



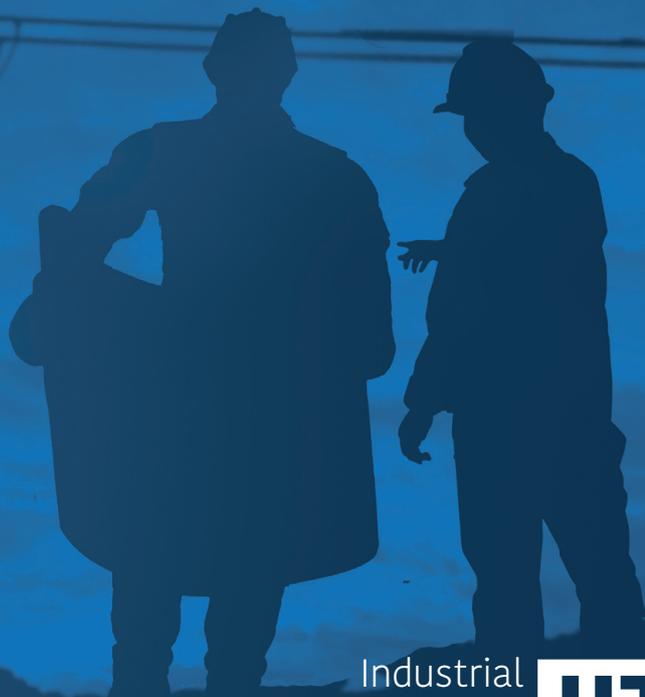
The University of Manchester



UNIVERSITY
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GOOD PRACTICE GUIDE

Innovation Management: Learning from the
Experience of Companies in European Countries



Industrial
Innovation in
Transition



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Introduction and Summary

The need for firms to innovate faster and more effectively has never been more important. It is not surprising then that managers seek ways to improve and to learn ‘what works’ from the success of others. A wide literature seeks to encapsulate such lessons as ‘best practice’, yet this is a moving target as industrial innovation is itself in transition.

The Industrial Innovation in Transition project (IIT) surveyed the innovation practices of companies in Europe, and examined the processes, support tools and policy instruments being used to innovate. The research approached innovation at three inter-connected levels (1) the practice of innovation management in firms, (2) the level of innovation ecosystems and (3) the policies and instruments promoting and supporting innovation.

This good practice guide is based on 694 interviews and 10 case studies with innovative firms from 5 sectors and 11 European countries, and focuses on the first two levels of analysis (a separate policy briefing will also be published). The research covered five of Europe’s key industrial sectors: ICT-Information & Communication Technologies (including ICT services), Manufacturing, Biopharmaceuticals, Agri-food and Clean-technologies. It covered 11 countries classified by the EU as Innovation Leaders, Followers and Moderate Innovators: Austria, Czech Republic, Estonia, Finland, Germany, Italy, Ireland, Portugal, Spain, The Netherlands and United Kingdom.

This guide uses both qualitative and quantitative methods to explore good practice across a range of themes:

1 / Innovation Ecosystem (IES)

The results clearly confirm that companies use their ‘innovation ecosystem’ to obtain knowledge and insights about technological opportunities (e.g. from suppliers); develop new knowledge through collaboration; access information about future regulation; engage in collaborative foresight and to understand customer needs. Companies do not, however, only use their innovation environment as a source for knowledge and information, but also shape its development through practices like communicating future needs to policy makers and regulators, or developing common visioning with external partners, and developing new value and business models. Such interrelations have become more important for companies from all sectors.

2 / New models and tools

Approaches to innovation, such as the customer driven innovation model, web enabled tools and big data, allow companies to blend the physical and virtual spaces of the innovation process, and have become embedded as important part of effective innovation practice. These tools make it possible for people in different companies or parts of the innovation process to co-operate, contribute and become involved in innovation activities.

3 / Open Innovation

The opening-up of innovation processes to enable knowledge, ideas and assets to flow into and out from companies appears to be widely adopted by companies. Over half of the companies studied already (or had recently started to) rely on external knowledge for innovation on a regular basis. Structures for open innovation include supplier-producer partnerships, strategic partnerships with universities, collaborations with customers and end-users, and clusters, networks and platforms. However, there are multiple interpretations of which practices are involved in open innovation, and certain issues should be considered when undertaking this practice.

4 / Future innovation environment mapping

In an increasingly fragmented knowledge landscape and distributed innovation process, analysing the innovation landscape and its likely evolution is essential to identify new trajectories, opportunities, threats, competition and alliances. Companies combine very different information sources and methods to develop an understanding of their future business environment, including highly structured processes like patent analysis, scenario-building and road-mapping, and more informal elements like attending conferences and fairs or drawing on personal and professional networks. Web-enabled tools can be an important means of identifying research and innovation priorities and analysing technology and market intelligence and support idea generation, for example using social media or crowdsourcing. Some aspects this future mapping may be sector-specific.

5 / Innovation process and management

There are multiple ways to organise the actual innovation process, but the de facto practice is still largely based on the stage-gate model. The second principal practice is the customer-driven, lean start-up approach, which is used to organize more disruptive or radical innovation projects in (semi)autonomous innovation units. However, new management systems and organisational arrangements are required to manage the increasing complexity of innovation activities surrounding these processes, given the increase in collaborative innovation, the shorter time horizon for producing innovations, and the use of web-enabled innovation tools and open innovation to manage the increasingly fragmented knowledge landscape. Developing increased capacity to absorb and integrate external knowledge within internal innovation processes is now critical, and ensuring this requires a coupled innovation and business strategy.

The remainder of this guide is structured as follows:

- Innovation ecosystems: implications of the increasing interdependence between innovation actors for flows of knowledge, finance, people and services.
- Tools and models for effective innovation.
- Open innovation: managing the opening-up of innovation processes to allow inflows and outflows of ideas, knowledge and assets.
- Future environment mapping.
- Organising and managing the innovation process.

We recognise that differences between sectors, firm size, positions within value chains and the regulatory and competitive environment all moderate the significance of an approach and comparison of practice across sectors is never straightforward. Nonetheless, the aim of this guide is to open a dialogue between innovation managers, company leaders and other innovation actors to help reflection on the ways innovation can be managed to achieve further competitive advantage.



1 / MANAGING INNOVATION IN THE INNOVATION ECOSYSTEM



1.0 Managing Innovation in the Innovation Ecosystem

In their daily business, companies have to deal with changing and dynamic environments that go beyond their core industry, market and value chain. Fast-paced changes in market requirements and operations resulting from the digitalisation of knowledge and production offer new opportunities but also introduce uncertainty about how value will be created and captured in the future.

Companies rarely contain the required knowledge and competences to manage these challenges on their own. A strong innovation ecosystem containing actors along and beyond the current value chain provides the knowledge, collaborations and resources to fill these gaps.

An Innovation Ecosystem (IES) typically forms around a product or technology and is based on flows of resources such as knowledge, capital, humans and materials. Innovation ecosystems are defined as “...collaborative arrangements through which firms combine their individual offerings into a coherent, customer facing solution” that enables individual firms to generate additional value through innovation¹.

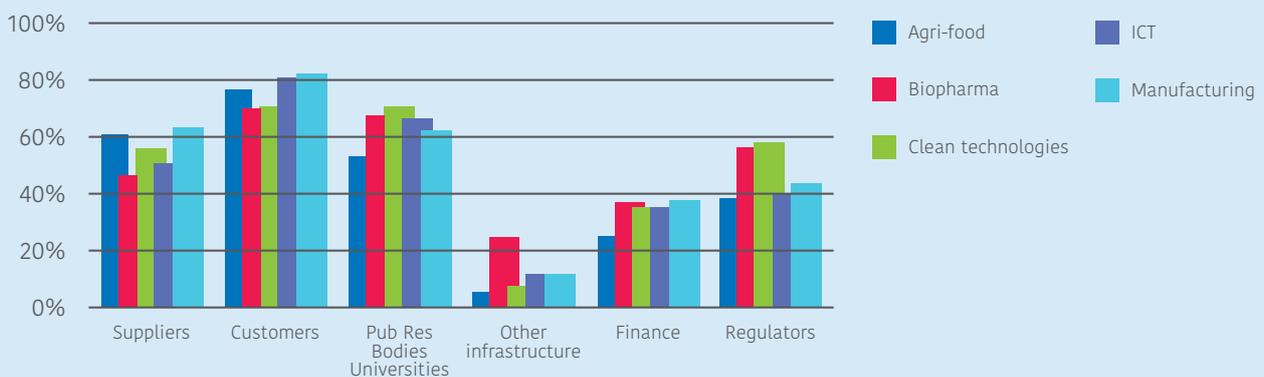
Through interactions with their innovation ecosystem, companies can access external innovation inputs – such as customer, technological, regulatory and societal needs and requirements – and at the same time they also shape its development by influencing other actors in the innovation ecosystem, for example by influencing supplier innovation strategies, communicating with policy makers and regulators, or developing joint visions of future technology trajectories via networked foresight (see section 5). Supplier-producer interactions are central for building capacity for

innovation in the production process and understanding the impact of new technological developments on the value chain. Knowledge developed through collaborative research projects with ecosystem actors can help to coordinate the future evolution of the ecosystem, and collaborative foresight and customer engagement can help ensure business models are optimised for creating value.

