

IIT Deliverable

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Abstract
<p>Whereas the WP4 is dedicated to the assessment of current innovation policies in light of Europe 2020 strategy for smart, sustainable and inclusive growth, this D2.4 has the purpose to create a common workshop concept (see Task 4.1) applicable to workshops for innovation policy assessment, and the briefing paper for the European Policy Workshop to support the future development of industrial innovation ecosystem.</p> <p>In order to this, the base is the company's perspective on innovation policy obtained through quantitative and qualitative interviews in the WP2, in which specific questions were made to interviewees about importance of public policies supporting innovation, main limitations in innovation, and main public policy gaps. It is also necessary to take into account the overview of the innovation policies of eleven member states, jointly elaborated by the IIT partners in the WP3.</p> <p>All this information has been the base for the realisation of national level policy workshops in Finland, UK and Austria, as planned in the DoW, and an additional policy workshop in Ireland; also in Spain IIT results on public policies have been presented to the national administration.</p> <p>Based on all these results, the IIT project has elaborated policy recommendations that are being used in the different European policy workshops already carried-out and those planned for the next future.</p>

Innovation policy assessment

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1 Introduction

Open Innovation, innovation systems and innovative creativity on one side; stage-gate processes, speed-to-market and intellectual property on the other side have become buzzwords in innovation research and innovation policy. The results of the IIT project show that open, creative and systemic innovation strategies are very widely discussed and supported by innovation research and policy measures while companies consider concepts as open innovation rather skeptical. European and National innovation policy should encourage companies to experiment and anticipate future more widely, linking their market perspective with societal challenges such as health, demographic change and sustainability.¹

This Deliverable has the purpose to create a common workshop concept (see Task 4.1) and briefing paper for the European Policy Workshop to support the future development of industrial innovation ecosystem. The basis of this briefing paper built two previous work packages: first; the information gathered and analysed from 694 interviews and 10 case studies regarding innovation policy issues; and second, the results from the national focus groups with representatives from relevant ministries, funding authorities, industrial associations. The outcome of national focus groups will feed into a common policy briefing and input paper for a high level workshop at the European level (second building block) focusing on the specific role, appropriateness and coherence of national and European instruments in order to support industrial transition.

¹ Hahn K., Kuhlmann S., Konrad K., Klaasjan V. (2007), Co-creation: Embedding companies' innovation practice in wider innovation ecosystem dynamics

2 Objective

The WP4 is dedicated to the assessment of current innovation policies in light of Europe 2020 strategy for smart, sustainable and inclusive growth.

According to Task 4.1 'Methodology development', several national focus groups will feed into a common policy briefing and input paper for a high level workshop at the European level focusing on the specific role, appropriateness and coherence of national and European instruments in order to support industrial transition.

This Deliverable 4.2 has the purpose to create a common workshop concept (see Task 4.1) applicable to workshops for innovation policy assessment, and the briefing paper for the European Policy Workshop to support the future development of industrial innovation ecosystem.

3 Innovation Policy Assessment

An important task within the IIT project has been a systematic matching and analysis of the interplay between emerging trends in innovation practice and innovation policy design and implementation within and across European Member States. To support this task the project has assessed existing innovation policy at national and European levels as a basis for developing recommendations for improving Europe's innovation potential. Additionally, the interviewees were asked to report their experiences about innovation policy initiatives and where they see the biggest gaps between current innovation practices and public support for innovation practices.

3.1 Overview of the innovation policies of eleven member states

National strategies for science technology and innovation

In every country studied, a high level national strategy for science, technology and or innovation was clearly identifiable. Common aspects of the strategies we reviewed were for most of the countries the following:

- **Attempts to reduce the fragmentation of public support for business R&D and innovation:** By streamlining and consolidating public programmes governments seek to lower the administration and application costs of innovation policy instruments. This improves and simplifies access to public programmes and combines with other activities to leverage private funding for innovation.
- **Emphasizing business innovation and innovative entrepreneurship:** Encouraging entrepreneurial culture is seen as critical for stimulating impactful innovation, both in business and society. To support innovative entrepreneurship the strategies promote and design start-up initiatives, fundraising opportunities, the provision of risk capital, and encourage large scale appropriation of innovation and tax initiatives focused on R&D expenditure.
- **Targeting innovation support at nationally strategic technologies or sectors**
- **Investing in the public research and human resources:** This supports to build up and improve the general science base that will provide the source of future innovation. This means that in the higher-performing countries research and innovation support is focused on gaining competitive advantage in areas of emerging growth such as nanotechnologies, green technologies, information and communication technology (ICT) and health technology, and global challenges.
- **Adopting quantitative targets:** Quantitative targets should help to benchmark the performance and progress of their innovation policy, particularly through targets for R&D spending

Financial instruments

Financial instruments include both direct (e.g. credit loans and guarantees, repayable advances, competitive grants, innovation vouchers) and indirect funding (e.g. R&D tax incentives). Indirect government support through tax incentives is considered the major part of governmental funding for business R&D in many of the EU member states; like in Austria, in the Netherlands, in Portugal in the UK. R&D tax incentives have been simplified and made more generous (e.g. by increasing the tax relief rate) and made more accessible to larger numbers of beneficiaries. Most of the R&D tax incentives address a specific group (e.g. SMEs) or type of R&D (e.g. subcontracted R&D), and R&D tax incentives have become a way of increasing the attractiveness of the national research ecosystem and inter-country competition to attract foreign R&D of multinational enterprises. For example, the Netherlands has made tax relief one of the main instruments of its industrial

policy. In 2013 the United Kingdom introduced an expenditure credit scheme to make R&D tax relief more attractive to large firms and to leverage domestic R&D activity.

Although a few countries – Estonia, Germany, and Finland – do not offer specific tax arrangements for R&D and innovation at central or federal level, R&D tax incentives are universally used. Enhanced deductibility of R&D-related expenditures and accelerated depreciation of R&D investments are imputed on corporate income tax in a broad range of countries, in Austria, in Portugal, in Spain and in the UK. Several governments offer preferential tax treatment for corporate income from royalties, licensing and R&D capital gains in order to encourage the commercialisation of R&D results and to attract or retain intellectual property (IP) like In Italy, in Netherlands, in Spain and in the UK.

Governments offer direct financial support for innovation through public procurement for R&D and a variety of grants, subsidies, loans or equity funding. Direct financial support is offered through competitive grants and debt financing, such as loans for R&D projects. Risk-sharing mechanisms are widely used to provide lenders with insurance against the risk of default and improve firms' access to credit. A loan guarantee implies that in the event of a loan default, the credit guarantee scheme will reimburse a predefined share of the outstanding loan to the lender. Some direct support is also linked to public procurement.

Indirect support

Other innovation policy instruments outside R&D-related schemes include measures to facilitate the commercialisation of innovation, support the development of networks, promote regional innovation hubs/clusters, and ease access to information, expertise and advice. Innovation vouchers or technology consulting services and extension programmes are major policy instruments in this respect.

Good examples of policy instruments that support innovation clusters exist in Germany. The network of Catapult Centres being developed in the UK aims to give businesses access to specialist equipment and emerging technologies and connect them to academic expertise. The Retos-Colaboración call in Spain is an instrument for public-private collaboration to increase the participation of private funding in innovative activities, facilitate company access to public research and foster the development of technology-based companies and young innovative companies. The Czech Republic has a Centres of Competence programme to create conditions for the development of long-term cooperation on R&D and innovation. In the Dutch 'Topsectors' approach, each sector has a council governed by a team consisting of firm representatives, an SME, an academic and a high-ranking government official. The government offers financial support for R&D cooperation between business and higher education/RTO's through the 'Topconsortia for Knowledge and Innovation' (TKI's).

Sector/technology specific development

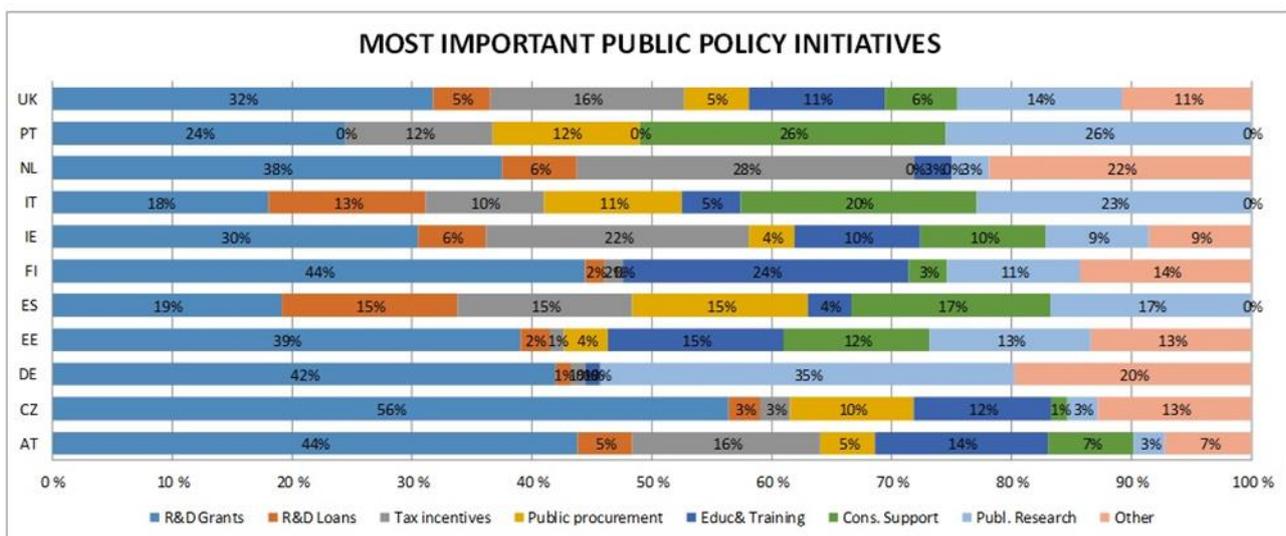
A number of the countries studied are making new large-scale R&D investments in promising technology fields or sectors, for example:

- **United Kingdom:** Under its new Industrial Strategy, the United Kingdom granted £600 million in 2013 to its Eight Great Technologies. Funding should prompt large and smaller players to increase participation in cooperative projects, support "Smart Specialisation" and encourage technology monitoring and foresight analysis in order to identify technological niches and long-term technology developments.
- **Germany:** The High-Tech Strategy (launched 2013) stands for the aim of moving Germany forward on its way to becoming a worldwide innovation leader.

