Lines as well for the European SME community to get access to the Merger & Acquisition and scouting departments of the large corporates. The BDA will establish these connections and organise match-making events in order the establish a European deal flow on technologies, SMEs, ideas and talents.

3.2 | ENTREPRENEURIAL EDUCATION: EMPOWER ICT TOP TALENTS FOR THE FUTURE

3.2.1 | Education: Deploy Innovative Blended Learning Programmes

Educate Technical Entrepreneurs

Via its education programmes, EIT ICT Labs intends to improve the availability of excellent T-shaped professionals for the European industry. These "Technical Entrepreneurs", as they may also be described, combine technical skills with domain expertise. They also offer innovation skills, entrepreneurial skills and creativity skills. Table 3.1 provides examples for T-shaped job profiles that are expected to become relevant in the context of the EIT ICT Labs Action Lines, together with typical competence areas that attractive candidates for such positions should bring to the table.

By combining Schools and Tools, a unique and innovative blended pan-European education system focusing on excellence is put in place (see figure 3.2). Student mobility is stimulated by geographically connecting the schools to the Action Line activities.

The following sections highlight the mission, achievements and impact of the Schools towards 2016.

Cyber-security Engineer		Cyber-physical Architect	
	– Security Technology – Database Technology – Privacy – Business Modelling – (Inter-)National Legislation		– Sensors & Actuators – Network Technology – Domain Knowledge – Embedded Systems – Internet-of-Things
Big Data Analyst		**Urban Systems Architect**	
	– Programming – Statistics – Domain Knowledge – Mathematics – Visualising & Communicating		– Converging Technologies – Policy – User Experience – Complex System Design – Networks & Services
Interaction Designer		**Health Architect**	
	– Interface Technologies – User-driven Design – User Experience – Living Labs – Multi-disciplinary Teams		– ICT Innovations – Domain Knowledge – Ethics – Business Modelling – Convincing Stakeholders

Table 3.1 Example T-shaped job profiles and selection of associated competence areas

▸ **Master School – Tomorrow's ICT Innovators and Entrepreneurs**

Mission: Create T-shaped professionals with state-of-the-art technical excellence in key ICT areas, especially in those addressed by the EIT ICT Labs Action Lines, in combination with strong expertise in Innovation & Entrepreneurship. The goal is to establish a world-renowned Masters Level Education brand.

Motivation: The European market has a strong demand for Masters Level engineers that can facilitate innovation. The EIT ICT Labs Master

EIT ICT Labs
MASTER SCHOOL

School is the first systematic effort on a European scale to combine ICT technical education on Masters Level with training in Innovation and Entrepreneurship as well as promoting pan-European mobility. The graduates will represent a new generation of ICT entrepreneurs, boosting the innovation rate and addressing societal challenges, especially in the areas covered by the EIT ICT Labs Action Lines. The

Master School	Doctoral School	Professional School

Blended Education

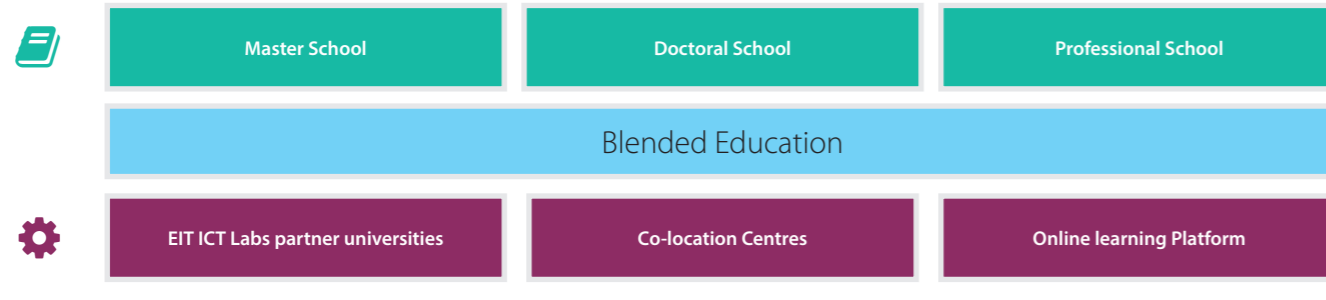| EIT ICT Labs partner universities	Co-location Centres	Online learning Platform

Figure 3.2 EIT ICT Labs blended education system

involvement of leading European universities as EIT ICT Labs partners ensures excellence and supports brand building.

Achievements 2016

Consolidated Education of T-shaped Professionals: Strong interest in the programmes as demonstrated by growing number of completed applications; Strong study performance ratios and growing number of graduates per year; Critical mass of students at all EIT ICT Labs nodes; Sustainable balance between paying students and students with scholarships.

Establishment of a Strong Masters Level Education Brand: Scoring system established and used for continuous improvement towards better scores (student satisfaction, partner satisfaction); Regular evaluation of public perception (e.g. via press articles) shows progress towards brand establishment; Suitable measures established and monitoring started for career success for alumni (including new ventures) and strong indications for career success of alumni (shorter time to job / to promotions, better average salary, better entry level salary); Growing number of bilateral agreements with non-partner universities.