Such ecosystem-based interrelations have become more important for companies in all sectors, with every second company in the manufacturing, agri-food, biopharmaceutical sectors citing an increased importance, and 60% of clean-technology companies. Companies in the ICT sector did not identify such a significant rise in ecosystem thinking (40% confirming an increase), which may be related to the already open and interlinked approach to innovation that is characteristic of this sector due to practices like open-source software development.

Innovative companies have a broad innovation ecosystem. These companies include the usual value chain partners such as customers and suppliers in their innovation ecosystem as well as public research bodies, investors, providers of infrastructure, regulators, consultants and policy makers.

Figure 1: Innovation Ecosystem Stakeholders





“When we’re doing these long-term projects, there we naturally network and form partnerships with all the players in the value chain. And each partner has its own specialty in the network. And we have ours. And of course this includes the end customer. So we are in favour of these kinds of consortiums, which have the possibility to execute the project from the beginning to the end.”

Large Finnish manufacturing company

1.1. Roles and influence in Innovation Ecosystems

Companies do not use their innovation environment as solely a source of knowledge, some actively influence the other actors in the ecosystem and the evolution of multi-organisation competences and business models as part of their innovation strategies. Strategies for doing so include, influencing standard setting, financing collaborative research within Public Research Organisations (including specialised professorships at universities), actively supporting industry associations, and incorporating specific technologies within their value chain, using incentives and capacity building.

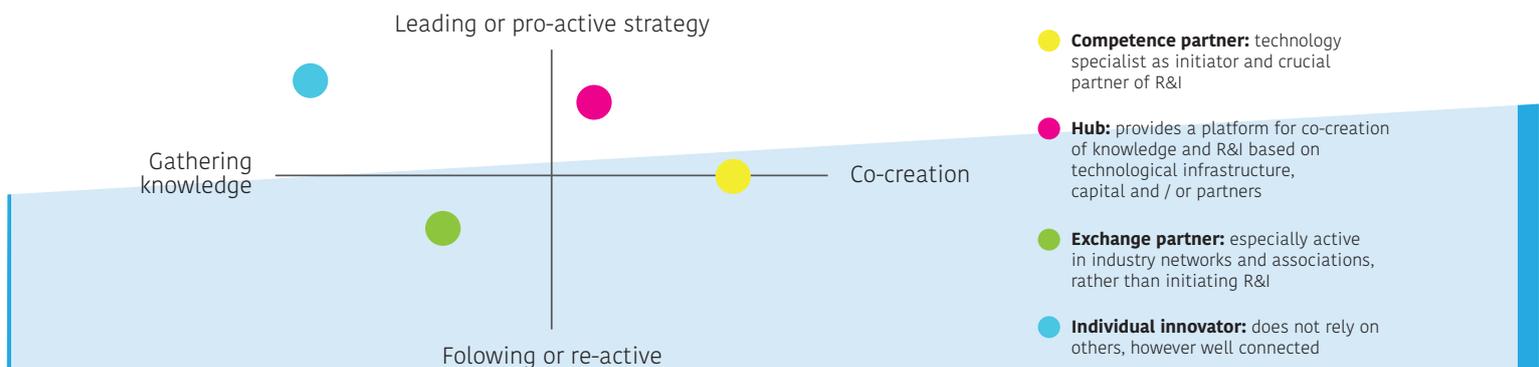
Subsequently, companies can have different positions within their innovation ecosystems based on their role in knowledge creation and exchange (a result of a company’s ability and/or willingness to share and create knowledge in collaboration), and the intensity of their engagement - that may be more active or passive depending on the extent the company seeks to guide the innovation strategies of other actors.

Knowledge-related roles range from using the ecosystem solely to gathering external knowledge and information to actively co-creating knowledge, for example through open innovation projects. More passive engagement is associated with following the innovation programmes initiated by other actors, with more pro-active roles including creating opportunities for collaborative learning, experimentation and knowledge development.

Our analysis reveals four types of innovation ecosystem role, each contributing to the overarching dynamics and functioning:

- **The exchange partner** is highly active in exchanging ideas and information, for example, in the context of meetings of associations. This type of partner may be involved in research or development projects but they are not the driving force for or within multi-actor innovation.
- **The competence partner** provides advanced and crucial knowledge about a specific product and/or process and is therefore a welcome expert in collaborative innovation projects, although they are not necessarily the initiator.
- **The hub provider** opens their company (or at least parts of it) to initiate collaborative knowledge creation. They actively reinforce collaboration by providing technical interfaces and linking other partners by offering collaboration infrastructure and resources, such as shared labs or capital. Companies taking this intermediary and integrative position are sometimes described as system integrators. Providing a platform for collaboration also secures control and opportunities to steer the innovation process, and consequently, this actor has an interest in coordinating the evolution of the innovation ecosystem.
- **The individual innovator** follows a company-centred innovation strategy and does not engage in substantial collaborative innovation, often because their business model values independence and sole-ownership of a particular resource or competency. This company may still be connected to others and try to influence other ecosystem actors through networks and associations.

Figure 2: Roles of established industry companies in IES



1.2. Positioning in Innovation Ecosystems

Companies from all sectors rely on quality improvements and/or developing new technological competences to maintain, strengthen or improve their position within their innovation ecosystem. Influencing policy on standards and regulations helps to create an ecosystem that supports existing or future value creation, and developing alliances is another important strategy for positioning within the ecosystem – e.g. as a strategy for controlling access to critical assets, resources or knowledge. Open innovation may also be a way of managing the introduction of new knowledge, technologies and competences within a specific part of the production or innovation process, lending those that engage in it a crucial role in how certain value chains or market segments evolve. Interestingly, marketing measures such as publicity or price-strategies are not typically associated with innovation ecosystem-related activity.

Firms engage with ecosystem members to address gaps in foundational knowledge (e.g. via new scientific facilities), which they can later commercialise through the ecosystem by optimising business models. For example, one UK manufacturing SME described how they were coordinating partnerships with city-region governments, new applied research with local universities and central government funding to establish the new technological competences, critical mass of innovation activity, and future supply of skilled labour needed to embed a new innovation ecosystem within their region.

Our interviews show that innovative companies in Europe are well interlinked and connected within their innovation ecosystem. They apply strategies in line with their position and try to develop and catch up with new developments.

The following sections articulate the richness and dynamics of the IES that can be transferred to innovation practices within the company.

“Firms engage in employee development programmes with other members of the ecosystem especially universities to address skills gaps. These include training networks with PhD students.”

Medium-sized ICT company

“Active participation in trade associations helps corporations to lobby policymakers, influence policymaking and standards setting, design plans to create social value, and influence education and skills provision.” Medium-sized biopharmaceutical company

“One major challenge in our technological field is that if we want to enter a new business field we need a good reputation. Why should somebody commission an unfamiliar company with a project which is worth millions? Either you possess a breakthrough technology and can therefore convince your customers or you have to cleave step-by-step a way to them: This means a lot of networking, building of prototypes...” Large manufacturing company

“The company has scaled-up in the frame of an Innovation Accelerator which aims at building an open, sustainable ecosystem around public, royalty-free and implementation-driven software platform standards that ease the development of new Smart Applications in multiple sectors. Thanks to it, totally 10.5€ Mill of additional funds have been obtained for financing 101 different developments from 19 European countries.” Small ICT company



2 / INNOVATION MODELS AND TOOLS

2.0 Innovation Models and Tools

Effective innovation management requires models and tools that link the increasingly distributed innovation process, incorporate fragmented sources of innovation-related knowledge and connect the full range of innovation ecosystems actors - including customers.