- **Netherlands:** Top Sectors initiative (2010) introduces a sector approach across government policy for nine top sectors: water, food, horticulture, high technology, life sciences, chemicals, energy, logistics and creative industries.
- **Italy:** The Italian strategy supports micro-enterprises and small-sized companies, combining traditional farming, craftsmanship and manufacturing with high-end high-technology sectors.
- **Estonia:** The current R&D&I strategy 'Knowledge-based Estonia' sets out three growth areas: ICT, cybersecurity, software development or the use of ICT for automating industrial processes; health technologies and services and more effective use of resources.

3.2 Company's perspective on innovation policy

Keeping the status quo of the innovation policies of the eleven member states in mind, we asked the companies in the quantitative interviews, about the **importance of public policies supporting innovation** (D2.4):



As it can be observed in the above figure, respondents placed particular importance on public policy initiatives of financial character: especially R&D Grant, but also R&D loans and Tax initiatives were relevant. Also other policies with a more indirect character, as they are Education and Training and Public Research, have a significant importance in most of the 11 countries analysed.

Also we asked the companies in the qualitative interviews, which are their most common **limitations in innovation**; how national, European and international public policy initiatives support them in this regard and what the needs are rising from company situations. This helped to identify better the gap between actual needs in innovation policy and reality of innovation policy.

The **main limitations in innovation identified in the qualitative interviews have been:**

- **Regulation and standards:** to cover the regulatory environment, including the existence of challenging frameworks such as REACH or clinical trials regulation and the costs of compliance. Also in this category concerns about a lack of stability in regulation and of varied levels of compliance preventing a level playing field.
- **Access to finance:** this covered only the challenge of insufficient funding for innovation.

- **Conditions and priorities for public funding:** this category includes bureaucratic processes for obtaining funding, risk-aversion, delays, inconsistency between policies, the requirement for more strategic investments, disagreement with priorities for funding (e.g.: technical areas, company size)
- **Skills deficits:** the ability to recruit people with the right technical or management skills including wider criticisms of the education system.
- **Market barriers in the public sector:** including failure of public procurers to adopt innovations and other barriers to purchasing such as defence competition requirements for suppliers.
- **Wider framework conditions:** e.g. fiscal environment, energy policy, carbon or other environment policies.

Barriers to accessing the finance needed for innovation (at national/regional level) were cited more by companies in Spain, Italy and Portugal. The spread of innovation policy support instruments accessed recently also varies nationally amongst the companies interviewed. A good example is tax incentives which don't exist in all countries observed to the same extent.

Related to these challenges were the **public policy gaps cited by interviewees**. The more frequent responses include: 1) Global trade difficulties; 2) difficulties in knowledge transfer from research sector; 3) bureaucracy and complexity in policy support; 4) lack of coordination and consistency over time in policy environment; 5) insufficient seed, venture and growth funding; 6) insufficient skilled people and development of talent/capabilities; 7) systemic bias/difficulties for small firms; 8) regulation around innovation (seen both as barrier and positive factor); 9) need for more demonstrators, pre-commercial procurement, procurement of innovation and 10) insufficient grant funding available.

Taking a closer look at the limitations in innovation and the identified gaps between the needs in innovation practices and the current public innovation policy, **the idea of an ecosystem approach in innovation policy becomes more present. 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. 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. For example, as pointed out above, some of the current innovation policy initiatives focus 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. However, innovation policy initiatives which target the flow of knowledge between customer and supplier are less visible. The financial contributions of intermediary actors (such as incubators) may also take on a new relevance.

Furthermore, 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)** and also 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.

4 National level policy workshops for innovation policy assessment

4.1 Policy workshops model

Summarizing the IIT workshop concept developed in D4.1 and applying it to the **policy workshops** to be carried-out at national and European levels, these policy workshops will follow a common model regarding their preparation, execution and reporting:

- Generate a future oriented policy discussion with high level policy experts at the national level
- **Addressing different stakeholder groups** (representatives from the industrial side, representatives from the policy side and representatives from the research side)
- **Preparing a workshop invitation** and an agenda with:
 - Opening Session: Introduction into the IIT project
 - 1st Session: Collecting first comments of workshop participants on the project results
 - 2nd Session: Grouping the workshop participants in 2-3 working groups and group work on working hypothesis/working questions
 - Closing Session Collection of the findings from the group work
 - Discussion of the findings and summing up
- **Creating short input paper** for the high level policy experts before the workshop with:
 - aim of the workshop (Hypothesis/ Key questions to be answered with help of the workshop participants)
 - key points of the IIT project,
 - initial results of the interview analysis regarding innovation policy issues
- During the Workshop a **documentation of the workshop results/findings** should take place
- **Take minutes**
- **Photograph documentation**
- Finally **main findings are summarizing in English**, using a standardized form.

4.2 National Policy Workshops in Practice

National level policy workshops are going held in three member countries (Finland, Austria and United Kingdom) according to the Description of Work of the IIT project. The following section describes each of these events in detail.

- **In Finland:** OECD/ Ministry of Economic Affairs and Employment of Finland – Seminar “The Role of R&D in Fostering economic performance; lessons from Research and implication for Finland”. 1st December 2016. <https://tem.fi/en/rdseminar-01-12-2016>

The aim of this workshop is to give an overview of the IIT results in general and, in particular, for Finland. There was a wide debate about the findings. Policy conclusions were discussed widely as the event was associated with the OECD review of the Finnish innovation policy. Many critical

observations were presented about the recent developments in Finland. Ecosystem, open innovation and innovation management issues were considered highly interesting and their policy implications were widely debated.

The most interesting outcome of this event was that OECD reviewers took some key IIT recommendations in the final Review report:

<http://www.oecd.org/finland/oecd-reviews-of-innovation-policy-finland-2017-9789264276369-en.htm>

And they are now part of the new Research and Innovation Councils roadmap draft which will be adopted by the Government of Finland during the autumn 2017. The critical issues taken were:

- Recognize the continued importance of R&D, innovation and skills
- Develop a new vision for the Finnish research and innovation policy
- Enhance research addressing industrial and societal challenges
- Strengthen the ‘third-mission’ of universities
- Improve internationalization of business and research
- Further improve framework conditions for innovation and entrepreneurship

Also as a practical outcome of these discussions is that the Government of Finland decided in spring 2017 to increase funding to TEKES and the Academy of Finland by 130 million € for the years 2018-2019.

- **In Austria:** “ALPBACH technology symposium, conflict and cooperation”. August 2017.
In overall in the Alpbach Technology Symposium, leading representatives from the ministries, the Federation of Austrian Industries and the Austrian Council for Research and Technology Development will discuss current priorities, challenges and demands for a future RTI agenda in the digital age, addressing conflict as well as cooperation. In the framework of these lecture series JOANNEUM team organizes a short session to present our results from the IIT Project and discuss it with high level policy experts and important nation policy makers. An expected outcome of the workshop is to develop recommendations for further policy intervention, to fostering open innovation, economic ecosystem and well balanced national innovation policy system.
- **In the United Kingdom:** a workshop was held at the Department for Business, Energy and Industrial Strategy (BEIS) on 12th July 2017. Prior to the workshop the attendees were provided with two briefing documents (see Appendix 1). Attendees included the BEIS team writing the UK’s new Industrial Strategy and representatives from Her Majesty’s Treasury, the Cities and Local Growth Unit, and Sian Westlake, Ministerial Adviser to The Rt Hon Jo Johnson MP, Minister of State for Universities, Science, Research and Innovation. The UNIMAN team gave two presentations: the first on the findings of the IIT company research, and the second on the policy implications of the results (See Appendix 1). After each presentation a detailed discussion was held about the specifics of the project, the methodologies applied to derive the findings, and how the UK data compared to other countries. An hour long debate was then conducted concerning how the scope and content of the UK industrial strategy in light of the research. The industrial strategy team requested further written

input from the UNIMAN team for the Industrial Strategy White Paper due to be published in autumn 2017.

