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Innovation and the digital economy: What role for innovation policies?

Summary

Workshop of the Working Party on Innovation and Technology Policy
14 June 2017

Main messages from the workshop

- The digital transformation is **changing business models** and dynamics across all economic sectors with implications for innovation policy. Three developments in particular are relevant:

  – **Servitisation**: For manufacturing industries, this often involves moving from traditional manufacturing towards services. Ericsson, for a long time a hardware manufacturer, now mainly focuses on the provision of software services; Philips, the world's largest manufacturer of lighting devices, is moving towards lighting services. This shift may require **revision of the possible bias in innovation policies** towards manufacturing as service-based business models become more important. An example of a policy in support of service innovation are the *service design vouchers for manufacturing SMEs*, a policy introduced by the Netherlands to support SMEs develop service innovations which are related to their products.

  – **Data-driven innovation**: Companies are also shifting towards **data-driven strategies**, transforming existing products and services into digital products and services and entering new digital markets. Where data turn into a critical input for innovation, access conditions to data, including to data generated by the public sector, become important for policy consideration.

  – Speed: Digital transformation is **increasing the speed of innovation** in many sectors which often leads to rapid market disruptions. Such acceleration in the pace of technological progress may require **flexible and experimental policy responses**. Policy makers should adopt a start-up mind set ("***fail fast, learn fast***"). The essence of this approach consists in implementing pilot programmes with small budgets but targeted actions, and adjusting them over time in view of the impacts.

- Rapid technological changes do not have the same **impacts across actors. SMEs** often lack the organisational capacities to address new challenges and acquire the necessary technologies to successfully transition towards the digital economy. Competition barriers may also affect opportunities for different actors to engage; access to (big) data has changed competitive conditions in some contexts. Further policy efforts are thus needed to ensure **effective and wide digital technology diffusion.** Upholding free market entry and competitive conditions is relevant in this context.

- The new innovation context requires **new skills and competences**, and new skill mixes. Today, **multidisciplinary research and business teams** (that include ICT talent but also other disciplinary backgrounds including social scientists) may be better equipped to contribute to innovation and to adapt to changing environments.

- Accessing skills and expertise across a wide range of fields is often the main rationale for firms engaging in **collaboration activities** with research institutions or with other firms (including technology start-ups and firms in other sectors). Today, **many companies look for partners in universities that have an entrepreneurial mind-set**, a challenging skill for research institutions to build.

- **Access to data** becomes critical for businesses and can also motivate collaborations. Priority access to data however may distort market competition. The **revision of standards and competition regulations** can prevent data-related anti-competitive behaviours, such as the use of data-mining to discriminate against consumers. Such regulations may also help build trust and facilitate the uptake of digital technologies.

- A number of **open questions** that were raised and that will be addressed by the OECD Digital and Open Innovation project or future TIP work include: the impacts of digital transformation across different industries, the nature of industry-science collaborations at local and national levels, as well as the assessment of impacts of different innovation policies in view of the changing nature of innovation. The question of how policy can ensure that the digital transformation contributes towards sustainable and inclusive growth was also raised.

ABOUT THE WORKSHOP

Digital transformation is taking place at **rapid pace**, modifying established **business models** and the ways firms conduct their **innovation activities**. The increasing relevance of intangible components of production such as data and services, the important role of networks and platforms and the growing need for new types of competences for innovation are some of the characteristics of these changing innovation ecosystems. Such changes are in turn raising the **demands for innovation policy**.

The workshop "**Innovation and the digital economy: What role for innovation policies?**" of 14 June 2017 gathered more than 120 participants from 37 different countries, including the delegates of the Working Party on Innovation and Technology Policy (TIP) and experts from academia, industry and policy-making bodies. It was organised in the context of the OECD projects on "Open and Digital Innovation" and "Assessing the Impacts of Knowledge Transfer and Policy" of the Working Party on Technology and Innovation Policy (TIP).