2.1. Innovation models

The role of customers in the innovation process has changed in recent years from a passive to active one² and in many industries the firm-centric and product-oriented way of thinking is adapting to include customer-centric and market-oriented ways of thinking³.

The majority of companies we interviewed stated that their innovation strategy is organised primarily around customer needs (ICT: 64.4% of all ICT companies interviewed, manufacturing: 64.3%, biopharmaceutical: 52.2%, agri-food: 48.5% and clean-technology: 54.3%). It is subsequently unsurprising that the most important external stakeholders for companies in each sector are the customers (ICT: 81.1% of all ICT companies interviewed, manufacturing: 82.0%, biopharmaceutical: 69.6%, agri-food: 76.8% and clean-technology: 70.7%).

Any form of customer involvement in innovation activity requires appropriate competences, from communication and negotiating skills, along with flexibility and ability to interpret customer demands as they relate to specific products and production processes. For some companies integrating customers' needs at an early stage is an essential aspect of their business model, making the ability to co-operate with them (e.g. by developing and maintaining stable customer networks) a core competence.

Passive customer involvement occurs more frequently in the sectors with long and stable product cycles, such as sub-sectors of the manufacturing industry like plant engineering.

But even passive customer involvement is evolving from customer observations or anonymous customer satisfaction surveys to engaging through face-to-face conversations and direct contact through social media to collect experiences used to refine or adapt products and services. Some companies reported continuous contact (on-going conversations) with customers through feedback-loops during the development of the technology or product.

More **active forms of customer involvement used include problem-focussed or usability workshops or focus groups, or future-oriented brainstorming of ideas for new technologies or products**, which may also be co-ordinated using crowd-sourcing competitions aimed at customers or customer-focussed idea platforms.

Especially trusted customers are involved in testing and refining products or bringing products to the market.

“We demonstrate it to a number of trusted customers and allow them to use the technology; to test the technology and if they are comfortable with the technology; we will continue to build that technology and make it available.”

Small ICT company

Very active forms of customer involvement include co-creation. In one example an Austrian company related how it locates some of its technical employees at the customer site. There they assist the customer to learn to use the product and are able to immediately identify problems and modify the product in situ with the customer. Another British-Irish company reported:

“We have hot houses, where we have a customer and they articulate their opportunity or challenge, and we bring out experts, and we spend three days working out a solution to that opportunity.” *Small ICT company*

*“They tell us what they want and we do the research
into the requirements and build up a plan to
give them exactly what they require.”*

Large biopharmaceutical company



2.2. Web enabled tools

Innovation processes comprise a variety of activities at managerial and operational levels. Web enabled tools help to systemise and structure activities and flows of information and consequently make activities on both levels more efficient in terms of time, money, and human resources, and more effective in terms of outcomes.

Web enabled tools (including on-line and web-based tools) are being used to manage the innovation portfolio and to monitor and adapt the company's innovation strategy to changes in the business environment.

Larger companies in particular are using these tools to identify and select priorities in research and innovation, gather and analyse technology and market intelligence, and facilitate foresight processes. This information is then used to prioritise and rank current innovation projects and the interests of the company.

“The ranking system helped us to understand that we do not have to accept every project just to be seen by external partners, but just those from which we truly benefit.”

Large manufacturing company

Companies that use priority ranking tools highlighted the objective assessment they facilitate, which makes it easier to identify and stop innovation projects that have become uncompetitive or unproductive due to changes in the business environment. Personal affinities of employees to unprofitable projects become harder to justify and resources are efficiently channelled to projects with more potential.

Smaller companies are less likely to manage their innovation projects with the help of web enabled tools, as smaller project portfolios mean it is easier to maintain a manual overview. Additionally, smaller companies have more flexible structures and can maintain intensive relationships with their external partners and effective communication between employees.

“We're all in one building on one floor. So, the easiest way of spreading information, is walking to somebody and talking to them.”

Small ICT company

At the operational level a variety of web enabled tools are helping companies to innovate. These tools can be divided into internal and external tools.

Companies in all sectors and sizes are using intranet platforms or other similar tools⁴ for creative idea generation and to open up the organisation of internal innovation processes and knowledge flows to ensure opportunities for improvement, or open innovation for example, are not overlooked. These platforms may be accessible to all employees and sometimes even customers, clients or suppliers. Some companies operate anonymous internal idea-sharing platforms to encourage full participation; and others are competitive with rewards for the best ideas. Nevertheless, effective use means continuous maintenance by dedicated staff.

Another important characteristic of these tools are that they support flexible working by being independent of place or time (or both). This can help increase the competitiveness and attractiveness of companies to highly skilled employees. For example, firms located in rural areas that face considerable problems recruiting highly qualified people benefit from the distance-working facilitated by these tools.

“We decided to solve the brain drain problem in our region with establishing a virtual firm structure. Most of our employees are not sitting here.”

Micro-sized biopharmaceutical company

Dedicated task-oriented tools are used in some industries and a variety of service platform approaches exist to support design, development, prototyping and validation.

Companies specialising in product innovation often use specialised tools for supporting the design and engineering process.

Web-enabled tools are also being used to facilitate cooperation with external partners through collaborative workspaces for sharing and editing (e.g. Dropbox, Wikis, and cloud tools). These tools are particularly useful to support co-operative innovations and to co-ordinate large-scale innovation communities such as regional, national and international clusters or other forms of private-public-partnerships.

“We are strongly involved in an ICT cluster... The synergies give birth to something that is much more efficient than anything achievable by just one of us alone.”