Societal Impact: EIT ICT Labs alumni are hired quickly into attractive positions and move fast towards their first promotion(s); EIT ICT Labs alumni stimulate innovation within Europe; Other Education programmes within Europe are adjusted to follow the lighthouse approach created by EIT ICT Labs; Students across Europe are aware of

the EIT ICT Labs programmes and prioritise them for the fulfilment of their Master Level ambitions.

Economic Impact: Key industry positions can be filled without delays with excellent candidates; EIT ICT Labs alumni create new companies, with positive economic impact as well as attractive employment opportunities; European ICT industry is aware of the EIT ICT Labs programmes as an excellent source for highly skilled staff with unique innovation and entrepreneurship capabilities; European ICT industry gradually achieves a higher rate of innovation successes.

▸ **Doctoral School – Tomorrow's ICT Leaders**

Mission: Create world-class ICT Leaders with deep technical expertise in key ICT areas, especially in those addressed by the EIT ICT Labs Action Lines, in combination with strong background in Innovation & Entrepreneurship and establish a world-renowned Doctoral School brand.

Motivation: Today's ICT leaders, who increasingly occupy key roles also outside of the core ICT sector, often lack a truly entrepreneurial mind-set as well as hands-on innovation experience; Doctoral School provides a unique opportunity for a different focus, emphasising entrepreneurship and innovation as well as mobility; By complementing the traditional disciplinary- and technology-focused tracks with more hands-on innovation and entrepreneurship skills, the Doctoral School can play a unique role in generating European ICT leaders

EIT ICT Labs
DOCTORAL SCHOOL

that are equipped with the capability to identify innovation and business opportunities.

Achievements 2016

ICT Leaders: 120 doctoral graduates with innovation and entrepreneurial skills and competencies per year (from 2017 or 2018 onwards); First cohort of doctoral candidates finish the entire cycle and receive the EIT certificate (2015).

Doctoral School Brand: Being recognised as a valuable resource by business partners and as a valuable education programme by thesis directors for their doctoral candidates; Employability of Doctoral School graduates confirmed and well-known by partners and throughout the ecosystem; Proven excellence of the innovation and entrepreneurial education becomes a role model for other scientific domains not covered by EIT ICT Labs.

Societal Impact: EIT ICT Labs alumni are hired quickly into influential leadership positions, from where they stimulate innovation

and business creation; Concept of the Doctoral School education is adapted by European Higher Education Institutions to follow the lighthouse approach created by EIT ICT Labs; Students across Europe are aware of the EIT ICT Labs programmes and consider them for their Doctoral Level ambitions; Educators advise students to consider the EIT ICT Labs Doctoral School.

Economic Impact: Leadership positions within the European ICT industry can be filled without delays with excellent candidates; EIT ICT Labs alumni create a more innovative European ICT industry, which leads to positive economic impact; European ICT industry is aware of the EIT ICT Labs programmes as an excellent source for highly skilled leaders with unique innovation and entrepreneurship capabilities and gradually achieves a higher rate of innovation successes.

▸ **Professional School – Certified ICT Competence**

Mission: Raise the ICT competence level of Europe's professionals, especially in those key ICT areas that are covered by the EIT ICT Labs Action Lines, via blended learning packages of technology updates with peer-education. The offerings will have a multimodal format, combining university-grade content and online modules with hands-on skills building and certification, to establish a world-renowned Professional

Education brand. The target group is made up of professionals, executives and decision makers.

Motivation: The high relevance and dynamism of ICT in most areas of life and business leads to a strong need to stay current for professionals on all levels, no matter whether they are working in ICT or in other sectors that apply ICT. Companies and societal organisations need to learn how major ICT technology trends may change their business, will have to adapt their workforce and HR strategy to new technologies. The target group of professionals and executives is subject to time constraints, prefer on the job learning and is heavily stimulated by learning from peers. EIT ICT Labs can assist the European workforce with critical knowledge and skills especially in those areas that are covered by its state-of-the-art Action Lines. Building on its toolset of the partner network, Co-locations and Online Platform, EIT ICT Labs can develop and operate the blended education programmes that optimally match the needs of busy professionals and their employers, incorporating peer education elements and providing relevant certifications.

Certified Professionals Accelerate Innovation: Continued strong interest in the professional education programme offerings; Accepted pricing levels cover costs; Broad range of programmes operational and key Action Line content fully covered; Close relationship with innovation departments of EIT ICT Labs partners; Flawless operation of programme platform and processes.

Establishment of a Strong Professional-Level Education Brand: EIT ICT Labs programme certifications are recognised as positive differentiator for professionals and the EIT ICT Labs programme is preferred outlet for education partners; Positive feedback received in programme satisfaction surveys, both from learners as well as from their employers; Regular evaluation of public perception (e.g. via press articles) shows progress towards brand establishment; Suitable measures established and monitoring started for involvement of programme participants in innovation activities within their companies.

Societal Impact: European employees have an additional effective option to improve their employability and marketability; European workforce capable of establishing innovation leadership in areas addressed by EIT ICT Labs Action Lines; Further improved innovation culture and skills within European society.

Economic Impact: Programme participants work on successful key innovation programmes within their companies; Increased innovation rate (and resulting positive economic effect) within companies

that utilise the programmes; Companies can innovate effectively as participants in the EIT ICT Labs Action Lines and allocate their best team members in combination with suitable professional education programmes.