The workshop addressed the following questions:

- What are the important **dimensions of change to innovation** across different industries as they adopt the digital economy?
- What are the **implications for innovation policy**?

The agenda, blog contributions from speakers and all presentations are available at:
www.innovationpolicyplatform.org/digitalworkshop2017

Jerry Sheehan, Chair of the OECD Working Party on Innovation and Technology Policy (TIP) and Assistant Director for Policy Development of the National Library of Medicine, National Institutes of Health (United States) highlighted the challenges that arise in a digital economy from a policy perspective. This includes assessing whether existing policy approaches are sufficiently rapid and adaptive to digital challenges; and whether new instruments should be considered.

What are the new business model developments and trends brought by digital transformation?

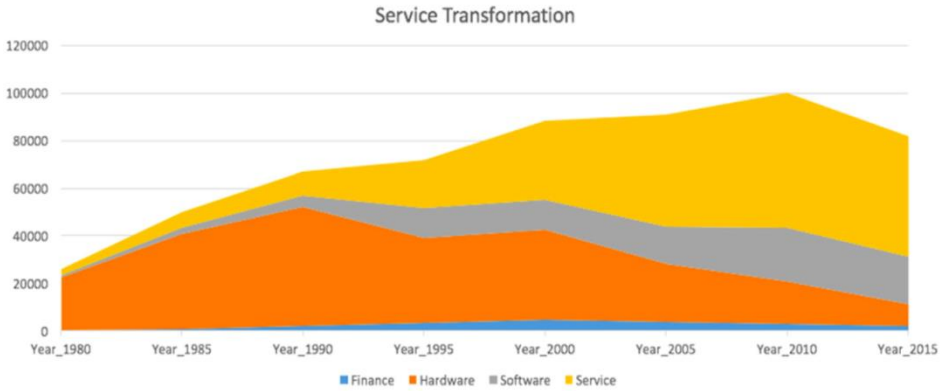
Prof. Dr. Bart Nieuwenhuis, from Fontys University of Applied Sciences (the Netherlands), stressed that manufacturing firms are **increasingly selling services ("servitisation")**: **IBM**, for instance, has shifted from being mainly a hardware producer to being a major industrial research organisation and service provider (Figure 1). Another example is **Philips**, the largest manufacturer of lighting in the world. Its activities are progressively moving from selling products to offering lighting solutions, ranging from design of a lighting project to installation and post-project maintenance.

Rolls Royce introduced its well-known "power by the hour" model as early as 1962, allowing customers to lend machines and pay only if they use them. Today, servitisation is a robust trend across all sectors of the economy. As a result, the **service sector becomes increasingly important in many economies**: it accounts for more than 80% of employment in the Netherlands.

"It's all about service."

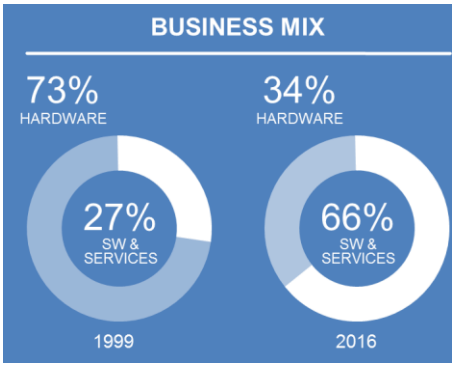
- Bart Nieuwenhuis

Figure 1. IBM revenue by segment, 1980-2015



Source: Spohrer (2017)

Figure 2. Ericsson revenue by segment, 1999-2016



Source: Presentation by H. Edquist

Ericsson has also gone through fundamental changes in their business model over the past years, from being mainly a hardware provider to a software and service provider (Figure 2). Harald Edquist from Ericsson Research (Sweden) emphasised that **connectivity will soon become a commodity**. 5G (fifth generation mobile network), the Internet of Things and cloud services will be the key building blocks of the fifth technological revolution. The focus of value creation is thus progressively shifting **from devices and connectivity to data, analytics and automation**. This has impacts on the way firms compete in the market and raises questions regarding data ownership and access to data (see Box 2).