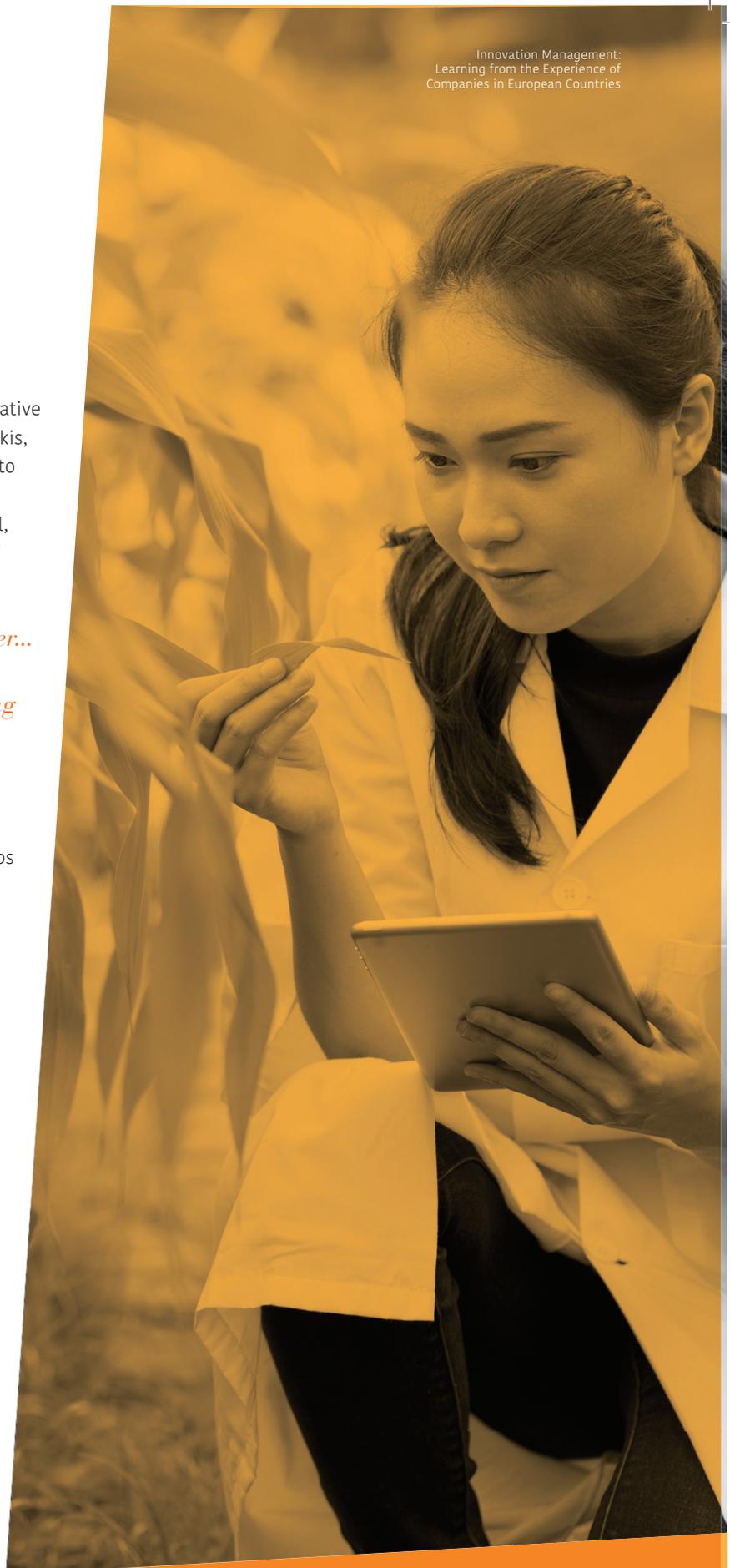
Medium-sized ICT company

Other externally-focussed tools with a more explorative and experimental character are living labs or innovation labs in various forms (virtual, physical or both).

“We established internally a so-called ‘learning factory’. It is designed in a way that employees with different backgrounds and different educational level (not only with an academic background) come together and develop new innovative ideas.”

Large clean-tech company

Crowdsourcing and crowd-funding are growing in significance as a means for facilitating interactions across the boundaries of the company.



2.3. Big Data

Most companies acknowledge that **‘big data’ and the ‘internet of things’ are two potential “game-changers” in the near future** and have begun collecting data in more or less systematic ways. However, the formal use of big data as a tool for innovation and is still far from being standard for the majority of companies.

Unsurprisingly, companies in the ICT sector were more likely to say they used big data (Figure 3), with 46.8% of those interviewed collecting and analysing broad-scale data for innovation and competitive purposes. This activity was relatively common amongst all companies.

The most frequently reported uses of big data were:

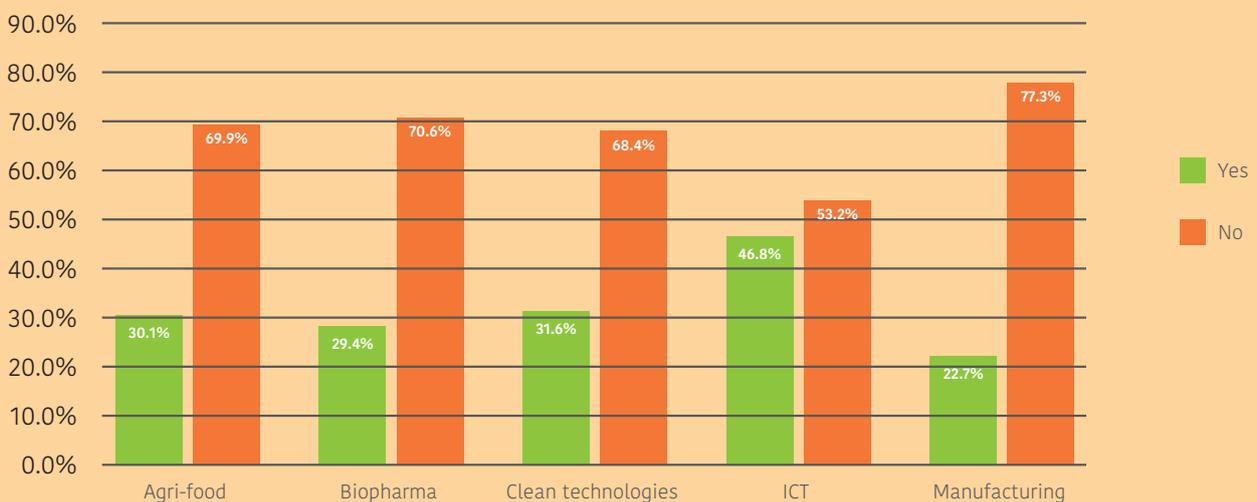
- **Mapping and analysing market trends and consumer needs** using sales/public domain data.
- **Mapping user behaviour** (e.g. energy consumption) to develop new business models.
- **Evaluating and improving current products/services** by recording performance data provided by technologies in use or during production to refine new versions, pre-empt problems and find solutions to bugs. E.g. one UK company monitored the performance, location, usage and replacement of all of their fuel cells sold.
- **Generating insights for new technology application areas** by interlinking data from different fields.

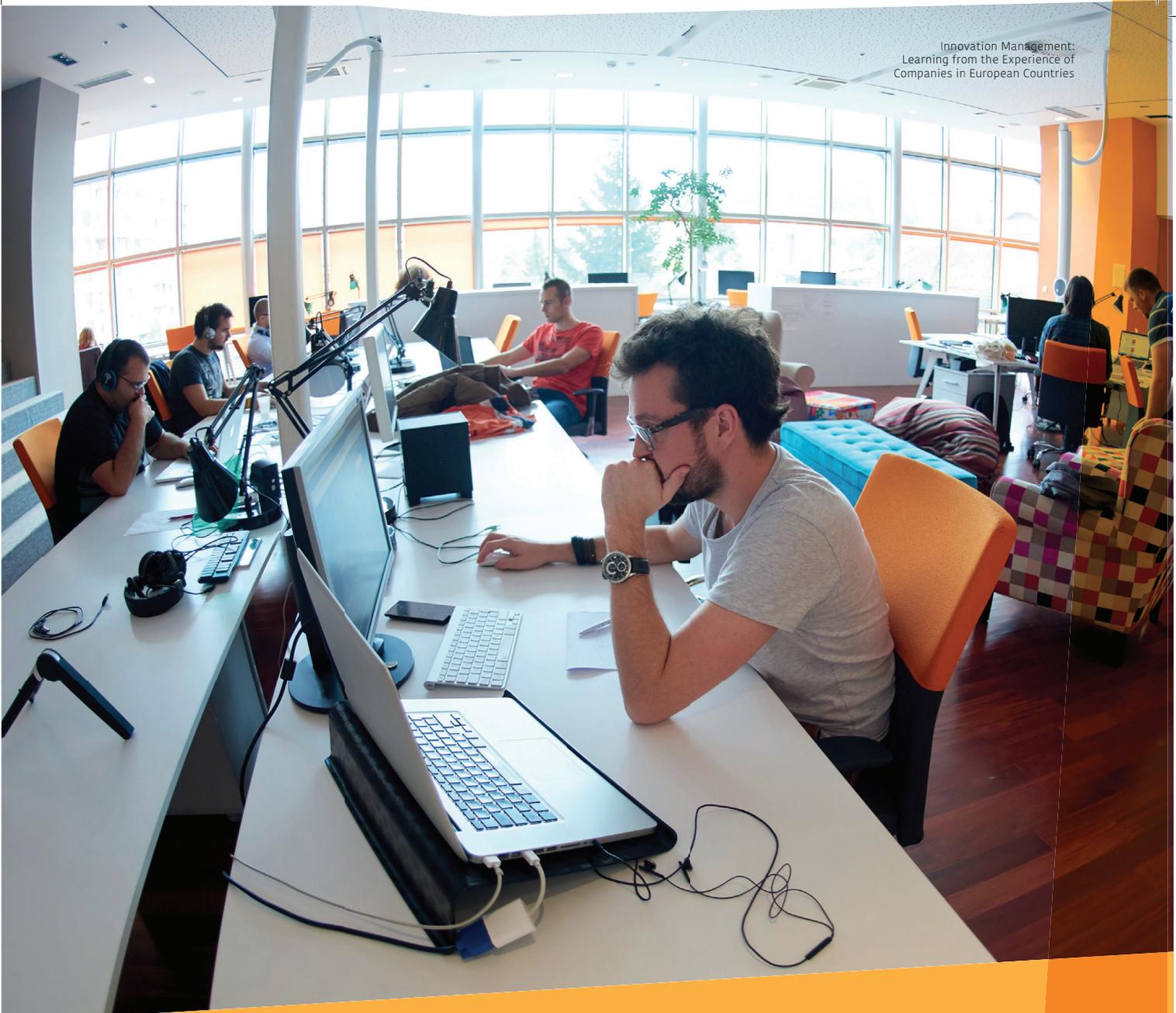
Whilst many companies already collect large volumes of data, it is not necessarily used effectively: the amount of information available is greater than the current analytical capabilities, resources (time, financial) and IT infrastructure required to maximise its potential value. Specialist big data service providers and consulting companies are being used by some companies to provide the relevant skills and appropriate infrastructure, although this is not yet common practice.

