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D3.2 Policy Brief

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Abstract

Globalisation, digitalisation and an increasingly networked production process are creating fundamental change in the industrial innovation landscape. To retain competitive advantage and access to the skills and resources required to innovate, companies need to adopt new tools such as open innovation, ecosystem management, public-private partnerships, demand-led innovation and tools to map their external environment. This brief updates policymakers with these trends and raises key policy issues that need to be addressed in this new environment.

The briefing is primarily based on the qualitative interviews (Deliverable 2.4) but has been supplemented with some analysis from the web survey (Deliverable 3.4)

Contents

1. Introduction	4
2. Overview of the Policy Brief	4
3. Annexes	5

1. Introduction

The objective of Work Package 3 was to apply a bottom-up approach to consider the implications for innovation policy arising from the understanding of the innovation practices of companies. The aim is to take the current state of innovation practices as a starting point and assess these practices against national and European innovation policy goals (see Deliverable 3.1).

Based on the findings from the qualitative interviews (Deliverable 2.4), we conducted a gap analysis to understand how well current innovation policies are supporting the changing innovation practices of companies. This analysis is based on the innovation ecosystems concept and application that has formed a central plank in our analysis.

2. Objective of the Policy Brief

The policy brief is designed to provide policy-makers with an overview of the findings of the IIT study and their implications for future innovation policy design and frameworks.

It is designed to be relatively brief in order to deliver a clear message and to trigger further engagement and discussion between policy makers and the research partners as a legacy of the project.

The full policy brief can be found in Appendix 1. It will be hosted on the IIT project blog and website, and partner websites.

3. Annexes

Annex 1: Policy Brief (overleaf)

Policy Brief: Responding to Transitions in Industrial Innovation

Globalisation, digitalisation and an increasingly networked production process are creating fundamental change in the industrial innovation landscape. To retain competitive advantage and access to the skills and resources required to innovate, companies need to adopt new tools such as open innovation, ecosystem management, public-private partnerships, demand-led innovation and tools to map their external environment. This brief updates policymakers with these trends and raises key policy issues that need to be addressed in this new environment.

The Industrial Innovation in Transition (IIT) research project examined the innovation practices and strategies of companies in 11 European countries and five industrial sectors to understand the extent that the innovation practices of industrial firms have changed to reflect this new landscape – in particular adopting the view of a business/innovation ecosystem approach - and the implications for innovation policy¹.

Underpinning many of the other changes is the **importance of widespread external collaboration** during the course of innovation projects. We found that customers are the most frequent collaboration partner, along with public research bodies and suppliers. Regulators participate in more than 50% of innovation ecosystems of the bio-pharmaceutical and clean technology companies interviewed.

¹ Project details can be found in Appendix 1.

Knowledge exchange is also increasingly systemic involving both weakly-tied and close ecosystem partners. Almost every second company regularly relies on external partners for essential innovation-related knowledge. However, 38.6% of companies interviewed have problems accessing knowledge needed for innovation.

Open Innovation is being widely applied to solve technical problems relating to the development production or distribution of products and services (30.6%); expand the market prospects of innovations by engaging with customers or end users (23.8%), or for other reasons (24.4%). Bilateral open innovation, e.g. collaboration with universities or customers is well-established practice, often secured by non-disclosure agreements. More open forms of inter-organisational innovation are less common and may not be aligned with the business models of many companies.

Beyond managing current challenges we found that companies sometimes **collaborate to collectively map their future innovation environment**. Mapping technological developments is the most important element of future foresight for most companies. The agro-food sector focuses most frequently on customer behaviour whereas companies in clean technology and bio-pharmaceutical industries focus more on regulatory and political developments.

This increase in external collaboration and distributed innovation is part of a **broader shift towards an innovation ecosystems perspective among companies**. 47% of all the companies interviewed (all sectors and sizes) stressed the **innovation ecosystem was highly important for developing new products and services** and realising their business strategies. Companies are actively developing and applying strategies to influence and govern their innovation ecosystems, which include participating in the development of regulations, developing alliances and improving their quality and technology offer to retain their system position.