Dr. Byeongwon Park from the Center for Strategic Foresight, Science and Technology Policy Institute in Korea pointed out that digitalisation is disrupting all industries: **every industry is becoming increasingly digital**, and thus the boundary between ICT and non-ICT industries is becoming increasingly blurred. In turn, the current trend towards servitisation implies that there will soon be **no distinction between goods and services**.

This, he argued, requires fundamentally **redefining value-creation mechanisms** and making greater use of data in decision making.

"To succeed in the new context, firms need to be open to collaboration with external actors"

- Frédéric Oru

Frédéric Oru, founding member of NUMA, a French company that provides acceleration programs for start-ups and supports innovative business ideas of tech entrepreneurs, noted that one of the most important developments brought by the digital transformation has been the **blurring of boundaries between industries.** That is, to succeed in digital markets it is necessary to combine different types of capabilities previously of importance to other industries. An example includes the need for software skills and traditional automotive construction skills for the development of new cars. To succeed in the new context, firms need to implement radical changes in their business models and **be open to collaboration with external innovators** who can provide the expertise needed to find solutions to new problems.

He suggested that, in this rapidly changing environment, policy makers should adopt a start-up mind set ("***fail fast, learn fast***"), which implies being more flexible and open to change. In his opinion, they should also put greater focus on implementing **pilot programmes** with smaller budgets but more targeted actions – since it is impossible to predict what will work, the best option is **experimentation**.

One example of an adaptive approach is the ***DataCity*** programme, an open innovation programme that aims to foster collaboration among different actors (local authorities, established firms and start-ups) to jointly address city challenges by using data and new technologies (Box 1). Once a solution is found for one city, the objective is to scale it globally.

Box 1. The example of DataCity - Intelligent Street Lighting in Paris

The project aims to develop dynamic lighting solutions in the streets of Paris that take into account street use at different times at night, so as to reduce energy consumption. The existing maps showing activity in the streets of Paris at night are only based on noise produced by motor vehicles, whereas light grading also needs to accommodate other types of transportation, including pedestrians and bikes.

The experiment was undertaken in collaboration between established companies (Bouygues Energies & Services and SFR), start-ups (Quantmetry, Dataiku) and the city of Paris. Quantmetry teamed up with Dataiku to predict urban travel patterns at night, using georeferenced data on street lighting facilities and travel-related data from mobile devices. They developed a web application that is able to visualize off-peak travel time that can be used to save light leading to cost and energy savings.

Source: NUMA

"Open innovation initiatives are critical"

- Jun Nakaya

Jun Nakaya, of Fujitsu Ltd and the Japan Electronics and Information Technology Industries Association, agreed that **sharing of best practices** and the **engagement with different actors** is key to create the right environment for the digital economy to develop competitive business models.

Fujitsu, a multinational company headquartered in Japan that produces information and communication technology equipment and services, **is implementing a range of open innovation initiatives**: the *Digital Transformation Centre*, a co-creation workshop space where Fujitsu helps customers solve problems with design approaches using the latest technologies and in-house expertise; the *Open Innovation Gateway*, a platform to connect and grow ideas, based on the collaboration of internal and external partners, with the objective of transforming them into practical businesses; the *TechShop*, which provides spaces and resources for makers, so as to help them turn their ideas into innovations; and the *MetaArc Venture Programme*, aimed at fostering collaboration and co-creation with start-ups.

He also pointed to the **necessity for policy makers to address barriers** to the development of new technologies and advocate for global market standards, regulatory convergence, and multilateral trade framework. Mr. Nakaya also suggested that **it is important to facilitate free cross-border data flows** to promote innovation and address global issues through digital technologies.