Furthermore, new business models are required to capture the value of the technology and tools for collecting and analysing big data in the market.

“Yes, we collect data. We collect data just because they are there and storage space doesn’t cost anything. We are Little Google’.”
Large clean-tech company

Figure 3: Usage of ‘big data’ in innovation activities; n=561¹





“We definitely have had a big innovation project last year where we were specifically looking into the use of big data, but I think we slightly struggle with it in so far as if we come back again to our core customers, if your customer doesn’t see the value in it then you’re never going to make money off it.” Medium-sized clean-tech company



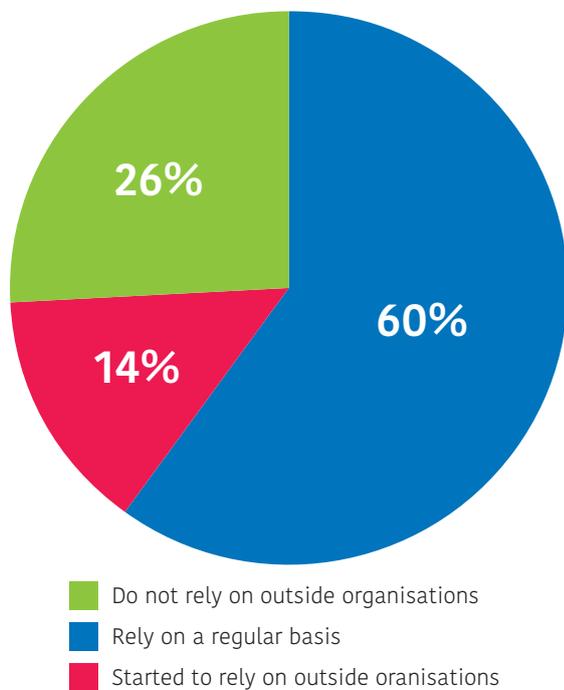
3 / OPEN INNOVATION

3.0 Open Innovation

The term ‘Open Innovation’ refers to the opening-up of innovation processes to allow the inflow and outflow of ideas, technologies or knowledge to accelerate internal innovation and expand markets for external use of innovation.

This enables companies to escape the immediate restrictions of their internal capabilities or to create value from innovation assets that are outside the day-to-day business strategy of the firm⁵. Large numbers of companies said they engage in open innovation (e.g. 90% of UK companies). This trend is undoubtedly linked to the increasing reliance of companies on knowledge from outside the company for innovation – at least half of the companies in the study stated that they already (or have started to) rely on external knowledge for innovation on a regular basis.

Figure 4: Innovation-related knowledge sourced from outside the company (original elaboration on IIT Survey data)



One motivation for engaging in open innovation may be to solve technical problems. Companies in the manufacturing and biopharmaceutical sectors report taking this approach more often, whilst for companies in the ICT sector the motivation behind opening innovation is mostly to expand the market prospects of their products and services.

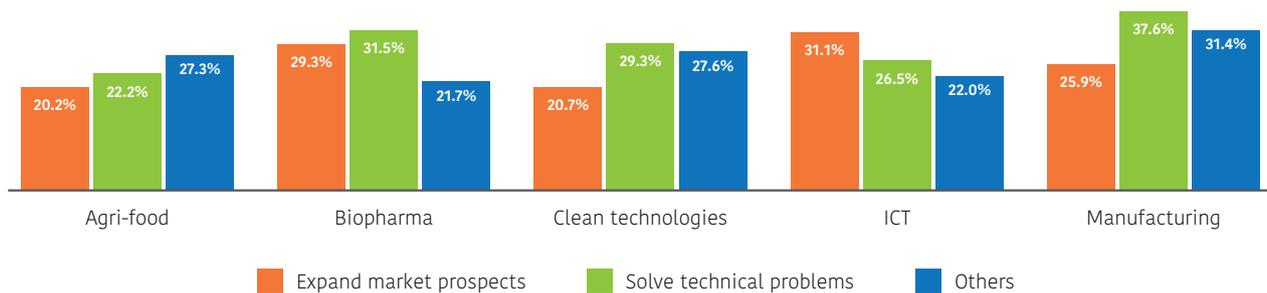
A typical example is to use open innovation techniques to develop non-core processes, technologies or services needed to develop the company’s core offering to market. For example, a small UK Clean Technology company told us how the company focuses its internal innovation activity on the main requirements for the commercial development of its core technology but uses collaboration with the academic and technical sectors to solve problems and acquire other elements of the product necessary to bring innovations to market.

Another practice that falls within the scope of open innovation activity is the use of acquisitions to supplement the innovation portfolio and capacity of a company, but these are less common when the additional knowledge or technology required is outside of the company’s competency area or the company plays an integrating role. In these circumstances it may be more appropriate to create partnerships.

“So we’re playing the role of technology integrator and the best way to do that is to form partnerships rather than acquire.”

Large manufacturing company

Figure 5: Main applications of open innovation (original elaboration on IIT Survey data)



To develop and expand the market prospects of products or services, or to capture value from innovations outside the core business model, companies may license technology or ideas for commercialisation. Other licensing agreements may be driven by the desire to further exploit intellectual property that the producing company is not using or fully exploiting, or to underpin a broader collaboration – where a company licenses out its IP, materials, processes and development capability for joint innovation with another actor in their innovation ecosystem. These broad-based collaborations may be more likely when the subject is a wholly new area of competence or technological evolution.

Open innovation within long-term partnerships or collaborations can also be used to facilitate long term changes in direction or significant improvements required to improve the competitiveness of an innovation ecosystem, producing benefits for all involved.

“We have hot houses, where we have a customer and they articulate their opportunity or challenge, and we bring out experts, and we spend three days working out a solution to that opportunity.” Small ICT company

3.1. Structures for open innovation

Structures for open innovation include:

- Partnerships that evolve between suppliers and producers;
- Strategic partnerships with universities;
- Engagement and collaborations with customers and end-users, and
- Clusters, platforms and living labs.

As customers and suppliers tend to be the most important innovation stakeholders, closely followed by public research bodies, open innovation may emerge more frequently here.

Supplier-producer partnerships and open innovation can involve co-creation in the supply chain: creating more integrated relationships between integrators and suppliers in which information can be shared and resources integrated – including synchronising safety and auditing processes and the timing of innovation in each entity. The mutual benefit that is derived from this type of open innovation is improved production/performance – improved speed to market or co-discovery – and may be formally or informally underwritten.

“So it’s two partnerships now, we exchange samples, we do some basic characterisation and we learn something which is good for everybody. It tends to be hopefully the pre-competitive nature of things”.

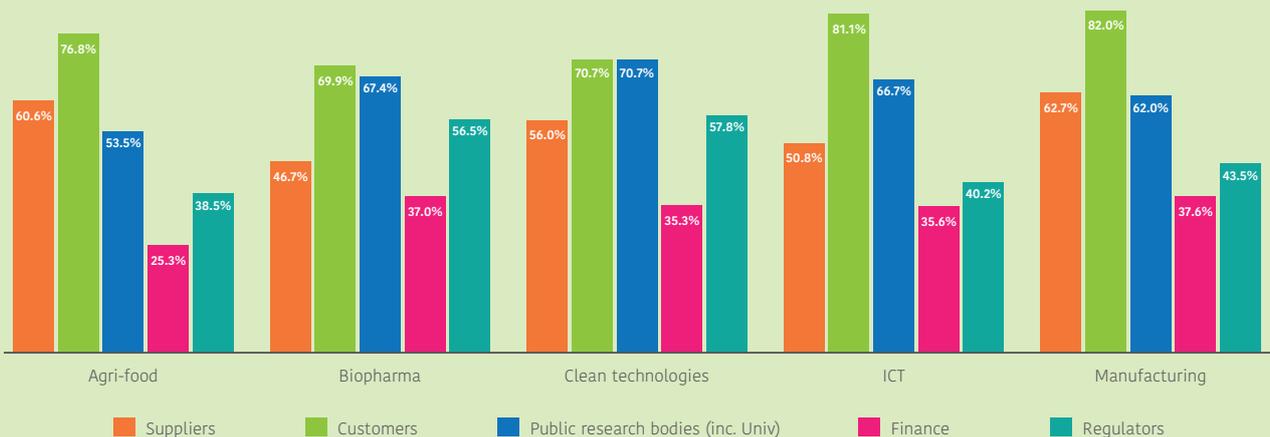
mall clean technology company

Partnerships with adjacent businesses – that is those that are not directly in the company’s supply chain but are part of the delivery of the product to market – can also be a source of open innovation.