3.3 .2 | Establish a Recognised EIT ICT Labs Brand based on Blended Learning

The main ambition of the education domain towards 2016 is to establish EIT ICT Labs as a recognised brand for ICT education for students and employers by scaling up the Master- and Doctoral Schools, developing a Professional School, and deploying novel ICT online learning platforms to deliver a blended combination of virtual and physical presence education. The start of an EIT ICT Labs Alumni network should result in a vibrant and active community.

The education activities should lead to global competitive access to top ICT talent for employers, and enable a wave of new entrepreneurs to create successful ICT ventures. Towards 2016 EIT ICT labs will focus on blending the education activities even stronger with the research- and business activities within the Action Lines. To this end Master and Doctoral students will be stimulated to participate in innovation activities.

Strengthen integration of business experience
Strong industrial presence in the different Master Programmes is a crucial success factor. Therefore, thematic Summer Schools will be

organised in all Action Lines, to increase industrial partner commitment and involvement as well as introduce students to real life business cases. Furthermore, commitment of industry will be sought for project courses, mentorships and internships.

Doctoral Training Centres are established as hot spots where doctoral students, industrialists and academic faculty meet and together

develop the doctoral students to two-tiered PhDs; academic and industrial with a solid business experience. The involved business schools and industrial partners will participate in the governance and operation of the Doctoral Training Centres. They will ensure the definition of the addressed themes, providing scientific and business challenges as well as funding for doctoral candidates. A critical mass of 200 doctoral students participating in the school should be reached by 2016.

Towards 2016, the Doctoral School will actively work on the development of innovation and entrepreneurial content, course deployment across the participating Higher Education Institutes and closely monitor the progress. Intensive efforts, both centrally and locally, within the Doctoral Training Centre framework will be made to ensure strong business engagement in the actual operations to host the final requirement of the innovation and entrepreneurial certification, called the Business Development Experience.

Inject Online Learning Platform
Towards 2016, the Professional School will be further developed towards a large-scale initiative consisting of online learning platforms with a growing portfolio of technical, science and business modules. Having access to an online learning platform enables EIT ICT Labs to provide blended education programmes that combine the benefits of classroom learning with the advantages of online learning. The online learning platforms will align the skills of students and needs of employers effectively with the offerings of the education providers and can easily be complemented with different social platforms.

Underlying scientific work will be performed on optimising e-Learning processes based on promises for improved pedagogy and increased effectiveness of students and teachers. The online courses facilitate a broader outreach for the Master School and help EIT ICT Labs to promote selective lifelong learning. Instruction videos on various topics (e.g. High Impact Initiatives, Master School registration process, activity proposal submission process, etc.) can be offered via the platform as well.

Monitor uniformity and quality of the Schools
Monitoring the uniformity and quality of the innovation and entrepreneurial modules of the schools will be one of the priorities towards 2016. The EIT label is essential for the quality brand of the schools and of particular importance to safeguard that the innovation and entrepreneurship skills hold the highest quality. New concepts and an internal Quality and Learning Enhancement (QALE) system will be introduced by 2014. This assessment will involve students, Alumni and the partner companies. Comparing the forthcoming results with 'good practices' from other existing KICs will further improve the Schools and inform the newly created KICs on how they should design their own education lighthouses.

3.3 | Pan-European Ecosystem: A Vibrant Ecosystem of Innovation Hotspots

The physical EIT ICT Labs ecosystem consists of seven interrelated Core Nodes and two Associate Partnerships. These EIT ICT Labs

Nodes are regional anchor points for involving and empowering the partner network (see Figure 3.3). They represent local ICT communities with strong links to leading national stakeholders creating impact on (and synergies with) national programmes and initiatives while providing each of them a window to Europe. Within the Nodes physical Co-location Centres (CLCs) are established. These CLCs act as meeting places for all those engaged in ICT education and innovation. They are the core of EIT ICT Labs strategy driving the desired change in European ICT innovation culture from "knowledge investment" to "value extraction" through on premise execution of activities stimulating the mobility of people, ideas, technologies and investments.

3.3.1 | Strengthen Excellence of the Ecosystem

Strengthen strategic industrial footprint
Towards 2016, EIT ICT Labs will further improve the commitment of industrial partners who are endorsing the adopted open innovation principle. Existing business contacts with the Core Partners will be strengthened at executive level by involving them in the strategic dialogue on EIT ICT Labs' future. New prominent industrial partners from the local ecosystem will be attracted. To increase impact and market penetration, application partners and partners from outside the ICT industry, the end-user community (see paragraph 4.2), will also be involved.