Public research institutions are important contributors to innovation in firms and industries as they develop new business models for the digital economy. Highlighting the relevant role of such institutions, Paola Bonomo, an Italian digital business advisor and early-stage investor in technology companies, pointed to the **importance of continued public spending on R&D and skills** in order to enhance the capacities needed to develop the technologies of the future. She also stressed the need to increase students' interest in pursuing **science and technology degrees**, which should be of the highest quality.

Not all countries, however, go in this direction. In Italy, total gross domestic expenditure on R&D in 2015 stood at 1.3% of GDP against the OECD average of 2.4%. In view of this, she suggested creating a Marshall plan for science and technology to **steer public funds to develop digital technologies of the future**.

"We will need a Marshall plan for science and technology."

- Paola Bonomo

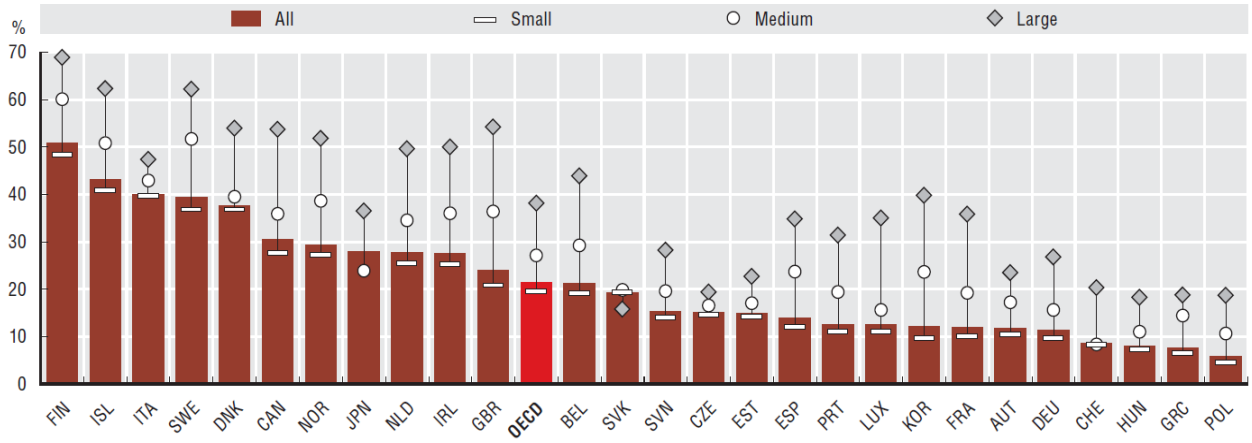
What are the opportunities and challenges that digitalisation brings for SMEs?

Prof. Nieuwenhuis highlighted that digital technologies have the potential to increase firms' efficiency, facilitate interaction with customers and customisation, and allow for the creation of new services and product enhancements. However, **SMEs are sometimes not aware of those opportunities or do not have the capacities to exploit them**. This is where public policies, he argued, have a key role to play. A recent initiative in this regard is the *service design voucher for manufacturing SMEs*, an experimental scheme implemented in the Netherlands to **help manufacturing SMEs develop services which are related to their products**, making them more competitive by progressively shifting towards service-based business models.

Prof. Dr. Egon Müller from the SME 4.0 Competence Center of the Technische Universität Chemnitz (Germany) pointed out that many **SMEs often do not understand what digitalisation means for their business.** While they are aware that they have to introduce changes in their business practices, they often do not have sufficient capacities to do so. Consequently, they often lag behind in terms of adoption of new technologies (Figure 3).

The SME 4.0 Competence Centers provide SMEs **with support and assistance in developing digitalisation and networking capabilities** with the objective to remove uncertainty about digitalisation and facilitate the adoption of new business models.

