European Commission

Boosting Open Innovation and Knowledge Transfer

in the European Union

Independent Expert Group Report on Open Innovation and Knowledge Transfer

Research and Innovation

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Independent Expert Group Report on
Open Innovation and Knowledge Transfer

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Boosting Open Innovation and Knowledge Transfer in the EU

EXECUTIVE SUMMARY

> *'The EC, Member States, universities and public research organizations, corporate sector, financial institutions, local communities and their citizens have no option but to advocate and to support an open, networked and collaborative innovation-led growth on which, in different ways, their own intellectual, operational and financial vitality will increasingly depend'.*

Creating value out of knowledge and ideas: is Europe living up to its potential?

Europe faces two existential challenges: (1) how to create sustainable growth given the vast overhang of public and private debt and (2) how to do this given the transformational impact of disruptive technologies (e.g. the impact of the newly emerging Key Enabling Technologies) on traditional models for business and public sector organizations (e.g. energy and health), banks, universities and public research organizations (PROs). Asia and North America face similar challenges.

Evidence on knowledge transfer (KT) suggests there is still a gap when Europe is compared to the US, even though the Knowledge Transfer Office (KTO) profession has been maturing all over Europe. While Europe performs better than Japan, we see a rising level in China that will become a fierce contender in the knowledge transfer landscape in the decades to come. Furthermore, we see a significant heterogeneity in Europe. Although heterogeneity is present in the US as well, there exist significant differences between European countries, both in terms of the critical mass and professionalism of their KTO functions, such as in their performance, output and impact. Finally, there is room to improve both the breadth and the depth of interactions between Europe's knowledge institutes and industries, although a multitude of interaction patterns are shaping up and taking form. In other words, KT is a two-way street that requires all actors to understand the value added by joint innovation actions.

This results in a mixed message: more should and could be done in Europe, though it is advocated to thereby focus on selected, future-oriented market pockets as our scarce resources have to be pointed to the most promising development opportunities. So far, though, we have been quite effective in what we have done. An explanation of this effectiveness is the European tradition of collaboration in science and business. European R&D policy has already propelled collaboration and KT to the forefront before the current emphasis on Open Innovation took hold in Europe. The advent of both OI and Triple Helix thinking (emphasizing the multiple, fruitful, joint actions and interactions between university, government and industry actors) has put even more emphasis on the collaborative dimension of innovation activities.

The foundation for creating value out of knowledge and ideas must continue to rest on a critical mass of public and private investments in R&D:

Stick to existing ambition: Stick to and reach the 3% norm regarding public and private R&D investment as a percentage of EU GDP to improve EU long-term dynamic innovation and economic competitiveness.

The response to the challenges Europe is facing has to be smart, radical and above all, innovative, imposing a new urgency on businesses, universities, public research organizations, financial institutions, intellectual property providers, and government to work together in a clear-eyed and decisive way.

A new, advanced Open Innovation paradigm: building and funding ecosystems for co-creation

This report sets out to develop coherent whole of policy recommendations for OI and KT, across four priority areas where this Expert Group recognizes that actions must be taken (either at EU, Member State or stakeholder level, depending on the specificities of the recommendation). For the EU to continuously raise and reach its growth potential, it has to be innovative and thoroughly enterprising. An enterprising Union should:

1. Offer better modes of coordination across the economic actors involved in order to enhance productivity, output and innovation rates. OI and KT imply challenges to businesses, universities, PROs, financial institutes and governments.

2. Build and grow innovative markets, innovation hubs and networks. There are challenges to competitiveness, to industrial organization, to demand, to business models and to social entrepreneurship.

3. Enhance the role of universities as co-creators and as interactive partners in innovation systems. There are challenges to universities' co-creation capabilities, to the design of incentives for academics when working with users and to the absorptive capacity of academic knowledge within firms. This requires enhancing the skills for OI and KT across the industry–science spectrum. It involves challenges to the management and leadership skills within the KT profession as well as the support of 'good' governance practices of universities.

4. Build more innovation-friendly financial instruments and institutions. In particular, create a smart funding ecosystem in which OI and KT can thrive.

In order to bring OI and KT to the next, more advanced, level it is essential to build an ecosystem in which OI and KT, or co-creation, can thrive. The necessary building blocks for an ecosystem for co-creation are:

Action 1	Put Open Innovation and Knowledge transfer in the spotlight
Action 2	Embrace innovative businesses, grow innovative markets, innovation hubs and networks
Action 3	Make Universities and PROs more entrepreneurial
Action 4	Smart integration of capital into the ecosystem

An ecosystem for co-creation in turn will breed trust, visibility and transparency. Co-creation ecosystems will thereby act as magnets for innovation and economic development.

Action 1: Put Open Innovation and Knowledge transfer in the spotlight

A first priority puts OI and KT in the spotlight.

Knowledge transfer can be seen as major tool for open innovation (OI).

Open Innovation 1.0 implies accelerating internal R&D and innovation along value chains through transactions between the technological supply- and demand-side.

Open Innovation 2.0, however, moves from bilateral transactions and collaborations towards networked, multi-collaborative innovation ecosystems. It means that a specific innovation cannot be seen as an isolated activity without considering the consequences for its entire economic and social environment. For instance, the extended use of smart phones has changed customers' behavior, and fostered opportunities for further innovations. This co-creation approach to OI is more than simply sharing of and transacting on resources, risk and reward. It is about integrating across different value nodes throughout the ecosystem and thereby creating new markets and more effective business models, which wouldn't exist otherwise.

Co-creation refers to the joint development of knowledge through relationships with specific partners. Relationships can be consortia of competitors, suppliers, customers as well as universities and PROs. Cooperation is usually characterized by a profound interaction between parties/partners over a longer period of time.

Within an eco-system, co-creation works on different levels. For instance, external ideas from users may be captured and integrated by an organization to co-create platforms with universities and/or other companies. Certain tasks which create value may be distributed to other individuals or groups. Tools for co-creation can be traditional (meetings) or developed online (platforms, chatrooms).

This ecosystem approach requires a step change in research, development and innovation infrastructure as well as smarter incentive schemes for stakeholders. For instance, one approach to co-creation activities may focus on leveraging various types of funding mechanisms, accessible to the triple helix partners or by combining regional, national and European funding schemes to make a specific co-creation trajectory work. It is obvious that different funding sources can complement and reinforce each other's impact on co-creation trajectories.

A precondition for this approach is that all parts of the ecosystem are engaged in developing 'exchange' and 'absorptive' capacity. Relevant players take part in and benefit from it. As such this co-creation approach implies challenges to the Member States (MS), their businesses, their financial institutions, their universities and PROs. For instance:

Besides traditionally serving markets, businesses could build new structures to better absorb externally developed (public or private) knowledge into their organisations. As such they will not only enhance their co-creation capabilities but also contribute to the development of new academic knowledge.

Universities and PROs can be more than suppliers of knowledge and talent. They could grow and build structures that incorporate and respond to the needs of their users. As a result PROs could become real-time co-creators of new solutions alongside their basic missions of talent development and knowledge creation.

The financial sector, supporting entrepreneurship, could also go beyond being suppliers of knowledge and equity to enable innovations. New funding models,

based on improved absorption and deeper understanding of the specific innovation opportunities and needs, could offer benefits in relation to the regions, markets, sectors and networks they operate.

Last but not least governments (regional, MS, EC) would need to go beyond roles as regulators or facilitators of grants and become more active and enabling co-players in the ecosystem. This approach has also implications for monitoring innovation performance in the co-creation era and for organizing and deploying an effective and efficient Intellectual Property system.

This leads to the following recommendations:

1. New ambition: **Implement a European-wide Open Innovation 2.0 policy** where relevant stakeholders are collaborating along and across industry and sector-specific value chains to co-create solutions for grand socio-economic and business challenges. This co-creation process should join forces at the EU, MS and regional level.

2. Adjust existing ambition: **Develop intelligence and monitoring systems** on EU and MS level capturing how well our organizations, institutions and regions attune to the **OI ecosystem needs**, and translate their findings into performance metrics or diagnostic tools of key performance indicators.

3. Adjust existing ambition: Through the implementation of a **harmonized European high quality, informed and influential IP policy**, the EU can become an even more attractive place for creators and users of IP, including public and private research organizations as well as businesses.

Action 2: Embrace innovative businesses; grow innovative markets, innovation hubs and networks

A second priority embraces the genesis of innovative businesses. It also adopts novel approaches to develop competitive markets and growing European economic hotspots.

Market fragmentation still poses challenges to company growth and development in Europe. Reducing market fragmentation throughout Europe therefore remains a high priority, on par with the 3% R&D priority. While reducing market fragmentation, we also need to stimulate firm growth throughout Europe. From an OI and KT perspective, this implies creating incentives for major anchor research institutions and large firms to take advantage of Europe's vibrant SME community and its entrepreneurs, and vice versa. In this way, SMEs can be nurtured, since they can productively connect and anchor into global value chains via collaborative engagements with large firms.

However, OI does not mean completely free access to knowledge that is competitively relevant, as we need to ensure the European economy capitalizes on the OI networks we spur on. The EC is therefore encouraged to actively stimulate the development and growth of prospective, infant industries while embracing opportunities for smart specialization clusters to grow and to mature. This is

important in order to enable more European start-ups and SMEs to grow into large firms and to improve leadership skills of EU firms in global competition. In this way, Europe will provide appropriate answers to the strategies used by our global competitors such as USA, China and Korea. A revised competition policy will thus allow Europe to develop competencies and to build scale advantages, thereby overcoming the constraints posed by our current small firm populations and diverse country base.

OI, collaboration and competition are an important trinity. OI-based competition means that collaboration around common (socio-economic or business) challenges is essential whereby each party brings its competencies and competitive strengths, often with previously unrecognized synergies. Europe has embraced the development of smart specialization policies into its remit, but they now should be made tangible and concrete. We need an evidence-based implementation of smart specialization strategies. The overall aim should be to build and maintain competitive positions in global value chains. Therefore, the implementation should focus on a) developing the appropriate measures for stimulating and monitoring cross-border connectivity while b) focusing on the presence and the development of the awareness, the skills and instrument base that are needed for OI and KT.

Finally, user involvement and engagement are keys to successful innovation processes. The way in which these users can actively be drawn into innovation activities is in and of itself a form of social innovation. User-driven innovation and social innovation therefore often co-evolve. OI offers the perfect approach to operate at the intersection of this co-evolution, because nearly each implementation of a radical (technological) innovation also signals a need for significant changes in social relationships and collaborations. This symbiotic relationship is captured by the shared value innovation concept. It offers a novel approach to innovation management and policy that explicitly focuses on the highly valuable and relevant intersection of (social and market) innovation. For instance, new solutions in the healthcare sector can be a result of co-creation between academic and economic actors as well as civil society (such as patient groups). Technological opportunities for shared innovation and engineering trajectories are obviously present in the Key Enabling Technologies that will now spread across Europe.

This leads to the following recommendations:

3. New ambition: It should be a core aim of the EC to stimulate firm growth by reducing European market fragmentation, while fostering **faster market access and development through OI and KT practices**. To this end, the EC is encouraged **to reconsider its competition policy frameworks** and allow for stimulating the development and growth (or scaling-up) of prospective, infant industries while at the same time maintaining a dynamic competitive single market environment.

4. Make existing initiatives tangible and concrete: Now that the EC has embraced smart specialization as a policy concept, it should develop **a tangible and real 'smart specialization' strategy framework** in order to operationalize and to capture pan-European, cross-border specialization and collaboration opportunities.

5. New ambition: Actively stimulate and support user-driven innovation by translating and connecting major societal challenges into market opportunities. This could be done while **using a shared value innovation model**, **empowering our user-citizens** and **embracing OI business models** through stimulating access to novel Key Enabling Technologies (KETs) in such areas as health, energy, Big Data, etc.

Action 3: Make Universities and PROs more entrepreneurial

A third priority focuses on encouraging Europe's universities and PROs to become still more entrepreneurial. The role of universities and PROs as co-creators in innovation systems needs to be further enhanced. This provides challenges a) to Universities' co-creation capabilities, b) to the design of incentives for academics when working with users and c) to the absorptive capacity of academic knowledge within firms.

The arrangements in many EU universities and PROs have been reported to be still too bureaucratic. The focus seems to be more on managing innovation relationships rather than supporting the delivery of outputs. Evidence suggests that individual scientists are the strongest source of initiating interactions with the stakeholders of innovation ecosystems – often with limited involvement of university administrators. It is important to focus on nurturing and accelerating the development of universities and PROs into entrepreneurial institutions, so that they may become catalysts of Triple Helix interactions. For this to happen, the role of scientists as knowledge providers would need to be complemented with a role as co-creators. Furthermore, the role of knowledge transfer offices (KTOs) would have to be transformed from isolated entities into fully embedded professional service units within universities and research organizations.

Universities and PROs should therefore be encouraged to develop and adopt a Charter and Code in their Entrepreneurial and Innovation Policy. This Charter and Code in universities and PROs' is not about implementing more rules, but about ensuring that their scientists are encouraged to actively embrace more entrepreneurial objectives. This must also allow for more strategic flexibility at the national and regional level, accepting that research institutions become more

autonomous and rewarded for their dedicated and targeted contributions to the innovation ecosystem.

Professionalism must be linked to the new imperative of open innovation. Measures should be put in place to ensure that OI and KT as a 'profession' is recognized in universities and PROs, in order to update the skills to support OI. Skill development should be aimed at a) developing the entrepreneurial and innovation skills of scientists and b) the legal, administrative and coordination skills of support staff that facilitates this.

An appropriate incentive schemes should be further developed to stimulate scientists, academics and KTO staff to engage in co-creation processes with the users of their knowledge. This involves recognition of the entrepreneurial engagements of academics/scientists beyond the traditional recognition of publications and scientific impact. It also involves willingness to support the services provided by KTOs to engage in different co-creation mechanisms with businesses, social institutions, governments, and citizens etc. These incentives should be incorporated into performance indicators for career progression. This should be anchored at stakeholder (University/PRO) level.

Thus, our proposed Charter and Code in policies and practices for making universities and PROs more entrepreneurial and innovative should aim to stimulate scientists to become co-creators with the stakeholders of innovation ecosystems. Those measures can also be integrated in the HRS4R policy that is now gaining ground within a plethora of EU universities and PROs.

The EC thus needs to support and encourage the adoption of good practices that enables universities and PROs to co-create knowledge with their collaborative partner-innovators. Research institutes need to be supported to adopt good practices when engaging with users. This enables them to build trustworthy, transparent and long-term relationships with those users. It means that universities and PROs need to implement effective strategies to reap the full benefits of co-creation.

This leads to the following recommendations:

7. New ambition: MS and the EC should stimulate universities and PROs to develop and adopt a Charter and Code on their entrepreneurial and innovation Policy. This policy code can build upon the same approach as the 'HR Strategy for Researchers' (HRS4R). The articulation and adoption the code should be recognized as a quality label, for instance in funding programs.

8. New ambition: The EC needs to put measures in place to ensure that 'OI and KT' as a 'profession' is recognized in universities and PROs, in order to update the skills to support OI. The Knowledge Transfer Offices (KTOs) should play a central role in this process of professional development and maturation.

9. Adjust existing ambition: European universities and PROs need to adopt appropriate incentive schemes for scientists and KTO staff to engage in co-creation processes with the users of the knowledge they generate. These should be incorporated into performance indicators for career progression. These should be anchored on University-PRO level.

Action 4: Smart integration of capital in the ecosystem

In order to stimulate innovation, policymakers mainly focus on creating environments that favor Triple Helix collaborations, often directed at the establishment of knowledge-intensive service clusters. Despite its clear benefits, the Triple Helix model does not include all the drivers for knowledge production, innovation and growth. This is where the civil society (fourth helix) and natural environment (fifth helix) come into play. Those two novel dimensions are increasingly needed to provide incentives to the 'Triple Helix actors' to engage. There are, however, also problems with pushing the quadruple or quintuple helix models too far: a) the extended innovation models prove difficult to implement as they heavily rely on the actors' willingness and ability to think and act beyond their own functional boundaries, and b) the models arguably put too much emphasis on the interrelations of human and social capital in the process of innovation and collaboration. The importance of financial capital and financially driven incentives thereby tends to be ignored.

These financial incentives are necessary to accelerate growth and achieve market leadership. Venture capitalists (VCs) and other risk capital providers can and must play a crucial role not only in the area of KT and OI, but also as 'social impact' investors that attempt to solve global economic, social and environmental problems, such as global warming and healthy ageing. This brings us to the financial challenges that policymakers and governments face in building a VC ecosystem:

First, it is important to bring the 'private sector'/private investors back to the VC market in Europe. Clearly, VCl is needed to get the start-up companies through the valley of death. Private capital is not only needed to effectively address the financing and funding gaps in proof of concept projects and the early to mid-stage development of start-up companies, but also in the growth phase of promising SMEs in Europe. The focus on funding and supporting SMEs is important to encourage KT and OI in the EU. To help SMEs get through the valley(s) of death while developing and growing will undoubtedly further leverage KT and OI initiatives. It is here that a 'funding ecosystem' plays a crucial role. For instance, empirical research shows that high potential growth SMEs thrive in well-developed VC ecosystems.

How can a funding ecosystem be created, which is better and more accessible to SMEs?

A straightforward answer is: The introduction of smart co-investment schemes in which European public funding is used to provide a leverage effect to investments from the private sector.

a) In order to make a SME instrument 'smart', private and public investors should jointly act as diligent lead financiers. Co-financing of SMEs by investors is a must. Serial entrepreneurs/fund managers could act as coaches to the SMEs. Probably most important is that the funds need to operate as 'public–private partnerships' in which public funds are pooled with capital from private investors. These partnerships are preferably managed by private sector fund managers who are not only in a better position to pick 'winners', but also ensure that the funds are connected to the existing VC industry.

b) The government acts as a strategic investor. Its main objective and interest is the development of a robust funding ecosystem. Here it should be recommended that government initiatives typically are organized as 'revolving programs', which means that the government participates in the distribution of returns and interests from initial investments. However, unlike most government support programs, a new SME program should be 'smarter' and designed to attract and incentivize private investors, such as cash rich corporations and family offices. One way to do this is to split the profits disproportionally.

c) But there is more. Corporate investment and partnering with universities' and PROs' OI and KT programs, as well as with innovative SMEs and venture investors, hold great potential for growth in the medium and long term. However, corporate investments need to be actively encouraged by the EC. Particular attention should be given to the interests of SMEs so that corporate investment programs seek a win–win partnership with them. A smart EU-wide Accompanying Measure to foster collaborative corporate venturing programs could lead to a substantial increase of the capital available to investment in PRO programs as well as innovative SMEs.

We already observe an increasing interest in investments in European SMEs, which offers an excellent opportunity for the introduction of smart financing schemes. Consider for instance the corporate investors and family offices which have started to play an important role in the European VC industry. Also investors from the US are willing to invest more in European start-up companies. It should be noted that private investors are also experimenting with collaborative funding models. Important examples are corporations which increasingly become anchor or general investors in VC funds and the micro-VCs.

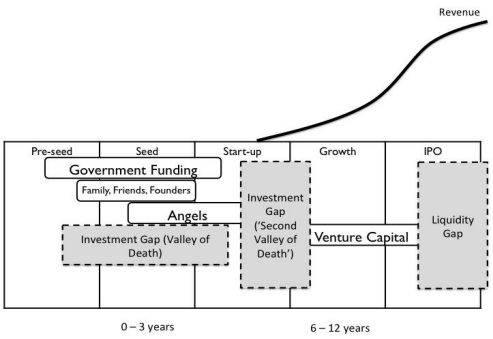
Second, most MS and their regions have very active policies and incentives to encourage more and better private investment. This is good, but the problem is that they are not aligned with each other and all too often not aligned with the needs of private investors. Also, policies and incentives vary from country to country, even from region to region and sometimes from one government to the next. The conditions created by this patchwork of uncoordinated incentives and policies have resulted in a fragmented, opaque and unstable framework which is perceived as unattractive for investors looking at investing for the long term. Therefore, it is recommended to support national/regional policymakers to develop smarter incentives for private investors in national or regional initiatives and investment schemes. Obviously, it is not being recommended that one policy framework be created, nor that national or regional policy schemes be standardized, but rather that more awareness is facilitated among policymakers to install smarter incentives and investment schemes that are attractive to private investors and encourage decisions to make medium- to long-term investments in innovation and KT. The

principles for creating smart incentives for private investors are outlined in the report.

Third, stimulate collaborative funding platforms. Crowdfunding has evolved from a way to finance creative projects (such as films) into a new type of entrepreneurial finance which has the potential to significantly change the VC ecosystem. Accessibility and speed are the key drivers behind the emergence and development of crowdfunding platforms. What is even more important, is the emergence of online platforms that streamline the fundraising/investment process by matching high potential growth SMEs with investors and letting investors syndicate deals. In this regard, online platforms can stimulate the emergence of collaborative funding models and encourage long-term investments. Most commentators claim that the impact of crowdfunding on the innovation ecosystem is exaggerated. Still, we argue that equity-based crowdfunding or similar online initiatives have the potential to become a serious alternative to traditional start-up funding if angel investors, family offices, corporate VC funds and Venture Capitalists also start working off the crowdfunding platforms.