Established education brand
Ambition 2009 ▸ current status ❖ target 2016

Doctoral and Master School ▸ Established ❖ Expanded and internationally recognised
Lifelong learning -> Professional School in development ❖ Renowned Professional School established

New ICT-based learning techniques ▸ First assessment of need and opportunities ongoing ❖ Online learning platform and blended learning implemented in curricula offered under the EIT ICT Labs brand
Industry exposure ▸ Summer Schools organised for several Action Lines & Doctoral Training Centres in development within CLCs ❖ Integrated in all eight Action Lines and organised physically within the CLCs

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EIT ICT Labs
ECOSYSTEM

- ⬤ **Node**
- ⬤ **Associate Partner**

Aalto University
VTT
Nokia

Ericcson
KTH
SICS

HELSINKI

STOCKHOLM

SAP
DFKI
Deutsche Telekom
Siemens
TU Berlin
Fraunhofer

CWI
Philips
Océ
TNO
NIRICT

LONDON

Imperial College
Intel
University College London
British Telecommunicatons

BERLIN

EINDHOVEN

Budapest University of Technology and Economics
Eötvös Loránd University

Thales
Alcatel Lucent
France Telecom Orange
CEA
Universite Paris-Sud XI
Institut Mines Télécom
Université Pierre et Marie Curie

PARIS

BUDAPEST

TRENTO

Engineering Ingegneria Informatica
Telecom Italia
TrentoRise

MADRID

Fundación IMDEA Software

Figure 3.3 Innovation Ecosystem comprising of Nodes (with Core Partners) and Associate Partnerships (with Associate Members).

Co-location Centres as stimulating innovation environments
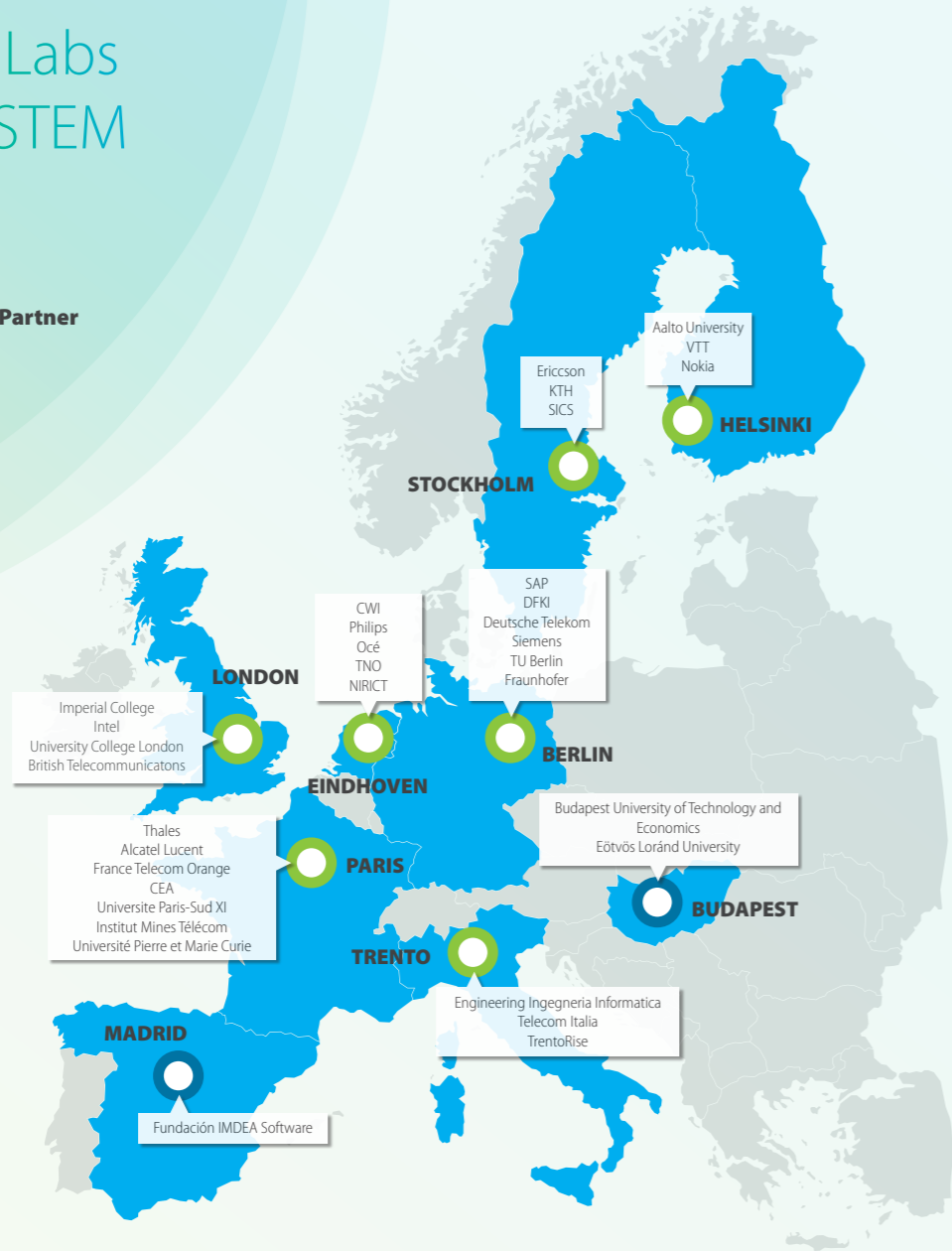With its Co-location Centres (CLCs), EIT ICT Labs has created physical spaces in which innovation and entrepreneurship are brought to life through a portfolio of catalysing activities. The CLCs are the physical representation of the integration of Education, Research and Business. Professionals with different backgrounds, from different organisations and from different countries come together, united by a common mission of collaboration and openness, to work and learn together in a stimulating environment. When professionals return to their original organisations after spending a period of time at a Co-location Centre, they will have broadened their networks and gained experiences they otherwise would not have had access to. In this way, the CLCs provide an excellent opportunity for personal

development and growth for professionals, who are exposed to this environment for a longer period.