These practices **present new challenges to traditional innovation policy instruments**. This document discusses these challenges in more detail and presents a set of recommendations for the future of innovation policy.

1 The shift to an innovation ecosystems perspective

“We see ourselves in the centre of an eco-system. That is what we do. We integrate technologies and capabilities together ... the R&D manager’s job is to create that eco-system which best feeds our central hub.”

Innovation Ecosystems can be defined as the sets of actors, relations, and rules which are needed to conceive, create, sell, and embed innovations, and the flows of knowledge, finance, people and services between them.

They typically comprise *“a network of inter-connected organisations, connected to a focal firm or a platform, that incorporates both production and use-side participants, and creates and appropriates value through innovation”* (Autio and Thomas, 2014: 205²).

Since the 1990s innovation policy thinking design has been dominated by the ‘systems of innovation’ framework, which highlights the importance of institutions at national, regional and sectoral level and identified coordination failures that could be the target of public policy. The growth of open innovation and partnership or distributed innovation drew attention to the interdependence of firms with their external actors for innovation, and the importance of the wider environment that innovation takes place in: shifting the focus to an innovation ecosystem framework.

² Autio, E., Thomas, L.D.W. (2014) Innovation Ecosystems: Implications for Innovation Management, **The Oxford Handbook of Innovation Management**. Dodgson, M., Gann D.M. and Phillips, N. (Eds) Oxford: Oxford University Press. pp. 204-228.

This biological analogy puts the focus on interdependencies and flows between actors such as large and small firms, universities, funding bodies and support agencies, standards institutions and research and technology organisations. The key flows are knowledge, mobility of people, financial support and services. Ecosystem thinking also leads to questions about the balance of actors and institutions present in a particular territory or industry, and their interdependency and evolution over time. As with the systems approach an ecosystem can be conceived at multiple levels and the term is also used to describe networks of large companies, particularly in the ICT sector. Figure 1 shows a stylized depiction of the UK innovation ecosystem.

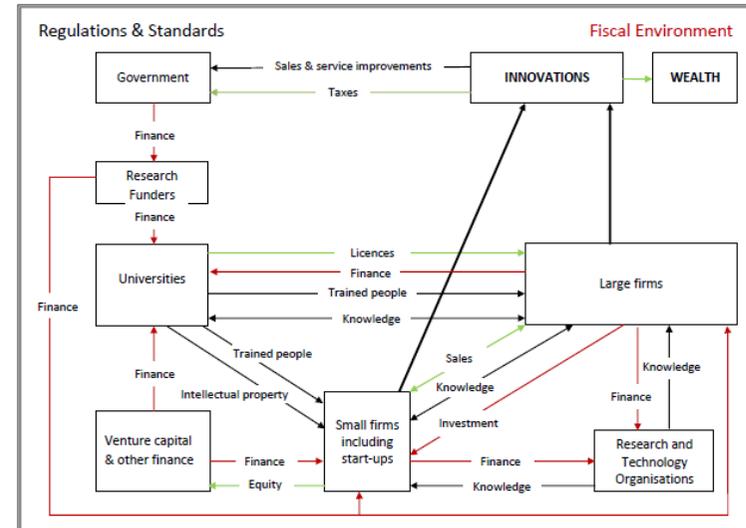


Figure 1. The Innovation Ecosystem.³

³ Source: L.Georghiou cited in House of Commons Select Committee on Science & Technology Report Bridging the valley of death: improving the commercialisation of Research, March 2013.

Companies engage with their innovation ecosystem to access knowledge, shape the innovation activity of other actors and positioning themselves to create and capture value. Companies' inter-linkages with ecosystem stakeholders are often well established and well organized. For example, many innovative Dutch and German companies were strongly inter-linked with their external environment, profiting from access to knowledge, skills and finance and actively shaping its future trajectory.