- **An additional policy workshop was conducted in Ireland.** Professor Georghiou presented 'Industrial innovation in Transition: Key findings for Ireland' and Dr Dale Clough presented some 'Early reflections on policy implications for Ireland from the IIT project'. The audience numbered some 60 people including The Deputy Prime Minister Frances Fitzgerald TD, the Minister for Jobs, Enterprise and Innovation, the Secretary General in the Prime Minister's Department, the Secretary General in the Department of Jobs, Enterprise and Innovation, staff from Innovation, Science and Industrial Policy units; Department of Finance and Public Expenditure and Reform; Research Centre Leaders and Research Grant Agencies. The event was organised in collaboration with Professor Mark Ferguson, Director General of Science Foundation Ireland and the location of the event was the Department of Toiseach, Merin Street, Dublin. (Secretary General for Jobs, Enterprise and Innovation thanked Professor Georghiou and the Manchester team for a thought provoking talk and for a wonderful and interesting session. The audience raised over 40 questions about different aspects of the research and its policy implications.
- Also in the **Spanish IIT dissemination event carried-out in Madrid by the 1st June 2017** in the CDTI (Ministry of Economy of Spain), main public body for financing R&TD & Innovation in Spain, the results of IIT on public policies for supporting innovation were presented.

5 Policy Brief for the European policy workshop

Policy recommendations based on the analysis and insights from the IIT industry survey can be provided with two main priorities: **first**, on the **specific role policy makers should take over within this IES** and **second** on **more concrete examples for specific policy instruments**. The overall objectives are primarily to strengthen the innovation ecosystem engagement of companies in general and secondly, to transfer these IES dynamics and knowledge to concrete, transformative innovation projects.²

Our analysis (Tasks 2.4, 2.5, 3.1, 3.2 and 3.3) showed a wide variety of existing instruments in every country addressing issues that are part and parcel of the innovation ecosystem perspective. But sometimes innovation policy instruments merely coexist and send signals in different directions.

i) Principles of innovation ecosystems policy

Policy instruments within innovation ecosystems should be directed towards ensuring that the dynamic exchange, creativity and inspiration found in different innovation ecosystems can be harnessed and transferred into the innovation processes of companies enabling transformative ideas. Policies are required that facilitate:

- co-creation of future developments
- experimentation
- collective anticipation of future needs and trajectories

ii) Facilitating collective governance

This type of innovation activity involves joint governance – a feature of innovation ecosystems. Activities that facilitate joint governance are:

- Involving industry in establishing indicators for assessing innovation funding schemes and regulatory reforms.
- Establishing a European wide innovation guarantee system with a wide enough portfolio of investments to make it profitable, extend the equity base and overcome limitations in Governments ability to make investment decisions.
- Tools for opening industrial innovation ecosystems to include cities, citizens etc. to integrate the ultimate end-users of innovation and source of innovation inspiration.
- Innovation funding that is cross-sectoral, breaks value chains, and is focused on transformation over preservation.
- Introducing funding criteria requiring awardees to design links to existing innovation ecosystems and/or create new ones.
- Improving education and skills to facilitate knowledge translation and increase the absorptive capacity of companies.

iii) Effectively functioning ecosystems

² Hahn K., Kuhlmann S., Konrad K., Klaasjan V. (2007), Co-creation: Embedding companies' innovation practice in wider innovation ecosystem dynamics

Policy-makers can support effective functioning of innovation ecosystems using:

- Mobility programmes related to specific skill shortages, developed through national/European-level dialogue between governments, academia and industry focused on future skills requirements, and establishing skills as a strategic asset for national competitiveness.
- Addressing global trade difficulties and market access that enable access to new flows of knowledge and finance.
- Facilitating knowledge transfer from the research sector by harmonising the rules for Public-Private Partnerships to encourage cross-border activity, incentivising collaboration with industry, unifying the European and other international research areas.
- Supporting the emergence of new system integrators.
- Supporting the emergence of collective innovation trajectories by providing foresight, demonstrators and pre-commercial procurement.
- Providing optimal amounts of funding at the right junctures of the innovation ecosystem (seed, venture and growth funding), providing instruments for risk-sharing to encourage private Venture Capital development. The optimal funding channel may be within the ecosystem itself (universities, large companies, innovation platforms etc.) or outside it (emerging clusters of actors around new knowledge).
- Embracing multi-level policy channels: national/European coordination of policy making.
- Signposting and linking, e.g. helping SMEs find ecosystem partners and understand which IES to join to capture value and increase competitiveness.
- Simplifying innovation support schemes and speeding up decision making to enable ecosystem adaptation and evolution.

Appendix 1. UK Policy Briefings and Presentations

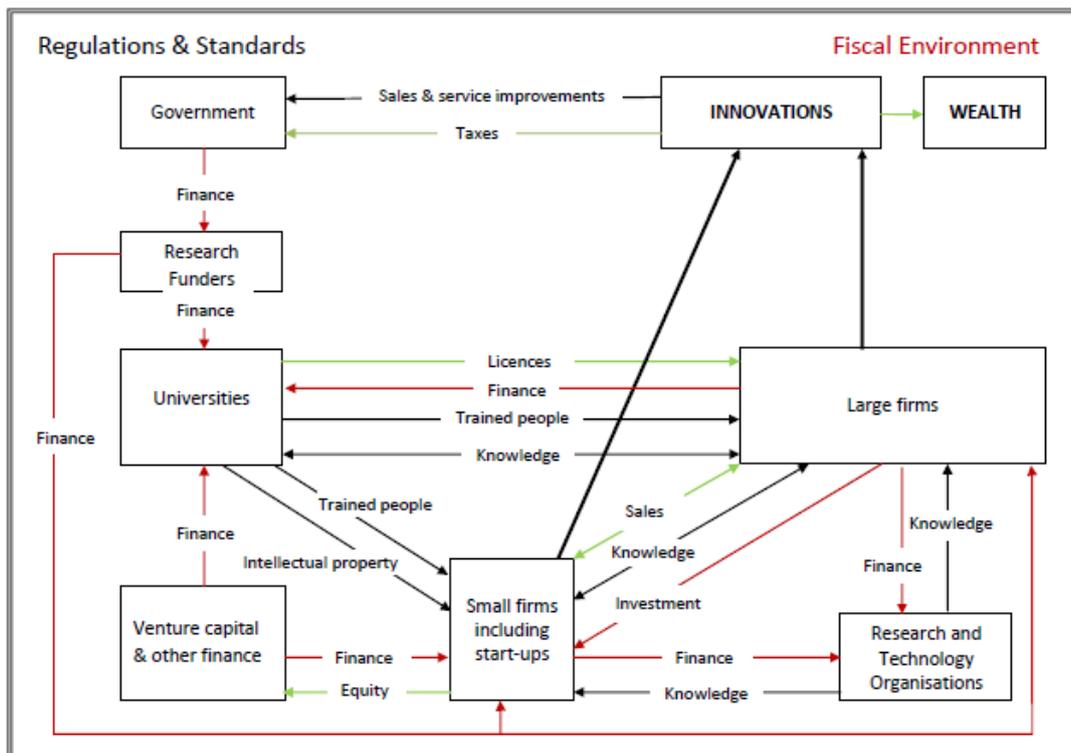
Brief for Industrial Strategy on Implications of an Innovation Ecosystem Approach for Policy Design

This brief for the Industrial Strategy is based upon findings from the Industrial Innovation in Transition project that included a recent survey based on in-depth interviews with senior managers in 694 innovative firms in 11 European countries, including 93 in the UK. The survey addressed changing patterns and strategies in industrial innovation and their implications for innovation policy. In particular it explores one of the core themes emerging from the survey findings, the rise of the ‘innovation ecosystem’ (IES) perspective. After indicating firms’ perceptions of the innovation ecosystem, the brief examines innovation policy through the lens of this approach and identifies key questions that follow for the Industrial Strategy. Some points are illustrated by quotes from interviewees.

1. Innovation ecosystems

During the 1990s thinking about innovation policy design was dominated by the ‘systems of innovation’ framework. This highlighted the importance of institutions at a national, regional and sectoral level and identified coordination failures that could be the target of public policy. From another direction, a decade later, the open innovation concept drew attention to the growing use (and provision) of external ideas by firms to improve success in innovation. Both these approaches highlight the wider environment in which innovation takes place. They come together in the concept of an innovation ecosystem. Taking a biological analogy this 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 have been characterized as knowledge, mobility of people, financial support and services. As with the systems approach an ecosystem can be conceived at multiple levels and the term is also used to describe the networks of large companies, particularly in the ICT sector. Figure 1 shows a stylized depiction of the UK innovation ecosystem produced for the House of Commons Select Committee on Science and Technology.

Figure 1 The Innovation Ecosystem



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

2. Why is the ecosystem approach significant?

"We see ourselves in the centre of an eco-system. That is what we do. We integrate technologies and capabilities together because the trick is, which is the challenge for the R&D manager, the R&D manager's job is to create that eco-system which best feeds our central hub."

Among the UK firms surveyed in the IIT project, two thirds (67%) were familiar with the concept of an innovation ecosystem (IES) and just over half (52%) sought to develop the ecosystem they were in as an active part of their company strategy. The concept of an IES was seen to have increased in relevance/importance in the past 5 years by 38% of respondents while none thought it had got less relevant or important. UK firms saw their customers as having the greatest influence on them within the ecosystem (33% saw as greatest influence) followed by public research/universities (27%), regulators (18%), suppliers (14%) and finance (12%).

"We have a lot of interaction between our customers and our development partners pretty much on a weekly basis, so there's a constant flow of ideas and, you know, planning for the future and features and technology directions"

"Our eco-system really is our customer base I think. Then it is the providers of staff to us, if the universities are doing good research then they are then training people we need to take."