Fourth, give attention to the liquidity gap in the ecosystem. One important effect of the sluggish Initial Public Offering (IPO) market is the focus on deregulation and the emergence of a new generation of securities markets. These deregulated markets are considered important to stimulate entrepreneurial activity and attract VC. However, the introduction of these new markets and accompanying deregulatory measures are often not successful. One of the reasons is that founders of emerging growth companies increasingly believe that it is in the best interest of the company to remain private as long as possible.

This development has led to another gap to be bridged in the funding ecosystem: A liquidity gap.



In order to bridge the liquidity gap, there is a growing need to develop platforms or encourage other arrangements that can facilitate pre-IPO trading in the shares of non-listed VC-backed firms. It is therefore not surprising that (1) companies build relationships with private equity firms (e.g., Twitter and Blackrock) to provide pre-IPO liquidity to employees, (2) NASDAQ enters into a joint venture with a private company shares platform and (3) the Securities and Exchange Board in India announced plans to allow SMEs to list their shares without an initial public offering (IPO) in October 2013. It could be argued that these trading platforms/arrangements will become a critical component of the VC ecosystem and therefore more attention should be given to establish a pre-IPO market (as they can bridge the liquidity gap in the ecosystem and reduce the fragmentation of the VCl industry).

This leads to the following recommendations:

10. New ambition: Based upon private–public initiatives, the EC must introduce and encourage the establishment of co-investment schemes to address the financing and funding gaps in the innovation ecosystem in Europe.

11. New ambition: Develop smart incentives and instruments that foster collaborative investments. Corporate investors, banks, pension funds, insurance companies, angel investors, family offices, foundations, (sovereign) wealth funds and alternative asset managers need to be convinced that investing in innovation and entrepreneurship makes sense from a financial and strategic perspective in the medium- to long-term, i.e. that it will deliver attractive, sustainable financial and/or strategic returns at an appropriate risk profile. The guiding principles for creating smart incentives are outlined in the report.

12. New ambition: The EC must stimulate the emergence and development of online collaborative funding platforms, including crowdfunding, where capital accessibility and speed are the key drivers (see Annex 2).

13. Attention needed: More attention should be given to the 'liquidity gap' in Europe. Policymakers in Europe should not only focus on the recovery of the IPO market, but also on the establishment of a pre-IPO market for equity- and debt-financing. One important effect of the sluggish IPO market is the focus on deregulation and the emergence of a new generation of securities markets.

A new, advanced Open Innovation policy paradigm *- As genuine co-creators EU stakeholders must be more open, more networked, more collaborative, and more absorptive of external ideas - enabled by the establishment of smart, innovative co-investment schemes*.

EU stakeholders (businesses, universities, PROs, financial institutions, citizens and governments) have no option but to sponsor open, networked and collaborative innovation-led growth on which -in different ways- their own intellectual, operational and financial vitality will increasingly depend. If implemented well, these recommendations will enable the EU to get more value for the money invested in education, R&D and innovation. It will provide better access to finance (particularly for SMEs) and smarter and more ambitious governance and regulation of our knowledge domains. That is why Europe needs to put the emphasis on stimulating OI and KT among all these stakeholders.

The European Expert Group on
Open Innovation and Knowledge Transfer

9 December 2013

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Open Innovation and Knowledge Transfer: Key elements in the policy agenda of the European Commission

The gradual emergence of the EU from the economic and financial crisis, coupled with the need to tackle global challenges and exploit opportunities has rendered innovation more crucial than ever. Opportunities and challenges such as climate change, sustainability, green growth, health and an ageing population, the digital economy, big data and the 'Internet of Things' all involve the introduction of innovative solutions.

At least twenty years of EU-level innovation policy has attained remarkable outcomes and has been responsible for a continuous improvement of Europe's innovation performance. However, the world is changing rapidly and so is the pace at which innovations are introduced in the economy worldwide. For the EU to secure its global competitive edge, it has to adopt a market-driven approach to innovation.

To address this need for a change in its approach to innovation, the European Commission (EC) presented a comprehensive innovation strategy from research to retail. The Innovation Union is one of the seven flagship initiatives of the Europe 2020 Strategy, which was agreed by Member States (MS) in June 2010. Horizon 2020, the financial instrument implementing the Innovation Union, was also agreed upon by MS and the European Parliament. It is a EU Research and Innovation programme with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract.

The Innovation Union initiative sets out the directions that the EU research and innovation policy must take to help to solve the grand challenges of our times. In particular, the European Council concluded that[1]: "*Europe needs a unified research area to attract talent and investment*. *Remaining gaps must therefore be addressed rapidly and the European Research Area completed by 2014 to create a genuine single market for knowledge, research and innovation."*

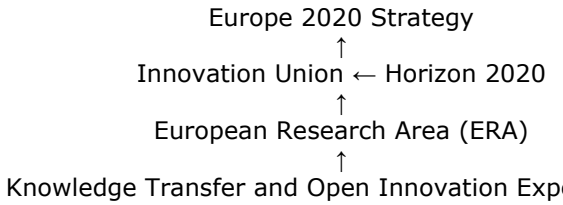
In order to step up this political initiative the EC adopted in 2012 the Communication "A Reinforced European Research Area Partnership for Excellence and Growth". The aim of this Communication is to build upon what has been achieved so far and enter into a reinforced partnership with MS and stakeholders to deliver on key priorities. The goal is to create an area in which researchers, scientific knowledge and technology circulate freely and through which the Union and its MS strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges. ERA should become reality in 2014. One of the priorities of ERA is the transfer of scientific knowledge.

The EC has committed to developing a comprehensive policy approach to open innovation and knowledge transfer, and to consulting stakeholders on it. For this purpose a high level expert group was set up at the end of 2012.

The members of the Expert Group and their biographies are listed at the end of this report.

[1] European Council Conclusions February 2011; European Council Conclusions March 2012.

Figure 1. European Union policy channels to boost knowledge transfer and open innovation



The Expert Group adopts a stakeholder approach, focusing on the various inter-linked roles played by businesses, universities, financial institutions, providers of the intellectual capital base, and an enterprising Union including its Member States.

A need for action

The Expert Group on open innovation and knowledge transfer was set up under the EU Capacities Work Programme[2]. The policy aim of the group is to support the coherent development of Research Policies and to strengthen the evidence base and monitor performance.

As stated in the terms of reference:

"The objective of this Expert Group is to support the development of a comprehensive policy approach on OI [Open Innovation] and KT [Knowledge Transfer]. The in-depth analyses of the Expert Group should include the implications of the current movement towards OI on existing KT policies, actors and stakeholders."

In order to meet the objective, the Expert Group was asked to consider:

- Is Europe less good than others in 'valorizing' knowledge?
- What can be done to foster knowledge sharing and utilisation and by whom (EC, MS, Stakeholders)?

[2] See section C1 of EU Capacities Work Programme, European Commission C (2012) 4526 of 09 July 2012.

Approach and report structure

Rather than addressing explicitly whether Europe less good than others in 'valorizing' knowledge (i.e. is there a 'valorization' gap'?), the expert group considered whether Europe performs below its potential in creating value out of knowledge and ideas.

The goal of our recommendations is to provide a roadmap of how Europe can improve the performance of Open Innovation (OI) and Knowledge Transfer (KT) to promote a smooth, direct, and successful transfer of our research base, including public research, to a competitive market environment. In particular, we will recommend policy actions that promote businesses and universities collaborating as co-creators to solve socio-economic and business challenges. We also address how the European boost OI and KT from concept to market via appropriate financial instruments and intellectual capital, as well as via an enterprising Union, which should act as a convenor and co-player in the EU's innovation ecosystem.

In order to achieve these goals, priorities for policy actions at three levels (EU, national, institutional-regional) are set out.

To support the creation of a genuine single market for knowledge and research without fragmentation, we have decided to build upon the challenges set out in the 'Innovation Union'. The expert group also build upon the actions identified by the European Research Area (ERA) Communication concerning how the untapped potential of OI and KT can be realized. Where applicable, the implications for funding programmes are also considered (for instance Horizon 2020).

To ensure that the policies to boost OI and KT in the EU were joined up, and to avoid further fragmentation, the group is adopting a stakeholder approach, focusing on the various inter-linked roles played by businesses (Action 2), universities (Action 3), financial institutions (Action 4), and an enterprising Union (Conclusion) including governments. The need to put OI and KT, including our intellectual capital base, in the spotlight is dealt with up front (Action 1).

Action 1: Put Open Innovation and knowledge transfer in the spotlight

Priorities and policy recommendations

1) Confident and effective public and private investment in Research and Development: Stick to and reach the 3% norm regarding public and private research and development investment as a percentage of EU GDP to improve EU long-term dynamic innovation and economic competitiveness.

Current EU spending is 1.9% of EU GDP on research and development. Encourage each Member State (MS) to reach the 3% R&D intensity as percentage of GDP. Only by sticking to that objective will Europe be able to attain the critical mass of innovation efforts that should propel it to the global economic forefront. To achieve this goal, stimulate at an EU, MS and regional level further private innovation efforts by a reliable, innovation-friendly regulatory environment and by smart and harmonized fiscal incentives, such as tax credits, public procurement regulation, innovation vouchers, etc. In addition to that, continue funding collaborative projects, to address societal challenges at an EU, MS and regional level.

2) From Open Innovation 1.0 to Ecosystem Innovation: Implement a European-wide Open Innovation 2.0 policy where relevant stakeholders in Europe from academia, business, government, and society are collaborating along and across industry and sector-specific value chains to co-create solutions for the grand socio-economic challenges (e.g. sustainability and health) and for business challenges (e.g. new business models). This co-creation process should join forces at the EU, Member State and regional level.

This ecosystem approach requires a step change in research, development and innovation infrastructure as well as smarter incentive schemes for stakeholders. Mechanisms can include co-creation between various types of funding mechanisms, between the triple helix[3] partners (business, academia and government), or between regional, national and European funding. These different funding sources can complement and reinforce each other's impact: Traditionally, Europe has tried to achieve this in a top-down manner through setting a strategic innovation agenda to which actors from various MS and regions can adhere. Now we recommend also implementing a bottom-up approach where actors, who join forces to set up specific innovation infrastructures and strategies (e.g. via a pilot) are able to leverage the regional and national funding sources they have mobilized with European funding in order to 'fast track' innovation. In other words, rather than just attempting to complement EU funding with local funding, we advocate to leverage local investment with EU funding when dynamic, entrepreneurial actors have joined forces already. In order to make Open Innovation 2.0 really work, the deep awareness, the skill base and the instrument base of OI frameworks and approaches should be monitored and stimulated throughout European innovation programming for and across all actors involved.

[3] Triple Helix is a concept referring to the collaboration of university, government and industry: see Action 3.

3) Intellectual Property regime fit for Open Innovation 2.0: Through the implementation of a harmonized European high quality, informed and influential IP policy, the EU can become an even more attractive place for creators and users of IP, including public and private research organizations as well as businesses.

The European Intellectual Property (IP) system could benefit from allowing the recognition and adoption of flexible and accessible intellectual property mechanisms for our firms and for the management of university–business interactions. Firms that use IP protection strategies generally rely upon bundles of both formal and informal mechanisms. Such bundles include not only patents and copyright, but also trademarks, design rights, open source and creative commons, private commons, publications, secrecy, and non-disclosure agreements. These bundles also include more informal IP such as restricted access to information, the role of fast innovation cycles and complex product design, and cultivating commitment, trust and loyalty. It is therefore recommended that Triple Helix actors understand and adopt a portfolio approach towards managing IP in this Open Innovation 2.0 environment.

4) Diagnostic tools for measuring process and economic performance of Open Innovation and Knowledge Transfer: Develop intelligence and monitoring systems capturing how well our organizations, institutions and regions attune to the open innovation ecosystem needs, and translate their findings into performance metrics or diagnostic tools of key performance indicators.

This approach for new diagnostic tools differs from traditional indicators (such as size, turnover or number of patents), which neglect how well organizations act as co-creators in driving growth and welfare. In other words, develop, implement and monitor indicator systems that capture 'connectivity' in the burgeoning innovation ecosystems that should emerge as a result of the interaction and the joint leveraging of European innovation instruments and funding with local innovation instruments and funding.

The recommendations are explained in more detail below.

Implications

1.1 Confident and effective public and private investment in R&D

One of the major instruments Europe has been operating in order to build a strong R&D and innovation area in Europe is the 3% norm: first by 2010, then by 2020, the public and private investments on R&D within Europe should reach a target of 3% based on GDP. Today's figure (1.94% for EU27) is far off that mark. This fact leads to a dual message:

On the one hand, the EU has invested substantially less on R&D than its counterparts. It should not be forgotten, that already in the 1950s the US spent between 2.5% and 3% of its GDP on R&D. The US has maintained this effort consistently over the last 60 years. Japan has also invested considerably higher amounts of its GDP in R&D (2.8% to 3% in recent years) than the EU over the same period. In recent years we also see that China has understood this message and is building an endogenous R&D and innovation base at significant speed.

The R&D investment within EU yields a substrate of scientific insights on which to base an innovation-driven and entrepreneurial business climate. Because of Europe's relative underinvestment it definitely has a disadvantage here compared to

other regions of the world. Its critical mass of R&D on which to build new business and innovations is more restricted than that of the US and Japan. To keep up with its major counterparts, the EU's R&D and innovation base requires further continuous and sustained private and public investment to reach the same critical mass as the one present in countries like the US and Japan.

As is shown in the Table 1, the R&D investments of European MS are highly variable and differing, with the Scandinavian countries reporting R&D expenditures in excess of the 3% target, while countries like Italy still do not reach 1.5%. Needless to say, this heterogeneity has a serious impact (and also puts a serious strain) on both the intensity and the performance of OI and KT activities[4] across Europe.

On the other hand, Europe's innovation performance, in terms of having the capability to bring new scientific insights to business and market fruition, has been considerable in certain areas namely, telecoms, chemistry, life sciences, pharmaceuticals and automotive. Despite a more limited critical mass, Europe has in those important markets excelled in turning research knowledge into valuable innovations. This points to the effectiveness of the European R&D and innovation system in particular market pockets.

Recent empirical studies by ProTon[5] and ASTP[6] clearly demonstrate that knowledge transfer (KT) activities in Europe have steadily increased their levels of performance over the last decade. However, compared to the US with a longer tradition in KT activities, Europe in general still lags behind. Nevertheless, we perform better on certain output indicators, for instance, a 2010 ASTP study shows that it takes 87.9 million PPP$ research expenditures to create one spin-off company in the US versus 53.8 million PPP$ in Europe.

[4] Definitions of Open Innovation and Knowledge Transfer follow in Action 1, section 1.2.
[5] Proton, The Proton Europe Ninth Annual Survey Report, 2012.
[6] ASTP, Survey for Fiscal Year 2008, Respondent Report, 2010.

Table 1. GERD as a percentage of GDP

	2003	2005	2007	2009	2011
Belgium	1.87	1.83	1.89	2.03	2.04 (p)
Czech Republic	1.20	1.35	1.48	1.47	1.84
Denmark	2.58	2.46	2.58 (a)	3.16	3.09 (cp)
Germany	2.54	2.51	2.53	2.82	2.84 (c)
Finland	3.44	3.48	3.47	3.94	3.78
France	2.18	2.11	2.08	2.27	2.25
Greece	0.57	0.60	0.60 (c)		
Hungary	0.94 (d)	0.94	0.98	1.17	1.21
Ireland	1.16	1.25	1.29	1.76 (c)	1.72 (cp)
Italy	1.10	1.09	1.17	1.26	1.25 (p)
Luxemburg	1.65	1.56	1.58 (c)	1.72	1.43 (cp)
Netherlands	1.92	1.90	1.8	1.82	2.04 (ap)
Norway	1.71	1.51	1.59	1.76	1.64 (p)
Austria	2.24 (c)	2.46 (c)	2.51	2.71	2.75 (cp)
Poland	0.54	0.57	0.57	0.67	0.77
Portugal	0.71	0.78	1.17	1.64	1.49 (p)
Slovakia	0.57	0.51	0.46	0.48	0.68
Spain	1.05	1.12	1.27	1.39	1.33
Sweden	3.80 (m)	3.56 (a)	3.40	3.60	3.37 (ac)
United Kingdom	1.71	1.72	1.72	1.81	1.79
EU27	1.76 (b)	1.74 (b)	1.77 (b)	1.92 (b)	1.94(bp)

The production of one licence agreement in Europe, however, costs 19.1 million PPP$ in research expenditure versus 13.5 million PPP$ in the US. A recent ProTon report (2012) shows that European KTOs on average create 549 spin-offs a year while their US counterparts reach 671 (ProTon 2011 data). The yearly number of licences and options amounts to 6,051 (US) versus 5,477 (Europe) (ProTon 2011 data). The same ProTon data report a difference in invention disclosures of 21,856 (US) versus 6,337 (Europe). However, in interpreting these last numbers we must take into account the differing institutional IP contexts between the US and the different EU countries. In addition, we must admit that there is quite some variance in outputs reported across various surveys (see Table 3.3, p. 25, ProTon 2012 report). Finally, both in Europe and the US, there is a considerable skew both in KTO characteristics and performance, with the top percentiles of KTOs accounting for significantly higher output levels than their counterparts in the other percentiles.

What do those studies and their results imply?

First, they demonstrate that, although the KTO profession has been maturing all over Europe, there still is a performance gap to be closed when compared to the US. In addition, and while Europe performs better than Japan, we see a rising activity level in China that will become a fierce contender in the KT landscape in the decade to come.

Second, they demonstrate significant heterogeneity. Although heterogeneity is present in the US as well, the various surveys underline the significant differences that exist between European countries, both in terms of the critical mass and professionalism of their KTO functions, such as in the performance, output and impact of those KTO functions. A recent empirical study on the entrepreneurial performance of European universities (Research Policy, 2011) emphasizes the critical relationship between critical mass, professionalism and performance.

Third, they demonstrate that, although a multitude of interaction patterns between Europe's knowledge institutes and industries are shaping up and taking form, there is room to improve both the breadth and the depth of those interactions. In other words, KT is a two-way street that requires all actors to understand the value added by joint innovation actions.

When looking at innovation policy and innovation performance in the EU, we have a mixed message: more could and should be done, though in selected market pockets, we have been effective in what we have done so far.

One of the explanations for these mixed results is the European tradition of collaboration in science and business. Before the current emphasis on OIin Europe took hold, European R&D policy had already propelled collaboration and KT to the forefront. The advent of both OI and Triple Helix thinking (of university, government and industry collaboration, see Action 3) has put even more emphasis on the collaborative dimension of innovation activities.

Proposed specific actions relating to public and private R&D and innovation investments are:

- Stimulate public and private investment in R&D and Innovation in order to achieve the minimum level of 3% with respect to EU GDP.
- Stimulate private investment in R&D and innovation at EU, MS and regional level by providing reliable, innovation-friendly regulatory frameworks and fiscal instruments, such as project funding and public procurement, innovation vouchers and tax credits.

1.2 From Open Innovation to ecosystem innovation

1.2.1 Open Innovation 1.0: Open approaches to accelerate internal R&D and innovation along value chains

The EC elaborated on a notion of Open Innovation (OI), focusing on how companies develop collaborative approaches to R&D, by combining in-house and external resources, aiming to maximize economic value from their intellectual property, even when this is not directly linked to their core business.[7]

In this original version of OI it was defined as the purposeful outflow and inflow of knowledge into the innovation process[8]. This includes e.g. the search for new technologies outside of the firm´s R&D department, the integration of customers' ideas, the co-development with suppliers and the spin-off of new businesses not fitting the core strategy. OI is here a strategic decision of the company to increase and accelerate innovativeness and/or efficiency by using external resources. This approach to innovation management is widespread in Europe although the degree of openness varies in companies with different strategic approaches and sizes. OI is in this context naturally not the cure for every problem and there are still good reasons (e.g. confidentiality, lack of expertise outside the company, weak collaboration culture within the company or within an industry, more focus on incremental innovation) to apply differently intensive OI strategies. Still, mastering OIin order to explore its full potential is regarded as challenging, especially for SMEs, because of resource constraints in collaborative business models with small and big companies and in cross-industry innovation (learning from other industries) to name a few. Thus, Open Innovation 1.0 is based on transferring knowledge, expertise and even resources from one company or research institution to another.

1.2.2 Knowledge transfer as a major tool for open innovation

Knowledge transfer (KT) is a concept used broadly to describe the flow of (scientific) knowledge between research organizations (including universities and PROs) and business, with the objective of creating socio-economic impact through promoting better use of the (public) research base. This concept replaced the formerly used 'technology transfer' (TT) to reflect the wider knowledge base than just technology being transferred. Nowadays the term 'knowledge exchange' is used instead to reflect the fact that the flow of knowledge is neither one-dimensional in the direction 'research organization to industry', nor only between the players on this scale. This concept evolution generally reflects the subsequent change of perception of the research–business interaction from a linear and one-dimensional flow to a complex structured process involving many different players – academic institutions, enterprises, governmental agencies and municipalities, and communities. In short, KT is about treating public research as a strategic resource in transferring and applying basic research into marketable products and services.