However, despite the resonance of innovation ecosystem approach, it was remarkable to find that internal innovation processes were still organised in largely linear ways, following paths closely aligned with immediate customer needs:

“[Innovation] is based on unsolved problems of customers that we observe. Either something very concrete related to a customer or something that we discovered on the market as un-solved problem”.

This is driven by the “speed to market logic” that pushes daily innovation activity, or the need to respond short term customer and market requirements. Subsequently, time for creative thinking and failure is rare. Managing innovation using an ecosystems approach helps manage the challenges of a constantly changing, dynamic socio-technical environment and the need to overcome uncertainties about future developments. However, the challenge is to integrate systemic dynamics, broad views and insights and daily management and strategy.

2 Questions for policy-makers

We propose six key questions for policy-makers

Key Questions

1. Is the population of actors balanced?
2. Are intermediary institutions sufficient to support innovative firms?
3. Is there sufficient demand for innovation in the system?
4. Is there sufficient mobility of people towards and between innovative firms?
5. Is the scale and balance of finance for innovation appropriate and are there gaps in finance for innovation and the institutions that provide it?
6. Are knowledge flows working sufficiently well?

i. Is the population of actors balanced?

Policy-makers should consider whether there are sufficient actors with capacity to act as system integrators such as public institutions, innovation agencies, funding vehicles or large multiproduct, multi-technology firms, and how functional innovation ecosystems are across different sectors.

Following this are the questions of *entry and exit* from different ecosystems – what are the patterns of birth, growth, acquisition, or death of firms involved, are there mechanisms for effective selection of innovation opportunities? Concerns about how easy it is to start a company should be balanced against over-support of non-viable start-ups when people and resources would be better re-invested in new prospects.

ii. Are intermediary institutions sufficient to support innovative firms?

“Intermediary services ... help us develop supply chains ... find partners”

Is the scale and reach of research and technology organisations (e.g. Catapults), standards bodies, measurement and testing services, consultancy support and services from innovation and business support agencies sufficient? Does the portfolio match the needs of future industries?

Although large numbers of companies we interviewed indicated they did not face barriers to **establishing the partnerships required for innovation**, others reported increased barriers to partnerships at international levels – particularly in the bio pharmaceutical and agri-food sectors, and companies categorized as ‘Market Followers’. Establishing partnerships is more problematic in price only markets (34%) than non-price only markets (20%).

iii. Is there sufficient demand for innovation in the system?

“I think at the moment it’s customers and leading edge people [leading the innovation ecosystem]”

Customers were the main source of innovation inspiration for most companies. However, customer preferences may crowd out innovation through lock-in to existing solutions or rigidities in procurement. Customer-led innovation is often bilateral, closed innovation, which reduces the risk but doesn’t lead to transformation unless customers are particularly visionary. This is a particular problem when there is a need for system transformation, for example to low carbon transport.

Market barriers in the public sector were identified as a problem with companies citing low rates of innovation adoption and defence competition requirements amongst the issues. Public procurement of innovation was not referred to at all by companies in Germany, Finland

and The Netherlands indicating the specific instruments in these countries are small-scale or tightly defined (Table 2).

Regulations and standards are important for determining innovation incentives and structuring markets. Regulation is especially important in the clean technology sector, while standards are core to competitiveness in ICT. Both can act as barriers as well as drivers of innovation. Regulatory instability; challenging frameworks (such as REACH or clinical trials regulation), and costs of compliance present barriers to innovation, although this varied across country and industry with agri-food, Bio Pharmaceutical and clean technology companies citing this more often. Both Market Leaders and Followers perceive regulatory barriers to innovation to be stronger at the EU rather than national level⁴.

iv. Is there sufficient mobility of people towards and between firms?

“... there’s been a lot of growth in the UK and that’s challenging to get people that have a good, sound knowledge base”

A lack of capability to innovate in firms is often associated with insufficient absorptive capacity to take advantage of externally available knowledge. Absorptive capacity is partly determined by organizational deficiencies, but also arises through an inability to recruit or train people with appropriate levels of skills or talent.