Showing sectoral differences, regulators were seen as substantially more important in the biopharma and clean technologies sectors. The importance of knowledge flows was emphasized by UK firms (42% seeing these as most important), followed by mobility of people (19%), with finances and services at 11% each. Firms' strategies for influencing the ecosystem most commonly focused on developing alliances (27%) followed by efforts to influence policy or regulations and standards (17%).

3. Application to Policy Design

3.1 Overall ecosystem approach

As with other systems of innovation approaches, ecosystem thinking leads towards questions about the balance of actors and institutions present in the territory under analysis (which could be the UK as a whole or a particular region). An ecosystem approach also places a focus on how those actors and institutions co-evolve and moderate or direct flows of knowledge, people and finance. Examples of questions for the industrial strategy that could emerge are:

i. ***Is the population of actors balanced?***

"I think there are equally important connections between all partners, be it the agencies, suppliers and customers, and other co-partners, other co-development partners or whatever it might be; I think they're all sort of part of the team"

For example does the country have a balance between large multiproduct, multi-technology firms who can act as system integrators and a dynamic population of smaller companies sustained by venture capital who can provide innovative ideas and products? What is the role for established SMEs? How different does this ecosystem look across sectors? Are those differences driven by the nature of the technology and/or market or are there historic drivers? A policy conclusion might be that there are not enough innovative firms in a system leading to diffusion measures, or that there is a need for more integrators, perhaps creating a focus on inward investment. Following on from the population issue is one of *entry to and exit* from the ecosystem – what are the patterns of birth, growth, acquisition, or death of the firms and do these enable effective selection of innovation opportunities? There are often concerns about how easy it is to start a company; could there also be concerns that the UK over-incentivises survival of non-viable start-ups when the people and resources would be better re-invested in new prospects?

ii. Are the UK's intermediary institutions sufficient to support innovative firms?

"Intermediary services will help us, like people to help us develop supply chains, people to help us find partners, so as a small company a lot of the time, things where we fail, we have to rely on people who don't have a lot of capacity to scale up our technology, so they're fine at this stage but suppose we got an order to make 1000 sales, who's going to help us? So it would be welcome if there could be organisations or groups, networking which could help us develop supply chains."

Research and technology organisations (e.g. Catapults), standards bodies, measurement and testing services, consultancy support and more broadly services from innovation and business support agencies provide support for innovation without normally having the role of taking the innovations to market. Is their scale and reach sufficient. Does the UK's portfolio match the needs of future industries?

iii. What are the gaps in finance for innovation and the institutions that provide it?

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

The most common perceived 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. Should we incentivise a degree of consolidation for funds and funders?

iv. Is there sufficient demand for innovation in the UK system?

"there are many 20 million pounds that have got into research at [a] university which five years later will be basically obsolete because needs have moved on. ... You define the need and then you're going to get a better result, it's [the SBRI scheme] a shiny model I think of positive-ness."

"I know we've a public procurement contract for tenders because we are all the time on the look for that. That would be with our older products now it has to be said, because when your products would be in trials and pilots ... so would be in a different category from the point of view from public procurement."

"a lot of it is trying to find lighter and lighter solutions because of the demands for fuel efficiency in vehicles"

"On the technical side that's easier, you know, given the fact that the clients are demanding ever more higher-end technologies from us it's an easier thing to push forward with upgrades to technology on that side. It's harder to bring technology upgrades into the office or into the company."

A system may crowd out innovation, for example through lock-in to existing solutions or rigidities in procurement. This is particularly important when innovation involves a need for system transformation, for example to low carbon transport.

"I think at the moment its [leading the innovation ecosystem] customers and leading edge people ... but there's standardisation, there's going to be standards are going to start taking over in the next year or so to tidy up the [networked street lighting] market."

"the actual regulations it's something that makes customers probably want to buy our products"

Regulations and standards are important in determining the incentives for innovation and structuring markets. Regulation is especially important in the clean tech sector while standards are core to competitiveness in ICT. Both can act as barriers as well as drivers of innovation.

3.2 Moderating the flows in an innovation ecosystem

With attention focused on the flows of people, finance, knowledge and services, policy questions may follow:

i. *Is there sufficient mobility of people towards and between innovative firms?*

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

“we do have a lack of skills, trained...skilled engineers and we would...we are currently spending a lot of our time recruiting from Eastern Europe.”

Lack of capability to innovate is often associated with insufficient absorptive capacity in firms to take advantage of externally available knowledge. Absorptive capacity is in part determined by routines in the firm, and hence can be categorized as an organizational deficiency. It can also arise through an inability to recruit or train people with appropriate level of skills or talent in technology or management. At 29%, access to skills was the most frequently cited barrier to successful innovation among UK respondents.

Moving from the organisational to the ecosystem level, policy concerns include ensuring the population of skills in relevant technologies and entrepreneurship capability. Typical instruments include training and advice in capabilities and specific measures to encourage recruitment of these skills into deficient firms. Effective roles for people in an innovation ecosystem require maximum levels of mobility to match talent to opportunity. Barriers to this mobility include 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.

ii. *Is the scale and balance of finance for innovation appropriate?*

“there is a huge difference between British or EU and America ... if you look at us 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. ... of course, the dynamics of everything is different because we are doing... extremely lean production and sometimes it can be prohibitive because if you have more money you can do things faster, probably not so efficient but you can definitely do things faster and [with] a bit less stress.”

Finance remains critical for innovating firms and is often a constraint for younger and growing firms. 19% of our sample identified lack of suitable finance as a barrier to innovation. Assessing the right amount of public support is rarely (if ever) calculated on the basis of aggregate social returns and some consider that capital markets and therefore company management also underestimate the returns on innovation. If that assumption is true then innovation ecosystems typically run with sub-optimal levels of finance available at key points. This area nonetheless is a focus for innovation policy with public finance through grants, loans and fiscal incentives accounting for the bulk of public support for innovating firms. There are also policies designed to mobilise private finance through co-investment, risk-sharing or other measures to facilitate the provision of venture capital.

Approaching finance from an ecosystem perspective could place more emphasis on the need for policy measures to 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.

iii. *Are knowledge flows working sufficiently well?*

“I would say it’s something that we suffer from is being able to link ourselves with the right partners, who are doing research in the areas that interest us. I’d love to be able to go to someone and say, here’s the industry we’re in,

we're interested in innovation, give me a list of all the universities and start-ups in Europe, who are working on similar things."

That an innovating firm requires access to *knowledge* is self-evident. 56% of UK firms in our sample sourced knowledge from outside the firm on a regular basis and only 11% described themselves as fully self-sufficient. Nonetheless, the nature of that knowledge and the means of acquisition may vary considerably. The traditional distinction between tacit and explicit knowledge emphasises that the flows of knowledge between organisations, or even within them, goes well beyond that which is formally published - even if open access is facilitating that transfer. For decades innovation policy has focussed on promoting collaborative links between organisations to facilitate such flows and the joint production of new knowledge. The most frequent policy target has been science-industry links, with funding and incentives designed to bring universities and research organisations closer to business.

Less visible in policy initiatives is the natural flow of knowledge between customer and supplier. Our survey identified these as most important for firms. 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 also 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 in respect of knowledge flows is complex, as it brings knowledge into the explicit domain but then restricts flows except under 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.

iv. Are the services needed for innovation being effectively supported?

Services from innovation and business support agencies, professional services industries (e.g. patent lawyers), professional technical services businesses (e.g. testing, measurement etc businesses), design and creative services all provide support for or contribute to innovation. The services industry dominates the UK economy – and the UK has a growing base of ‘mediating’ structures, including Professional Services Businesses and Professional Technical Services Businesses, which play a significant role in reducing the risks of innovation. This sub-sector is considered as a value adding area of the services industry, but it is hard to identify in company statistics and measures due to its cross sectoral coverage. Subsequently, targeted policy support may be absent or difficult. These services also include information and communications technology and the adoption of web-enabled tools and platforms used to interact with and map the external innovation environment and engage with different innovation stakeholders.

4. Governance of innovation ecosystems

An overarching question is whether the role of policy makers within innovation ecosystems is different or changed from their role in other types of innovation system (e.g. spatial or technological). If policy makers, regulators etc. are considered as active players in an innovation ecosystem, does this offer new opportunities for developing and applying systemic policy measures, and what capabilities do policy-makers require? Conversely, does ecosystems policy imply a less directive role than in a territorial innovation system, which is oriented towards providing frameworks over specific instruments and support programmes? Furthermore, how is the issue of boundaries to be addressed in innovation ecosystems policy? National and regional innovation systems approaches draw boundaries that are easily mapped onto geographies of policy responsibility, and technological innovation systems follow technologies, which often resonate with the boundaries of sectoral or industry based innovation policy. Innovation ecosystems are often international and not always clearly focused on a particular field of technology, this creates challenges for organising innovation policy to address certain ecosystems. Is this a challenge that can only be resolved at company level? These questions are part of the more general question of who governs an innovation ecosystem and how?

5. Applying the Concept to Policy Design and Assessment

The Table presented in Annex 1 of this brief seeks to link the key prompts from the IES perspective with barriers to innovation identified by survey respondents and then linking these to identified policy gaps. The last column lists some of the measures which in principle are or could be addressing these gaps.

In some areas the IES perspective confirms the current direction of policy, though not always the scale of activity. Its principle added value is to highlight broader issues of balance in the innovation system and existing or potential measures to remedy deficiencies perceived by firms. As such it is well-placed to contribute to the development of the Industrial Strategy.