On the other hand, only if the knowledge can be absorbed from the desired company or research institution can it be beneficially used to increase innovativeness or efficiency. Certain problems can arise e.g. related to the collaborative capabilities of employees, the lack of search abilities, the cognitive distance between the knowledge possessed and desired. Successful KT also requires

[7] European Commission (2007): Communication from the commission. Improving knowledge transfer between research institutions and industry across Europe. DG for Research Directorate C – Knowledge Based Economy. DG for Enterprise and Industry Directorate D – Innovation Policy.
[8] Chesbrough, H.W. (2003): The Era of Open Innovation, MIT Sloan Management Review, 44, 3, 35.

the willingness and ability of the actors involved to understand and communicate complex scientific technical content within sometimes very diverse cross-disciplinary and cross-cultural university and business environments.

1.2.3 Open Innovation 2.0: from bilateral collaboration towards innovation ecosystems

Open Innovation 2.0 means, on the one hand, that a specific innovation cannot be seen as an isolated activity without considering the consequences for its entire economic and social environment. For instance, the invention and the extended use of smart phones have significantly changed customers' behaviour, created by this new market and fostering new opportunities for further innovations. On the other hand, close collaboration, interaction and exchange among all stakeholders in an innovation ecosystem addressing business and social opportunities or challenges can lead to higher impact of innovations. These incorporate the development of a new products, services and/or business models to address relevant socio-economic issues such as green growth, health care, nutrition, sustainable energy supply or the digital economy.

Stakeholders and participants in such an ecosystem can include business entities, universities, intermediate public and private research organizations, but also governmental organizations and agencies as well as citizens, societal interest groups and entities of the financial sector. Within such an ecosystem the relevant participants engage with each other, through multiple channels, even by the means of pooling their internal resources and equipment, including knowledge, technology, finance, people, markets, and data.

This co-creation approach to OI is more than simply sharing resources, risk and reward. It envelops the integration of the entire innovation ecosystem and thereby is about creating new markets and more effective business models and integrating supply chains, which would not exist otherwise. A precondition for this is that all parts of the innovation ecosystem are engaged in developing 'exchange' and especially 'absorptive capacity' to take part in it and benefit from it. While co-creation formerly meant cooperation between (mainly) complementary partners through alliances, cooperation, and joint ventures during which give and take are crucial for success, in an ecosystem co-creation works on different levels. Organizations can for example integrate external ideas from customers or users, can co-create their platforms based on those ideas with a university or another company and can distribute certain tasks of value creation to other individuals or groups. Tools used for co-creation can be traditional, such as workshops, meetings and projects, or online tools, such as platforms, social networks, virtual working spaces or chat rooms.

Co-creation refers to the joint development of knowledge through relationships with specific partners. Examples of relationships are consortia of competitors[9], suppliers and customers[10], joint ventures and alliances[11], as well as with universities and

[9] Hagedoorn, J. (1993): Understanding the rationale of strategic technology partnering: Interorganizational modes of cooperation and sectoral differences, Strategic Management Journal, 14, 5, 371–385; Ingham, M. and Mothe, C. (1998): How to learn in R&D partnership?, R&D Management, 28 (4), 249–260.

[10] von Hippel, E. (2005): Democratizing Innovation, MIT Press: Boston MA.

[11] Hamel, G. (1991): Competition for competence and inter-partner learning within international strategic alliances, Strategic Management Journal, 12, 83–104; Mowery, D.C., Oxely, J. E. and Silvermann, B. S. (1996): Strategic alliances and interfirm knowledge transfer, Strategic Management Journal, 17, 77–92.

research institutes[12]. Cooperation is usually characterized by a profound interaction between parties over a longer period of time[13].

The Open Innovation 2.0 concepts have various implications for different stakeholders and participants, which will be addressed in more detail in the following sections (Actions 2–4) and recommendations of this report.

- Markets are not just spaces and places where supply and demand for goods and services meet, but they underpin the design of business models, networks, sectors and places (see also Action 2).
- Besides traditionally serving markets, business entities will build new structures to better absorb externally developed knowledge from public and private knowledge spheres into their organizations if beneficial. They will then in addition enhance their co-creation capabilities to contribute to the development of new academic knowledge (see also Actions 2 and 3).
- Universities and PROs are not just suppliers of knowledge and talent, but must be ready to grow and build structures which incorporate the needs of their users, be they businesses, the public sector, students or citizens, and implement solutions to these needs through their strategies. They thereby become real-time co-creators of new solutions alongside their basic missions of talent development and knowledge creation (see also Action 3).
- The financial sector supporting entrepreneurship are not just suppliers of knowledge and equity to enable innovations. New models, based on improved absorption and deeper understanding of the specific opportunities and needs of businesses and entrepreneurs, can offer benefits in relation to the regions, markets, sectors and networks they operate in (see also Action 4).
- The EC, as well as national and regional governments, are not just regulators or facilitators via project grants. They must become more active, enabling co-players in the innovation ecosystem by, for example, also acting as convenors of intellectual property platforms (addressed below) and as buyers and investors via fiscal incentives, such as through public procurement, innovation vouchers and tax credits (see also Action 2) and by creating a market environment conducive to firm growth and internationalisation (see below).

Today, one of the biggest challenges for companies in OI intensive industries is related to finding unique, appropriate collaboration partners[14]. Innovative customers or suppliers are often already collaborating with other competitors. This is another reason why potential sources of unique knowledge outside of a firm's own industry sector need to be explored. This approach under the OI paradigm is called cross-industry innovation, enabling novel products and services across interfaces among different industry segments and likely to deliver disruptive innovations.

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[12] Bailetti, A. J. and Callahan, J. R. (1992): Assessing the impact of university interactions on an R&D organization, R&D Management, 22, 2, 145–156.; Santoro, M. D. and Chakrabarti, A. K. (2001): Corporate Strategic Objectives for Establishing Relationships with University Research Centers, IEEE Transactions on Engineering Management, 48, 2, 157–163.

[13] Hagedoorn, (1993): see above; Littler, D., Leverick, F. and Wilson D. (1998): Collaboration in new technology based markets, International Journal of Technology Management, 15, 1/2, 139–159; Fritsch, M. and Lukas, R. (2001): Who cooperates on R&D?, Research Policy, 30, 2, 297–312.

[14] For more information on cross-industry innovation Enkel, E. and Gassmann, O. (2010): Creative Imitation: Exploring the Case of Cross-Industry Innovation. R&D Management Journal, 40 (3): 256–270 and Gassmann, O., Zeschky, M., Wolff, T., Stahl, M., (2010): Crossing the industry-line: Breakthrough innovation through cross-industry alliances with 'non-suppliers', Long Range Planning 43, 639–654.

Differences in regional institutions and the interplay between them matter profoundly to competitive success because innovation does not take place in an institutional vacuum. Rather, it is determined by the configuration of businesses, finance, research, education, law, regulation, skills, local government, entrepreneurial spirit, social capital and more. All these institutions and organisations have unique features depending on the place.

Hence, the task for an enterprising region, city or country is to do all it can to configure its institutions in the best way it can to make the local innovation ecosystem as attractive as possible. This institutional design should build on the local innovation strengths (for example, local smart specialisation clusters: see Action 2) and overcome local weaknesses such as local takes on cross-border perspectives.

It should now be clear that the competitiveness and economic performance of firms, regions and nations must be understood in a local context. This is not despite, but because of the globalisation of production, trade and labour mobility; the growth of transnational corporations; information and communication advances; the emergence of e-business and new technologies, such as big data or 3D printing. Far from wiping out the role of regions and local business networks, these forces of globalisation reinforce their importance; this is further recognized when designing and implementing smart specialisation policies (see below). Directors of leading companies, for example, look closely at the innovation and investment ecosystems of different cities and regions when they make decisions about where to invest and create jobs.

Solving common challenges in an OI ecosystem provides access to markets, across sectors as well as across societal needs. Open Innovation 2.0 also enables the interaction across innovation stages, i.e. from feasibility via pilots to demonstration of commercial viability. It also enables co-creation of products and services across business sizes, including start-ups, covering also the needs of more mature companies[15].

In this context particularly, SMEs should be stimulated to embrace OI and KT, as innovation encompasses an ever more broad scope for them to tackle. For SMEs to be able to reap the benefits of OI and KT they need technical and legal support in areas such as:

- Developing collaboration contracts,
- Creating greater awareness of their competencies,
- Coaching and training to smooth collaborative project management,
- Stimulating an open and collaborative culture and
- More knowledge on how to spot new markets internationally.

Collaborative interaction among all stakeholders and participants across various value chains and industry sectors is a critical success factor as will be described in this and the following actions.

[15] Some US studies (High Impact Firms: Gazelles Revisited by Zoltan J. Acs et al. 2008 SBA Research Paper) indicate an average age of high-impact firms of 25 years and with fewer than 20 employees for 94% of them.

1.2.4 The value added by innovation intermediaries and technology & innovation centres

The main role of Research Technology Organisation (RTO) or an innovation intermediary (such as FhG, VTT, TNO, and Catapults) is to bridge the gap between internal and external know-how[16]. Besides acquiring complementary know-how, a company also aims to reduce the time to market and the time to know-how. By doing so, it increases its efficiency in product development by using the efficiency of its external service providers[17].

Innovation intermediaries, such as technical service providers, consultants and university institutes (namely academic KT organisations) tend to have a broader expertise, as they do not focus on only one industry. These intermediaries hire people with diverse industry backgrounds to constantly broaden their knowledge base. As such, intermediaries often realize innovation by adapting existing ideas, principles and concepts to other industrial ambits[18].

The most prominent intermediaries in Europe are rightly the almost 200 technology and innovation centres (TICs), including the German Fraunhofer Institutes, the French Carnot centres, the TNO centres in the Netherlands, the Finnish Technical Research Centre (VTT) and SHOK-TEKES centres, the Danish Advanced Technology Group GTS centres, the Norwegian SINTEF centre, the Spanish Tecnalia centres, and more recently the UK investment of £1bn to set up seven Catapult centres in 2013 in the UK.

Despite their differences, they all play an important role in moving technologies and ideas from concept to commercialization within the innovation ecosystems where they operate. The international evidence[19] is unambiguous. European technology and innovation centres generate success in separate ways. For instance, they anchor into markets, universities, PROs, finance and capital structures. They also move businesses (and other stakeholders of the innovation ecosystem) beyond their own capabilities, skills and constrained resources. They are aligned with the policy framework to deliver their country's research, science, innovation and growth plans. As such, they continuously contribute to and deliver their national innovation and research strategies for growth and, for the most part, being involved in their design and development. In addition they reduce the risk of innovation and help firms to go beyond their existing capabilities and what they can achieve with their own resources in a variety of ways. Finally, they act as anchor institutions and catalysts to build new markets, innovative sectors, clusters and networks.

European technology and innovation centres work with businesses of all sizes. Work for SMEs is considered essential (accounting for half of income) and focuses on

[16] See Burt, R. S. (1992): Structural holes: The social structure in competition, Boston, MA: Harvard Business School Press. Quinn, J. B. (1999): Strategic outsourcing: Leveraging knowledge capabilities. Sloan Management Review, 40, 4, 9–21. Quinn, J. B. (2000): Outsourcing innovation: The new engine of growth. Sloan Management Review, 41, 4, 13–28.

[17] Chiesa, V., Manzini, R., and Pizzurno, E. (2004): The externalisation of R&D and the growing market of product development services. R&D Management, 34, 1, 65–75.

[18] Hargadon, A. and Sutton, R. I. (1997): Technology brokering and innovation in a product development firm. Administrative Science Quarterly, 42, 4, 716–749.

[19] Andersen, A. and Le Blanc, E. (2013): Catapult to success: Be ambitious, bold and enterprising. Big Innovation Centre. Commissioned by the TSB, ESRC, and IET.

providing access to infrastructure and meeting or mitigating capability gaps. Large businesses use the centres for more specialised work[20].

1.3 Make the Intellectual Property regime fit for Open Innovation 2.0

The increasing importance of OI and new technologies – where innovation business models are created from combining information spheres – is placing new, more sophisticated demands on our Intellectual Property (IP) system. Every truly great inventor today acknowledges that his or her achievement is built on the achievements of others, and recognises that, quite often, similar breakthroughs could have happened elsewhere because science has an inescapable logic of peer competition and problem choice. This logic has indeed long been recognized in science and technology[21]. The recent trend towards scientific and technological specialisation has led to the increasing need for different inventions to be combined in order to generate bundles of commercially useful, exploitable IP. Hence there is the need to manage IP in even more sophisticated ways.

We therefore need to value the social benefits of IP to articulate a better corporate management of IP among future innovators and entrepreneurs, so they can best generate value from ideas and enter new markets. Such IP will include not only patents and copyright, but also trademarks, design rights, open source and creative commons, privacy commons, publications, and secrecy and non-disclosure agreements. It also includes more informal forms of IP such as restricted access to information, the role of fast innovation cycles (i.e. first mover advantage before others catch up or the technology moves on) and complex product design, and cultivating commitment, trust and loyalty.

We should also note the different international rules whereby our competitors, such as the USA, operate with IP 'user rights' (as opposed to exclusive rights for owners) to enable users of IP to innovate in an innovation ecosystem. In Europe we generally maintain exclusive rights for owners, which could hold back new business models and leave European entrepreneurs less competitive internationally. Thus, to fully benefit from the enormous potential of OI and sharing our IP, as a complement or alternative to enforcing 'exclusive rights', we need to further consider the way we legislate for IP. As part of this, EU IP policy should (continue) take a firm stance against predatory IP strategies.

Although value-driven IP has created and still creates many opportunities for businesses in the age of knowledge sharing, we need to acknowledge that there are institutional factors affecting the way in which markets for intellectual assets work. The increasing number of court cases is an illustration of one of these difficulties. It's important to underline in this context that knowledge has a social origin and is not solely the result of individual effort, especially in the context of innovation ecosystems.

Hence, we recommend that the IP regime takes the principles of co-creation in an innovation ecosystem into account. It will be beneficial to further incentivize co-creation and collaborative effort, wherein a multitude of firms participate in common spheres of knowledge, creativity, development, and commercialization, which tend to be multi-disciplinary and global.

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[20] Andersen, B. and Le Blanc, E. (2013): Catapult to success: Be ambitious, bold and enterprising. Big Innovation Centre.

[21] See, for instance, Merton R. (1973): Singletons and Multiples in Science, The Sociology of Science, University of Chicago Press.

If we succeed in developing an even more high quality, informed and influential IP policy, Europe can become an even more attractive place for creators and users of IP, including businesses and consumers. In this context, the European IP system would allow the single market to work better as a home market for the businesses of its MS and the Innovation Union can become the more effective go-to place for creators and users around the world who want to access, use, or support our IP, businesses or markets.

1.4 Develop diagnostic tools for measuring process and economic performance of OI and KT

As OI and KT capabilities become essential for our European organizations and institutions, the task is to translate what good looks like into concrete, operational, applicable measures of success.

Research as well as practice lack good performance indicators that allow OI activities to be compared and adapted. However, a clear link or fit between corporate strategy and open or closed innovation activities could indicate if the right business innovation processes are selected and supported (see Appendix 1 'Link between corporate strategy and open or closed innovation activities'). We could, therefore, measure OI excellence on a corporate level by the alignment between corporate strategy and activities. For example, the maturity framework[22] [23] measures the excellence of OI processes on five excellence levels, equal to total quality management. Yet, it is not the outcome that is measured but the process quality.

Most related key performance indicators measure the number of, for example, external partners, collaborative patents, or OI projects successfully finished, instead of the impact or reach of activities (e.g. membership in the most important networks, quality of the partners in their own network, or impact of open versus closed innovation projects on corporate performance). But in order to select or adapt activities, their impact or outcome needs to be measured. At the level of the individual, personal connectivity measured by participation in the right networks, projects, or presentations at major conferences (inside, but even more outside, their own industry), sharing knowledge and growing the personal network (e.g. through co-author analysis or email contact), and social network participation might give indications of an individual's openness. Besides, the individual's social skill and norms play a role[24]. Clearly, Facebook 'friends' are a weak indicator because these are not necessarily sharing valuable knowledge for innovation.

This requires putting in place the right set of performance indicators and diagnostic tools. The traditional indicators used to measure companies' OI activities have primarily been input-oriented. Other more output-oriented indicators look at innovation from a very traditional perspective by focusing on factors such as patents produced, licensing income, or number of companies assisted, as well as turnover and size. One important limitation of these indicators is that they fail to account for and assess collaborative innovation activities. These traditional indicators undervalue the contribution that organizations make to the innovation ecosystem because they fail to account for harder to measure intangible factors, such as the

[22] Bader, K. & Enkel, E. (2014): Understanding a firm's choice for openness: Strategy as determinant. International Journal of Technology Management (forthcoming).
[23] Enkel, E., Bell, J. and Hogenkamp, H. (2011): Open Innovation Maturity Framework. International Journal of Innovation Management, 15 (6): 1161–1189.
[24] Enkel, E. (2010): Individual attributes required for profiting from Open Innovation in Networks. International Journal of Technology Management, 52 (3/4): 344–371.

quality of their relationships, their convening power, and their capacity to identify and manage risk.

Ultimately, intelligence regarding how well our organizations and institutions serve the OI ecosystem needs to be translated into performance metrics or key performance indicators[25]. There are many OI and KT performance questions related to what 'good' looks like, but to mention a few:

- How well does the ecosystem in European regions support innovation and entrepreneurship by nurturing innovative markets, places and networks? Are there useful anchor points for particular capabilities or specialisms?
- For universities, how well do they and European research centres connect with local entrepreneurial and business communities? Could there be a better means of co-mapping risks, mitigating them, coaching entrepreneurs and identifying promising scientific and technological developments?

All organizations play an incredibly important, yet subtle and multifaceted role in our local ecosystems. It is an interactive process. The better organizations understand their role – and their role is understood – the better they can underpin the ecosystem: equally the stronger the ecosystem, the easier it is for organizations to grasp and seize their role in its division of labour. Thus, performance indicators should be related to how well our organizations and institutions underpin the linkages within the innovation ecosystem.

Proposed recommendations regarding diagnostic tools and key performance indicators are:

- The EC and MS are encouraged to develop and implement diagnostic tools to measure OI and KT effectiveness and efficiency on European, national, project, company, community or individual levels in order to detect changes and challenges early and act accordingly.
- The EC is encouraged to initiate and implement indicators and collect data about the OI behaviour of the different stakeholders of the OI ecosystem. The purpose of this data collection is to identify opportunities for OI and KT and obstacles and challenges to OI and KT as well. This data should be collected via new forms of data collection such as connectivity or network analysis, mining tools and so forth.
- Additionally, the EC and national funding institutions are encouraged to prefer individuals and institutions with a strong reputation in knowledge sharing and collaboration, proven by collaboration and network analysis through indicators such as partners in projects, co-authors, network participation, and connectivity with other organisations inside, but also outside, their field of expertise or industry.

[25] See e.g. Gawer, A. and Cusomano, M. A. (2008): How Companies become Platform Leaders. MIT Sloan Management Review. Winter 2008.

Further reading for Action 1

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Action 2: Embrace innovative businesses, adopt novel approaches to developing competitive markets and grow European hotspots

Priorities and policy recommendations

1) Stimulating firm growth by reducing European market fragmentation, while fostering faster market access and development through OI and KT practices should be a core aim of the EC. To this end, the EC is encouraged to reconsider its competition policy frameworks and allow for stimulating the development and growth (or scaling-up) of prospective, infant industries, while at the same time maintaining a dynamic competitive single market environment.

Market fragmentation still poses challenges to company growth and development in Europe. Reducing market fragmentation throughout Europe therefore remains a priority. While reducing market fragmentation, we also need to stimulate firm growth throughout Europe.

From an OI and KT perspective, this implies the creation of incentives for major anchor research institutions and large firms to take advantage of Europe's vibrant SME community and its entrepreneurs, and vice versa. From this point of view we need to ensure that the smartest people in the companies and universities, research centres etc. are working together more closely and interactively along and across industry and sector-specific value chains. This is different from Open Innovation 1.0, which was merely building upon the approach that 'not all the smart people work for me'.

In this innovation ecosystem, SMEs can be nurtured, since they can productively connect and anchor into global value chains via collaborative engagement with large firms (see for instance the OI actions initiated by the Eindhoven-based Brainport together with ASML, the Netherlands). Large firms can host OI networks and clusters where SMEs are invited to join. This joining of forces will in turn spur regional development and strengthen networks in local communities, i.e. the way in which local ecosystems can grow.

However, OI does not mean completely free access to knowledge that is competitively relevant, as we need to ensure the European economy capitalizes on the OI networks we spur on. The EC is therefore encouraged to actively stimulate the development and growth of prospective, infant industries while embracing opportunities for smart specialization clusters to grow and to mature, in order to enable more European start-ups and SMEs to grow into large firms and to improve leadership skills of EU firms in global competition. In this way, Europe will provide appropriate answers to the strategies used by our global competitors such as USA, China and Korea. A revised competition policy will thus allow Europe to develop competencies and to build scale advantages, thereby overcoming the constraints posed by our current small firm populations and diverse country base. Taking full advantage of OI and KT practices when stimulating the growth of prospective, infant industries requires European competition policy frameworks to be revisited and state aid regulations reconsidered and adapted where needed.

2) Now that the EC has embraced smart specialization as a policy concept, it is encouraged to develop a 'smart specialization' strategy framework in an innovative manner in order to operationalize, to monitor and to capture pan-European, cross-border specialization and collaboration opportunities among firms and universities/research centres, with the aim of building a competitive presence in global value chains.