Around 50% of firms experienced barriers to accessing skills and companies are concerned about constraints on their ability to recruit people with the right technical or management skills. Skills and capability deficits are more commonly experienced as national issues and in the Bio pharmaceutical and Clean Technology industries (where the intensity of knowledge specialisation per employee is on average higher), although

⁴ This may be partly due to the characteristics of the companies interviewed which tend to conduct proportionately more of their business within the EU and subsequently have more interactions with the regulatory setting here.

Manufacturing and ICT companies were not far behind. Companies in markets with limited competition or who were not Market Leaders reported skills shortages more frequently.

At ecosystem level, policy concerns include ensuring the population of skills in relevant technologies and entrepreneurship capability. Typical instruments include training and advice and specific measures to encourage recruitment into deficient firms. Effective ecosystem functioning requires maximum levels of mobility to match talent to opportunity, which may be restricted by structural issues in the labour market such as portability of pensions. Other instruments may be designed to increase mutual understanding, inter-organisational learning and knowledge exchange, thereby supplying “system building” provisions.

v. Are the flows of people, knowledge, finance, and services sufficient for ecosystem functioning?

v. Is the scale and balance of finance for innovation right?

“Finance is by far and away the most difficult thing for the company because we have a long term development horizon.”

19% of our sample identified lack of suitable finance as a barrier to innovation. Companies from countries with comparatively lower Business Expenditures in R&D (BERD as % GDP) (Portugal, Spain) express strong concerns about accessing national sources of finance, although this is a common concern of companies in countries where average BERD is much higher (The Netherlands, Estonia). Overall, barriers accessing national finance sources were reported more often than at EU level (17% to 10% for market leaders and 25% to 19% for market followers respectively). This response is more common amongst companies operating in markets

where competition is price-based (47%) rather than quality based (40% at international level).

Finance is often a constraint for younger and growing firms, and common gaps are seed funding and second stage venture capital. This may reflect risk culture, but can also be a feature of the *scale* of the ecosystem – large volumes of transactions as in the USA can allow specialization and potentially higher returns on investment deriving from larger home markets. This leads to the question of whether policy-makers should incentivise a degree of consolidation for funds and funders?

“... there is a huge difference between British or EU and America ... we are, what, a five year old company and we managed to raise around £10 million of funds. When you look at American companies of a similar age in a similar market they tend to use ten times more in dollars.”

Conditions and priorities of public funding for innovation may present barriers, including bureaucratic and long application processes, risk-aversion, inconsistency between policies and priorities and the need for more strategic investment. Nevertheless, public finance - through grants, loans and fiscal incentives - accounts for the bulk of public support for innovation in firms. An ecosystem perspective would place more emphasis on policy measures that increase the rewards to those investing in innovation and to ensure that private and social benefits flow back to the source of investment. The financial contributions of intermediary actors (such as incubators) may also take on a new relevance.

vi. Are knowledge flows functioning effectively?

Innovation is an iterative, multi-partner and multi-directional activity by public and private actors involved in the production and diffusion of knowledge and technology. Flows of knowledge were identified as the

most important element of innovation ecosystems (across all countries 62% of respondents selected this while 20% selected mobility of people, 25% selected flows of finance and 20% selected exchange of services) (Figure 2).

These findings were confirmed using our data triangulation survey, with a lack of R&D, risk and venture funding perceived as limitations for companies' innovation activities. Around 60% of the firms surveyed identified knowledge flows were blocked by lower than desired levels of collaboration and mobility between public and private sectors and the level of skills in the workforce.