Luke Georghiou and Lisa Dale-Clough on behalf of the IIT team, Manchester Institute of Innovation Research, Alliance Manchester Business School, University of Manchester.

Annex 1: Barriers, Gaps and Policy Instruments in the Innovation Ecosystem Perspective

Ecosystem		Barriers to Innovation	Policy challenges and gaps (survey-based unless indicated)	Policy measures (examples)
Flows	People	Lack of capabilities or skills	<i>Skills deficits</i> – the ability to recruit people with the right technical or management skills including wider criticisms of the education system	<ul style="list-style-type: none"> • Training and advice in capabilities • Measures to encourage recruitment of skills into deficient firms • Reduction of mobility barriers
	Finance	Access to finance	<i>Access to finance</i> – insufficient funding for innovation	<ul style="list-style-type: none"> • Grants, loans and fiscal incentives • Policies to mobilise private finance (co-investment, risk-sharing, facilitate provision of venture capital).
			<i>Conditions and priorities for public funding</i> – bureaucratic processes, risk-aversion, delays, inconsistency between policies, un-strategic investments, priorities.	<ul style="list-style-type: none"> • Simplification • Foresight on priorities
	Knowledge	Access to knowledge	<i>Partnership issues</i> - transfer of knowledge from research sector	<ul style="list-style-type: none"> • Promotion of science-industry links • Diffusion measures
			<i>IP system</i>	<ul style="list-style-type: none"> • Patent box
Services	Exchanges enabling innovation	<i>Heavy reliance on external knowledge for innovation and increasing importance of innovation ecosystem approach, creates a greater role for services that enable connectivity and exchange</i>	<ul style="list-style-type: none"> • Support for RTOs, standards bodies, measurement and testing services, consultancy support, and professional (technical) services Service Businesses • Digitalisation, adoption of ICT in innovation planning and implementation. 	
Systemic	Regulation and Standards	Regulation	Challenging frameworks (e.g. REACH or clinical trials), costs of compliance, instability, varied compliance (level playing field)	<ul style="list-style-type: none"> • Simplification • Proactive regulation
		Standards		<ul style="list-style-type: none"> • Support for standards projects
	Insufficient demand for innovation	Access to markets	<i>Market barriers</i> in the public sector – inc. failure of public procurers to adopt innovations and other barriers to purchasing. Also international trade issues	<ul style="list-style-type: none"> • Procurement for innovation • Pre-commercial procurement • Supply chain measures
	Intermediary institutions		[Lack of middle TRL R&D] [Lack of technology infrastructure] [Lack of capacity to assist firms]	<ul style="list-style-type: none"> • Support for RTOs, standards bodies, measurement and testing services, consultancy support, and professional (technical) services Service Businesses
	Populations of actors and entry/exit conditions		[Deficiencies in anchor firms] [Lack of entrepreneurship]	<ul style="list-style-type: none"> • Promotion of technological inward investment • Support for scale-up firms • Support for start-ups • Student entrepreneurship education & support

	System transformation		[Lock in] [Coordination failure]	<ul style="list-style-type: none">• Challenge-based initiatives• New mission-oriented research
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Response to Building Our Industrial Strategy

Findings from the Industrial Innovation in Transition Survey

1. About the research: This brief for the Industrial Strategy is based upon findings from the Industrial Innovation in Transition project.³ The objective of the project is to create a holistic understanding of the current practices of the innovative companies across Europe, how they relate to their external environment and the challenges they face, including the implications for innovation policy.

The project employs a multiple method research design, including interviews, case studies, a survey and policy review. This briefing is based on the recent survey based on in-depth interviews with senior managers in 694 innovative firms in 11 European countries, including 93 in the UK. The survey covered companies in the agri-food, bio-pharmaceutical, clean technology, information and communication technology (ICT), and manufacturing sectors, which were selected to represent the diversity of modern industrial practice. The interviews lasted 1-2 hours and addressed changing patterns and strategies in industrial innovation and their implications for innovation policy, including the rise of the ‘innovation ecosystem’ (IES) perspective.

2. The sample: Innovative UK companies were identified using the European Union Innovation Survey results from 2014 and 2011, and the lists of Innovate UK grant and programme participants from 2011-2015. Companies were invited to take part individually and a balance was sought between size and sector. A larger proportion of the companies interviewed were in the 0-49 employees range (44.1%) and the 50-249 employees range (21.5%), reflecting the composition of the UK economy. The sample was relatively evenly split between entities that were members of a company group (43%) and independent (single) companies (49.5%). There were a low number of listed companies compared to some countries.

The majority were business-to-business companies (81.7%), which was similar to the samples in The Netherlands, Austria, Estonia and Spain, and over half had an international market orientation (55.9%) - similar to the samples from Italy, Austria and the Netherlands. Some countries had very high numbers of internationally focussed companies (Finland; Spain, Portugal and Germany), and Estonia had a very high number of domestically focussed companies.

The UK sample was relatively evenly spread over the five sectors (Manufacturing (24.7%); ICT (18.3%); Biopharmaceutical industry (22.6%); Clean Technology Industry (23.7%); Information and Communication Technology Industry (18.3%)), and contained companies identifying as suppliers (44%); integrators (29%); producers (33%) other (12.9%), noting that some companies occupy multiple value chain positions in different markets.

3. Innovation and UK companies: strategies, focus and time horizon: *What is the relationship between innovation and business strategy amongst UK companies?* 47.3% of UK companies surveyed stated that innovation drives their business strategy. This is similar to the number of Austrian (54.7%) companies who reported innovation as the business strategy driver and greater than Finnish (20.3%) and Estonian (12.5%) companies. But 83.3% of companies surveyed in the Netherlands, 92% of companies in Germany and 96% of Portuguese companies state they are driven by innovation. Furthermore, less than a third of UK companies reported that innovation was driven by the business strategy (29%) suggesting that innovation and business planning are not as integrated amongst companies in the UK compared to other countries.

The *focus of innovative activity amongst UK companies* is relatively evenly spread between ‘supporting current processes and markets’ (67.7%) and ‘developing next generation products and processes’ (74.2%). The large proportion focussing on next generation products and processes may explain the low level of integration with business strategies as this type of activity often takes place in separate units or joint endeavours. A smaller proportion of Austrian

³ This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 649351. The project is being delivered by 5 partners: Aalto University, Manchester University, University of Twente, Joanneum Research Center and Zabala Innovation Consulting.

companies emphasised this activity (49.3%), whilst higher proportions of Estonian, Italian, Dutch and Portuguese companies focussed on this category of innovation (>90%). UK companies emphasised establishing new businesses (34.4%) and developing and implementing core technological competences (31.2%) to a lower degree. This trend was shared by companies in the Netherlands for example, but companies in Finland and Germany are much more focussed on establishing new businesses through innovation (82.6% and 78% respectively).

The *scope of the companies' innovation strategies* varied significantly. Companies in the Netherlands placed a strong emphasis on technological (95.8%) and functional innovation (60.4%), whilst UK companies focus is customer needs (54.8%). This was a feature shared by companies in Austria (62.7%); CZ (76%); DE (60%); ES (71.1%) and IE (73.3%), who did this to a greater extent. Reflecting this scope, 62.4% of UK companies surveyed reported customers were the main factors involved in beginning an innovation project compared to employee driven initiatives (16.1%), cost factors (12.9%), product driven developments (24.7%) and R&D drivers (29%) – and other (16%). Customers are also mentioned most often amongst German firms, but employee driven initiatives (40%) and R&D driven activity (46%) are also much higher. For firms in the Netherlands employee driven initiatives are even higher (60.4%), followed by product driven developments (52.1%) and R&D driven initiatives (47.9%). This suggests that UK companies are very demand driven, and may be overlooking opportunities for employees to drive innovation and capitalise on product development and undertake R&D. Lower proportions of companies who state R&D is the main factor in the beginning of an innovation process were found amongst Austrian firms (18.7%), Finnish firms (24.6%) and Irish firms (25%). 35.5% of UK companies reported using start-ups to manage innovation and also acquisitions of other companies or intellectual property (37.6%). The use of start-ups is similar to German companies, but the use of mergers and acquisitions is much lower than by German and Dutch companies (62% and 56.3% respectively).

UK companies more often reported 'general management' as the main innovation decision-making actor (59.1%), compared to 'R&D departments' (24.7%), 'Dedicated Central Innovation Committees' (15.1%), 'Strategic Business Units' (11.8%) and 'Marketing Departments' (18.3%). General management is reported most often across the sample (e.g. by 72% of German companies), which is interesting given the greater role of R&D at the start of the innovation process reported elsewhere. German and Italian firms more frequently reported using dedicated central committees (40% and 35.6% respectively) to make decisions about innovation.

Less than a third of UK respondents cited changes in how innovation is managed within the company in any category: organisation of innovation (28%); innovation processes (25.8%); tools/methods for innovating (12.9%); other (15.1%). This profile is similar to Finnish and Estonian companies but not German, Dutch or Spanish companies who more often reported changes in how innovation is organised (52%, 60.4% and 51.1% respectively) and the processes used for innovation (44%, 31.3% and 53.3%). This suggests the practices for managing innovation across a company used by UK industry could be updated and comparatively improved.