OI, collaboration and competition are an important trinity. Innovation-based competition is a well-known superior business approach and policy than short-term, low-price or low-wage competition, as it is a driver for growth, prosperity and welfare. OI-based competition, means that collaboration around common socio-economic or business challenges are essential while each party brings their competencies and competitive strengths, often with previously unrecognized synergies. Europe has embraced the development of smart specialization policies into its remit, but they now should be made tangible and concrete. More specifically, an evidence-based implementation of smart specialization strategies should actively and cleverly foster and monitor the connectivity among firms and universities/research centres across national and regional borders in Europe with the aim of building and maintaining competitive positions in global value chains. Therefore, the implementation of smart specialization strategies by Member States and regions should focus on developing the appropriate measures for stimulating and monitoring cross-border connectivity, while at the same time focusing on the presence and the development of the awareness, skills and instrument base that is needed for OI and KT to become essential building blocks in the smart specialization strategies that will be enacted across Europe.

3) Actively stimulate and support user-driven innovation by translating and connecting major societal challenges into market opportunities using a shared value innovation model, empowering our user-citizens and embracing OI business models through stimulating access to novel key enabling technologies (KETs) in such areas as health, energy, big data, etc.

User involvement and user engagement are key to successful innovation processes. Numerous studies have highlighted the central role of users in turning innovation endeavours into successes. The way in which these users can be actively drawn into innovation activities is in and of itself a form of social innovation. User-driven innovation and social innovation therefore often co-evolve. OI offers the perfect approach to convening and to operating at the intersection of this co-evolution, because nearly each implementation of a radical (technological) innovation also signals a need for significant changes in social relationships and collaborations. This symbiotic relationship is captured by the shared value innovation concept, which offers a novel approach to innovation management and policy that explicitly focuses on the highly valuable and relevant intersection of social and market innovation.

Technological opportunities for shared innovation and engineering trajectories are obviously present in the Key Enabling Technologies that will now spread across Europe, such as health technologies, new energy technologies, and the big data revolution.

For instance, the last one has the potential to empower citizens to access the public and business data held on them, while creating a revolution in other sectors (we especially refer to how it may transform health, green growth and communications). We encourage the EC to research a policy framework for big data research and exploration that incorporate the following key principles: (i) Balance both individual security and innovation and economic growth; (ii) Focus on governing the uses of data rather than controlling the data itself; (iii) Empower individuals in relation to

data usage by giving them the tools to express choice and control over how their personal data is used.

Implications

2.1 Stimulate firms to grow faster, foster new markets and access, and revisit Europe's competition policy frameworks

Innovations first and foremost need markets to thrive. An innovation's full potential only becomes visible in a market environment. It is generally known and accepted that competition fosters innovation while innovation in its turn fosters competition. The link between innovation and competition, therefore, is an intimate one that should be at the heart of European policymaking. It is the job of the 'heroic' entrepreneur to explore and select market opportunities and to take the risks in pursuing them.

However, the 'heroic' entrepreneur will thrive best when operating in a favourable innovation ecosystem that facilitates the selection, experimentation and implementation of market opportunities. It is the job of policymakers to nurture the appropriate context for those thriving and dynamic innovation ecosystems and to uphold a competitive environment that allows them to be turned into growth markets. To accomplish this, we advocate that the European innovation area should focus on some major priorities which address market underperformance regarding innovation deployment.

Those priorities and recommendations can be summarized as follows:

- Reducing current market fragmentation that still poses challenges to company growth and development in Europe.
- Facilitating the rapid development of emerging markets across European countries, thus enabling start-up companies and SMEs to form and to grow at higher rates than we are used to today. Thereby the EC is encouraged to reconsider its competition and state aid policy frameworks in order to stimulate the development and the growth of prospective, infant industries.
- Stimulating innovation-driven entrepreneurship throughout Europe by: (1) making innovation opportunities more accessible and transparent across the Union; (2) fostering knowledge on financial instruments available to entrepreneurs and (3) creating market conditions that allow for mobilizing the capital necessary to high growth companies.
- Enabling the creation of cross-border Triple Helix-based co-creation platforms as part of the Horizon 2020 thrust, building on the Key Enabling Technologies that have been identified as one of the Horizon 2020 priorities (see also section 2.3 below).
- Supporting the creation or maintenance of large technological infrastructures that can act as the foundation for large-scale prototyping and demonstration projects to turn scientific and technological insight into business and market opportunities, thereby encouraging new markets and industries to grow and thrive while putting user involvement and engagement at the core of European innovation culture.
- Maintaining a dynamic regulatory environment for intellectual capital that allows European Triple Helix actors to reap the competitive benefits of the IP they create (see also Action 1 above), while at the same time fostering a growth-friendly context of competition and value creation.

- Using public procurement budgets strategically to stimulate the commercialisation of innovation and knowledge. Indeed, the EU is still largely unable to tap into public high-tech procurement. As acknowledged in 2007, with the Communication on pre-commercial procurement following the recommendations of the Aho report (2006),[26] the lack of significant innovation procurement programs, including cross-border procurement, has been at the centre of Europe's lack of innovation-driven market development. If efforts are not stepped up, it will be difficult to have a significant impact, whether in defence, infrastructural networks or other challenge-driven lead markets.
- Finally, reliable and predictable innovation-friendly regulatory frameworks and regulations throughout Europe are to be strived for in order to enable all of the above.

2.2 Embrace, cleverly operationalize and monitor smart specialization

New growth strategies that put regional smart specialization at their core are now emerging, partly because current market underperformance is an impediment to the growth of new businesses. Smart specialization refers to strategies that focus R&D and innovation investments in activities, rather than sectors per se, that either are activities where a region has some comparative advantage (specialization) or emerging activities where entrepreneurs could develop new businesses (diversification). A plethora of independent scientific studies, EU reports and OECD reports has been promulgated on this subject over the last couple of years (see reference list). The smart specialization framework articulates a choice and selection process of economic activity based on:

- the unique knowledge, innovation and economic capabilities present in a region or nation;
- the clustering of economic activity by an entrepreneurial discovery process;
- the presence of cycles of policy learning in a Triple Helix context and process.

Thus, rather than focusing on determining if a hypothetical region has a 'strength' in a particular set of activities, such as tourism or fisheries, smart specialization focuses on determining whether that region would benefit from and should specialize in R&D and innovation in certain lead activities such as tourism or fisheries. This means that smart specialization must address the missing or weak connections between innovation resources on the one hand, and the sector-based structure of the economy on the other hand. Smart specialization strategies are envisioned as a way to foster the development of markets and growth of new innovation-driven businesses by focusing on the connectivity dimension that is central to OI and KT.

The EU has translated the principles of smart specialization into operational elements of regional innovation strategies. Regional innovation strategies for smart specialization are integrated, place-based transformation strategies that:

- Concentrate public resources on innovation and development priorities, challenges and needs;
- Outline measures to stimulate private investment in R&D and innovation;

[26] Aho, E., Cornu, J., Georghiou, L., and Subira, A. (2006): Creating an innovative Europe, EC Luxembourg.

- Build on a region's capabilities, competences, competitive advantages and potential for excellence from a cross-border and global value chain perspective;
- Foster stakeholder engagement (users being the first and foremost stakeholders) and encourage innovation and experimentation in governance;
- Are evidence-based and include sound monitoring and evaluation systems that focus on the connectivity underpinning smart specialization strategies.

Policies and instruments oriented towards fostering OI, KT and knowledge co-creation are particularly suited to both meet these principles of smart regional specialization and to unleash the economic potential of businesses' knowledge, creativity, ideas and other intellectual capital.

For this to materialize, the main policy priorities and recommendations at the EU level and at the national/regional level might embrace the following principles.

At the EU level:

- Pool resources to create world-class innovation and market-oriented infrastructures that enable the regions and their businesses to fully exploit the potential in a global perspective;
- Ensure that there is a match between European research areas and the areas where the region or country has stronger capabilities, competences and competitive advantages. If we do not have research in the right areas, entrepreneurs will have difficulties in getting access to the right innovation resources, which will be detrimental to growing innovative businesses;
- Often start-ups cannot reach economies of scale in the European Market due to different legal frameworks across countries. Further work needs to be done on reaching an effective single market with as few government barriers as possible to national market entry in diverse areas, such as the agro-food industry and pharmaceuticals.

At the national/regional level:

- Countries/regions are encouraged to identify the key areas, activities or technological domains where they are more likely to enjoy competitive advantage through OI and KT, by building on their local networks of businesses, universities, and research centres, but also through involving multi-national corporations and international organizations;
- The role of government intervention is important, but it is subsidiary. Policy intervention is required, not to select the areas or activities for investing public resources[27], but to help 'entrepreneurial discovery' to occur and to be stimulated (e.g. by providing incentives or removing regulatory constraints). Governments should create the necessary, reliable conditions, environment, dynamics and structures through which entrepreneurs and government learn about costs and opportunities and engage in strategic coordination[28]. To illustrate, this could mean justifying public support for 'exploring' the opportunities which may arise from applying general purpose technologies to existing industries (e.g. via demonstration projects and training);

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[27] Foray, David and Hall (2009): 'Smart specialisation: the concept', in Knowledge for Growth: Prospects for science, technology and innovation, Report, EUR 24047, European Union.

[28] Rodrik D., (2004): 'Industrial Policy for the Twenty-First Century', prepared for UNIDO.

- National/regional policies need also to ensure the necessary pre-conditions for OI and KT, notably entrepreneurial or absorptive capacity. To assume that these pre-conditions or capacities always exist may lead to government failures and unsatisfactory results. Experience illustrated by country case studies show that in some regions horizontal and general framework policies are a necessary first step. Other regions reveal difficulties in strategic capacity building. These regional differences cannot be ignored and they need to be addressed[29];
- SME policies should focus on those companies with innovative excellence, demand-driven and cross-border/international growth potential including:

    - SMEs raising private funding (see also Action 4),
    - SMEs developing innovation driven by the demand side (i.e. users needing solutions for real problems and demand) versus technology push,
    - SME with cross-border strategic and investment partners
    - SMEs developing or acquiring IP,
    - Universities and research centres engaging in a process of 'thinking along' (Berends et al., 2011) with SMEs as they develop, as they grow and as they mature their innovation capabilities. Where 'mature' innovation-intensive firms can adopt co-creation as a major OI approach, less 'innovation-mature' firms may lack the skills and capability to co-create. What they then need to do is to build the capability to co-create. To achieve this they should engage with research actors in a process of 'thinking along' on innovation, rather than jump to co-creating innovation. Innovation voucher schemes can be a valuable instrument for achieving this goal.

In addition, Europe has long tried to achieve innovation and growth in a top-down manner through setting a Strategic Innovation Agenda to which actors from the various MS can adhere. But these considerations suggest it would also be beneficial to implement a bottom-up approach, where OI actors who have joined forces through KT to set up specific innovation infrastructures and strategies (e.g. via a pilot) are able to leverage the local funding with European funding in order to 'fast track' innovation. In other words, rather than just attempting to complement EU funding with local funding, the recommendation is to complement local funding with EU funding when dynamic, entrepreneurial actors have joined forces already that may be further stimulated by adding EU funding and leverage to them.

To conclude, given all of the above, the implementation of smart specialization strategies should now focus on developing the appropriate measures for stimulating and monitoring cross-border connectivity. At the same time they should focus on the presence and development of the awareness, skills and instrument base needed for OI and KT to become essential building blocks in the smart specialization strategies that will be enacted across Europe (see also Action 1).

[29] McCann, P. and Ortega-Arguiles, R., (2011): Smart Specialization, Regional Growth and Applications to EU Cohesion Policy, see: http://ipts.jrc.ec.europa.eu/docs/s3_mccann_ortega.pdf

2.3 Stimulate and support user-driven innovation by translating and connecting major societal challenges into market opportunities

2.3.1 Focus on user-driven innovation and shared value innovation enabled and leveraged by key enabling technologies

User involvement and user engagement are key to successful innovation processes. Various processes through which users are actively drawn into innovation activities are, in and of themselves, a form of social innovation. More generally, it is often the absence of such corresponding social innovations that prevents the spread and implementation of many sophisticated and radical technical innovations into helping society and its citizens. OI offers the perfect approach for convening and operating at this intersection, because nearly each implementation of a radical (technological) innovation also signals a need for significant changes of social relationships and collaborations.

Shared value innovation offers a novel approach that explicitly focuses on the intersection of social and market innovation. For example, academic actors, economic actors and civil society (such as patient groups in hospitals) co-create new solutions in the healthcare sector. This co-creation became visible and tangible in the recent approval process of two novel immunotherapy treatments that have recently been approved by the FDA in the US.

Technological opportunities for shared innovation trajectories clearly reside in the Key Enabling Technologies that will now spread across Europe, such as health technologies, new energy technologies, and the big data revolution.

For instance, the digital revolution is throwing up a range of public and private data across all sectors and citizens. What were previously data silos can now be connected via advanced digital technology. In fact, big data is turning into a technological revolution, changing everything from the way businesses work (e.g. business models) to the way our products and services are produced, delivered, received and consumed (e.g. health, energy, finance, smart cities) – even the very way we live our lives. Because it spans all industries, private and public sectors alike, big data has the potential to be a new general-purpose technology, which is better exploited through OI. In contemporary capitalism the information and knowledge embedded in big data is key to economic competitiveness. For the economic potential of big data to materialize we need both a data privacy regime and an IP regime fit for the purpose.

Companies, societies and nations that understand how to build a framework allowing their data to be combined with both public and private data in other networks will have the competitive edge. When combined, data can change the way in which products and services are produced, stored, delivered and consumed. It can lead to the reorganisation of the entire economic system of production, the entire system of science, and create new business models and ways of living. There are already great examples of big data contributing to the world economy and welfare, for example by increasing the quality of products and services in the healthcare or financial sectors, or by reducing energy waste in households.

An example is the UK Government's investment in the Open Data Institute (ODI). The UK Economic and Social Research Council is investing £64m in 16 big data

platforms to enable research and test-beds to build the future of Britain[30], and most large firms are involved in their own private data platform activities. The 'big data revolution' has already taken off abroad, with more relaxed data regimes in the USA (with user rights) and in South Korea.

Recent discussions[31] often focus on how to protect the 'privacy' of individuals with regard to releasing and using personal data. These are important issues, but what we should really be asking ourselves is: What are the big challenges we want to solve with big data? Are we willing to share our data to co-create the solutions? Are we willing to protect privacy at all costs, at the expense of having poorer customer services and fewer innovative products and services?

We encourage the EC to research policy framework for big data that incorporates the following key principles, such as:

- Balance individual security with innovation and economic growth;
- Focus on governing the uses of data rather than controlling the data itself;
- Empower individuals in relation to data usage by giving them the tools to express choice and control over how their personal data is used.

In addition to a fit-for-purpose data privacy regime, for the big data revolution to flourish organizations could also beneficially adopt an OI approach in their management styles to allow for the co-creation of new, open production ecosystems. OI will be key to unlocking big data, starting with transparency in public and private information.

The big data case is only one example of how technological prowess coupled to social innovations generates novel entrepreneurial and market opportunities. Similar cases can be built around Europe's Key Enabling Technologies initiative. New OI-driven business models should be developed around them and an appropriate policy framework to nurture and grow pan-European markets (as indicated previously) can foster their societal and economic deployment.

2.3.2 Champion social innovation across Europe

A great deal of attention is now paid to the support and deployment of social innovations. This concept is defined as "the development and implementation of new ideas (products, services and models) to meet social needs and create new social relationships or collaborations" (see Guide to Social Innovation, EC, February 2013). Its emergence and growing importance reflects the shift from the 'technology transfer paradigm' to the more broadly defined 'knowledge exchange paradigm' and the growing understanding that innovations in enterprises (the main focus of attention until recently) are only a part of the complex set of activities intended to preserve and increase the wellbeing of our society.

While due importance should be attributed to social innovations per se, that is to innovations in the area of activities generally regarded as social care (care for the elderly and disabled, inclusion of minorities, the fight against poverty, etc.), the

[30] It is under the RCUK scheme 'Big Data Capital Funding', 9 April 2013.
[31] See e.g. European Commission (2012): 'Regulation of the European Parliament and of the Council' on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation) http://ec.europa.eu/justice/data-protection/document/review2012/com_2012_11_en.pdf

standing definition also allows a broader interpretation. In the paradigm of OI, a more general interpretation of social innovation is fully appropriate, because nearly each implementation of radical innovation based on technology also brings significant change to social relationships and collaborations in general. And it is often the absence of corresponding social innovation that prevents the spread and implementation of many sophisticated and radical technical innovations. This is where the aforementioned concept of shared value innovation comes in.

The example of medical telematics illustrates clearly this situation. With the still increasing costs of medical care, it is highly desirable to move patients as soon as possible from expensive hospital care to the much cheaper home care, providing the necessary quality is preserved. This can be achieved by using medical telematics that make it possible to register the basic physiological parameters of the patient and communicate them online to a central care unit, where critical situations are detected and necessary interventions can immediately be made. Although all necessary technologies (for example sensors registering the physiological and mental state and communication appliances) are available, the real potential of these technologies has still not been exploited. The main reason is because the healthcare systems in EU countries are rigid and lack social innovation. Health administrators, surgeons and even patients must change their behaviour and communication in line with this new pattern of healthcare.

Though it could be argued that social innovation brought about by a widespread implementation of medical telematics concerns predominantly the elderly, who surely are a group that deserves social care, it would in fact affect nearly everybody. To distinguish social innovations affecting the majority of the population from the social innovations that affect only minor social groups deserving support for their special needs, we call them general social innovations. The intellectual debate on the relationship between technological and social innovations still does not provide a clear and exhaustive picture. It seems to be indisputable that general social innovations will play an important role in fast and effective implementation of many radical technological innovations needed for meeting the grand societal challenges in Europe – be they in enterprises, governmental agencies or communities.

It is therefore recommended that these 'ecosystemic' relationships are analysed in more detail and measures are devised to stimulate the necessary coordination and cross-pollination of technological and social innovations.

Further reading for Action 2

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Action 3: Make Europe's universities and public research organizations more entrepreneurial

Priorities and policy recommendations

1) The EC should stimulate universities and public research organizations to develop and adopt a Charter and Code in their Entrepreneurial and Innovation Policy.

This should allow EU universities and public research organizations (PROs) to stimulate entrepreneurial leadership. Such a policy code can build upon the same approach as the 'HR Strategy for Researchers' (HRS4R)[32]. The articulation and adoption of such a code would be recommended to be recognized by the EC as a quality label, for instance in funding programmes.

While EU universities and PROs ask for more autonomy we need to recognize that autonomy also comes with accountability. A Policy Charter and Code in their entrepreneurial and innovation goals is not about implementing more rules, but about ensuring that they are encouraged to actively embrace more entrepreneurial objectives. This must also allow for more strategic flexibility at the national and regional levels, accepting that regional and so-called 'elite' research institutions become more autonomous and are rewarded for their dedicated and targeted contributions to the innovation ecosystem.

2) The EC, Member States and stakeholders need to put measures in place to ensure that 'open innovation and knowledge transfer' as a 'profession' is recognized in universities and public research organizations, in order to update the skills to support for open innovation. The scientists and KTO staff should play a central role in this process of professional development and maturation

Skill development within universities and PROs should be aimed at developing the entrepreneurial and innovation skills of scientists as well as the legal, administrative and coordination skills of support staff who facilitate the entrepreneurial engagements of academics. That is, professionalism must be linked to the new imperative of OI, co-creation and IP management in universities and PROs.

[32] http://ec.europa.eu/euraxess/index.cfm/rights/strategy4Researcher: "The 'HR Strategy for Researchers' (HRS4R) supports research institutions and funding organisations in the implementation of the Charter & Code in their policies and practices. The concrete implementation of the Charter & Code by research institutions will render them more attractive to researchers looking for a new employer or for a host for their research project. Funding organisations implementing the Charter & Code principles will contribute to the attractiveness of their national research systems and to the attractiveness of the European Research Area more generally. The logo 'HR Excellence in Research' will identify the institutions and organisations as providers and supporters of a stimulating and favourable working environment. Since the adoption of the Commission Recommendation on the Charter & Code in 2005, over 1.200 institutions from 35 countries in Europe and abroad (and European/international organisations) have expressed their explicit support for the Charter & Code and 102 have obtained the Commission's 'HR Excellence in Research' logo."

3) EU universities and public research organizations need to adopt appropriate incentive schemes for scientists and knowledge transfer office staff to engage in co-creation processes with the users of academic knowledge.

This involves recognition of the entrepreneurial engagements of academics/scientists beyond the traditional recognition of publications and scientific impact. It also involves willingness to support the services provided by knowledge transfer offices (KTOs) to engage in different co-creation mechanisms with businesses, social institutions, governments, and citizens etc. These should be incorporated into performance indicators for career progression (normally only the privilege of established professors and research fellows who have followed traditional career paths). Thus, our proposed Charter and Code in policies and practices for making universities and PROs more entrepreneurial and innovative should aim to stimulate early career academics and career scientists to become co-creators with the stakeholders of EU innovation ecosystems. Those measures can also be integrated in the HRS4R policy that is now gaining ground within a plethora of European universities and PROs. The EC thus is recommended to support and encourage the adoption of good practice that enables EU universities and PROs to co-create knowledge with their collaborative partner-innovators. This involves supporting EU universities and PROs to adopt good practices when engaging with users, enabling them to build trustworthy, transparent and long-term relationships with those users and to implement effective strategies to reap the full benefits of co-creation. It also involves incentives to stimulate scientists to be more entrepreneurial, incentives for incubation and spin-offs, and incentives to build appropriate infrastructures to ensure co-creation takes place between research institutions and the users of their knowledge.