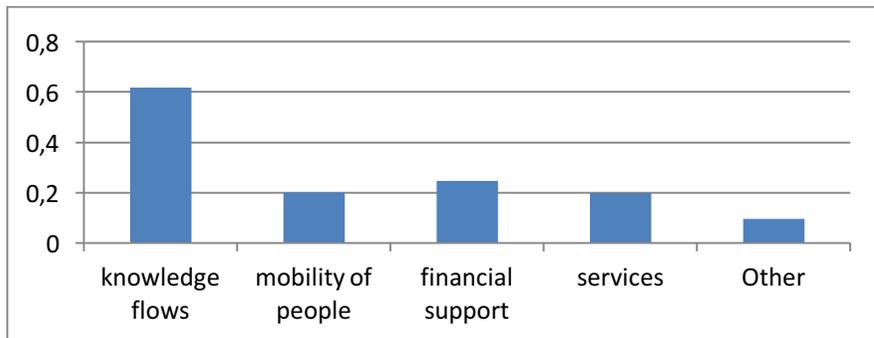


Figure 2. Most important ecosystem elements

For decades innovation policy has focused on promoting collaborative links between science and industry to facilitate effective knowledge flows and the joint production of new knowledge, using funding and incentives designed to bring universities and research organisations closer to business.

Less visible are policy initiatives promoting the natural flow of knowledge between customer and supplier. Some initiatives have targeted supply chains and public procurement to provide demand-pull for innovation but

these are relatively small scale. A wide range of policy instruments exists that seek to stimulate diffusion of technologies with the aim of raising the productivity or competitiveness of lagging firms.

The role of the intellectual property system here is complex, as it brings knowledge into the explicit domain but then restricts flows outside transactional arrangements. Adjusting the balance between investor rewards and wider benefits from the diffusion of knowledge has also been the subject of policy intervention through instruments such as the patent box.

Companies identifying as Market Leaders cited very few issues accessing knowledge at any level, but indicated that national and local exchange is more important and problematic, and Market Followers experience barriers more often overall (20% at local level; 7.2% at EU level). Interestingly, ICT companies reported low barriers in accessing knowledge at the national level but comparatively higher ones at the European level. Companies operating in markets with limited competition were more likely to cite issues at the EU level (22.4%) compared to companies operating in more open business environments.

3 A different role for government in innovation ecosystems?

The policy gaps regularly mentioned are categorised in Table 1. The overarching question from an ecosystem perspective is how to address this range of gaps to create a policy framework that extends beyond support for specific innovation projects and barriers, to strategic support for the on-going evolution and adaptation of knowledge, technology and innovation driving the innovation ecosystems within their territory.

The survey data confirmed that companies are asking for change in the role of governments in supporting innovation to address a wider spectrum of activity at micro level (firm) needs; meso level (promoting cooperation and coordination), and macro level (societal challenges and more fluid funding mechanisms).

Table 1. Innovation Policy Gaps

Institutional	Supply side	Demand side	Wider
Bureaucracy and complexity in policy support	Lack of seed, venture and growth funding, lack of strategic investment	Insufficient demonstrators, pre-commercial procurement, and procurement of innovation	Global trade difficulties and incomplete single market
Lack of policy coordination and consistency over time	Barriers to knowledge transfer from research sector	Regulation around innovation (seen as both a barrier and positive factor)	Lack of skilled workers and development of talent/ capabilities (technical/ managerial/ translational/ creative)
Systemic barriers to accessing policy instruments	Lack of grant funding	Lack of instruments supporting supply chain innovation and user/customer-led innovation	Fiscal environment, energy policy, carbon or other environment policies

The issue of boundaries requires attention. National and regional innovation system approaches draw boundaries that are easily mapped onto geographies of policy responsibility, and technological innovation systems follow technologies, which frequently resonate with the boundaries of sectoral or industry based innovation policy.

However, innovation ecosystems are often international and not always clearly focused on a particular field of technology, creating challenges for organising innovation policy that addresses certain ecosystems. Is this a challenge that can only be resolved at company level? Is governance of innovation ecosystems shared between policy makers and companies?

4 Policy for supporting industrial innovation ecosystems

Innovation instruments in each country address issues that underpin the functioning of the innovation ecosystems, but the question is whether they are applied in a systemic way? Sometimes innovation policy instruments merely coexist and send signals in different directions.