Figure 3. Enterprises using cloud services by size, 2014
(as a percentage of enterprises in each employment size class)



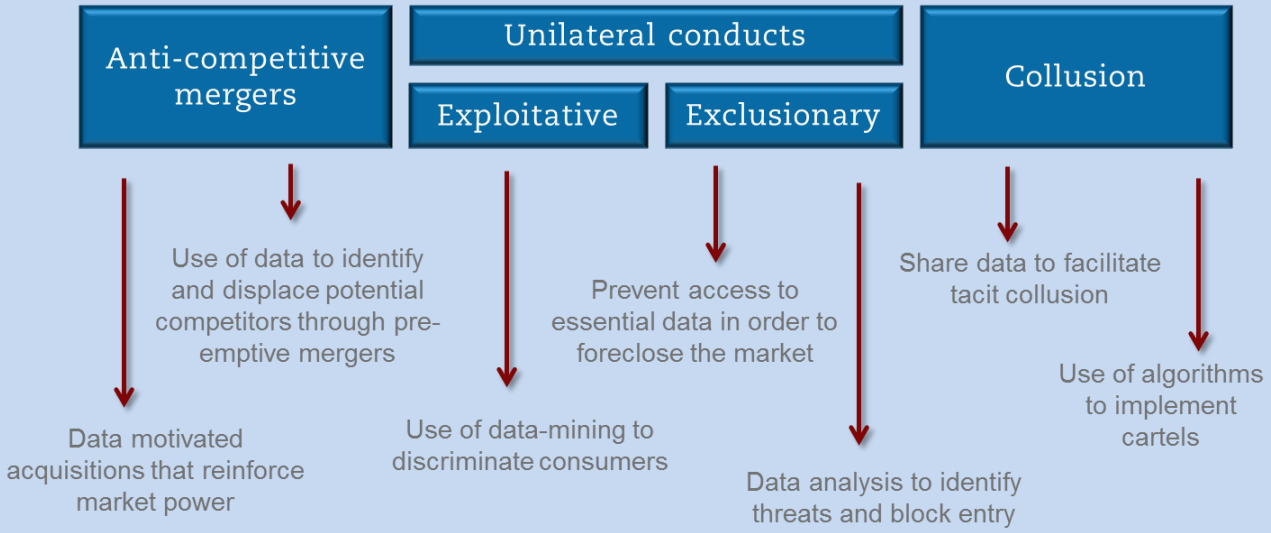
Source: OECD (2015)

Box 2. The role of competition in data markets

Ania Thiemann, from the Competition Division of the OECD, emphasised that data is changing competition: data markets are often characterised by **big market players** and **winner-takes-all dynamics** due to economies of scale and scope, network effects and data feedback loops. Data feedback loops (or "now casting") means that firms are able to observe real-time in the market.

Businesses today can extract value from priority access to data, for example by conducting predictive analysis and process optimisation using their customer data. For instance, they can instantaneously use customer data to outperform competitors. However, priority access to data may distort market competition. **Competition law enforcement**, she argued, has a key role to play in preventing data-related anti-competitive behaviours (Figure 4).

Figure 4. Overview of data-related anti-competitive practices



What role is public research playing in supporting business innovation in the digital economy?

> **"An entrepreneurial mind-set is now as important as 'excellence' for university partnering."** *- Lars Frølund*

Lars Frølund, from the Lab for Innovation Science and Policy of the MIT Innovation Initiative, explained that traditional technology companies (e.g. in automotive or aerospace sectors) experience the **co-existence of different speeds of innovation** within their firms (i.e. longer term traditional R&D activities and faster digital innovation cycles). Policies, he argued, should consider these different speeds of innovation and provide tailored solutions.