Furthermore, it is critical to realize that universities and PROs do not only co-create with businesses, but also with social institutions, government, public sector organizations and citizens.

The recommendations are explained in more detail below.

Implications

3.1 Stimulate EU universities and public research organizations to put in place a Charter and Code in their Entrepreneurial and Innovation Policy

The arrangements in many EU universities and PROs have been reported to be too bureaucratic, and too focused on managing and stimulating innovation relationships rather than supporting the effective and efficient delivery of outputs. Similar trends were found in a study carried out in the US in which bureaucratic inflexibility was found as a major barrier for science–business interactions[33]. This had also caused several negative impacts on academics when they acted as co-creators of knowledge since it restricted their autonomy to closely work with the stakeholders of innovation ecosystems[34]. It is widely evident in the literature that individual scientists are the strongest source of initiating interactions with the stakeholders of innovation ecosystems.

[33] Siegel, D. S., Waldman, D. A., Atwater, L. E. and Link, A. (2003): University–industry collaboration. The Journal of High Technology Management Research, 14, 111–133.

[34] De Silva, L. R., Uyarra, E. and Oakey, R. (2012): 'Academic Entrepreneurship in a Resource Constrained Environment: Diversification and Synergistic Effects' in Audretsch, D. B., Lehmann, E. E., Link, A. N., and Starnecker, A. (eds.) Technology Transfer in a Global Economy. International Studies in Entrepreneurship, Zoltan and Audretsch, D. (series eds.), Vol 28: Springer, 73–97.

For instance, a survey administered to more than 11,000 scientists in the US revealed that about 2/3 of them carried out entrepreneurial activities by themselves without the involvement of university administrators[35]. Hence, it is important to introduce a Policy Charter or Code in order to empower scientists to work closely with the users of their research to co-create knowledge. A code of good practice is recommended to be put in place to ensure that all the partners in consortia of EU-funded or MS funded projects deliver the outputs they initially agreed, rather than being free riders relying on consortium leaders to take the burden of delivery.

The MS and the EC are recommended to focus on nurturing and accelerating the development of universities and PROs into entrepreneurial institutions, so that they may become catalysts of Triple Helix interactions. For this to happen the role of academics/scientists as knowledge providers would need to be complemented with a role as co-creators. Furthermore, the role of KTOs would have to be transformed from isolated entities into fully embedded institutions within universities and research organizations. To this end, the EC is recommended to also consider taking into account their OI/KT activity and output as evaluation criteria. The EC is further recommended to support the adoption of good communication and collaboration practices by universities and PROs through their KTOs.

3.1.1 Make Entrepreneurial Universities and PROs catalysts of Triple Helix interactions

The Triple Helix thesis puts entrepreneurial universities and PROs at the heart of the innovation ecosystem. "…[T]he potential for innovation and economic development in a Knowledge Society lies in a more prominent role for the university and the hybridisation of elements from University, Industry and Government to generate new institutional and social formats for the production, transfer and application of knowledge"[36].

The significant role played by universities and PROs within knowledge driven economies is further strengthened by the transformations happening in businesses and other users of academic knowledge in which they are increasingly becoming collaborative innovators and targeting breakthrough and radical innovations around products, services, technology and business models[37].

Within this context the messages in terms of new ways forward are[38]:

- Universities and PROs must take a more prominent role in innovation, on a par with Industry and Government in the Knowledge Society, in addition to the pioneering role they should maintain in basic science;
- Innovation policy is increasingly an outcome of interaction and collaboration rather than a prescription from Government or solo activity by individuals or institutions[39];
- Universities, PROs, businesses and government institutions take the role of the other, performing new roles as well as their traditional functions. Institutions

[35] Fini, R., Lacetera, N. and Shane, S. (2010): Inside or outside the IP system? Business creation in academia. Research Policy, 39, 1060–1069.
[36] Etzkowitz, H. (2003): The Triple Helix concept http://triplehelix.stanford.edu/3helix_concept
[37] Breakthrough innovation and growth; PWC; (2013): http://www.pwc.com/gx/en/innovationsurvey
[38] The Triple Helix concept http://triplehelix.stanford.edu/3helix_concept
[39] Adler, R. (2012): Connecting the Edges: A Report of the 2012 Aspen Institute Roundtable on Institutional Innovation.

taking non-traditional roles are viewed as a major potential source of innovation.

As a consequence, clearer government policies stimulating these practices will strengthen the links between universities, PROs and the rest of society. In particular, firms will increasingly use university and PRO research infrastructure for their R&D objectives.

Within this context:

- Universities and PROs must involve themselves in socio-economic development and increase the usefulness of their research. They have a wealth of knowledge, advanced technologies and resources that should be used more to support innovation and growth in the EU innovation ecosystem. It is argued that since the taxpayer funds universities as an investment in the production of knowledge on behalf of society, there is a need to increase the usefulness of academic research[40]. We are not advocating that universities become 'like business' and give up their role as developers of basic research in order to suit the needs of business, but rather that universities and businesses can collaboratively tackle market challenges and capitalise on opportunities, each with their own distinctive role to play. Although the market should not determine all directions of research in universities, we must acknowledge that firms are more likely to go to universities in the USA than in Europe to source their basic knowledge[41].
- Universities must stimulate and foster entrepreneurial students and build inter-organizational capabilities to transfer technology, and especially to step up their OI capabilities. For example, universities could develop schemes for students to become entrepreneurs and firm founders, e.g. through entrepreneurship and incubation programmes and new training modules at venues such as science parks, academic spin-offs, incubators and venture capital firms[42]

The Triple Helix model[43], which rose to prominence in the technology policy literature of the second half of the 1990s, has therefore pushed the attention to the beneficial effects of multiple and diverse links between industry, academia, public research and government.

Universities play a major role in Europe. In addition to contributing to outstanding basic research and teaching, universities are active players with other economic stakeholders, such as businesses and government, demonstrating a key contribution to economic and social development.

Even though EU universities have moved a long way from their historically criticised position of 'ivory towers', completely insulated from the economy, towards a more collaborative status within the EU innovation ecosystem[44], there still seems to be room to improve their interactions with businesses and other stakeholders. A survey

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[40] Knowledge Transfer from Public Research Organisations; STOA - Science and Technology Options Assessment, Technopolis Group, (2012): http://www.europarl.europa.eu/stoa/default_en.htm

[41] Decter, M., Bennett, D. and Leseure, M. (2007): University to business technology transfer – UK and USA comparisons. Technovation, 27, 145–155.

[42] Etzkowitz H and Zhou C (2008) Building the Entrepreneurial University: A Global Perspective, Science and Public Policy 35 (9): 627-635. Etzkowitz H., Almeida M and Mello, J.M.C (2012) Organizational Innovation in a Developing Country: Invention and Diffusion of the Brazilian Cooperative Incubator, International Journal of Technology and Globalization 6(3):206-224.

[43] Etzkowitz, H., Leydesdorff, L. (2000): The dynamics of innovation, Research Policy, Vol. 29: 109–123.

[44] Etzkowitz, H., Webster, A., Gebhardt, C. and Terra, B. R. C. (2000): The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm. Research Policy, 29, 313–330.

from 2013 conducted in the UK revealed that, while universities play a good role as providers of knowledge, a lot needs to be done to improve their role as co-creators of knowledge or truly entrepreneurial universities[45].

Especially in the delivery of the Innovation Union, the role of universities as OI co-creators with users of academic knowledge must be implemented, but this requires a step-change. The same holds, of course, for PROs.

To conclude, while EU universities rightly do ask for more autonomy, we need to recognize that this autonomy also comes with accountability. Given the Triple Helix considerations just highlighted, a Policy Charter and Code in their entrepreneurial and innovation goals is advocated. Such a Charter or Code is not about implementing more rules or bureaucracy, but about ensuring that universities are encouraged to actively embrace more entrepreneurial objectives. The same remarks hold, of course, for PROs.

3.1.2 Complement the role of academics as knowledge providers with a role as co-creators

The 'third mission' that introduced entrepreneurial engagement, as an extra activity to the traditional teaching and research roles of academics, was a major revolution in the 1990s, the basis for which was the assumption that academic knowledge could be better used by businesses and other stakeholders of innovation ecosystems to generate socio-economic wealth. This knowledge transfer process, associated mainly with a technology 'push' approach to commercialising university-generated knowledge, has been encouraged and supported nationally and at EU level by deploying considerable financial and human resources. However, over time with the change of innovation process from a linear model to a systems approach, the role of academics as providers of new knowledge and advanced technologies has changed[46, 32]. They are now co-creators of knowledge with their collaborative partner-innovators.

Knowledge co-creation involves the development and integration of knowledge on the part of all stakeholders of the innovation ecosystem to address opportunities ranging from the development of a new product or process to larger socio-economic issues. Stakeholders include businesses and citizens, universities and intermediary organisations, engaging with each other through multiple channels while pooling their internal resources (knowledge as well as finance, people, markets and big data). This approach to knowledge co-creation is more than simply sharing risk and reward; it encapsulates the integration of the entire innovation ecosystem, and is about co-innovating new markets and more effective business models which integrate supply chains that would not exist otherwise[47].

The role of academics in this new co-creation paradigm is more complex than the unidirectional transfer of knowledge from universities to business since academics need to closely work with all the stakeholders of innovation ecosystem to generate new knowledge. If EU universities and their users are to reap the full benefits of this

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[45] Andersen, B., De Silva, L. R., and Levy, C. (2013): 'Collaborate to innovate: How business can work with universities to generate knowledge and drive innovation', Big Innovation Centre report. Commissioned by the UK Intellectual Property Office.

[46] Knowledge Transfer From Public Research Organisations; STOA – Science and Technology Options Assessment, Technopolis Group (2012): http://www.europarl.europa.eu/stoa/default_en.htm

[47] Andersen, B., De Silva, L. R., and Levy, C. (2013): 'Collaborate to innovate: How business can work with universities to generate knowledge and drive innovation', Big Innovation Centre report. Commissioned by the UK Intellectual Property Office.

knowledge co-creation paradigm, the MS and EC are recommended to appropriately nurture the transformation of the academic role from 'only and merely' knowledge providers towards also being knowledge co-creators.

The MS and EC are recommended to support and encourage the adoption of good practice that enables EU universities and PROs to co-create knowledge with their users[48]. This involves supporting them to adopt good practices when engaging with users that enable them to build trustworthy, transparent and long-term relationships with those users and to implement effective strategies to reap the full benefits of co-creation. This involves incentives to stimulate scientists to be more entrepreneurial, incentives for incubation and spin-offs, and incentives to build appropriate infrastructures that ensure co-creation can occur between academic institutions and the users of academic knowledge. This includes the development of physical (e.g. joint research labs) and institutional infrastructures (e.g. OI networks and co-creation platforms), and incentives to stimulate the creation of portfolios of open and flexible IP and open access mechanisms.

3.1.3 Transform the role of Knowledge Transfer Offices from isolated entities to fully embedded institutions within universities and public research organizations

From an innovation and technology policy perspective, attention was drawn to the role of the technology transfer offices (TTOs), the main aim of which was to support the role of universities and PROs as providers of knowledge by protecting, licensing and commercialising their knowledge. As discussed in the previous section, the transformation of the role of academics from being providers of knowledge to co-creators of knowledge and the innovation process from a linear to a system model demands broader facilitation than the technology-oriented support provided by the TTOs. This much wider understanding of the role of universities led to the development of Knowledge Transfer Offices (KTOs) with the aim of supporting knowledge co-creation rather than simply technology transfer[49]. By venturing this development effectively and efficiently inside the Triple Helix model, some universities have become increasingly and visibly entrepreneurial. They have professionalized their participation in the innovation process through the creation and the professional development of KTOs[50].

The rise and growth of this new function in academia can be marked by three stages of development[51].

Stage 1) KTO as isolated operation

During the period 1980–1995, academic KTOs operated mainly as 'isolated islands of technology transfer activity' within the university. Technology transfer occurred; it was tolerated and situated at the periphery of the academic activity spectrum. No solid KTO business model existed and KTO activities were confined to the legal

[48] See also the ProToN Responsible Partnering Manual.
[49] Knowledge Transfer From Public Research Organisations; STOA - Science and Technology Options Assessment, Technopolis Group, (November 2012): http://www.europarl.europa.eu/stoa/default_en.htm
[50] Van Looy, B., Landoni, P., Callaert, J., van Pottelsberghe, B., Sapsalis, E. and Debackere, K. (2011): 'Entrepreneurial effectiveness of European universities: An empirical assessment of antecedents and trade-offs', Research Policy, Vol. 40: 553–564.
[51] Debackere, K. (2010): 'The rise of the academic technology transfer organization', Review of Business and Economics, Vol. LV, No. 2: 175–189.

aspects of contract development and contract monitoring. KTO performance was not taken into account when assessing the academic performance of individual scientists. This 'stage 1 mode of operation' lasted well into the mid-nineties. It was characteristic of the first generation of KTO activities. Their impact and their visibility within the university were still quite limited.

Stage 2) KTO as a professional service supporting the third mission activities of the university

From 1995 onwards, we see the advent of a second stage or generation in KTO development. Rather than being situated at the periphery of academic activities, the KTO now becomes the centrepiece in the fulfilment of the so-called 'third mission' of the university. KTO activities are now deployed university-wide and the professionalization of the KTO operation occurs rapidly and effectively. Integrated business models appear, encompassing professional and university-wide IP management practices, the management of a complex and diverse contract portfolio (both bilateral and multilateral contracts), and business development through spin-off creation, including a proactive stance towards having an impact on regional development. Technology transfer has now become the third mission of the modern research university, alongside education and frontier research. KTO achievements are fully taken into account when assessing academic performance, both at the institutional level and at the individual level. This 'stage 2 mode of operation', also called the university-wide activity of the KTO, developed during the years 1995–2005 and can still be observed at many universities around the world. KTO impact and visibility have increased rapidly during this second generation of KTO development.

Stage 3) KTOs strategically embedded and fully diffused activity throughout the university

Over the last couple of years, we observe the development of yet another, ever more inclusive, activity pattern of the KTO within its academic context. This 'stage 3 mode of operation' can be summarized as the 'inclusive KTO operation'. Rather than 'just' being the centrepiece of the university's third mission operations, the KTO activities now diffuse and interweave across and alongside the two core missions of education and research. The KTO is becoming fully embedded within the university while KT activities generate a variety of spillovers (cognitive/intellectual as well as financial) that benefit the education and research activities of the university. The omnipresence of the KTO throughout the full internal value chain of the university turns it into a truly and fully inclusive activity. This third stage or generation of KTO development is expected to take full effect in the decade to come. It will further heighten the impact and the visibility of the KTO operations in academia.

Thus, the academic KT function within universities has operated very much as an isolated activity, serving those few academics who wanted to connect their scientific output to business, to taking on an explicit recognition of the academic KT function, to become strategically embedded throughout the university.

Although the KTO profession has been maturing all over Europe, there is still a performance gap to be closed when compared to the US. In addition, and while Europe performs better than Japan, we see a rising activity level in China that will become a fierce contender in the KT landscape in the decade to come[52]. The EC is recommended to take the necessary action to strategically embed and fully diffuse

[52] Proton (2012): The Proton Europe Ninth Annual Survey Report.

the activity of KTOs within universities. In addition, stimulating interactions amongst KTOs can further enhance their impact in European innovation ecosystems. Furthermore, the EC should also encourage structural interaction between KTOs on instruments and topics like IP, open science and open access, incubators and other themes that will enhance the success of the Horizon 2020 themes and the ensuing co-creation processes at EU level.

3.1.4 Support the adoption of good communication and collaboration practices by universities and public research organizations through their KTOs

University–business interactions (and similarly, PRO–business interactions) should adopt communication, collaboration and negotiation-related management practices, as they are key to successful collaborations: Management practices that unlock successful university business interactions were identified[53].: (1) Reaching a shared understanding with academics; (2) Increasing transparency, and an openness to collaborate with academics; (3) Implementing a strong programme structure with clear milestones; (4) Reducing top-down approaches with more team-level communications; (5) Enforcing contracts (e.g. avoiding opportunistic behaviour or other trust issues); (6) Capitalising on differences rather than trying to match the practices of academics or universities to business routines; and (7) Ability to negotiate (the price or other terms of the contract) with university technology support or business relations staff. An EC funded report has also illustrated 30 good practice case studies from Europe and emphasised the importance of learning from and adopting such practices since these are transferable. Hence, it is important that the EC supports EU universities to adopt such good practice[54]. University KTOs should play an instrumental role in this evolution.

3.2 Recognize 'open innovation and knowledge transfer' as a 'profession' in universities and public research organizations

Co-creation and co-innovation by universities and PROs with businesses, social institutions, government, and citizens need a specific set of skills that is different from the skills required for the unidirectional transfer of knowledge from universities. Hence, the EC is recommended to focus on supporting the development of those skills in university academics and KTOs that are essential for them to successfully capitalize on OI opportunities.

3.2.1 Support the skill development of university academics, scientists at public research organizations and the KTOs supporting them

All these various roles and activities of KT and co-creation over time have indeed challenged the talent base of university staff. Continuous professional development of academics, scientists and KTO professionals should be mentioned. The innovation scene where OI activities take place is rather complex and these activities cover many different fields of activity – from finance and law through IP protection and licensing up to project management and psychology. It is the quality of academics

[53] Andersen, B., De Silva, L. R., and Levy, C. (2013): 'Collaborate to innovate: How business can work with universities to generate knowledge and drive innovation', Big Innovation Centre report. Commissioned by the UK Intellectual Property Office.

[54] 30 Good Practice Case Studies In University–Business Cooperation (2009): Part of the DG Education and Culture study on the cooperation between Higher Education Institutions and public and private organisations in Europe. European Commission. http://ec.europa.eu/education/higher-education/doc/studies/munstercase_en.pdf

and KTO professionals engaged in these activities that determines – to a large extent – their success rate.

***KTO Professionals*:** The requirement for a high and steadily improving level of expertise is therefore a must for anybody aspiring to act responsibly in this area. This is especially true for KTOs and other institutions of this type, where those activities are mostly concentrated. It was as early as 2006 that a ERAC challenging expert group report (formerly CREST), [55], highlighted the major problems of insufficient and unsystematic training and lack of recognition of TT/KTT professionals in the EU. It identified a number of important issues including:

- lack of skilled people in general in TT or KT activities;
- absence of a registered TT or KT profession;
- absence of TT or KT education and recognised training standards;
- absence of career paths for TT or KT professionals.

As a reaction to those findings and recommendations, a bottom-up initiative was launched by a number of EU organisations interested in the active promotion of the TT/KT profession. This gave birth to two EC funded FP6 and FP7 projects – Certified Transnational Technology Transfer Manager (Cert-TTT-M project, 2011[56]) and European Knowledge Transfer Society (EuKTS project, 2013[57])– which have paved the way for implementation of the CREST (ERAC) recommendations in the field of KTT training. In these projects an EU-curriculum of the competencies necessary for knowledge and technology transfer professionals as well as a three-layer system of training and certification of KTT professionals were designed and laid out.

The first step in its implementation was accomplished by launching EukTS (an accreditation and certification body established as a not-for-profit international association and located in Brussels). At the moment EuKTS is a pioneering, fully comprehensive accreditation and certification system, since it offers recognition at all stages of the career of a KTT professional. Three pilot projects in Austria, Italy and the Czech Republic, have resulted in hundreds of KTT students being awarded EuKTS certificates at basic level. Applications for accreditation from five or six countries are currently under consideration. More than 30 institutions from 15 EU countries, plus Turkey, Macedonia and Serbia have already expressed their interest and support for the scheme. Intensive discussions are ongoing regarding the funding for launch of intermediate and advanced level certifications (the association will be self-supporting within three years) and possible official recognition by the EC authorities.

Discussions are also ongoing with other associations active in the certification of TT/KT professionals worldwide such as CLP[58] and ATTP[59] regarding possibilities for cooperation and mutual recognition.

The gaps in skills of KTOs as well as the changing landscape of knowledge co-creation underpin the importance of further deployment of EuKTS.

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[55] Report of the CREST OMC Expert Group on Intellectual Property (2006*)*: http://www.ipo.gov.uk/crestreport.pdf
[56] Cert-TTT-M project (2011): http://www.ttt-manager.eu
[56] Cert-TTT-M project (2011): http://www.ttt-manager.eu
[57] EuKTS project (2013): http://www.eukts.eu
[58] http://www.licensingcertification.org
[59] http://www.attp.info

To support this development, the EC is recommended to formally recognize the EuKTS accreditation and certification system as a part of the European Qualifications Framework (EQF). The MS are recommended, in addition, to incorporate education on KT into their national accreditation systems. Furthermore, support in funding programmes for the finalization and implementation of the EuKTS accreditation and certification system within the EU would be beneficial (including, where possible its crossover with (other) EU programmes with the aim of improving the level of the KT profession).