Across the whole population, companies did not indicate a decline in technical or non-technical innovation, but it is harder to say there has been a definitive increase in either when looking at sectors. In certain countries there have been significant changes, for example Estonian, Spanish Portuguese companies report large increases in technical innovation, whilst a small number of German companies reported a decrease in technical innovation (8%). Companies in Italy and Spain indicate a decrease in non-technical innovation, whilst 36% of German companies indicate an increase in non-technical innovation (36%). Companies in the Netherlands report an increase in technical innovation (29.2%) and non-technical innovation (41.7%). Low proportions of UK firms report increases in technical (12.9%) or non-technical innovation (17.2%), with the same number reporting no change (17.2%). The timescale of the innovation process has decreased for ICT companies – with companies from other sectors reporting more evenly between no change and a decrease.

4. Innovation Ecosystems: The concept of innovation ecosystems and its relevance is covered in our other briefing submitted to the Industrial Strategy consultation (*'Brief for Industrial Strategy on Implications of an Innovation Ecosystem Approach for Policy Design'*). Over half of the UK firm's surveyed report trying to develop their innovation ecosystem as part of their firm's strategy for business and external environment (51.8%) and only a small proportion definitively indicated that this was not part of their business activities (6.5%) compared to 78.8% of Estonia companies

who reported they did not do this, and 56% of Czech companies. The percentage of companies actively developing their IES is higher in the Netherlands (70.8%), Italy (64.4%) and Spain (63.3%). Activity undertaken by larger proportions of UK companies to maintain their position in their innovation ecosystems includes influencing policy and regulations (17.2%) and developing alliances (26.9%). Cost and pricing initiatives, quality initiatives, publicity, acquisitions and developing new technology were considered less often by UK companies compared to other countries.

The purpose of maintaining a position within an innovation ecosystem is primarily to ensure access to knowledge being generated outside the company. 41.9% of UK companies indicated that knowledge flows were the most important element of their innovation ecosystem, compared to mobility of people (19.4%); financial support for innovation (10.8%), services (10.8%) or other elements (6.5%). But what has the most influence over the ecosystem? Across the whole sample, companies indicated that customers have the most influence in determining the structure of their innovation ecosystems – be it end users or the next entity in the value chain of the company is a supplier to an integrator for example. The only exception to this was Austrian companies, who reported public research bodies as equally influential (this was the second most populated category for UK firms (26.9%)). More German and Dutch companies rated their own organisation as the most influential entity in their innovation ecosystem - 24% and 35.4% respectively, compared with 17.2% of UK companies.

Comparing sectors, customers are rated as the most important entity, with Agri-food and manufacturing companies also rating suppliers as influential to their innovation ecosystems reflecting the longer value chains in these sectors. Regulators are important for clean technology companies (33.6%) and bio-pharmaceutical companies (35.9%), sectors which are often policy-driven and highly regulated (particularly the bio pharmaceutical sector). Demand in these sectors is also driven by public bodies, making them more sensitive to the policy and regulatory setting of innovation. ICT companies rate public research bodies as the second most influential player in the innovation ecosystem.

When asked about stakeholders that are important within the company's own specific innovation ecosystem the dominance of customers changes when comparing countries. Whilst they are still ranked as the most important stakeholder for companies Portugal, Italy, Ireland, Finland, Estonia, Spain and the Czech Republic, public research bodies are considered the most important stakeholders for companies in the UK (75.3%), NL (77.1%), Germany (92%) and Austria (96%). Financial stakeholders, suppliers and regulators also feature more strongly when companies were asked about their own ecosystems.

Over half of UK companies said that they regularly rely on knowledge from outside the company for their innovation activities (55.9%), a similar figure to companies in Italy, Germany and the Czech Republic, and 20.4% said they have recently started to rely on externally produced knowledge. Sector differences are not as wide, indicating this may be a place based characteristic rather than an industry based one.

90% of the UK companies asked said that they are engaged in open innovation in one or more forms, either to expand market prospects (34.4%), solve technical problems (37.6%) or other purposes (46.2%). Using open innovation to expand market prospects was more commonly cited by Pharmaceutical companies, whilst solving technical problems was more often cited by manufacturing companies, reflecting the different business models of these two industries.

5. Policy needs and gaps: UK companies report using innovation policy initiatives more often than those in the Netherlands (who seem to access innovation policy support significantly less than in any other country) Finland, Estonia and the Czech Republic, but less than companies in Spain, Portugal, Ireland, and Austria. The initiatives used most are R&D grants (used by 57% of UK companies surveyed), followed by tax incentives (29%) and policy instruments that facilitate engagement with or joint innovation with public research organisations (24.7%). Public procurement was used by 9.7% of UK companies (similar figures were reported in Ireland, Austria and the Czech Republic), compared to 48% of Portuguese companies, 15.6% of Italian companies, 75.6% of companies in Estonia. No companies in the Netherlands or Germany reported using public procurement as an innovation policy instrument. Looking at policy instrument use across sectors, R&D grants also come out as the most widely used innovation policy instrument, followed by tax incentives for bio pharmaceutical companies, Consultancy support in the clean technology sector, and instruments for work with public sector research organisation in the Agri-food, ICT and manufacturing sectors.

Companies in the UK were amongst those reporting fewer changes in the innovation policy instruments they use (17.2%) along with Austrian (16%) and Finnish (4%) companies, whereas very high levels of change were reported in Italy, Spain and Portugal, and moderate levels in Germany (28%) and the Netherlands (25%). These changes were more strongly felt in the agri-food and manufacturing sectors.

Access to finance was a barrier to innovation for 46.2% of UK firms, and 19.4% stated that this was a barrier at the national level – as opposed to the European (8.6%) or in general (22.6% - said it was a barrier but did not specify the origins of the barrier). EU level finance was a bigger barrier (more important?) for companies in the clean technology and bio pharmaceutical sectors. A larger proportion of manufacturing companies reported finance was not a barrier to innovation.

50.5% of UK companies reported access to knowledge was not a barrier to innovation, a similar proportion as companies in Italy and Spain, but lower than the companies in the Netherlands, Germany and the Czech Republic (62.5%, 64% and 88% respectively). National and European level barriers to accessing knowledge were not reported very often by UK companies (6.5% and 3.2% respectively). Companies that did report national barriers to accessing knowledge were more often in the manufacturing sector.

Accessing markets was not reported as a barrier by many UK companies. Across the sample as a whole, national market barriers affected Bio pharmaceutical companies more often. 47.3% of UK companies surveyed said a lack of capabilities and skills were a barrier to innovation, and 29% of UK companies surveyed said this was a national problem, along with 18.3% who reported this as a general problem.

The national setting appears conducive for establishing the partnerships needed for innovation by UK companies (only 5.4% reported national barrier to partnerships), although there may be more general issues (15.1%). The same trend applied when asked about the IP system – with 0 firms reporting national issues, but 19.4% citing the IP system as a general concern. These barriers seem to affect manufacturing companies the least. Regulations are also considered problematic in general (20.4%) with global concerns (9.7%) and national concerns (11.8%) being cited less often than European level regulation (15.5%).

6. Key points

- UK companies are more reliant on external knowledge for innovation, particularly their customers. They employee-driven initiatives and R&D activity as the most important factors in starting an innovation process less often than companies in other countries.
- UK companies have become good at accessing external knowledge as over half report that this is not a barrier to innovation, however, higher proportions of companies in other countries do not experience barriers to accessing knowledge, who may also have more established internal capabilities for driving innovation.
- A lower proportion of UK companies report a change in the way that innovation is organised and managed within the company, suggesting room to increase capacity for effective and faster innovation.
- A lower proportion of UK companies report changes in the public policy initiatives they access. This may be indicative of a stable innovation policy environment, but it may also suggest the need for more extensive and tailored signposting in the UK (as the differences are not significant at sector level)

7. Contact and follow up

The [IIT Project](#) will continue until end of July 2017, and further results and dissemination activity from the interviews, web-survey and case studies will be completed in Summer –Autumn 2017.

To request further information or ask about a particular aspect of the research please contact:

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Industrial Innovation in Transition Key Findings

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Alliance Manchester Business School
University of Manchester

Setting the scene: a changing paradigm for innovation

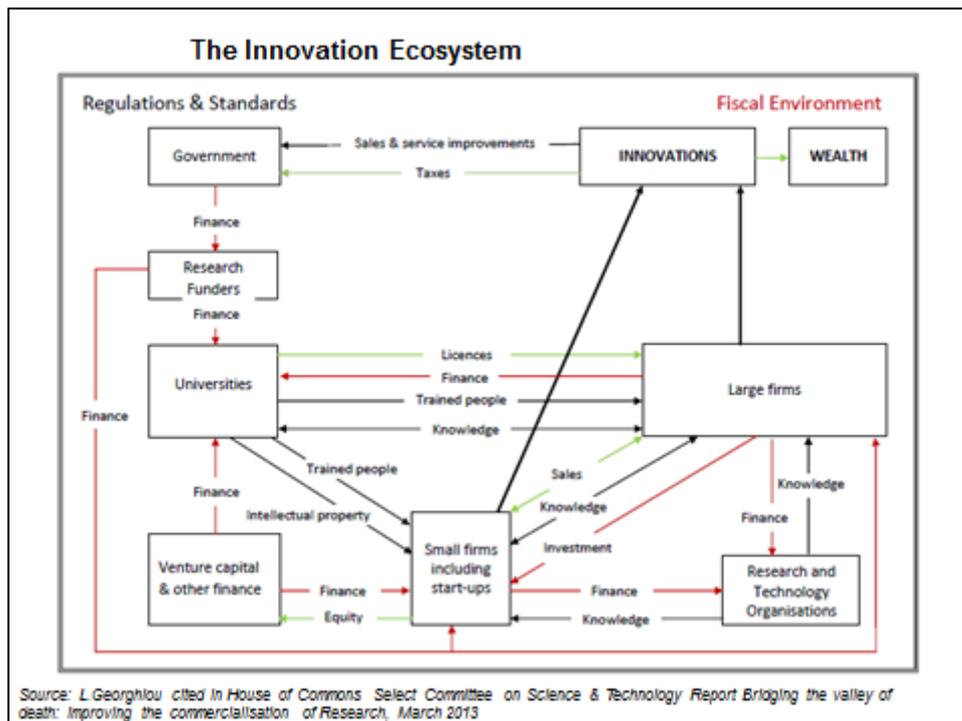
- Long term structures of post-war science and innovation built around largely self-sufficient major firms benefitting from science as a public good
- From 1980s cost pressures, rapid pace of technological change in critical technologies and political pressure for science base to demonstrate its contribution to socio-economic goals shifted system to much greater externalisation and transactional focus
- Policy thinking followed and key concepts of innovation systems were matched by stronger emphasis upon promoting collaboration
- By early 2000s crystallised in concepts of open innovation and innovation ecosystems