“We also do work with adjacent businesses in a number of cases to create new market opportunities so we have an example of a collaboration with a major appliance manufacturer where we’ve actually licensed a piece of ... technology related to water to them – to enable them to innovate in XXX systems to accept a consumable that [we] would create. So they’re not in our supply chain today and they won’t be in our supply chain but they’ll be critical to the success of this innovation because the machine availability will be tied into XXX ...” Large manufacturing company

Open innovation in the ICT sector often involves users, which has a dual motivation of accelerating innovation around new platforms of software and encouraging loyalty to the company’s brand.

Figure 6: Importance of stakeholders in the innovation ecosystem (original elaboration of IIT Survey data)





“... [we] upload a source code onto a public platform which can be downloaded free of charge, however, this is a way of making the users work with their product and possibly bind them to our type of technology. In other words, Open Innovation is used in order to exploit new market opportunities and promote innovation inside the firm.” Large ICT company

3.1. Structures for open innovation (cont)

Many companies had strategic partnerships with universities which underpinned the long term organisation of their innovation process.

“Mapping and innovation has been developed jointly with a University over the last 5 years. The two organisations have jointly filed a large number of patents, enabling the academic partner to gain some compensation whilst the company “gets to work the invention”. The academics teach students about the jointly-developed innovations, and our company has improved innovation management processes as a result of the division of labour.”

Medium-sized biopharmaceutical company

Both partners benefit from these long-term relationships: companies gain access to state of the art knowledge and universities access resources and opportunities to create impact.

“Academic laboratories generally - who read literature and then they’ll say can we take your drug and we want to test it in certain areas. And we’ll provide a drug to do that and let them test it. And often what comes out of those types of collaborations is a different way of using the drug or they’ll have a spectacular finding that it works in this particular breast cancer for example. So we do it in that regard.” *Small biopharmaceutical company*

Co-sponsoring PhD, EngD and Master’s students was a commonly cited practice. More strategic versions of this type of relationship are creating shared facilities.

“We share a facility built with a local university; which would house company staff, academics and technical staff and teaching spaces. That is a building that is a shell which will enable co-operation in the building. It’s an open building...The open space we use for spontaneous projects ...The idea of the space is for people to come together from different discipline areas from other industries.”

Large manufacturing company

Combinations of public and private funding, often forms the root of these structures for open innovation.

“[That’s] public, private and government investment in a major new facility that will take computer-aided materials science to a new place and that benefits both ourselves – we wouldn’t have invested in that capability on our own, neither would the University for obvious reasons but is also an open access capability so that stretches this concept of partner ecosystem a bit further”

Large manufacturing company

3.2. Central issues in all instances of Open Innovation

Despite the relevance of open innovation practices, there are still a number of central questions relating to how firms define and consequently apply open innovation, which also affect the common benefit that can be derived from it and issues of propriety and protection of the knowledge generated.

- **Definition:** open innovation is defined in different ways by different companies. **Each company should be sure that they understand their own definition of open innovation and that of their open innovation partners to avoid misunderstandings about how benefits and risks will be shared.** Definitions include
 - 1) Collaboration with external partners with strict rules about who can use the results;
 - 2) Collaboration with external partners with freedom for all to use results as they wish;
 - 3) Collaboration with external partners with strict rules to publish the results, and
 - 4) Internal innovation with freedom to share openly the results.
- **Common benefit:** the benefits generated from open innovation, their allocation and the requirements placed on participants vary with the size of the company. **Larger companies approach open innovation as a complementary strategy to their 'regular' innovation strategy.** They may have open innovation managers or departments and structure open innovation competitions within long term innovation planning to address innovative projects or technology areas, which are outside current core competences. **Smaller companies do not have the resources to approach open innovation as a complementary activity and it may involve considerable investment, re-structuring and management.**
- **Protection:** intellectual property can be either jointly developed or individually developed, depending on the knowledge boundaries and resources available to each partner.
- **Open innovation framework:** the **framework surrounding open innovation involves a set of strategic decisions about managing relationships within innovation ecosystems.** For example, companies should ask themselves whether they intend to set up a long term alliance, or a transitional team. If so how will it be governed and resourced? How will the resulting knowledge and/or innovations be introduced into the value chain and commercialised?



4 / MAPPING THE FUTURE ENVIRONMENT

4.0 Mapping the Future Environment

Our research shows a wide variety of external innovation inputs that help companies understand current and future challenges, and fill knowledge gaps related to complex customer, technological, regulatory and societal needs and requirements. In an increasingly fragmented innovation process, analysing the business environment, particularly with a view on how it will evolve in the future, is essential for identifying trends, new opportunities and threats, competition and alliances.

4.1. Sources and Methods of Mapping

Companies combine very different sources and methods for developing an understanding of their future business environment. These sources include highly structured processes such as patent analysis, scenario-building and road-mapping but also more informal elements including attending conferences and fairs, or drawing on personal and professional networks.

Firms also involve external partners in future mapping to identify and absorbing broader future-related knowledge. Some companies work with trendscouts, who perform global scans for emerging technological and market trends; others invite development partners, suppliers, start-ups or researchers into discussions, strategy meetings or road-mapping. An understanding of future developments emerges as a result of participation in R&D networks and innovation ecosystems, either from regular interactions or from explicit foresight processes conducted within the network, sometimes explicitly crossing industry boundaries.

In the case of a large Dutch multi-national company, foresight and design methods are mixed and applied in various ways together with either, innovation partners, end-users or policy actors.

“Since recently, we are active in a cluster, in order to jointly conduct foresight with [company X] and other suppliers of [...], as part of an excellence cluster.”

Large manufacturing company

Table 1: Methods of Future Mapping (excluding cases ‘did not ask’, N=650)

Formal	%
Market analysis	43
Scenarios / horizon scanning	35
Patent analysis	30
Roadmaps	27
Consultants	26
Networked foresight	20
Social media	15
Informal	%
Conferences and fairs	64
Personal contacts with customers	42
Public information	36
Professional networks	31
Personal contacts with partners	18



“universities and research institutes, invite for instance diverse development and system suppliers once a year, and ask for their appraisal where the journey is heading in the future.” Large manufacturing company

4.1. Sources and Methods of Mapping (cont)

Companies across the board appear to be increasing their future mapping activities and moving towards more systematic applications. For example, 20% of manufacturing companies reported they conducted this activity more systematically than before.

Some of the future mapping methods, particularly the more structured forms are more often used by large companies than by SMEs. For example, approximately 50% of the companies with 3000+ employees do scenario analysis and also approx. 50% of these companies state they do roadmapping. This is compared to 26% of companies with 10-50 employees state they do scenario analysis and 16% of this same group state they do roadmapping.

Attending and/or hosting conferences or trade shows addresses two aspects of mapping the environment. Firstly, it helps the firms to map the external environment in terms of tracking technological opportunities, regulatory requirements and competitors' behaviour and secondly, it enables firms to identify key opinion leaders for future mapping inputs.

“We always include regulators as observers/discussants in our events because the position of the regulators in this sector means they have an overview and understanding of the direction of technology development and their interventions and questions inform the research strategy of the company.”

Medium-sized clean-technology company

Medium and large companies often have structural arrangements and dedicated departments in either their central management divisions or in business functions that conduct mapping activities.

“We have a strategic science group that undertakes long-term mapping for all of the categories of products we manufacture, including mapping supplier capabilities and projected innovation strategies of our competitors” Large manufacturing company

Due to structural or resource constraints some companies often do not retain dedicated environment mapping teams. Companies often use temporary staff to complete dedicated assignments, which include internships and joint PhD and master's thesis students.