In addition, the EC is recommended to support the development of training courses by KT training providers compatible with this system in the MS and the implementation of this system by interested KT training providers even outside the EU. Finally the EC could stimulate KTOs to interact on a European level in order to strengthen the support, the level and the intensity of knowledge exchange activity in Europe. To this end, dedicated funding for KTO collaboration projects could be made available on a regional, a national and a European level to boost the interplay amongst innovation ecosystems in Europe.

University Academics: As discussed in Section 3.1.2 of Action 3, the role of academics has been enhanced from only carrying out teaching and research, to providing knowledge to their collaborative partner-innovators and, recently, to being co-creators of knowledge with the stakeholders of innovation ecosystems. The literature suggests that 'star scientists' are also the best co-creators[60]. Also, an EC funded report on the state of EU university–business cooperation has recommended that measures and corresponding effects should target academics since they are the key to successful university–business interactions[61].

- Stimulate the education of excellent scientists so that they could operate in interdisciplinary environments where skills for communication, innovation entrepreneurship, and hands-on learning are important for addressing big societal and business challenges[62]. A EC report (2013), which highlights lessons learnt from the INNO Policy TrendChart and The Innovation Union Scoreboard, states that funding allocated to support innovation skills development has been smaller than expected[63]. Hence, the EC is recommended to do more to support and fund the skill development of academics to engage in entrepreneurial activities.
- Support/stimulate the mobility of academics within the EU among different public and private organizations since mobility encourages knowledge exchange and mutual learning which will contribute to addressing this skill gap. A pan-European study has revealed that industry placements ensure a high quality of education, sound research and adequate preparation for diverse career

[60] Zucker, L. G. and Darby, M. R. (2001): 'Capturing technological opportunity via Japan's star scientists: evidence from Japanese firms' biotech patents and products'. Journal of Technology Transfer, 26, 37–58.

[61] The State of EU university–business cooperation (2011): European Commission. http://ec.europa.eu/education/higher-education/doc/studies/munster_en.pdf

[62] The First International Commercialization Forum, Ottawa, Canada, 30–31 March 2011: Report on Proceedings and Findings, http://www.theicalliance.com/documents/Proceedings_ICF_2011_Final.pdf
Léopold Demiddeleer, President of EIRMA, Responsible Partnering and Open Innovation, EARTO – Dubrovnik, 24 June, 2013: http://www.earto.eu/fileadmin/content/01_Seminars___Conferences/AC_2013/2013_PRESENTATIONS/1.Leopold_Demiddeleer_Resp_Partnering___Open_Inno_final_May_22_EARTO_Dubrovnik_last_version.pdf

[63] Lessons from a Decade of Innovation Policy. What can be learnt from the INNO Policy TrendChart and The Innovation Union Scoreboard, DG Enterprise and Industry (2013): http://ec.europa.eu/enterprise/policies/innovation/facts-figures-analysis/trendchart/index_en.htm

pathways[64]. Another successful, mutually beneficial teaching-based approach is the appointment of adjunct professors by Finnish universities. They are from industry, but they are working in technological fields related to the expertise of universities and they spend 20% of their time on university teaching[65]. This instrument can be systematically improved when universities and businesses collaboratively design research- or teaching-based placements with clearly defined objectives and outcomes (UK national survey, Andersen et al. 2013).

- Support spin-ins since they enable mutual knowledge exchange between companies, universities and PROs. A spin-in is a model where a large company inserts its daughter company into a university- or PRO-linked incubator to make use of the 'knowledge milieu' there.

3.2.2 Embrace open science alongside open innovation

Across Europe and internationally there is a movement towards Open Science. This movement is given further impetus by the technological opportunities in the digital economy. Open Science is the umbrella term of the movement to make scientific research, data and dissemination accessible to all levels of an inquiring society, amateur or professional. It is often campaign led[66].

It is important to stimulate the co-evolution of and the interaction between the move towards Open Science and the OI challenges highlighted in this report, as this will allow for scientific information, knowledge and data to be shared in a much more effective and systematic way.

In order to enable this co-evolution and interaction, the strategic policy agenda of the EC should consider implementing some key steps:

- Develop academics' skills and awareness. Empower academic communities to understand the benefits of Open Science as they entail a wider dissemination of and access to research outputs.
- Develop coordinating mechanisms and infrastructures. Develop support mechanisms to address many of the technical challenges associated with Open Science policies.
- Experiment with new platforms and business models as evidence of what works. Design platforms and coordinating mechanisms to support access to scientific output and results.

3.3 Adopt appropriate incentive schemes for academics, scientists and KTO staff to engage in co-creation processes with the users of academic knowledge

Universities and PROs cannot always easily change their traditional activities to embrace co-creation and co-innovation. The EC should focus on taking the necessary actions, so that, universities and PROs will reward scientists and KTOs by recognising their entrepreneurial engagements beyond publications and obtaining

[64] Borrell-Damian, L., Brown, T., Dearing, A., Font, J., Hagen, S., Metcalfe, J. and Smith, J. (2010): Higher Education Policy, 23, 493–514.
[65] Jones-Evans, D. (2000): Entrepreneurial Universities: Policies, Strategies and Practice. In: Pedro, C., Gibson, D. V., Heitor, M. V. and Shariq, S. (Eds.), Science, Technology and Innovation Policy. Santa Barbara: Greenwood Publishing Group.
[66] E.g. Oxford Open Science: http://science.okfn.org/community/local-groups/oxford-open-science/, and similar initiatives across the world.

patents. Also, the design of infrastructure that encourages knowledge co-creation needs to be designed, such as joint research labs, OI networks, new initiatives for SME–university collaboration, etc.

3.3.1 Adopt appropriate reward schemes for scientists and KTO staff

This changing landscape should be supported by recognizing and rewarding the entrepreneurial engagements, beyond publications, of academics and scientists at PROs, and the services provided by KTOs to academic entrepreneurs beyond patents. Through case studies of four European universities of science and technology in Finland, Ireland, Norway and Sweden a study has highlighted the importance of linking teaching, research and exploitation activities since they create synergies. The study highlighted that the challenge is to motivate the relevant parties to create such a culture through appropriate reward mechanisms[67].

The existing promotion mechanisms in the world of science, which mainly acknowledge publications, restrict the involvement of early- and mid-career scientists in entrepreneurial activities since they are pressured to develop their publication profile. An exclusive emphasis on publication activity and its impact does not sufficiently recognize and reward the involvement of academics in co-creation endeavours as advocated above. Therefore, it is important to restructure and complement existing reward and promotion systems for EU academic scientists by reflecting on the change in their role towards more co-creation and entrepreneurial activities, besides and alongside traditional teaching and research involvements. As a consequence, it is important to design and develop novel incentive schemes for academics that better take into account their role and their performance in OI co-creation activities as a full dimension of their academic endeavours.

Similarly, the performance measures of KTOs should not only take into account the volume of IP engagement (i.e. number of patents obtained) but also the quality of support services provided by them to academics to successfully co-create knowledge with their users[68].

3.3.2 Design infrastructures to support knowledge co-creation

The EC needs to ensure that an appropriate infrastructure framework is in place for knowledge co-creation between academic institutions, PROs and their collaborative partner-innovators. This includes the development of physical (e.g. joint research labs) and institutional infrastructures (e.g. OI networks and co-creation platforms) and the design of policy frameworks conducive to co-creation (e.g. open and flexible IP mechanisms and the open science movement). This leads to the following set of recommendations:

- Make funding available for new science–industry knowledge co-creation mechanisms. A EC report[69] highlights that, even though policy measures have been shifting away from individual research subsidies towards collaborative schemes, funding priorities could still do a better job in linking scientific and technological research to innovation. Since there is a positive correlation between funding allocated to science–industry links and involvement in

[67] Rasmussen, E., Moen, Ø. and Gulbrandsen, M. (2006): Initiatives to promote commercialization of university knowledge. Technovation, 26, 518–533.
[68] Knowledge Transfer from Public Research Organisations; STOA – Science and Technology Options Assessment, Technopolis Group, November 2012; http://www.europarl.europa.eu/stoa/default_en.htm
[69] Lessons from a Decade of Innovation Policy: What can be learnt from the INNO Policy TrendChart and the Innovation Union Scoreboard, DG Enterprise and Industry, June 2013.

collaborative innovation, the EC should aim to funding new knowledge co-creation mechanisms between EU universities, PROs and industry.

- Stimulate the formation of joint research labs and the sharing of resources between universities, public research organizations and businesses. A study conducted in the Netherlands and France highlighted a myriad of benefits received by co-locating technological platforms and other research infrastructures, but emphasised the need to adopt effective ways to manage the use of resources and to achieve both commercial and academic objectives[70]. In successfully managed joint research arrangements, businesses and universities independently conduct their own research activity, but align on infrastructure capabilities that both parties can access. Company staff members are temporarily or permanently seconded to labs located at universities, and vice versa. As a result, university and company researchers share common resources and equipment, collaboratively organise seminars, develop new advanced methods of conducting research and share knowledge on an ongoing basis. Whenever possible they conduct collaborative challenge-led research and development. Horizon 2020 is encouraged to adopt this approach in its toolkit. In the UK, this approach has enabled knowledge spillovers and the exploration of new collaborative opportunities by university and company staff. The model of joint research labs was found to be very successful at simultaneously meeting the commercial needs of companies and the academic needs of universities[71].
- Support and encourage the use of specific OI networks that bring about university interactions with businesses and other users. Networks are forums that facilitate universities, businesses, local authorities and other stakeholders to network and work together. A few successful examples of these in the EU are the University of Glasgow Innovation Network, Eindhoven Open Innovation network, Local Enterprise Partnerships in the UK, Entrepreneurship Stimulation Programmes in Sweden[72] and the University Industry Innovation Network based in Germany. Also, intermediary organizations that link the stakeholders of innovation ecosystems by creating open innovation forums/platforms can be supported as they are found to be key to the entrepreneurial engagements of universities[73].
- Stimulate SME–university interactions. While many businesses do engage with universities, there are still too many businesses, especially SMEs that are not reaping the rewards of collaboration. Not only financial incentives, but also other support mechanisms, should be in place to bring about university–SME interactions. A few successful initiatives are: (i) PathogenCombat (EU) that provided useful contacts, up-to-date information and forums for interactions to SMEs; (ii) the Competitiveness and Innovation Framework Programme (EU) that supports SME innovation and provides financial and business support services; (iii) the Accelerator model (UK) where large firms act as intermediaries between universities and SMEs; (iv) Mini-KTPs (UK) where funding and other support are provided to SME–university collaborative projects. A review of such EU programmes has revealed that while successful initiatives have to a great extent contributed to improving SME–university interactions, there is still much work

[70] Robinson, D. K. R., Rip, A. and Mangematin, V. (2007): Technological Agglomeration and the Emergence of Clusters and Networks in Nanotechnology. Research Policy, 36, 871–879.

[71] Andersen, B., De Silva, L. R., and Levy, C. (2013): 'Collaborate to innovate: How business can work with universities to generate knowledge and drive innovation', Big Innovation Centre report. Commissioned by the UK Intellectual Property Office.

[72] Jones-Evans, D. (2000): Entrepreneurial Universities: Policies, Strategies and Practice. In: Pedro, C., Gibson, D. V., Heitor, M. V. and Shariq, S. (Eds.), Science, Technology and Innovation Policy. Santa Barbara: Greenwood Publishing Group.

[73] The First International Commercialization Forum, Ottawa, Canada, 30–31 March 2011. Report on Proceedings and Findings: http://www.theicalliance.com/documents/Proceedings_ICF_2011_Final.pdf

ahead: the central problems of trust, language, and legal and educational issues are still impeding those processes[74].

Further reading for Action 3

- 30 Good Practice Case Studies in University–Business Cooperation: Part of the DG Education and Culture study on the cooperation between Higher Education Institutions and public and private organizations in Europe. (2009) European Commission. http://ec.europa.eu/education/higher-education/doc/studies/munstercase_en.pdf
- Andersen, B. and Rossi, F. (2011): 'The Flow of Knowledge from the Academic Research Base into the Economy: the Use and Effectiveness of Formal IPRs and 'Soft IP' in UK Universities'. Commissioned by the Strategic Advisory Board for Intellectual Property Policy (SABIP) http://www.ipo.gov.uk/ipresearch-flow-201010.pdf
- Andersen, B., De Silva, L. R. and Levy, C. (2013): 'Collaborate to innovate: How business can work with universities to generate knowledge and drive innovation', Big Innovation Centre. Commissioned by the UK Intellectual Property Office.
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- Debackere, K. (2010): 'The rise of the academic technology transfer organization', Review of Business and Economics, Vol. LV, No. 2: 175–189.
- Debackere, K. (2012): The TTO: A university engine transforming science into innovation. LERU Advice Paper 10, January 2012.
- Knowledge Transfer from Public Research Organisations; STOA – Science and Technology Options Assessment, Technopolis Group, November 2012; http://www.europarl.europa.eu/stoa/default_en.htm.
- Lessons from a Decade of Innovation Policy. What can be learnt from the INNO Policy TrendChart and The Innovation Union Scoreboard, DG Enterprise and Industry, June 2013: http://ec.europa.eu/enterprise/policies/innovation/facts-figures-analysis/trendchart/index_en.htm.

[74] Braun, S. and Hadwiger, K. (2011): Knowledge Transfer from Research to Industry (SMEs) – An Example from the Food Sector. Trends in Food Science and Technology, 22, Supplement 1, S90–S96.

Action 4: Create a smart funding ecosystem in which open innovation and knowledge transfer can thrive

Priorities and policy recommendations

1) Introduce and encourage the establishment of co-investment schemes to address the financing and funding gaps in the innovation ecosystem in Europe.

The European Venture Capital Association acknowledges that it is important to bring the 'private sector'/private investors back to the venture capital market in Europe. Clearly, venture capital (provided by both the government and private investors) is needed to get the start-up companies through the valley of death (which can be defined as the period between the initial capital contribution and the time the company starts generating a steady stream of revenue).[75] Here it should be noted that private capital is not only needed to effectively address the financing and funding gaps in proof of concept projects and the early to mid-stage development of start-up companies, but also in the growth phase of promising small and medium-sized enterprises (SMEs) (sometimes referred to as the second 'valley of death') in Europe (see Figure 3).[76]

It is important to note that helping SMEs get through the valley(s) of death (so that they can reach their full potential) will undoubtedly further leverage knowledge transfer (KT) and open innovation (OI) initiatives.[77] It is here that a 'funding ecosystem' plays a crucial role. For instance, empirical research shows that high potential growth SMEs thrive in well-developed venture capital ecosystems. What can be done to create a funding ecosystem and make it better and more accessible to SMEs? A straightforward answer is: The introduction of smart co-investment schemes in which European public funding is used to provide a leverage effect to investments from the private sector. We already observe an increasing interest in investments in European SMEs, which offers an excellent opportunity for the introduction of smart financing schemes.

Consider the corporate investors and family offices which have started to play an important role in the European venture capital industry. Also, cash rich investors from the US are willing to invest more in European start-up companies. Here it should be noted that private investors are also experimenting with collaborative funding models. Corporations that increasingly become anchor or general investors in venture capital funds and the micro-VCs (or super-angels) are important examples.

[75] Gompers and Lerner (2001): The Money of Invention, How Venture Capital Creates New Wealth, Harvard Business School Press.
[76] Dittmer, McCahery and Vermeulen (2013): The 'New' Venture Capital Cycle: The Emergence of Collaborative Funding Models and Platforms, Background Paper to the Report 'Boosting Innovation and Knowledge Transfer in the European Union' (Expert Group on Open Innovation and Knowledge Transfer), 2013.
[77] Pierrakis and Westlake (2009): Reshaping the UK Economy, The Role of Public Investment in Financing Growth, NESTA.

2) Develop smart incentives and instruments that foster collaborative investments. As mentioned, future policies need to focus on encouraging private-sector investors to support innovation and entrepreneurship in Europe.

Corporate investors, banks, pension funds, insurance companies, angel investors, family offices, foundations, (sovereign) wealth funds and alternative asset managers need to be convinced that investing in innovation and entrepreneurship makes sense from a financial and strategic perspective in the medium- to long-term, i.e. that it will deliver attractive, sustainable financial and/or strategic returns at an appropriate risk profile. This must be an overriding EU policy goal. Obviously, it is not being recommended (as it is impossible) that one policy framework be created, nor that national or regional policy schemes be standardized, but rather that more awareness is facilitated among policymakers to install smarter incentives and investment schemes that are attractive to private investors (including institutional investors, corporations, family and angel investors) and encourage decisions to make medium- to long-term investments in innovation and KT.

3) Stimulate online collaborative funding platforms.

Accessibility and speed are the key drivers behind the emergence and development of crowdfunding platforms. What is even more important is the emergence of online platforms that streamline the fundraising/investment process by matching high potential growth SMEs with investors and letting investors syndicate deals. In this regard, online platforms can stimulate the emergence of collaborative funding models (as mentioned under point 1) above) and encourage long-term investments (as mentioned under point 2 above).

4) More attention should be given to the 'liquidity gap' in Europe. Policymakers in Europe should not only focus on the recovery of the IPO market, but also on the establishment of a pre-IPO market.

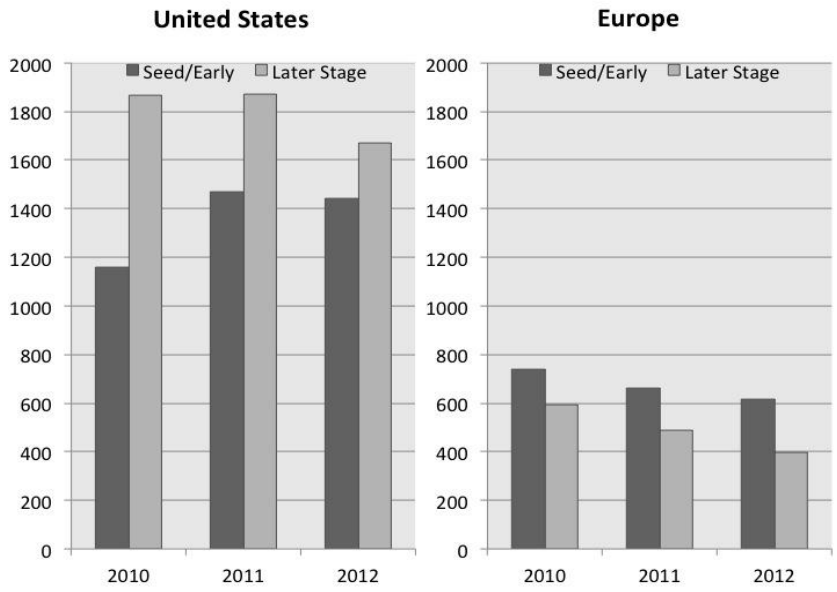
One important effect of the sluggish IPO (i.e. Initial Public Offerings) market is the focus on deregulation and the emergence of a new generation of securities markets. These deregulated markets are considered important to stimulate entrepreneurial activity and attract venture capital. However, the introduction of these new markets and accompanying deregulatory measures are often not successful. One of the reasons is that founders of (and investors in) emerging growth companies increasingly believe that it is in the best interest of the company to remain private as long as possible (mainly in order to avoid the cost of going and being public). This development has led to another gap to be bridged in the funding ecosystem: A liquidity gap. It is therefore not surprising that (1) companies build relationships with private equity firms (e.g., Twitter and Blackrock) to provide pre-IPO liquidity to employees, (2) NASDAQ enters into a joint venture with a private company shares platform and (3) the Securities and Exchange Board in India announced plans to allow SMEs to list their shares without an initial public offering (IPO) in October 2013.

Implications

The next sections of the report seek to provide some further insights and examples regarding the above mentioned recommendations. How can they help policymakers create a virtuous 'funding ecosystem' that (1) boosts venture capital fundraising (particularly from private investors), (2) addresses the later-stage funding gaps (see Figure 2) in Europe and makes venture capital (in the form of both debt and equity) available to early-stage and later-stage growth companies, and (3) encourages access to capital markets/stock exchanges in order to support the continued growth

of these companies, while at the same time improving liquidity and exit opportunities that enable venture capital funds to return capital to their investors.

Figure 2. Number of Venture Capital Deals in Europe and the United States



Source: Dow Jones VentureSource

The Action 4 sections highlights some of the challenges that European policymakers face in their efforts to improve the funding ecosystem in which KT and OI initiatives can thrive.

4.1 Introduce and encourage co-investment schemes

4.1.1 The role of finance in innovation ecosystems

In order to stimulate innovation, policymakers mainly focus on creating environments in which governments increasingly partner with large corporations, universities and knowledge and research institutions. These Triple Helix collaborations are, among other things, directed at the establishment of knowledge-intensive service clusters in which the structure and dynamics of interactions among the different actors drive the transfer of knowledge and provide other resources that increase the potential for innovation, growth and value creation. The Triple Helix approach has proven successful in that it has led to the formation of formal and informal networks of entrepreneurs and other economic actors, thereby increasing the availability of human capital and, more importantly, social capital[78].