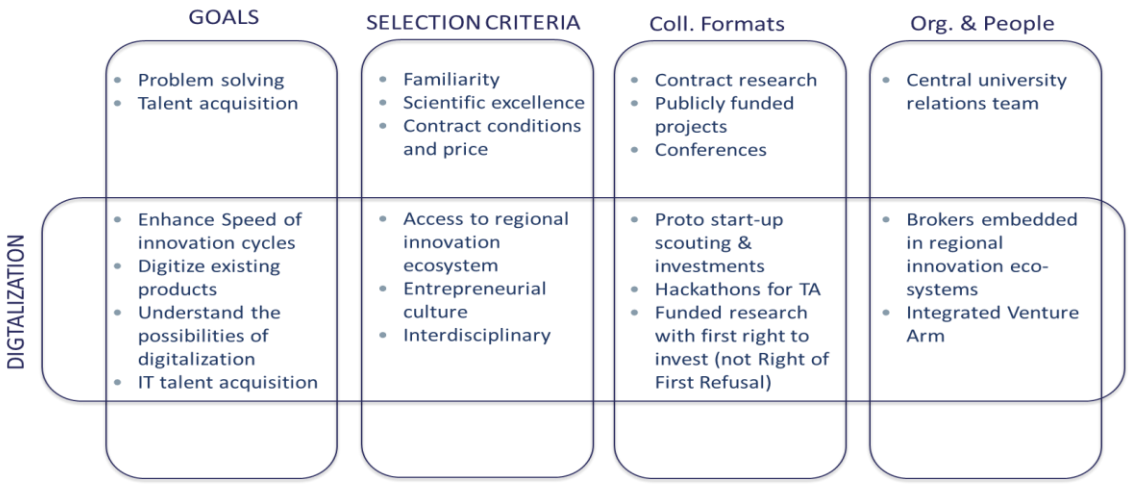
Digitalisation is also changing firms' demands for inputs from academia, affecting university-industry collaborations in several ways (Figure 5). Today, most companies **choose to partner with universities that have an entrepreneurial mind-set.** The purpose of such collaborations is often to enhance their speed of innovation, digitise existing products and better understand the opportunities offered by digitalisation.

The forms of collaboration with universities are also shifting, from mainly contract research and joint R&D projects to **business incubation and acceleration**. Many technology-intensive companies work closer with university technology offices and university incubators than before to find out about new digital innovations. Getting the most out of these relationships also requires firms to develop a good organisational model to work effectively with academia.

New forms of science-industry collaboration require new policy solutions. While IP policies still matter for traditional research activities, new incentives structures need to be considered, such as e.g. the "right to invest first" for research outcomes that also benefited from private funding.

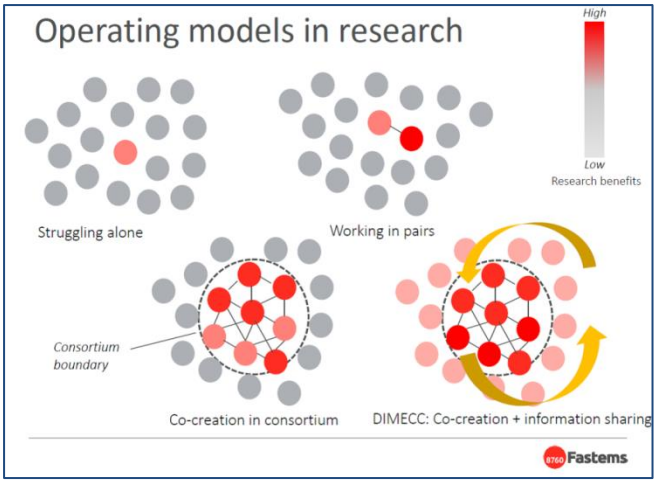
Geographical proximity to research centres still plays a considerable role for most companies, especially for talent acquisition and access to frontier knowledge. Here, companies need to be set up in a way that allows them to be embedded in a regional ecosystem.

Figure 5. Effects of digitalisation on university-industry collaboration from firm perspective



Source: Presentation of Lars Frølund

"Heterogeneous consortia are needed to maximise the impact of the R&D investment." – *Harri Kulmala*



Source: Presentation of Harri Kulmala

Dr. Harri Kulmala from DIMECC (Finland), an innovation platform that facilitates co-creation and commercialisation, referred to the importance of strengthening industry-science linkages for the development of the digital economy, which critically relies on scientific input. He mentioned **funding of collaborative projects and industry-inclusive research consortia** as ways for policy to promote these linkages.