“The literature reviews that these students undertake and their attendance at scientific and industry conferences provide vital sources of information for understanding the current and future innovation environment.” Large clean-tech company

Web-enabled tools can be an important means of identifying and selecting research and innovation priorities and analysing technology and market intelligence; supporting idea generation using social media, crowdsourcing, etc.

“The company carries out Technological Surveillance of large suppliers to know the new raw materials which can be used (i.e. nano-composites). Carried out with the support of a technological centre specialised in web search engines combined with technological assessment.”

Medium-sized manufacturing company

The act of applying for research funding, such as Horizon 2020, can also be a driver to map the innovation environment.

“Systematic environment mapping activity, including developing an overview of the context affecting whole value chains involved in realising innovation, is needed to apply for these funds successfully” Small manufacturing company

4.2. Reasons to Map the Future Innovation Environment

Future mapping is used for a wide range of purposes, including major strategic decisions, project-related decisions and shaping the ecosystem. An analysis of the future environment needs to cover a wide range of elements that will affect current and future innovation activity, which companies do to differing degrees. Most often monitored are technologies, followed by competition and customer behaviour, least regularly are policy & regulation. Economic development is in the focus of only a quarter of the companies.

Companies map diverse aspects of their environment but only some pay attention to developments outside their sector. One in six of the companies in the study pay attention to other markets and business, creating a risk that they are not aware of challenges and opportunities emerging from beyond their common environment.

Some aspects of future mapping are given more attention in specific sectors and sizes of company:

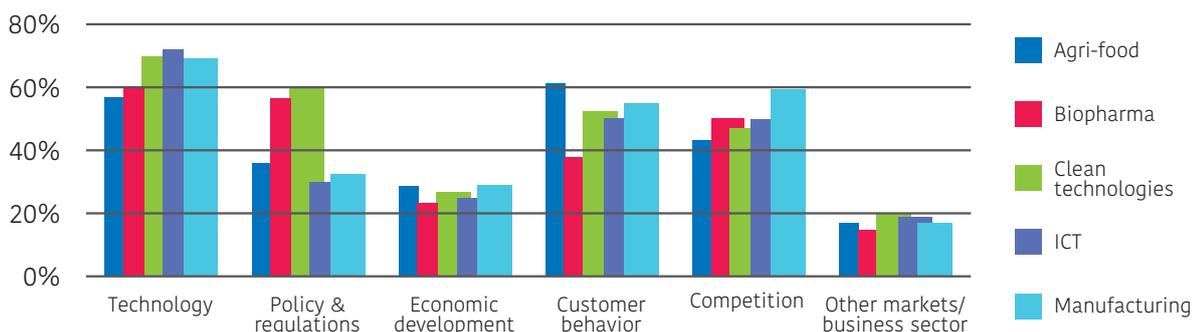
- The number of companies that consider technology, for instance, is particularly high in ICT, Manufacturing and Clean-tech.
- Policy and regulations are a strong focus for companies in the clean-technology and biopharmaceutical sectors, who appear to continuously monitor their legal environments.

- Customer behaviour is most important for companies in the agri-food sector and least for biopharmaceutical companies.
- Large companies (>3,000 employees) more frequently consider other markets and businesses, while policy and regulations and economic development are given more attention amongst the smaller companies.

These findings relate to the innovation ecosystem relevant to each company: companies which consider that the innovation ecosystem has a high or medium relevance for them more often clearly map policy and regulations, economic developments and customer behaviour compared to companies which rate the relevance of the ecosystem only as low or negligible. Companies rating the innovation ecosystem as more important to day to day activity also use road-mapping, consultants, systematic forms of foresight and networked foresight more commonly.

It is common practice to apply these analyses to strategy-building (41%) and exploring new market possibilities (35%). Some applications relate to shaping the ecosystem such as identifying new partners (20%) and in some cases agenda-building (11%). Insights are also used to inform decisions on specific projects, in particular initiation decisions (59%), but also to challenge existing projects (27%).

Figure 7: Future mapping – Main elements monitored



“It is being used quite intensively. For instance, if such a workshop shows that a trend is foreseeable then we really set up a related technology project and say, okay, the next two years we look at this more closely. A budget is created, say, 200.000, 300.000 euros. [...] If we see it does not deliver anything, then it is cancelled.” Large manufacturing company



5 / MANAGING THE INNOVATION PROCESS

5.1. Organising the innovation process

There are multiple ways to organise the actual innovation process, but the de facto organising practice, particularly in large companies, is the well-known stage-gate model. The second principal practice is the customer-driven, lean start-up model, although they are not mutually exclusive: many companies apply both practices across their portfolio.

Another salient issue in organising and managing the innovation process is the relationship between the overall business strategy and the innovation strategy and processes, which will vary in accordance with the company's business model.

“The innovation strategy is generated in this RTD unit, and really drives the whole business strategy of the company, because technology is very critical for the company business competition. “Near 0” energy consumption is becoming a key innovation factor in the product, so research on energy efficiency is more than a 40% of the RTD activity”.

Large manufacturing company

Larger companies tend to integrate innovation into the business strategy through specific entities or processes such as periodic meetings about innovation and brainstorming sessions.

“We have every week a jour fixe. This is a kind of brain-storming session, where every employee is able to discuss his ideas regarding new innovations; new start-ups, which would be promising to acquire; open-source activities or networking activities, he/she is involved at the moment.” Large ICT company

Smaller companies rarely dedicate a specific entity for integrating innovation into the business strategy, which tends to occur through informal connections or single actors.

“We are extremely lucky that we are at the moment a small development team with strong social cohesion. We are very connected and efficiently work together. That's why most of our ideas for new innovation projects are coming directly from us as persons or from discussions with our customers.”

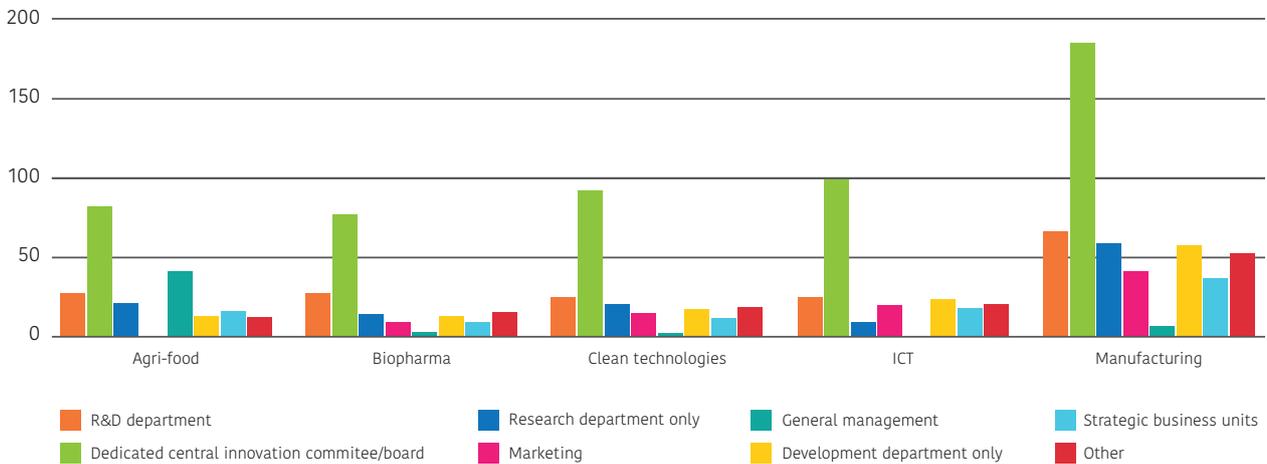
Small manufacturing company

These questions of integration are more salient when innovation activities take place across different business lines/units or within a centralised R&D department or unit that is removed from daily business activity. Both approaches are used by companies and often in combination.

“Each business area of our company has its own R&D department, which is responsible for idea generation and extension of the already existing product portfolio. Additionally to the business area specific R&D departments, there exists a central R&D department. This department concentrates on research and advance development of totally new innovation ideas.” Large manufacturing company

The main innovation-related decision-making actors in companies are general managers (over 70% in all the sectors), followed by the R&D departments. General management is often advised by the R&D department, other business units or single employees about emerging technologies, trends and needs of customers and markets.