Consider Brainport in the Netherlands. Brainport is a business location that is centered around Eindhoven in the Netherlands. It was established as a Triple Helix cluster. This initiative is considered very successful in terms of R&D spending, the production of patents and job creation. In 2011, companies invested €2.1 billion in

[78] Andersen, B. and Hutton, W. (2013): Raising the potential of the Triple Helix: Co-innovation to drive the world forward, Big Innovation Centre.

research and innovation, which resulted in the production of 42% of the total patents (approximately 1,100 patents) that were registered in the Netherlands. More than 60,000 industry jobs were created in the region. In terms of benchmarking the success of Brainport, the Triple Helix approach has arguably generated an ecosystem for innovation that is among the best in the world. In 2011, the Intelligent Community Forum named Eindhoven the 'Intelligent Community of the Year'. What is perhaps more important is that Forbes Magazine has ranked Eindhoven as the most inventive city in the world (with 22.6 patents for every 10,000 residents) in 2013.[79] To put this number in perspective, in the second-ranked San Diego, which is considered the world leader in the clean technology economy, this number is 8.9 patents for every 10,000 residents.

Despite the clear benefits of the Triple Helix model, there is a recognized concern that the Brainport hub may not realize its full potential.[80] Experts increasingly point to a missing fourth helix (and sometimes even fifth helix): the citizens or user communities (also called the 'civil society') and the 'natural environments of society'.[81] There is something to the quadruple or quintuple helix model. The unique collaboration among academia (research), industry and government focuses on the creation of an engaging and stimulating environment for OI and KT activities. However, the model does not include the drivers for knowledge production, innovation and growth. This is where the civil society (fourth helix) and natural environment (fifth helix) come into play. It is argued that these elements are necessary to provide incentives to the 'Triple Helix actors' to drive economic, social and environmental innovations to the market faster and more effectively.[82]

Still, there are problems with pushing the quadruple or quintuple helix models too far. Firstly, the extended innovation models prove difficult to implement, because they heavily rely on the actors' willingness and ability to think and act beyond their own functional boundaries. Secondly, the models arguably put too much emphasis on the interrelations of human capital and social capital in the process of innovation and collaboration, thereby ignoring the importance of financial capital and financially driven incentives. These financial incentives are necessary to accelerate growth and achieve market leadership. Venture capitalists and other risk capital providers can and must play a crucial role not only in the area of KT and OI, but also as 'social impact' investors that attempt to solve global economic, social and environmental problems, such as global warming and healthy ageing.[83] This brings us to the challenges that policymakers and governments face in building a venture capital ecosystem.

4.1.2 Joint public–private action in finance for innovation and entrepreneurship

As mentioned, the focus on funding and supporting SMEs is important to encourage KT and OI in the EU. It is therefore not surprising that SMEs will be encouraged to participate across Horizon 2020 programmes through a new dedicated SME instrument. This instrument aims to fill gaps in the financing and funding needs of early-stage companies as well as high-risk research projects. It is expected that a significant share of the total combined budgets of the 'Tackling Societal Challenges' Specific Programme and the 'Leadership in Enabling and Industrial Technologies'

[79] Pentland (2013): World's 15 Most Inventive Cities, Forbes Magazine, 9 July 2013.
[80] European Commission, DG Communications Networks, Content and Technology, Open Innovation 2013.
[81] Carayannis, Barth and Campbell (2012): The Quintuple Helix Innovation Model: Global Warming as a Challenge and Driver for Innovation, Journal of Innovation and Entrepreneurship.
[82] Curley and Salmelin (2013): Open Innovation 2.0: A New Paradigm, Conference Paper.
[83] Martin (2013): Status of the Social Impact Investing Market: A Primer, http://www.impacteconomy.com

objective will be devoted to SMEs. The new dedicated SME instrument will provide easy access with simple rules and procedures. It will be used across all societal challenges and the enabling and industrial technologies. The new instrument will encourage SMEs to put forward their most innovative ideas with an EU dimension. It will target highly innovative and research-driven SMEs which show a strong ambition to develop, grow and internationalize. Only SMEs will be able to apply for funding. The companies themselves can decide on how best to organize the project and with whom to collaborate, including subcontracting tasks if they lack in-house capabilities.

In order to make the SME instrument 'smart', private investors and public investors should jointly act as diligent lead financiers. Co-financing of SMEs by (public but preferably private) investors is a must. Serial entrepreneurs/fund managers could act as coaches to the SMEs. Indeed, what is probably most important here is that the funds operate as 'public–private partnerships' in which public funds are pooled with capital from private investors.

As noted above, these public–private initiatives are preferably managed by private sector fund managers who are not only in a better position to pick 'winners', but also ensure that the funds are connected to the existing venture capital industry. Venture capital fund managers and private investors are thus essential for the success of the government programmes. The government (both at an EU and a MS level) acts as a strategic investor. Its main objective and interest is the development of a robust funding ecosystem.

Here it should be recommended that government initiatives typically are organized as 'revolving programmes', which means that the government participates in the distribution of returns and interests from initial investments. Profit distribution arrangements require the fund managers to first return the invested capital to the government and the private investors. However, unlike most government support programmes, a new SME programme should be 'smarter' and designed to attract and incentivize private investors, such as cash rich (European and non-European) corporations and family offices. One way to do this is to split the profits (if and when realized) disproportionally: (1) the government receives 'just' a fixed (and relatively low) percentage; and (2) the remaining (and larger part of the) profits would then be distributed to the private investors.

But there is more. Corporate investment and corporate partnering with PROs' OI and KT programmes, as well as with innovative SMEs and venture investors, hold great potential for growth in the medium and long term. However, corporate investments need to be actively encouraged by the EC. Particular attention should be given to the interests of SMEs so that the corporate investment programmes seek a win–win partnership. A smart EU-wide Accompanying Measure to foster collaborative corporate venturing programmes could lead to a substantial increase of the capital available to investment in PRO programmes as well as innovative SMEs.

Consider here the High-Tech Gründerfonds in Germany. The German public–private partnership currently manages in excess of €550 million of committed capital in two funds (€272 in Fund I and €301.5 million in Fund II) and invests mainly in emerging growth SMEs in Germany. The German Federal Ministry of Economics and Technology as well as kfW Banking Group are the 'strategic' anchor investors in the two funds. The funds have been able to attract a significant number of corporate investors. Corporate investors in Fund I (which started to make investments in 2005) include BASF, Robert Bosch, Daimler, Siemens, Deutsche Telekom, and Carl Zeiss. Fund II, which began investing on 27 October 2011 and had a second close of €301.5 million in December 2012, was able to attract even more corporate interest

with commitments from ALTANA, BASF, B.Braun, Robert Bosch, CEWE Color, Daimler, Deutsche Post DHL, Deutsche Telekom, Evonik, LANXESS, m+mv, Metrogroup, Qiagen, RWE Innogy, SAP, Tengelmann, and Carl Zeiss. The involvement of these corporations is arguably important to give technical and market support to the entrepreneurial businesses. Interestingly, the High-Tech Gründerfonds is one of Europe's most active venture capital funds.

4.2 Create smart incentives and instruments that foster investments in SMEs

Most EU Member States (MS) and their regions have very active policies and incentives to encourage more and better private investment, including venture capital, angel investors and technology transfer and lately also crowdfunding. This is good, but the problem is that they are not aligned with each other and all too often not aligned with the needs of private investors. Also, policies and incentives vary from country to country, even from region to region and sometimes from one government to the next. The conditions created by this patchwork of uncoordinated incentives and policies have resulted in a fragmented, opaque and unstable framework which is perceived as unattractive for investors looking at investing for the long term.

Therefore, it is recommended to support national/regional policymakers to develop smarter incentives for private investors in national or regional initiatives and investment schemes. Such smart incentives for public financial instruments or investment schemes are generally characterized by a number of principles which are set out below:

- *Provide sufficient budget commitment* - Allocate a sufficient budget and commit for a sufficient time period to ensure acceptance.
- *Follow an intermediary or decentralized scheme with investment decisions made by specialized intermediaries*).
- *Implement co-investment funding* alongside lead co-investors who are able to pick winners and have 'skin in the game'.
- *Implement simple qualification criteria* focussing on management/ entrepreneurial skills as well as innovation excellence and growth potential by market participants will facilitate a demand-driven approach.
- *Encourage specialized intermediaries to develop cross-border investment and support activities* with knowledge, experience and cross-regional networks in specific sectors, technologies or societal needs across several MS. This is preferred in order to achieve critical mass and financial sustainability.
- Work with the cohesion/structural funds to deploy budgets available at the regional level. Moreover, EC/EIB and national/regional funding should ideally be pooled with the aim of having additional private capital available across regions.

Consider the introduction of a technology transfer financing scheme. In order for this scheme to be labelled as 'smart', the following recommendations could be considered. Firstly (and obviously), sufficient funds should be allocated to the scheme to ensure EU-wide acceptance and impact. For instance, in order to bridge the funding gap, a budget of at least €300 million should be allocated to the fund (with €100 million for a pilot scheme in the first two years (2014–2015)). Secondly, it is recommended that investment decisions be made by private actors (even if the scheme should be managed by a specialized EU-wide entrusted entity such as the EIB group). Thirdly, in order to achieve critical mass, specialized intermediaries from

different MS should work together to develop cross-border investments and support activities in specific sectors across MS. This decentralized and cross-border approach will also provide an opportunity to deal with the market fragmentation in the EU. Fourthly, these intermediaries should also be able to access already existing schemes, such as the venture capital schemes and RSI schemes (partially guaranteed loans) (see also Table 4.1).

4.3 Stimulate online collaborative funding platforms

Crowdfunding has evolved from a way to finance creative projects, such as books, films and games, into a new type of entrepreneurial finance which has the potential to significantly change the venture capital ecosystem. It makes it possible for early-stage start-up companies to raise 'venture capital' from a large group of individuals, sidestepping the traditional fundraising process that includes lengthy due diligence periods and tough negotiations over the pre-money valuation and contractual terms[84]. Clearly, the 'crowd' investors, who invest relatively small amounts through internet-based platforms – the crowdfunding websites – and/or through social networks – such as Facebook, Twitter and LinkedIn, needless contractual protection (the small investment amounts do not justify close involvement in the growth process of the start-up companies).

The emergence of new sources of financing can raise alarms among regulators and market participants. Particularly, the uncertainty or 'regulatory fog' can reduce the market's confidence in the services offered, with negative consequences for the venture capital ecosystem. We can already see that a wide range of regulatory options, from industry self-regulation to governmental intervention, is being considered in the area of crowdfunding[85]. Clearly, the following questions need to be addressed: is there a credible role for best practice guidelines in improving the venture capital ecosystem? Does each new initiative (equity-based crowdfunding) require the introduction of governance guidelines specific to the initiative and its business model? What institution or group is best placed to develop the right set of principles? Do industry-based associations ensure the creation of optimal guidelines?

Answers to most of these questions can be found in practice which already shows the emergence of distinctive guidelines for crowdfunding platforms. An example of a self-regulatory initiative can be found in the UK where a self-regulatory body has been established under the UK Crowdfunding Association (UKCFA). These initiatives have also appeared at the European level. Consider the European Crowdfunding Network (ECN). The goal of the self-regulatory bodies is clear: To provide transparency and ensure that members operate according to minimum standards without sacrificing the accessibility and speed that can make crowdfunding a real success. The question remains whether the venture capital ecosystem can fully rely on self-regulation? It is interesting to see that discussions about crowdfunding standards have mainly emerged in countries where these platforms have a significant presence.

It should be noted, however, that most commentators claim that the impact of crowdfunding on the innovation ecosystem is exaggerated. Still, we argue that equity-based crowdfunding or similar online initiatives have the potential to become a serious alternative to traditional start-up funding if angel investors, family offices, corporate venture capital funds and venture capitalists also start working off the

[84] Sameen and Quested (2013): Disrupted Innovation: Financing small innovative firms in the UK, Big Innovation Centre.
[85] O'Brien (2012): The future of crowd-sourced funding in the UK, Big Innovation Centre.

crowdfunding platforms (see also Annex 2).[86] Consider AngelList, an online platform in the US, that streamlines the fundraising process by matching start-ups with investors. The platform, which started in January 2010, is increasingly used by start-up companies to get easy and speedy access to a 'social network' of qualifying (with over US$ 1 million in personal wealth) and sophisticated angel investors. Besides the fact that AngelList offers a platform for start-up companies to quickly connect and negotiate seed and early stage financing, it also provides transparency to the ecosystem by making it possible for investors to 'follow' companies and track their growth and development.

The soaring popularity of AngelList among start-up companies has gradually drawn venture capital firms, corporate venture capital units and other institutional investors (that are eager to find early stage winners) to its network.[87] According to data collected by AngelList, 3,325 start-up companies were able to attract seed financing – ranging from US$ 50,000 to US$ 1 million – in the period 2010–2012 (in reality these numbers are probably much higher since not all deals are reported). Moreover, companies that are 'listed' on AngelList have also been successful in attracting follow-on rounds of finance: They have raised 230 series A rounds of financing, 49 series B, 5 series C and 60 companies were acquired. It is only to be expected that this number will rise significantly as AngelList has recently introduced a 'crowdfunding type' service.

Interestingly, we see similar developments in Europe. Firstly, equity-based crowdfunding grows in popularity. Secondly, Europe has had its own version of AngelList since November 2012. Dealroom (previously known as NOAH Insider) markets itself as a Pan-European tech-focused network that operates as a matchmaker. On 31 August 2013, 4,264 technology businesses and 407 investors were registered. Clearly, these developments cannot be ignored, but warrant further research/support at an EU level.

4.4 Give attention to the liquidity gap

4.4.1 Gaps in the funding ecosystem

In addition to the recommendations listed above, it is acknowledged that new funding schemes are currently being implemented or considered by European policymakers. Since risk-capital instruments (such as loan finance, guarantees and equity funding) that were introduced over the last decade have generally failed to live up to the hopes and expectations of policymakers and governments, given its risk profile, the new initiatives should be welcomed.[88]

Table 4.1 gives an overview of some of the new instruments in which the European Investment Fund (EIF) is involved. There are, however, more examples. Consider the design and implementation of an EU-wide proof of concept (PoC) scheme which is a good example of capital efficiency since – with relatively low amounts of funding – it will bring applied research closer to the attention of innovative companies, particularly SMEs. One critical observation should be made here. The new funding initiatives have to be 'smart' in the sense that their main purpose is to unleash private capital.

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[86] Colao (2012): Fred Wilson and the Death of Venture Capital, Forbes, 8 May 2012.
[87] Hindman (2011): Naval Ravikant, AngelList: A Social Network That Connects Startups With Investors, The Huffington Post, 20 September 2011.
[88] Mazzucato (2013): The Entrepreneurial State, Debunking Public vs. Private Sector Myths, Anthem Press. See also Mulcahy (2013): Myths about Venture Capitalists, Harvard Business Review, May 2013.

Figure 3: Gaps in the funding ecosystem

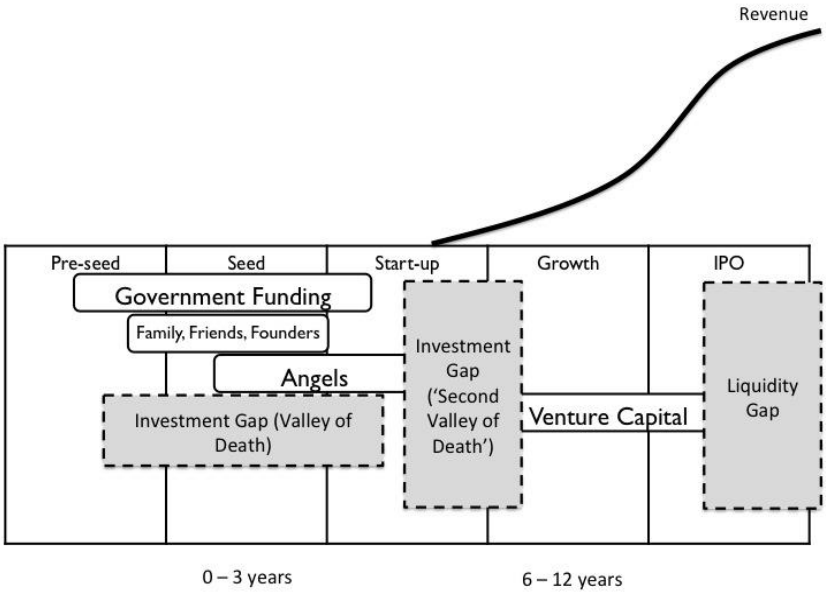


Table 4.1: An overview of new EIF & EIB instruments

European Angels Fund
Corporate Innovation Platform (CorIP)
Risk Sharing Instrument (RSI) for Innovative SMEs and Small Mid-Caps
Growth Finance Initiative (GFI)
Mid-Cap Initiative (MCI)

Source: EIB and EIF Financing Instruments for Innovation

4.4.2 The growing need to develop platforms or encourage other arrangements that can facilitate pre-IPO trading in the shares of non-listed venture capital-backed firms

This gap is tied to the significant increase in the time that elapses between the inception of the company, the first involvement of risk capital providers and their ultimate exit. This gap could discourage early-stage investors from making the necessary investments in start-ups. What is perhaps more important is that the 'liquidity gap' negatively affects the supply of entrepreneurs' and start-up companies' ability to attract and retain talented employees (who often have accepted a lower salary and additional payments in restricted shares and options). In order to ensure a steady flow of top talent and capital support, new liquidity options would thus seem to be required.[89] Indeed, it is widely acknowledged that investors place a high value on the liquidity that can be obtained when investing in a portfolio company. This holds true for the many other parties that hold stakes in high growth companies, such as founders and key employees. In light of the extended exit horizon, the sudden paucity of venture capital-backed IPOs (i.e. Initial Public Offerings) has ushered in a new era of venture capital financing. In this

[89] Mendoza and Vermeulen (2010): The 'New' Venture Capital Cycle: The Importance of Private Equity Market Liquidity, http://ssrn.com/abstract=1829835

altered world, trade sales have become important and often even preferable exit options for venture capitalists. Even though we can see a revival in the global IPO market starting in 2010, it seems hard to believe that going public will recover its traditional allure in Europe. It could be argued that by focusing on a trade sale exit, portfolio companies will be ready for an exit scenario earlier than in the event of an IPO, which currently takes close to seven years in the US. However, even though venture capitalists have been able to design new preferable exit strategies, the decrease in exit options still leads to liquidity gaps in the traditional venture capital model.

In order to bridge the liquidity gap, there is a growing need to develop platforms or encourage other arrangements that can facilitate pre-IPO trading in the shares of non-listed venture capital-backed firms. It could be argued that these trading platforms/arrangements will become a critical component of the venture capital ecosystem (as they can bridge the liquidity gap in the ecosystem and reduce the fragmentation of the venture capital industry). Consider, in this respect, the former Facebook employee who approached SecondMarket – a US company that offered an online marketplace for classes of stock in public companies and assets of defunct companies that could not be sold on the public market – to assist him in selling his stock options. This is indicative of the lack of liquidity options in 2008.

Clearly, the post-IPO fall in Facebook shares has dampened the excitement for the private start-up stock platforms among private investors in the US. However, governments and stock exchanges in Europe should not ignore the development of these platforms. For instance, stock exchanges that integrate platforms for secondary trading in shares of non-listed companies into their existing venues may obtain a benefit in the increasingly fierce competition to dominate the market for IPOs of high-growth firms. In fact, a segmented venue of this nature would allow stock exchanges to create bonds with these firms early on in their life cycles.

This may make it more likely for firms with high-growth potential to undergo their IPOs in the same venue that supplied their investors with pre-IPO liquidity, rather than in competing exchanges. The joint venture between NASDAQ, a stock market in the US (which has been a popular venue for high-growth companies to list their shares) and private company trading platform SharesPost Inc. is an example of the trend towards segmented stock markets. Another recent example can be found in India. The Securities and Exchange Board of India allows listings of SMEs without an IPO, a move expected to bridge the liquidity gap. The companies will be listed on a platform which is open only to institutional (professional) investors (in order to avoid the introduction of stringent regulations).

Further reading for Action 4

- Appendix 2 to this report: Dittmer, McCahery and Vermeulen (2013): The 'New' Venture Capital Cycle and the Role of Governments: The Emergence of Collaborative Funding Models and Platforms, Background Paper to the Report 'Boosting Innovation and Knowledge Transfer in the European Union' (Expert Group on Open Innovation and Knowledge Transfer).
- Lerner (2012): The Architecture of Innovation, The Economics of Creative Organizations, Harvard Business Review Press.
- Mazzucato (2013): The Entrepreneurial State, Debunking Public vs. Private Sector Myths, Anthem Press.
- Lerner (2009): Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed – and What to Do About It (Kauffman Foundation Series on Innovation and Entrepreneurship).

- Sameen and Quested (2013): Disrupted Innovation: Financing small innovative firms in the UK, Big Innovation Centre.
- Senor and Singer (2009): Start-up Nation: The Story of Israel's Economic Miracle.

Conclusion – Make Europe more enterprising

The only way forward – innovate!

The launch of an EU Expert Group on Open Innovation (OI) and Knowledge Transfer (KT) could hardly have been more timely. As identified in the first section *'Knowledge transfer and open Innovation: Key elements in the policy agenda of the European Commission'* we face two existential challenges: (1) how to create sustainable growth given the vast overhang of public and private debt and (2) how to do this given the transformational impact of disruptive technologies (e.g. the impact of the newly emerging Key Enabling Technologies) on traditional models for business and public sector organizations (e.g. energy and health, banks), universities and public research organizations (PROs). Asia and North America face similar challenges.