Towards 2016, the strategic intention is to further emphasise the role of the CLCs by shifting more activities towards these physical collaboration spaces, including a significant percentage of the High Impact Initiatives, and by further improving their infrastructure and thus their attractiveness.

3.3.2 | Outreach & Communication as Strategic Tools

Engage EU28
Towards 2016, results of the activities within EIT ICT Labs will be disseminated and exploited through communication and transfer into other application settings. Outreach activities will be considerably expanded through the Action Lines, each of which now includes a specific Outreach task in its management activities. EIT ICT Labs will focus on individual talent and improving cooperation with major international actors to further strengthen its Nodes and Associate Partnerships. Outreach activities will identify key geographical regions (Regional Innovation Schemes) and thematic focal areas to reach out to after 2016.

Connect to the USA via a true two-way street
EIT ICT Labs ambition is to set up an outpost at Silicon Valley in collaboration with its partners to establish a two-way, equal-base, Europe-USA connection. EIT ICT Labs Nodes and their partners are

Infrastructure for innovation ecosystem
Ambition 2009 ▸ current status ❖ target 2016

Nodes ▸ Seven established and two Associate Partnerships ❖ Outreach via X-Europe & Silicon Valley; Empowered partnership; Well-connected with C-Level executives of the partner organisations

Co-location Centres ▸ Seven established (plus three satellites) as innovation hubs ❖ Physical blended innovation spaces fully functional hosting joint collaboration activities

already tightly connected with the ecosystem in the Silicon Valley. Many EIT ICT Labs partner universities have collaborations with universities like Stanford or UC Berkeley. Large companies from the EIT ICT Labs network have their own facilities there, as well as a focus on research collaboration and technology scouting. In addition, many European ICT-related SMEs and start-ups are setting up offices and/or seeking investment capital in Silicon Valley. Main targets towards 2016 are: 1) to enhance mobility of ICT innovators (researchers, doctoral students, entrepreneurs, SMEs and investors) between the Nodes and Silicon Valley, 2) to stimulate joint work on selected initiatives, and 3) to improve access to finance. Opportunities within the BRIC countries will be explored towards 2016. More intense collaboration is envisioned after 2016.

Communication as a strategic tool

EIT ICT Labs uses communication as a strategic tool to interact with its stakeholders on the established strategy, operations, achievements, and brand. The strategic communication objective is to establish EIT ICT Labs as a recognised brand in education and research-based innovation and to build trust amongst stake-holders and better understand their needs and demands. For the period towards 2016, EIT ICT Labs will further improve its communication performance by evaluating the impact it has on its target audience.

Impact through dissemination & outreach

Ambition 2009 ▸ current status ❖ target 2016

Align with European initiatives ▸ Footprint EIT ICT Labs established ❖ Key geographical regions and thematic focal areas to reach out to identified
Key global hotspots of innovation ▸ Contact with Silicon Valley established ❖ Physical representation established in Silicon Valley and links to other world class innovation hot spots created

4 A Longer-term Perspective on the EIT ICT Labs Environment, Innovation Opportunities, Impact Measuring, IP Policy and Sustainability

4.1 | RELATIONSHIP BETWEEN EIT ICT LABS AND THE ENVIRONMENT

Shaping future European innovation activities through strategic collaborations

So far, EIT ICT Labs has contributed to several international platforms, initiated structural partnerships and has established high-level contacts in the USA and China in order to set its footprint and impact across its Research, Business and Education activities (see Figure 4.1).

Connect to application partners in the innovation areas of EIT ICT Labs

For EIT ICT Labs to be as relevant as possible, it is very important to identify the exact ICT needs within the end-user community. Several of these communities are (or will be) engaged through other KICs. The current Action Line "Smart Energy Systems" will serve as a pilot how to act as an effective interface to the KIC InnoEnergy. Based on the outcome of this pilot the Action Lines "Health & Wellbeing", "Cyber-Physical Systems" and "Future Urban Life & Mobility" will connect

DG-Connect	Directorate General for Communications Networks, Content & Technology
EIF	European Investment Fund
EuroCIO	The European CIO Association
FI-PPP	Future Internet Public-Private Partnership
FIRE	Future Internet Research & Experimentation
ERC	European Research Council
ETSI	European Telecommunications Standards Institute
IEEE	Institute of Electrical and Electronics Engineers
ITEA-2	Information Technology for European Advancement - 2
GSMA	GSM Association (Association of Mobile Operators and related Companies)
TDL	Trust in Digital Life partnership

Figure 4.1 Strategic Alliances across Research, Business and Education activities

to the related future KICs (see figure 4.2). Collaboration with end-users will be sought on a project-by-project basis. The EIT ICT Labs Summer Schools and deployment of Catalysts in all application areas will further strengthen the ecosystem.

Highlights of main strategic collaborations

Access to finance: Through the collaboration with the European Investment Fund, EIT ICT Labs will leverage the investment tools of the European Investment Fund with the investment capacity of EIT ICT Labs core industrial partners increasing overall efficiency. Furthermore, the collaboration will be essential in mobilising European venture capital to support entrepreneurship around the Co-location Centres of EIT ICT Labs.