4.1 Principles of innovation ecosystems policy

Healthy ecosystems adapt and evolve, meaning policy should be focussed on the direction and speed of change and the population of actors required for effective ecosystem functioning. This necessitates adaptive and simple policy frameworks, e.g. based on a smaller numbers of flexible instruments, or using intermediaries to match actors to policy solutions.

Policy is interlinked: correcting one area without addressing the overall balance may disrupt the flows and populations within the ecosystems that policy-makers intend to support. Policy instruments should ensure that companies can harness the dynamic exchange and creativity generated through interactions between ecosystem actors can be translated into concrete innovations through instruments that support:

- co-creation
- experimentation

- collective anticipation of future needs and trajectories.

4.2 Facilitating collective governance

Systemic innovation involves joint governance, potentially by:

- i. Involving industry in establishing conditions for innovation funding and regulatory reform.
- ii. A European-wide innovation guarantee system to overcome limitations in the ability of individual Governments to make investment decisions.
- iii. Including civic leaders and end users in innovation policy design and implementation.
- iv. Innovation funding that is cross-sectoral, breaks value chains, and focused on transformation over preservation.
- v. Funding criteria requiring awardees to design links to existing innovation ecosystems and/or create new ones.

4.3 Effectively functioning ecosystems can be supported by:

- i. Simplifying innovation support schemes and speeding up decision making to enable ecosystem adaptation and evolution.
- ii. Improving education and skills to facilitate knowledge translation and increase the absorptive capacity of companies.
- iii. Mobility programmes related to specific skill shortages developed via dialogue between governments, academia and industry.
- iv. Addressing regional and global trade difficulties and market access to enable access to new flows of knowledge and finance.
- v. Facilitating cross-border Public-Private Partnership activity and unifying the European and other international research areas.
- vi. Supporting the emergence of new system integrators.
- vii. Supporting collective understanding of future innovation trajectories through foresight, demonstrators and pre-commercial procurement.

- viii. Optimal funding at the right junctures of the innovation ecosystem, either within an existing ecosystem (e.g. universities, companies, platforms) or outside it (clusters of actors around new knowledge).
- ix. Signposting and linking policy to different types of ecosystem actor.

Appendix 1: Project background and methodology

The Industrial Innovation in Transition (IIT) project aimed to establish an holistic understanding of the current practices of innovative companies, and how well these practices were supported by current innovation policy instruments using a large programme of in-depth interviews. The research focused on three inter-connected levels: (1) the practice of innovation management in firms, (2) the roles of innovation ecosystems, and (3) the design of policies and instruments to promote innovation.

The primary data comprises of a set of approx. 700 company interviews and a web-survey that administered to triangulate the findings of the qualitative interviews. The companies interviewed represent a range of sizes (Table 2), sectors (Table 3) and countries (Table 4). The five industry sectors analysed in the IIT project are: ICT-Information & Communication Technologies (including ICT services), Manufacturing, Bio-pharmaceutical, Agro-food and Clean-technologies. The countries included in the study represent a range of Innovation Leaders and Followers and included: Austria, Czech Republic, Estonia, Finland, Germany, Italy, Ireland, Portugal, Spain, The Netherlands and United Kingdom.

Table 2. Interview sample distribution: firm size

Firms' size		
	Frequency	Percent
< 10	17	2.4
10-49	193	27.8
50-249	214	30.8
250-3000	191	27.5
>3000	76	11.0
Unknown	3	.4
Total	694	100.0

Table 3. Interview sample distribution: sector

Sectors		
	Frequency	Percent
Agri-food	99	14.3
Biopharma	92	13.3
Clean technologies	116	16.7
ICT	132	19.0
Manufacturing	255	36.7
Total	694	100.0

Table 4. Interview sample distribution: country

Interviews per Country		
	Frequency	Percent
AT	75	10.8
CZ	75	10.8
DE	50	7.2
EE	80	11.5
ES	90	13.0
FI	69	9.9
IE	44	6.3
IT	45	6.5
NL	48	6.9
PT	25	3.6
UK	93	13.4
Total	694	100.0