Julien Chiaroni from CEA-List (France), a public research institute committed to technological innovation in digital systems, mentioned that more and more data is created in a digital economy but **it is useless if we do not have the capacity to extract information and knowledge from it** in order to develop new products and services. **Collaboration and data sharing across actors** is the better way forward, as no single actor has enough capabilities to find the most innovative solutions to today's complex challenges.

"Challenges in enhancing science-industry linkages are still as important as before." – *Mu Rongping*

Dr. Mu Rongping from the Chinese Academy of Sciences argued that science-industry collaboration patterns are changing **from technology transfer to search for talent and innovation entrepreneurship.** He noted that while the digital transformation may change the needs for science, many of the challenges in enhancing science-industry linkages are still as important as before.

"The collaborative environment is increasingly complex and dynamic" - *Brian MacAulay*

Brian MacAulay from Digital Catapult (UK) noted that the rapid pace of technical change is not only re-shaping the economic landscape, but may potentially strain the institutional structures of less agile actors.

In the UK, 16 **Catapult Centres**[1] connect businesses with the UK's research and academic communities. Each of them focuses on a strategic technology area, and offers a space with the facilities and expertise to enable businesses and researchers to collaboratively solve key problems and develop new products and services on a commercial scale. Such centres thus play a key role in bridging the gap between high quality research, innovation, and its successful commercialisation – allowing for the realisation of economic benefits from research.

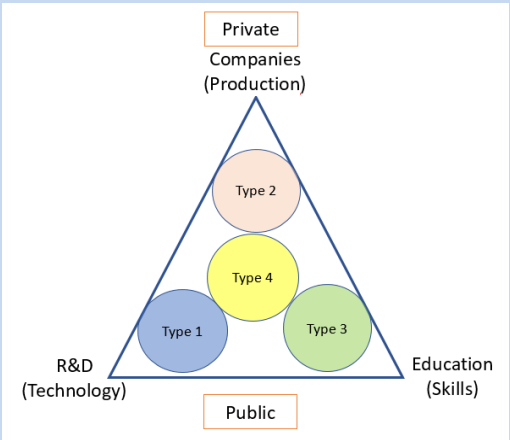
Tom van der Horst, from TNO (the Netherlands) , said that digitalisation requires a **bottom-up and adaptive policy approach** and new forms of cooperation between companies, knowledge institutes and government, such as the **Smart Industry Field Labs** in the Netherlands (Box 3). This, he suggested, is the best way for policy to deal with difficult-to-predict business model changes while still supporting their development.

He also highlighted that large research consortia are needed for international break-through innovation initiatives, while field labs and other initiatives at regional or national level can better assist SMEs through the process of digital transformation.

Box 3. What are Smart Industry Field Labs?

Smart Industry Field labs are public-private collaborative partnerships around ten selected sectors ("top sectors") where industry, public research institutes, and universities jointly develop, test, and implement new digital innovations. They operate on the regional or national level and also aim to assist SMEs with digitalisation of their business models.

Field labs are adaptive in terms of their ownership model (see Figure on the right). They can become a research institute (Type 1), a company (Type 2), or part of a university (Type 3). Over the past two years, 30 such field labs have been created in the Netherlands.



[1] https://catapult.org.uk/about-us/about-catapult/ (accessed 31 July 2017)

What challenges does digital transformation raise for innovation policies?

Digital transformation may require **new innovation policy approaches** to take into account fundamental changes in business models and innovation ecosystems. This was the focus of discussion in the **keynote speech** (Box 4) and the four **breakout session discussion**. They were chaired respectively by Dr. Tiago Santos from the Portuguese Foundation for Science and Technology (FCT); Göran Marklund from VINNOVA, Sweden; Prof. Kazuyuki Motohashi from the University of Tokyo and the Research Institute of Economy, Trade and Industry, Japan; and Prof. Margherita Russo from the Università degli Studi di Modena e Reggio Emilia, Italy.