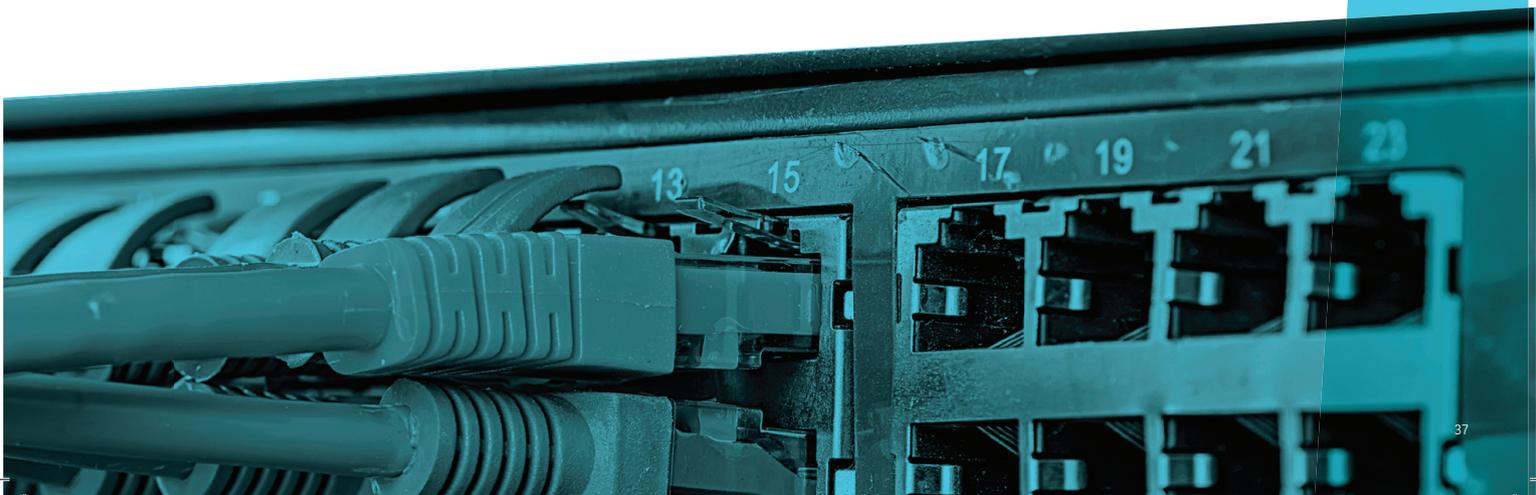
Figure 8: Main decision-making actors in innovation processes



Among the main decision-making actors involved in managing innovation (e.g. R&D, Marketing, Business Units, other), the R&D function is the most significant in all the sectors (46% in ICT, 62% in agri-food), but marketing

is also an influential decision-maker in agri-food (35%), manufacturing (28%) and ICT (27%) companies. Business units also take a greater decision-making role in companies in the ICT sector (33%).

“Ideas are collected from different sources and described regarding technological specifications, time- and cost-frame. In a first round the most promising ideas are selected. These are presented to the management. They then decide which projects should be conducted and which are too risky or do not fit the strategy.” Large manufacturing company



5.2. Balancing short and long term innovation requirements

The business strategies of companies are often designed to support the development of current products and to serve existing markets, which also determine the processes and structures within the organisation. This potentially creates an organisational disposition towards incremental innovation. Focusing solely on improving current products and services may lead to underinvesting in long term company renewal and problems in times of transition. Alternatively, investing excessively in disruptive innovation may lead to unsustainable loss of profits and competitive position. Consequently, ambidextrous strategies and practices are preferred, in which short-term incremental innovations are combined with long-term radical innovations.

”You know, formally we don’t have any barriers or limitations in our innovation activities. However, we know our businesses and we know our customers. So we think that the new ideas, they have to fit into our current strategy framework, they have to fit into our existing businesses. It’s not our thing to go like really far out there.” Large ICT company

”It’s important to establish a good balanced project portfolio: Really innovative, risky projects are always parallel conducted to incremental projects, with which we can position ourselves economically. It is important to establish a good balance between risky and economically attractive projects.”

Large biopharmaceutical company

Where the business unit leads with the stage-gate model, they can become dominant ‘guardians’ or ‘gate-keepers’ of the innovation process and strategy (particularly in large corporations). As in this case, the same structures subsequently govern both innovation and business activity, innovation is reviewed against direct business impact, which may negate innovations with longer-term potential. This is the classical innovator’s dilemma: a situation where a company rarely invests in disruptive innovation projects that might cannibalise their existing businesses. While not necessarily problematic in the short term, when taken too far this may lead a company to become ‘myopic’ in their innovation activities.

To counter these tendencies, some companies report oscillating between business-unit-dominant innovation models and R&D-unit-led innovation models over long periods of time. Another structural solution is to set up an ‘innovation board’ responsible for balancing short and long-term innovation and business needs. The overview provided by a central innovation board may help to avoid fragmentation of innovation activity and the investing in too many small projects that diverge from the overall business strategy.

Another **strategy to counter ‘operational myopia’ is to draw on the customer driven, lean start-up model, which uses rapid prototyping, pivoting (sharp turns) and early customer involvement to increase market-readiness and produce a ‘tailored’ innovation.** However, excessive customer-focus can lead to its own form of myopia.

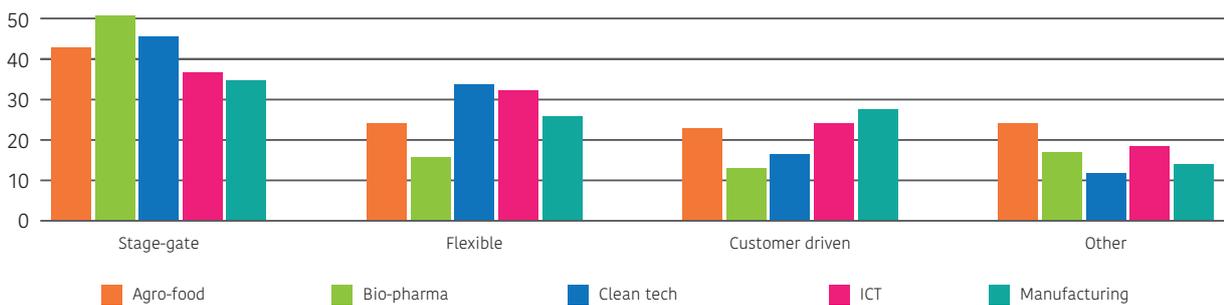


Autonomous organisational units ‘detached’ from the other business units and reporting directly to the CEO/ Senior Management Team can be used to shelter the development of more radical innovations from business unit pressure. This organising tactic is also sometimes coupled with the open innovation practices, for example, in the form of start-up competitions organised by one focal company. This may also involve internal start-up incubators and programs.

The question of whether to separate or integrate innovation activities that support current products and markets and those that focus on creating next generation/future focused

business opportunities and competences is hotly debated. Some advice favours a strict separation through spin-offs to foster an entrepreneurial spirit and prevent a venture from being crushed by existing business units. Others argue that spin-offs have difficulties upscaling their activities as they cannot use the parent company’s production and marketing resources and that any future integration with the parent company is problematic. Internal corporate ventures may be better at fostering integration, but they may limit entrepreneurial freedom. We found that companies increasingly use hybrid forms to create structurally ambidextrous organisations capable of balancing both incremental and disruptive innovation.

Figure 9: Different ways to organise the innovation process



Industrial innovation has changed fundamentally over the last ten years. Companies have widely adopted new tools such as open innovation, innovation networks and ecosystems, systemic innovations, public/private partnerships, crowd sourcing, social media, and demand based innovations.

The Industrial Innovation in Transition (IIT) project (funded by the European Commission: H2020 RIS / EURO-2-2014) has aimed to create a holistic understanding of what are the current best practices in the most innovative companies in order to produce an updated best practice documentation for European business leaders.

The project has assessed policy tools across Europe through policy review and workshops with national and regional stakeholders, and examined the current levels adoption of innovation in companies through in-depth interviews with 700 companies ranging from innovation leaders to followers in different parts of Europe.

IIT has been conducted by a consortium consisting of universities and public research organisations: Aalto University, Manchester University, University of Twente, Joanneum Research Center and Zabala Innovation Consulting .

www.iit-project.eu/