Our response has to be smart, radical and above all innovative, imposing a new urgency on businesses, universities, PROs, financial institutions, intellectual property providers, and government to work together in a clear-eyed and decisive way. The only way forward is to innovate our way out of this crisis.

This Expert Group has integrated a consistent set of contributions on the challenges, priorities and policy implications for boosting OI and KT to bring growth, innovation opportunities and prosperity back into the EU. We thereby address the key question that lie at the heart:

How to build an enterprising Union in which our businesses, universities, public research organizations, financial institutions, intellectual property providers, and member states co-innovate to solve the European challenges?

For the EU to continuously raise and reach its growth potential, it has to be thoroughly enterprising. The way forward indicates that an enterprising Union must turn the global challenges posed by financial crises, climate change, sustainability, green growth, health and the ageing population, the digital economy and other areas facing disruptive forces into growth opportunities.

Key highlights of the recommendations explained in Actions 1 to 4 are listed below. We believe that they will especially enable the Innovation Union, including the European Research Area, by stimulating a genuine single market for knowledge and research, while reducing fragmentation and accelerating research, development and market deployment for innovations to tackle major societal challenges; while pooling expertise and resources; and while boosting the competitiveness of EU industries and firms.

If implemented well, these recommendations will enable the EU to get more value for the money invested in education, R&D and innovation, and to provide better access to finance, particularly for SMEs, and smarter and more ambitious governance and regulation of our knowledge domains, universities, PROs and intellectual property (IP) system.

Highlights of the priorities and policy recommendations to boost OI and KT in the EU

The details listed below are explained in full in the priorities and policy recommendations in the chapters named Actions 1 to 4. They are hereafter qualified, taking into account the extent to which they further articulate an existing ambition, adjust existing ambitions or create new ambitions.

Firstly, the foundation of the 'Innovation Union' must rest on a critical mass of public and private investments in R&D. An enterprising Union must also offer better modes of coordination across the economic actors involved in order to enhance productivity, output and innovation rates. This implies challenges to the member states (MS), businesses, universities, PROs, financial institutions, and the IP system:

1) STICK TO EXISTING AMBITION: Stick to and reach the 3% norm regarding public and private R&D investment as a percentage of EU GDP to improve EU long-term dynamic innovation and economic competitiveness.

2) NEW AMBITION: Implement a European-wide Open Innovation 2.0 policy where relevant stakeholders in Europe from academia, business, government, and society are collaborating along and across industry and sector specific value chains to co-create solutions for the grand socio-economic challenges (e.g. sustainability and health) and for business challenges (e.g. new business models). This co-creation process should join efforts at the EU, member state and regional level.

3) ADJUST EXISTING AMBITIONS: Through the implementation of a harmonized European high quality, informed and influential IP policy, the EU can become an even more attractive place for creators and users of IP, including public and private research organizations as well as businesses.

4) ADJUST EXISTING AMBITIONS: Develop intelligence and monitoring systems on EU and MS level capturing how well our organizations, institutions and regions attune to the OI ecosystem needs, and translate their findings into performance metrics or diagnostic tools of key performance indicators.

Secondly, an enterprising Union must also build and grow innovative markets, places and networks. There are challenges to competiveness, to industrial organization, to demand, to business models and to social entrepreneurship:

5) NEW AMBITION: It should be a core aim of the EC to stimulate firm growth by reducing European market fragmentation, while fostering faster market access and development through OI and KT practices. To this end, the EC is encouraged to reconsider its competition policy frameworks and allow for stimulating the development and growth (or scaling-up) of prospective, infant industries while at the same time maintaining a dynamic competitive single market environment.

6) MAKE EXISTING INITIATIVES TANGIBLE AND CONCRETE: Now that the EC has embraced smart specialization as a policy concept, it should develop a tangible and real 'smart specialization' strategy framework in order to operationalize and to capture pan-European, cross-border specialization and collaboration opportunities.

7) NEW AMBITION: Actively stimulate and support user-driven innovation by translating and connecting major societal challenges into market opportunities

using a shared value innovation model, empowering our user-citizens and embracing OI business models through stimulating access to novel key enabling technologies (KETs) in such areas as health, energy, big data, etc.

Thirdly, an enterprising Union must enhance the role of universities as co-creators and as interactive partners in innovation systems. There are challenges to universities' co-creation capabilities, to the design of incentives for academics when working with users and to the absorptive capacity of academic knowledge within firms. An enterprising Union must therefore enhance the skills for OI across the industry–science spectrum. This involves challenges to the management and leadership skills within the KT profession as well as the support of 'good' governance practices of the European universities:

8) NEW AMBITION: MS and the EC should stimulate universities and public research organizations to develop and adopt a Charter and Code in their Entrepreneurial and Innovation Policy. Such a policy code can build upon the same approach as the 'HR Strategy for Researchers' (HRS4R). The articulation and adoption of such a code should be recognized by the EC as a quality label, for instance in funding programmes. A Policy Charter and Code in universities and PROs' entrepreneurial and innovation goals is not about implementing more rules, but about ensuring that they are encouraged to actively embrace more entrepreneurial objectives. This approach should lead to more strategic flexibility at the national and regional level, accepting that 'regional universities' and the so-called 'elite universities' and PROs become more autonomous and rewarded each for their unique and targeted contributions to the innovation ecosystem.

9) NEW AMBITION: The EC needs to put measures in place to ensure that 'OI and KT' as a 'profession' is recognized in universities and public research organizations, in order to update the skills to support OI. The knowledge transfer offices (KTOs) should play a central role in this process of professional development and maturation.

10) ADJUST EXISTING AMBITIONS: EU universities and public research organizations need to adopt appropriate incentive schemes for scientists and KTO staff to engage in co-creation processes with the users of the knowledge they generate. These should be incorporated into performance indicators for career progression and anchored on University-PRO level. The incentive schemes also involve incentives for incubation and spin-offs, as well as incentives to build appropriate infrastructures that ensure the co-creation between research institutions and the users of their knowledge. This includes the development of physical infrastructures (e.g. joint research labs) and other institutional infrastructures.

Fourthly, an enterprising Union must build more innovation-friendly financial instruments and institutions. In particular, it must create a smart funding ecosystem in which OI and KT can thrive:

11) NEW AMBITION: Based upon private–public initiatives, the EC must introduce and encourage the establishment of co-investment schemes to address the financing and funding gaps in the innovation ecosystem in Europe.

12) NEW AMBITION: Develop smart incentives and instruments that foster collaborative investments. Corporate investors, banks, pension funds, insurance companies, angel investors, family offices, foundations, (sovereign) wealth funds and alternative asset managers need to be convinced that investing in

innovation and entrepreneurship makes sense from a financial and strategic perspective in the medium- to long-term, i.e. that it will deliver attractive, sustainable financial and/or strategic returns at an appropriate risk profile.

13) NEW AMBITION: The EC must stimulate the emergence and development of online collaborative funding platforms, including crowdfunding, where capital accessibility and speed are the key drivers.

14) ATTENTION NEEDED: More attention should be given to the 'liquidity gap' in Europe. Policymakers in Europe should not only focus on the recovery of the IPO market, but also on the establishment of a pre-IPO market for equity- and debt-financing. One important effect of the sluggish IPO market is the focus on deregulation and the emergence of a new generation of securities markets.

A new open innovation policy paradigm – As genuine co-creators, EU stakeholders must be more open, more networked, more collaborative, and more absorptive of external ideas.

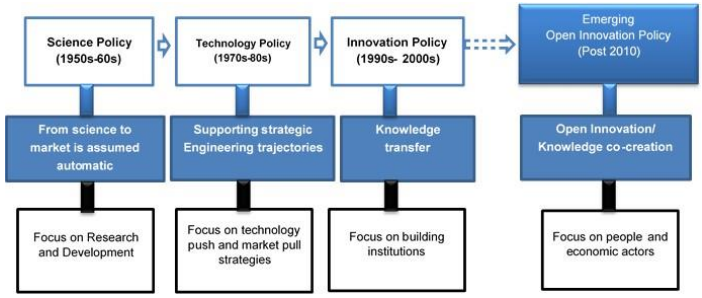
For the EU to succeed in the twenty first century, its policies have to be more daring and more effective in bringing innovations into the markets to solve the present economic and societal challenges. This is exactly what the Innovation Union initiative seeks to accomplish.

As argued from the outset of this report, policy must focus on the role played by the actors or stakeholders to understand the interplay between their organizations, emphasising an OI mindset as the key to unleashing growth. How organizations – or people within them to be precise – absorb each other's ideas, needs and propositions and then co-shape actions is key to the co-creation process. It is evident that this engenders a paradigm shift in policy (see below Figure 4).

Government policy has moved from the linear model of science policy in the 1950s–60s (i.e. a research-driven approach), which primarily focused on supporting the basic research base, to technology policy in the 1970s and 1980s with clear utilitarian – often engineering – perspectives (i.e. technology push and market pull approaches). More recently, innovation policy in the 1990s–2000s incorporated a KT mission through building institutions, e.g. technology transfer offices in universities and tighter IP enforcement. This focus clearly embraces the move towards a new OI landscape with a major focus on people and a more OI infrastructure.

This means that all the EU stakeholders – businesses, universities, PROs, financial institutions, citizens, EU institutions and MS' governments – need to be more open, more networked, more collaborative, and more absorptive of external ideas. The EC, the MS' governments, universities, PROs, local communities and financial institutions have no option but to sponsor such open, networked and collaborative innovation-led growth on which, in different ways, their own intellectual, operational and financial vitality will increasingly depend. That is why the 'Innovation Union' initiative needs to put the emphasis on stimulating OI and KT among all these stakeholders.

Figure 4. Paradigm shifts in science, technology and innovation policy.



Source: Andersen et al. (2013)[90] – Even though the major focus and activities in each historical epoch of science, technology and innovation policy were different in each era, it should be noted that these are not contrasting shifts from one policy to another, but rather building upon the achievements of one to the other.

The international evidence is unambiguous. Successful clusters of firms grow in self-consciously designed ecosystems in which there are 'thick' relationship networks between economic anchor institutions – from banks to universities – with both high absorptive capacity to the external and the new, and who actively seek to promote creative external relationships. This is the mechanism through which opportunities can be seized and the many risks associated with investment and innovation at the knowledge frontier mitigated. As we have established in the previous sections (Actions 1–4), some building blocks of what is needed are already in place: we do not start in a completely green field.

[90] Andersen, B., De Silva, L. R., and Levy C. (2013): 'Collaborate to innovate: How business can work with universities to generate knowledge and drive innovation', Big Innovation Centre report. Commissioned by the UK Intellectual Property Office.

Members and biographies

Birgitte Andersen (UK)

Director of the Big Innovation Centre

Professor of Business and Innovation at Lancaster University

As Director of the Big Innovation Centre, Birgitte Andersen is leading it as a London-based open innovation and investment hub, which includes a dozen global companies and world-class universities. She also leads the development of practical policy proposals to re-balance and grow the UK economy. Birgitte has an international reputation as an expert in business innovation and technology policy, as well as intellectual property rights. She is professor at Lancaster University.

Her work is regularly published in peer-reviewed journals, discussed in the media and highlighted in national and international government reports, including the UN World Development Report. Birgitte has directed several pan-EU projects on innovation, and advised economists and policy makers of national governments in and beyond Europe (including the OECD, UN and WIPO). She is used by the courts as expert defence witness.

Koenraad Debackere (BE)

Full professor Faculty of Economics and Business (FEB) , KU Leuven, Managing Director KU Leuven R&D

Koenraad's research has focused on the area of technology and innovation management and policy, the development of indicators for measuring the linkage between science and technology, the design and use of bibliometric indicators for science policy purposes, the design and development of effective knowledge transfer practices and policies, and the role of entrepreneurial universities in economic development. He is also actively engaged in knowledge transfer activities as managing director of KU Leuven Research & Development and Chairman of the Gemma Frisius Fonds (the seed fund) of KU Leuven.

Ivan Dvorak (CZ)

Co-founder, co-owner, and managing director of Innovation Leadership Agency (ILA)

Ivan Dvorak is the Managing Director and co-owner of consultancy company ILA, s.r.o and co-founder and former chair of the civic association Societas Rudolphina. He also served till 2013 as chair of AKTOP – Czech association of knowledge transfer organizations and professionals, and as

a member of the Board of ProTon Europe.

Prior to this, Ivan was the director of the Restructuring Division at the Commercial Bank (SG Group) and held positions at the Department of Venture Capital Financing and at the Department of Investment Projects and Restructuring in the Czechoslovak Trade Bank. Prior positions include Managing Director of Software602, Liaison Officer of WHO at the Ministry of Health of the Czech Republic, and Scientific Secretary at the Czech Research Institute for Psychiatry.

Ivan graduated in biophysics and mathematical modelling of complex systems and holds also a postgraduate degree in knowledge management and knowledge transfer. He authored more than 100 scientific papers, four books and many other publications in the field of mathematical modelling, innovation management, and knowledge and technology transfer.

Ellen Enkel (DE)

Professor of innovation management and director of the Dr Manfred Bischoff Institute of Innovation Management of EADS at the Zeppelin University in Friedrichshafen (Germany).

Ellen Enkel has written her dissertation on knowledge networks and is an international leading expert in open innovation, working in close collaboration with practice. She worked as researcher in knowledge networks at the University of St Gallen from 1999 and led the competence centre for open innovation at the University of St Gallen from 2003–2008. Her research focuses on topics such as open and cross-industry innovation, business models and innovation metrics. She publishes her work in leading international journals and is editor of the R&D Management Journal.

Peter Krüger (HU/DE)

Head of Bayer Working Group Nano-technology

Since June 2006 Dr Péter Krüger has headed the Bayer 'Working Group Nanotechnology' with responsibility for the global coordination of nanotechnology activities. In addition he is currently the Head of the Physics Department and of the Advocacy and Sustainability Group within the Business Unit Coatings, Adhesives and Specialties of Bayer MaterialScience AG. At the beginning of 2008 he was also appointed as the Head of the Germany based project cluster 'Innovation Alliance Carbon Nanotubes – Inno.CNT', funded partly by the government.

During his over 20 years with Bayer he has held several positions in R&D, starting as a research scientist for polymer physics within the former Central Research. Later

he took over the responsibility for the entire Polymer Physics Department at Bayer. Péter is an elected board member of the Research Society for Plastics 'Forschungsgesellschaft Kunststoffe' in Darmstadt. He currently heads the board of the Dechema ProcessNet Section 'Nanotechnology' and also heads the Dechema/VCI Working Group 'Responsible Production and Use of Nanomaterials'. Peter Krüger is currently also Co-Chair of the NANOfutures initiative.

Helena Malmqvist (SE)

Head of External Research Collaboration for ABB AB

Helena is coordinating the external research activities for ABB Sweden, i.e. all collaborations with universities and institutes and EU projects.

She is involved in collaborations with all major universities in Sweden and is active within several Swedish external funding agencies such as Vinnova and the Swedish Foundation for Strategic Research. Helena is on the board for The Knowledge Foundation and she also has an active part in Teknikföretagens RoD reference group.

Prior to this position, Helena held several management positions within ABB AB, Corporate Research and also worked in the steel and pulp and paper industry.

Andrius Plečkaitis (LT)

Innovation Manager, INFOBALT

Andrius Pleckaitis has more than 20 years of experience in IT services business development, strategic consulting and innovation. In 2010 he joined Infobalt, an association of IT businesses and academia in Lithuania.

Andrius has a vast experience in initiating and running innovation and capacity development projects for IT businesses, networking with partners and stakeholders, facilitating cluster initiatives, promoting creative technology use at schools and bringing students, researchers and companies together.

Alf Rehn (FI)

Chair of management and organization, Åbo Akademi University

Alf Rehn holds a chair of management and organization at Åbo Akademi University in Finland, and was previously a professor of innovation and entrepreneurship at the Royal Institute of Technology in Sweden. His research has dealt with subjects as varied as creativity, haute cuisine, project management, popular culture, philosophy, boredom,

innovation and luxury, and has despite this been published by prestigious publishers and in top international journals. He is a devoted fan of Ethel Merman and the divine Patsy Cline. For more, see: www.alfrehn.com

Sara Secall (ES)

Director –Technology Based Start-Ups, Fundacio Bosch i Gimpera

Since February 2013 Sara has been Investment Director at Inveready Asset Management, a Barcelona based Seed Venture Capital group focusing on IT and biotechnology. From 2006 to 2013 Sara was first consultant and then Director of Spin-outs for the University of Barcelona, where she helped launch and finance over 25 start-ups and negotiated numerous technology licences. Her prior experience includes working as an analyst for Chevron Technology Ventures, the Corporate Venture Capital Fund of the US's second largest integrated oil company, with US 210 Million under management, where she was involved in investing and successfully exiting energy-related technology start-ups.

Sara also worked for Dames and Moore (now URS Corp), the environmental consultancy firm, in the US, Canada and Latin America as well as the World Bank and the International Finance Corporation. She holds a BS in Chemistry from the University of Barcelona, a Master's in Environmental Science from Indiana University, and an MBA from the London Business School.

William Stevens (BE)

Founder & CEO of Europe Unlimited: organises 24 international venture and technology bodies partnering with over 1000 entrepreneurs, TTOs, and dealmakers.

William Stevens embarked on his professional career at the European Venture Capital Association (EVCA) where he was appointed Secretary General at the age of 25. He launched several ambitious initiatives, one that led to the creation of EASDAQ (which became Nasdaq Europe) while significantly growing revenues, profits and membership.

William founded Europe Unlimited in 1998 to be a much-needed European hub for fast-growing entrepreneurs raising their profile with venture capital investors. Today, Europe Unlimited has achieved that difficult mission and is a profitable company. Europe Unlimited organises 25 international venture and technology partnering forums with over 1,000 presenting entrepreneurs every year attracting a real network of venture capital investors, corporate partners, university tech transfer groups, innovation policy makers and deal makers.

Erik Vermeulen (NL)

Professor of Business and Financial Law, Tilburg University, the Netherlands

Erik Vermeulen is Professor of Business and Financial Law at Tilburg University and Tilburg Law and Economics Centre (TILEC). He is also Senior Counsel Corporate/Vice President at the Corporate Legal Department of Philips International B.V. in the Netherlands. Vermeulen is also a founding council member of the International Venture Club, a collaborative platform that aims to encourage open innovation activities throughout the European Union by facilitating the building of partnership-type relationships among venture capital and other risk capital investors, governments, corporations, universities and entrepreneurs.

Vermeulen has written extensively in the area of corporate and partnership law, corporate governance, joint ventures, venture capital and innovation. He has worked on national and international projects for organizations, such as the OECD, the Dutch Development Finance Institution and local governments in the Netherlands, concerning financial and venture capital markets, corporate law, and corporate governance of listed and non-listed companies.

Dorien Wellen (NL)

Director K/TTO, Radboud University Nijmegen, the Netherlands

Dorien Wellen is coordinator of the KTTO at Radboud University Nijmegen, where she coordinates all knowledge and technology transfer activities, and she advises the board of the University on public–private partnerships, business contracts, intellectual property, spin-off development, incubation facilities, risk management and other business creation.

Dorien is active as representative on knowledge transfer for the Dutch Federation of Medical Centre's (NFU) and Dutch Association of Universities (VSNU). She is a member of the Technopartner advisory board for the Dutch government and member of business boards such as Biocentre, GO!, ICA and NBIC. She chairs the valorisation board of a national brain-computer interface consortium called BrainGain with SMEs and Philips and Siemens as consortium partners. She is also co-founder and chair of the Dutch TTP-Association, for technology transfer personnel. Dorien Wellen has participated in expert panels and working groups of the European Commission such as ITTE, Crest and ERAC, and worked – commissioned by the DG Research and Innovation – on the formation of indicators and methods for valorization.

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A high level independent Expert Group on Knowledge Transfer and Open Innovation was set up at the end of 2012 to assess if there is a case for more policy action on Open Innovation and Knowledge Transfer. In order to meet the objective, the Expert Group considered whether Europe performs below its potential in creating value out of knowledge and ideas, and what can be done to foster knowledge sharing and utilisation.

Europe faces two existential challenges: (1) how to create sustainable growth given the vast overhang of public and private debt and (2) how to do this given the transformational impact of disruptive technologies on traditional models for business and public sector organizations, banks, universities and public research organizations. The response to the challenges Europe is facing has to be smart, radical and above all, innovative. For the EU to continuously raise and reach its growth potential, it has to be innovative and thoroughly enterprising.

This report delivers a new, advanced Open Innovation paradigm: building and funding ecosystems for co-creation. It provides a coherent whole of policy recommendations for Open Innovation and Knowledge Transfer, across four priority areas where this Expert Group recognizes that actions must be taken. The necessary building blocks for an ecosystem for co-creation are: 1) to put Open Innovation and Knowledge transfer in the spotlight; 2) to embrace innovative businesses, grow innovative markets, innovation hubs and networks; 3) to make Universities and PROs more entrepreneurial and 4) the smart integration of capital into the ecosystem.

In order to bring Open Innovation and Knowledge Transfer to the next level it is essential to build an ecosystem in which Open Innovation and Knowledge Transfer, or co-creation, can thrive. An ecosystem for co-creation in turn will breed trust, visibility and transparency. Co-creation ecosystems will thereby act as magnets for innovation and economic development.

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