Box 4. Perspective from Rob Atkinson

"Innovation policy needs to be oriented to spurring widespread adoption of ICTs in all industries."

Robert Atkinson, founder and president of the Information Technology and Innovation Foundation (ITIF), a Washington-based independent think tank that focuses on critical issues at the intersection of technological innovation and public policy, argued that in order to enhance the adoption of ICTs, it is important to:

- Ensure that public policies (including particularly **innovation and competition policies**) do no prevent the adoption of digital technologies by indirectly raising the costs of ICT goods and services or limiting access. Moreover, **social regulations** should not pose barriers for digital producers to provide more and higher-quality or lower-priced services.
- Ensure that **market regulations** do not prevent digital business models that have the power to disrupt incumbent businesses (e.g. sharing economy models).
- Adopt **size-neutral policies** and work toward regulatory, fiscal, and tax parity between large and small firms
- Take a **sectoral approach** when designing digitalisation-related policies, since the role and use of ICT products, services and systems differs significantly between industries.
- Focus **R&D-support policies** on areas where the private sector is not very active.

Innovation policy approaches are (and need to continue) adjusting to new needs

The following issues were identified in group discussions on the impacts of the digital transformation on **innovation policies**:

- Their main focus should go beyond traditional R&D activities and also include **innovative entrepreneurship** (incl. student entrepreneurship) and **digital skills and competences**. They should also move from targeting mainly manufacturing to increasingly target also **service activities**. The need to foster collaborations among actors (large firms, SMEs, start-ups, research institutions) is even more important in the digital context.
- **Provide adaptive responses** to rapid digital technology disruptions. As technology disruptions often coexist with traditional (slower) innovation cycles within single firms, innovation policies may have to find new ways to accommodate the needs of these different speeds of innovation.
- Adopt a **systemic approach to policy design**, as digitalisation is having wide-raging effects (e.g. from changing the roles of IP, to effects on competition and consumer welfare). Coordination across policy areas is consequently important. The Digital Roadmap in Austria is an example of this whole-of-government and systemic approach (Box 5).

- Policy should **address societal challenges**, notably promoting initiatives for sustainable and inclusive growth, where possible together with the private sector (e.g. to finance experimental local pilot projects) in view of the current context of tight public budgets.
- Ensure continuing **public spending on R&D and skills**. A new "Marshall Plan for Science and Technology", as suggested by Paola Bonomo, would enhance the capacities needed to develop the technologies of the future.

Box 5. Austria's Digital Roadmap

The Digital Roadmap Austria on Industry 4.0 is one approach for policy to become more responsive to disruptive changes. The Digital Roadmap identifies **150 specific measures** that guide investment decisions of industry and science actors in order to optimally exploit the potential of digitalisation. These **measures are continuously adapted to the latest developments** in digitalisation using a **broad public consultation process**, including through an online consultation platform. The roadmap approach to policy-making allows policy to receive rapid feedback from society and industry regarding still existing barriers to the digital transformation.

Issues for the TIP Digital and Open Innovation project

- Provide insights on **new innovation policy rationales**. These include addressing market failures (e.g. priority access to data that create monopoly rents; barriers to technology diffusion) as well as coordination failures (i.e. actors that do not collaborate optimally).
- Adopt an **inclusive growth approach.** Global social and environmental challenges can be tackled using digital technologies. However, policy should also consider that digital technologies pose dangers for inclusive growth as benefits are increasingly concentrated within a few leading firms.
- Facilitate **knowledge sharing** among countries, including exchange on challenges faced and policy best practices, and provide evidence that help address open policy questions.

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Related ongoing activities of the TIP

Digital and Open Innovation project: www.innovationpolicyplatform.org/TIPdigital

Assessing the Impacts of Knowledge Transfer and Policy: www.innovationpolicyplatform.org/impact

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Harald Edquist, Master Researcher at Ericsson Research and Associate Professor at Stockholm School of Economics, Sweden

Lars Frølund, Visiting Scholar at MIT Innovation Initiative, USA

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