Market pull: Through its connection with EuroCIO, EIT ICT Labs will promote ICT as an innovation accelerator in a broad area of application areas by introducing engaged partners, relevant education programmes and stimulate joint programming aligning market need with EIT ICT Labs activities.

Accelerate innovation: Future Internet PPP will accelerate the development and adoption of Future Internet technologies in Europe, advance the European market for smart infrastructures, and increase the effectiveness of business processes through the Internet. EIT ICT Labs will collaborate with this European programme providing the set of tools needed to accelerate innovation and reaching out to potential end-users.
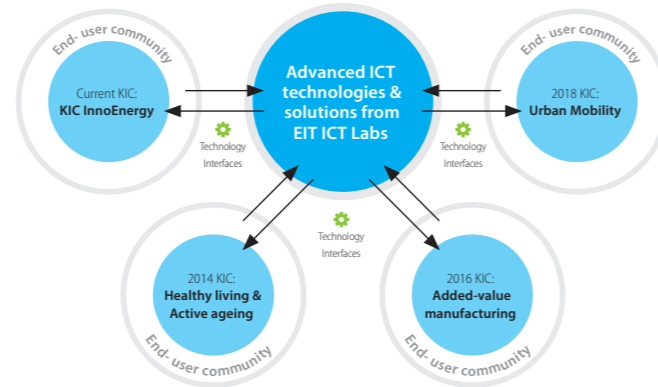

Figure 4.2 Interconnection between EIT ICT Labs and other KICs

Connecting to ICT related ecosystems worldwide

EIT ICT Labs' unique feature is that it creates a system of ecosystems. By connecting physical innovation hotspots (EIT ICT Labs Nodes), EIT ICT Labs has been able to leverage proven successful approaches and instruments in a short time. On a global scale, three successful ICT related innovation ecosystems can be identified which could be considered as innovation ecosystems of a similar - or larger - scale (see figure 4.3). In maturing over the years they have built up experience in how to organise complex ICT ecosystems with considerable impact. By connecting to these ecosystems EIT ICT Labs will be able to learn from their lessons learnt, facilitate access to their resources and benchmark its progress giving insight in possible improvements and supporting strategic decisions towards the future.

Relevant ICT ECOSYSTEMS worldwide

Website www.siliconvalley.com
Region United States
Establishment 1940s (Semiconductor Genealogy Chart)
Category Geographical concentration without a central organisation
Employment 1.2 million – of which 17% is in Science and Engineering (all industries)
 # Companies 177,853 establishments, including leading global players; in 2009 174,900 non-employer firms (all industries); semiconductors industry: 41 semiconductor companies, 7 equipment producers
Areas of activities Silicon chip innovations; Software innovations; Other technological innovations
Noteworthy Prime example for global technology clusters; employment grew with 42,000 jobs in 2011 (+3.8% vs. +1.1% nationwide); firm closures outpaced firm openings in 2010 for the first time since 2000; 13,311 new patents in 2010, an increase of 30% over 2009.

SILICON VALLEY

Website Silicon Wadi, no central website
Region Coastal plain in Israel, particularly the Tel Aviv region
Establishment 1960s (founding of ECI Telecom, Tadiran, and Elron Electronic)
Category Geographical concentration without a central organisation
Employment As of 2010, more than 35,000 professionals are employed in Israeli R&D centres of multinationals alone. This does not include R&D personnel in start-ups
 # Companies Tel Aviv already accommodates 700 early stage start-ups, according to city data. The overall Israeli start-up community constitutes over 4,800 companies.
Areas of activities Wireless technology, hard-core technologies and innovation, specialised chips and advanced telecom equipment
Noteworthy Silicon Wadi has the number 2 start-up ecosystem in the world, and 61 NASDAQ listed companies (more than Europe, Japan, Korea and China combined). In Israel, most university graduates become IT entrepreneurs or join start-ups (twice as many as in the US).

SILICON WADI

Website www.a-star.edu.sg
Region Singapore
Establishment 1991
Category Statutory board under the Ministry of Trade & Industry, supporting Singapore's key economic clusters
Employment R&D workforce over 2011: 38,000
 # Companies In 2013, 14 start-ups were founded
Areas of activities Biomedical sciences, electronics, cleantech, chemicals and materials, aerospace, automotive, manufacturing, infocomms and media, and precision engineering.
Noteworthy Government research institute that ranks 9th in the 2013 WIPO report. In terms of number of patents, licenses and start-ups per billion S$ R&D spending, performs better than for instance the UCal System, Harvard or MIT.

SINGAPORE

Figure 4.3 Overview of relevant ICT ecosystems worldwide

4.2 | LONGER-TERM PERSPECTIVE: OPPORTUNITIES ON THE HORIZON

Via its Innovation Radar EIT ICT Labs continuously monitors tech-no-socio-economic trends in order to steer innovation and to be well prepared for disruptions that profoundly change our lifestyles or industries. Given the EIT ICT Labs mission to bring technologies to the market, timing is of utmost importance. The strong EIT ICT Labs research partners drive technology development and enable early detection of innovation opportunities. Via precise timing, the EIT ICT Labs business partners can accelerate valorisation, providing first-mover advantage.