Distinguishing open innovation and innovation ecosystems

- Open innovation (OI) concerns the use (& provision of) of external ideas by firms to improve success in innovation & the methods & strategies needed to achieve this
- The innovation ecosystem focuses upon the dynamics of the wider environment in which innovation takes place. It encompasses both the OI approach & the focus on institutions of the innovation systems approach
- Distinction is on understanding the flows and interdependencies at a systemic level:
- *“The added value of thinking of this system as an ecology is the focus it brings to the distribution and abundance of research performers and knowledge and their interactions with each other and the broader environment”* (ERA Rationales Report, European Commission 2008: 23)

Linking it together – four key flows in the innovation ecosystem

- People
 - Having the right skills and talents, retaining the best graduates from our education system, critical mass in labour markets for creative people
- Finance
 - Investment in research, support from banks for growth companies, seed capital, venture funding, enabling investment in infrastructure (physical and intangible)
- Services
 - Infrastructure and associated services for innovation including incubators, science parks, digital connectivity, business support, access to equipment for testing etc.
- Knowledge
 - Flow of ideas, IPR and opportunities emerging interactively from universities, hospitals, RTOs, business R&D, creative sector





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The IIT Project

- IIT project reviewing changing nature of industrial innovation in past 10 years across 5 sectors and 11 European countries
- Central instrument a survey of 693 companies by means of in-depth interviews subsequently coded for quantitative & qualitative analysis
 - 93 firms in UK (13.5%)
- Further aim to assess adequacy of current policy frameworks and instruments



IIT
Industrial
Innovation
in Transition



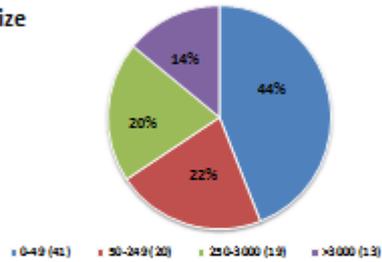




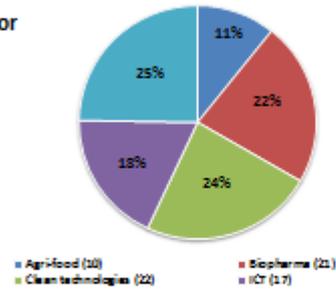
 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101019122. The European Commission has no liability in respect of the data contents.

UK Companies

Size



Sector



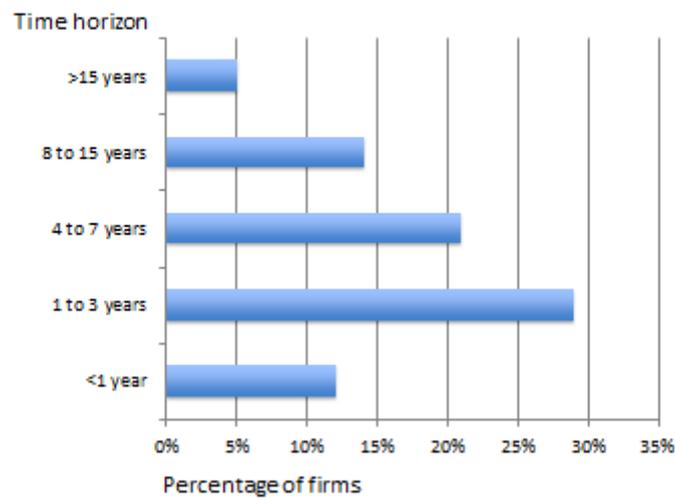
Sampling:

- *Innovate UK*
- *FAME*

How does innovation sit in UK firms?

- Innovation drives business strategy more often than vice-versa (47% vs 29%)
- Supports both current processes & markets and next generation products & processes
- Innovation strategy scoped on customer needs (55%), with main factors involved in beginning an innovation project showing less employee or R&D-driven initiatives than German or Dutch firms
 - New projects mostly from customers (62%)
 - Much lower % than Germany citing employees (16% UK vs 40% DE or 60% NL) or R&D (29% UK vs 48% DE & NL)
- Centralised or general management main innovation decision makers

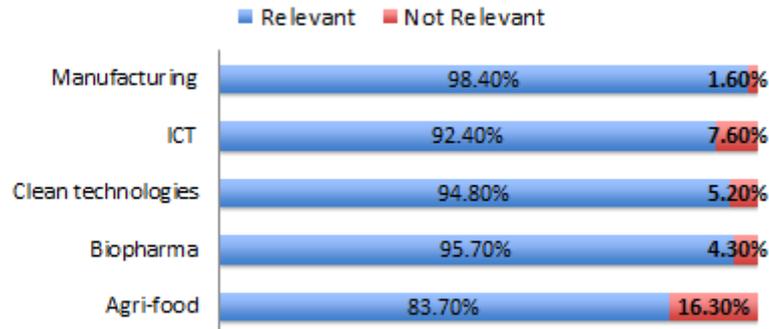
Time-horizon for innovation (UK firms)



Reliance on knowledge from outside the firm

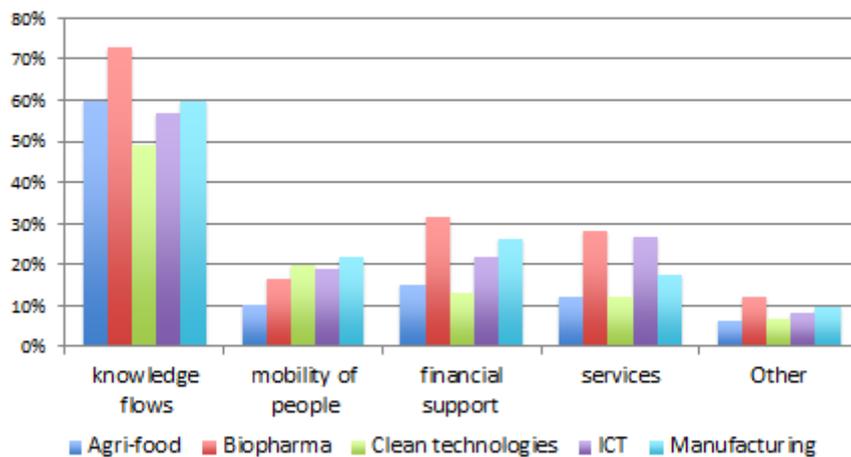
- 56% of UK firms use external knowledge on a regular basis, 20% have started to do so and only 11% do not
- 90% of UK firms engaged in open innovation
 - to expand market prospects (34.4%) esp. Clean Tech and Agrifood
 - solve technical problems (37.6%) esp. Clean Tech and Manufacturing
 - other purposes (46.2%)

Percentage of firms considering ecosystem concept relevant for their innovation activities (all countries)

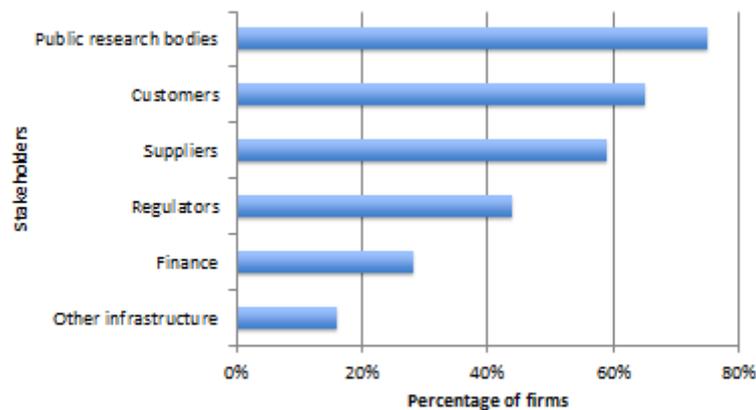


“We see ourselves in the centre of an eco-system. That is what we do. We integrate technologies and capabilities together because the trick is, which is the challenge for the R&D manager, the R&D manager’s job is to create that eco-system which best feeds our central hub.”

Most important elements of the ecosystem (all countries)



Importance of stakeholders in the innovation ecosystem



"Our eco-system really is our customer base I think. Then it is the providers of staff to us, if the universities are doing good research then they are then training people we need to take."