EIT ICT Labs currently works on a collection of carefully selected Action Lines covering areas of vital interest for Europe. At the same time our Innovation Radar is closely following trends that may lead to innovation opportunities for EIT ICT Labs in the mid- to long-term. Some of these trends are listed below.

Via its adaptive strategy EIT ICT Labs manages the lifecycle of its Action Lines and activities based on the development of trends as listed above. This leads to a continuous evaluation of the innovation investments of EIT ICT Labs in order to timely focus on those innovation opportunities that have most societal or economic impact.

3-D Printing: Next to challenges in mechanics and material science, 3-D printing also needs ICT to reach its maximum potential, e.g. to optimally utilise the flexibility resulting from a highly decentralised production infrastructure, integrating this into supply chain management and supporting new business models.

Supercomputing: Computing paradigms based on optical methods, carbon nanotubes and/or quantum principles may once again allow further extension of Moore's law and lead to a next revolution in available computing power, further commoditising "regular" computing capabilities. This enables previously unimaginable high-end applications and generating even higher data transmission bandwidth demands.

Collaborative Consumption: A society, in which sharing becomes part of the culture, requires robust and secure tools (potentially including virtual currencies) to manage common ownership and usage.

Brain Understanding: Truly understanding the human brain as a biological supercomputer, as intended by the €1 B Human Brain Project, requires a combination of ICT and Biology. This interplay is expected to create new ICT paradigms via biology-inspired engineering.

Technological Singularity: Further advances in computing power and effective machine learning techniques lead to the point where artificial intelligence surpasses human intelligence for an increasing number of knowledge-intensive tasks for which automation becomes possible. Next to new opportunities, this development leads to profound questions as to whether man or machine is in control.

Ambient Computing: As sensors that are connected to the Internet of Things continue to get smaller and less expensive, ever more measurement data becomes available for interpretation.

Context-based Interfaces: Systems that learn to anticipate their user's intentions are more efficient, but also cause concerns about privacy and fault tolerance.

Graphene material science: Optimally creating new materials based on graphene and using them for innovative applications is the second €1 B project supported by the EU for which ICT skills and tools (e.g. for simulations) are needed.

Work-Life Integration: Rather than just balancing work and life, employees will increasingly blend their private, social life with their work life. They and their employers need fitting solutions to facilitate and manage this.

Aging Population: This inevitable demographic trend has far reaching consequences throughout society and economy. ICT-supported solutions become increasingly important to support seniors and their families and to help with managing the associated challenges.

4.3 | FROM KPI MONITORING TOWARDS IMPACT MEASURING

Maturing organisations shift from a focus on input and process monitoring in the early phases of their set-up via a focus on output when evolving towards a focus on impact measuring when becoming

established. After focusing on input and process monitoring, EIT ICT Labs is now shifting emphasis on output measuring. To this end, EIT ICT Labs tracks a set of Key Performance Indicators (KPIs) focusing on tangible successes towards innovation acceleration and new business creation as well as the effectiveness of the EIT ICT Labs education programmes (see table 4.1).

	Input -> process -> output		
Research-based innovation	Innovation acceleration Adoption of knowledge resulting from KIC activities by KIC partners as well as its transfer to external stake-holders	Commercialisation Creation of new as well as improved products, services and processes	Business development Incubation of business ideas as well as creation of start-up and spin-off companies
Entrepreneurial education	Attractiveness/Market demand Number of eligible applications for the Schools	Capacity Maximum number of students that can enter the respective programmes	Results/Market supply Number of graduates

Table 4.1 Current KPIs EIT ICT Labs have evolved towards output monitoring

While the current set of EIT ICT Labs KPIs regularly measures the output in a number of important categories, it does not yet truly measure the longer-term impact for the European ICT economy. For

example, the number of created start-ups is measured, but neither their long-term success nor their economic impact in terms of jobs created. Similarly, the number of graduates is measured, but not their positions with European ICT companies and their success in the marketplace. Without neglecting the current parameters, EIT ICT Labs will shift further towards measuring its long-term impact.

EIT ICT Labs' ambition is to create impact through excellence. Excellent tools to stimulate innovation acceleration will create successful companies, products and services with significant market impact. Excellent education programmes with a lighthouse character will breed graduates that will move into key roles within the European ICT industry and create a reputation for themselves – they will be noticed, talked about and reproduced. This is what EIT ICT Labs intends to accomplish and progress towards this desired state should be measured. A suitable set of indicators providing input for future strategic decisions will be explored in collaboration with the EIT.

4.4 | TOWARDS AN IP POLICY STIMULATING OPEN AND COLLABORATIVE INNOVATION

Intellectual Property (IP) is a critical element in innovation management, which is especially true in the field of ICT. IP-related concerns can have a limiting and decelerating effect on open and collaborative innovation. In this context, the EIT ICT Labs IP Committee has developed a set of IP policy guidelines with the main objectives of

supporting an open and collaborative innovation approach, creating a trusted environment for knowledge exchange and sharing and facilitating a fair profit sharing model.

This IP policy builds on existing IP schemes for base activities (carriers) and develops own guidelines for the KIC added value activities (Catalysts), with the intention to provide clear guidance on all relevant IPR aspects to EIT ICT Labs' partners as well as the KIC Legal Entity itself. The policy addresses sharing of information, ownership and access rights and return on investment.

EIT ICT Labs supports all types of open innovation and expects from all partners the willingness and mindset to contribute to such an ICT innovation ecosystem and to work along IP policy guidelines that are in line with the imperative of open innovation. Partners are encouraged to integrate IP management throughout their activities, from idea generation to commercialisation, and to consider IP protection measures at all appropriate times. This includes ensuring at the start of each Catalyst activity that suitable contractual relationships are established for all project contributors. EIT ICT Labs will stimulate the adoption of its IP policy and intends to establish suitable incentives.

The IP policy guidelines focus on facilitating collaboration as well as commercialisation by removing potential IP-related hurdles. It intends to ensure access to background IP (pre-existing IP) as well as foreground IP (IP created during the Catalyst activity) under fair terms, be it royalty-free conditions or FRAND (Fair Reasonable And Non Discriminatory) conditions especially within activities and also

within the overall EIT ICT Labs partnership. It intends to establish transparency with respect to the handling of IP at the start of each activity and to create a safe collaborative environment.

With the current IPR policy, an important step has been made towards an open and collaborative innovation practice. EIT ICT Labs will further elaborate on this through a strengthening of the IPR function and the IPR management in the coming years. This will take place in an iterative way of working, where the experiences of the EIT ICT Labs partners and the KIC Legal Entity will be used for the further evolution of the guidelines.

4.5 | TOWARDS A SUSTAINABLE FUTURE

EIT ICT Labs is financially supported by the EIT. The EIT financial support constitutes 25% of the EIT ICT Labs budget while the remaining 75% is raised from the ecosystem. In order to create a more sustainable future with reduced dependency on EIT financial support EIT ICT Labs has investigated the subject of sustainability in 2012 EIT ICT Labs together with external consultants.

In order to fundamentally explore sustainability of a novel entity like a Knowledge and Innovation Community it is key to analyse current investment of the EIT financial support. The EIT financial support is exclusively invested in the catalysing activities that broadly fall in four categories: 1) the Catalyst activities to run the eco-system including its Co-location Centres, 2) the Research Catalyst activities focused on

maturing and experimenting promising technologies, 3) Education Catalysts focusing on entrepreneurship and mobility (to a large extend via scholarships) and 4) Business Catalysts focusing on bringing technologies to the market and providing access to finance for start-ups and SMEs.

These different investment categories offer different opportunities for alternative financing. Running the ecosystem for example might be financed via service offerings to players in and outside the ecosystem. While the investment into scholarships can be addressed by a combined approach of fewer scholarships, as a result of growing reputation of the EIT ICT Labs education, and scholarship fundraising where also the EIT Foundation could play a role.

Based on the 2012 investigation, in 2013 a number of schemes have been developed that will be deployed in 2014. Example schemes are Brokering platforms for Experience & Living Labs, Support services for growing companies, Professional education activities and services provided to the pan-European ICT ecosystem.

In a strategic dialogue with EIT, EIT ICT Labs will further develop its sustainability schemes in the coming years, incorporating experiences from its current schemes.

5   Concluding Remarks

In 2009, EIT ICT Labs set out to radically accelerate ICT innovation in Europe by:

– Invigorating the innovative spirit within the existing European ICT industry;
– Creating a new generation of entrepreneurial engineers;
– Catalysing new ventures that can grow to become future world leaders.

By 2013, after the conclusion of its start-up phase, EIT ICT Labs is established, recognised and well on its way towards realising its ambitions by delivering:

– A pan-European ecosystem of ICT innovation Co-location Centres stimulating the mobility of people, ideas, technologies and investments;
– Scalable Pan-European Master and Doctoral Schools focused on excellence, systemic change through technical programmes with deep embedding of innovation and entrepreneurship, and delivering T-shaped talents with a passion for innovation;
– A portfolio of Action Lines integrating Education, Research and Business and driving research-based innovations to the market;
– A pan-European Business Development Accelerator driving value extraction and entrepreneurship;
– Strategic collaborations with established players such as the European Investment Fund, Future Internet PPP, ITEA, and the European CIO Association.

For the period 2014 - 2016, EIT ICT Labs will further step up by pursuing specific and ambitious goals, including:

– Expanding its impact through London as full Node, by rolling-out X-Europe EU-28 and by connecting to Silicon Valley;
– Scaling the Master and Doctoral Schools, building and running the Professional School, and via deployment of online platforms, bringing European universities the future of blended education;
– Carrying out a balanced portfolio of top-down High Impact Initiatives as well as bottom-up activities in a set of focused Action Lines that target vital European interests;
– Expanding the pan-European Business Development Accelerator for value creation and further drive of entrepreneurship amongst others via idea competitions.

EIT ICT Labs will be established as a renowned vibrant pan-European ICT ecosystem that is a recognised entrepreneurship and innovation driver as well as an established educator of Technical Entrepreneurs. Continuing on this journey that is characterised by a passion for innovation, a focus on quality and a drive for results, EIT ICT Labs has the ambition to be a lighthouse and a desired ICT innovation partner. Through its societal and economic impact EIT ICT Labs wants to be a continuous driver of innovation that, on a European scale, opens new avenues for the consistent creation of economic growth and enhancement of quality of life.

Acknowledgement