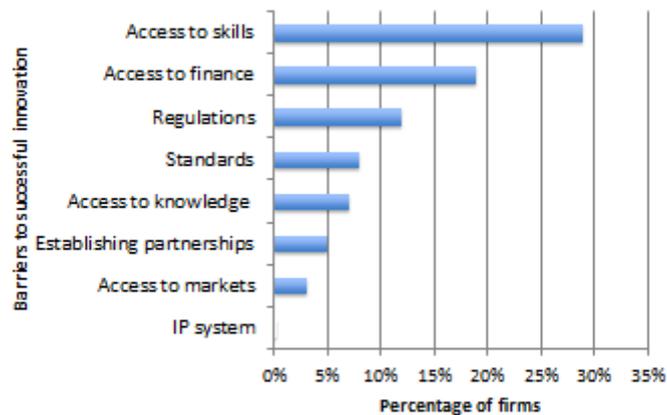
Managing in the ecosystem

- 52% (UK) develop ecosystem as part of their business strategy vs 7% who do not.
 - Influencing policies and regulations (17%)
 - Developing alliances (27%)

"I think at the moment its [leading the innovation ecosystem] customers and leading edge people ... but there's standardisation, there's going to be standards are going to start taking over in the next year or so to tidy up the ... market."

"the actual regulations it's something that makes customers probably want to buy our products"

Barriers to innovation



"People is a challenge, getting good people, there's been a lot of growth in the UK and that's challenging to get people that have a good, sound knowledge base"

Differences between UK and other EU firms

- UK firms more reliant on external knowledge for innovation, particularly their customers
 - other countries may have better established internal capabilities for driving innovation
- A lower proportion of UK companies report a change in the way that innovation is organised and managed within the company
 - Scope to improve speed and effectiveness
- A lower proportion of UK companies report changes in the public policy initiatives they access
 - Suggests need for more extensive and tailored signposting in the UK
- Advanced competitors eg Germany & Finland find skills to be much less of a barrier

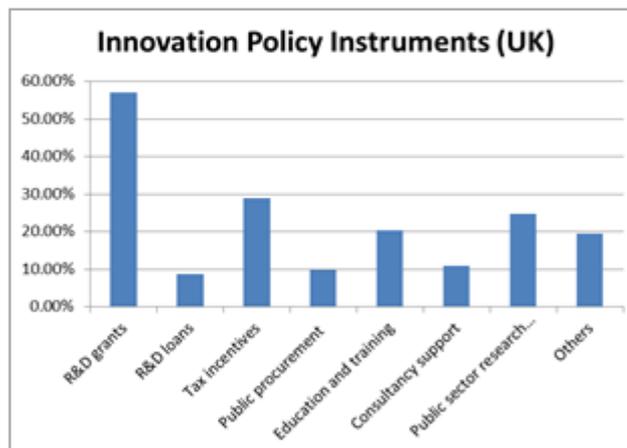
Transitions in Industrial Innovation and Innovation Ecosystems

Early reflections on policy implications for the UK from the Industrial Innovation in Transition Project

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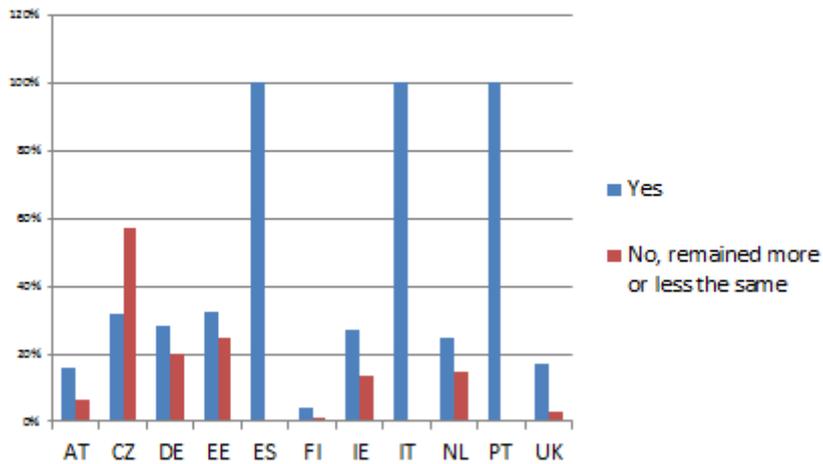
Importance of Policy Instruments (UK)



For UK firms, R&D grants are considered the most important instrument, followed by tax incentives, funded public sector research organisations, and education and training (supporting flows of finance, knowledge and people).

Whole sample also ranks R&D grants first, followed by public sector research organizations, consultancy support, then tax incentives.

Changes in public policy initiatives used



*"The main problem relating to innovation for us as a small company ... would be the **lack of an innovation uptake agenda in the NHS** ... because the NHS didn't have the means to put any money into actually develop beyond the concept, or in many cases even patent protect it, generally speaking, it didn't work ... **if you looked at how many ever made it into the public domain, it's almost none.**" [UK Bio-Pharmaceutical SME].*

*"It's going to fail in the middle ... no manager in the KTN wants to be behind something that's gone wrong because it's probably going to reflect on his career, so they bet on the **sure fire winner which is the academic research** ... It can be less effective, but it's really something that can't go wrong because you're getting it to pre-commercial ... and then once big companies pick it up of course you're nearly certain of success ... They have these competitions, but then you have competition advisors who try and make it look the best possible ... and it'll be put into the flavour of the day ... **it's just a system which supports the behaviour that is actually unhelpful.**" [UK Bio-Pharmaceutical SME].*

*"... **the beauty of the SBRI scheme is that it uses the innovation ecosystem** ... the successful ones that we're involved with would include **one or two SMEs, they include the university, they include clinicians** and we will obviously be **subcontracting** parts of that work to other people. You're getting a good cross section and they obviously include the people within SBRI who are **the quango-crats** as it were as part of that system. **I think they're great examples.**" [UK Manufacturing SME].*

Policy Gaps (UK)

Institutional	Supply side	Demand side	Wider
Bureaucracy and complexity mean policy instruments not responsive and difficult to identify support (mentoring)	Lack of seed, venture and growth funding, lack of strategic investment, translational R&D, and links to service innovation	Insufficient demonstrators, pre-commercial procurement, and procurement of innovation	Global trade difficulties and incomplete single market
Lack of overarching strategy/ coordination for innovation between depts, agencies, policies, national-regional	Barriers to knowledge transfer from research sector (mobility and access)	Regulation around innovation (seen as both a barrier and positive factor)	Lack of skilled workers and technical/ managerial/ translational/ creative talent/ capabilities
Not enough emphasis on disruption and momentum of knowledge and market development	Gap in support for companies between SME and Large Company	Lack of instruments supporting supply chain innovation and user/customer-led innovation	Fiscal environment, energy policy, carbon or other environment policies (consumer policies)

Principles of innovation ecosystems policy

- Healthy innovation ecosystems adapt and evolve – **policy focus should be direction and speed of change** and the population of actors involved / needed for effective ecosystem functioning.
- Necessitates an **adaptive but simple system**, e.g. one that is based on a smaller number of flexible instruments, or that uses intermediaries to match the policy solution to the company/innovation.
- Whatever the mix, **attention is required to all elements simultaneously** as they are all interlinked. Correcting one area without addressing the overall balance of policy may disrupt the flows and populations within the ecosystems policy-makers intend to support.
- **Organisations and the interactions between them** are they key elements

Policies are required that facilitate:

- *Co-creation (co-evolution, cooperation)*
- *Experimentation (learning and adaption)*
- *Collective anticipation of future needs and trajectories (directionality)*

Improving organisational capacity

- ✓ Mobility programmes and dialogue on future skills requirements.
- ✓ Improving education and skills facilitating knowledge translation (sectors / places).
- ✓ Use of tools for effective internal/external knowledge management/

Facilitating learning

- ✓ Signposting and linking and mentoring.
- ✓ Simplifying innovation support schemes to speed up access to resources.
- ✓ Opening industrial innovation ecosystems (include cities, citizens etc).

Facilitating effective change management

- ✓ Supporting collective strategic thinking about innovation trajectories.
- ✓ Innovation funding that is cross-sectoral, breaks value chains, and is focused on transformation over preservation.
- ✓ Funding criteria requiring awardees to design links to existing innovation ecosystems and/or create new ones.

Problem is policymaker's cannot maintain 'Olympian' overview needed to fully organise the policy system:

- Innovation ecosystems are often *international and not always clearly focused on a particular technology field*, creating governance and organisation challenges.
- Policy makers, regulators etc. are *active players with domain specific knowledge* – advantages are superior coordinating ability and political legitimacy (so emphasise facilitation).
- *Policy needs adapt as ecosystems evolve*, e.g. early stages are potentially volatile and require support to establish viable networks, later stages may see stagnation and require interventions to add new/different resources (extinction?)

1. Does the country (and the regions) have actors with **capacity to act as system integrators** and coordinate ecosystem 'initiation', 'maintenance' and 'development' (e.g. multiproduct, multi-technology firms or anchor institutions)?
2. Is there a **dynamic population of smaller companies** sustained by venture capital who can introduce disruption?
3. What is the role for **established SMEs**? Productivity improvement?
4. To address deficient demand, administrations seek to attract and retain **'anchor firms'**. **But as these consolidate and become fewer in number** we need alternatives, e.g. procurement and supply chain initiatives, lead markets, demonstrators that build ecosystems.
5. Is there a **collective understanding** about the future direction of industries and supply chains with significant presence in the country/regions?
6. How can companies **capture more value** from innovation ecosystems?