



The impacts of digital transformation on innovation across sectors

Workshop summary

London, 21-22 September 2017

ABOUT THE WORKSHOP

Digital transformation is affecting the entire economy in multiple ways: new business models are emerging, firms modify how they engage in innovation processes, and capabilities at the heart of firms' activities are rapidly changing. The transformation changes both opportunities and challenges for different actors in innovation ecosystems.

With these changes the digital transformation raises a fundamental question: **What is the role of innovation policies in the digital transformation?** Answering this question also requires understanding the new forms of innovation arising across and within sectors, and how these affect different actors (e.g. SMEs); as well as the characteristics of collaboration for innovation between industry and public research at local, national and global levels emerging in the new context.

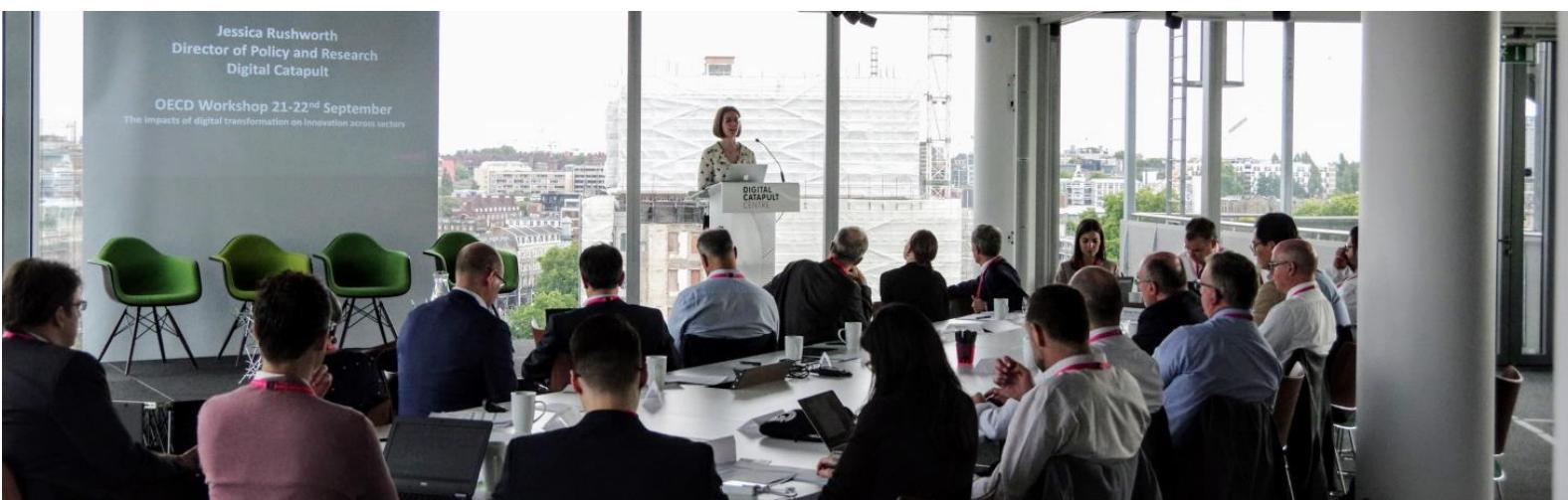
The workshop "The impact of digital transformation on innovation across sectors", which took place in London on 21-22 September 2017, addressed this question. Organised in the context of the OECD TIP Digital and Open Innovation project and OECD-wide Going Digital initiative, the workshop gathered more than 40 participants from different countries, including experts from academia, industry and policy-making bodies and delegates of the Working Party on Innovation and Technology Policy (TIP). In particular, the workshop discussions shed light on:

- The changes in business models and innovation dynamics across sectors, and their impacts on different actors;
- The role of technology intermediaries in technology development and diffusion;
- The framework conditions and policy instruments needed to develop vibrant innovative ecosystems; and
- The role of smart cities in the new context, and their impacts on territorial inclusiveness.

A comprehensive analysis of the key properties of the ongoing digital transformation to better understand the digital transformation and its policy implications is undertaken in the context of the Going Digital project (<http://www.oecd.org/going-digital/>)

The agenda and all presentations from speakers are available at:
www.innovationpolicyplatform.org/LondonWorkshop2017

More information on the OECD Digital and Open Innovation project can be found at:
www.innovationpolicyplatform.org/TIPDigital



Eight main messages from the workshop

1) Digital transformation is different from "traditional" (non-digital) innovation in the following ways:

- a. The speed of technological change is faster. While it took 38 years for the radio to reach the 50 million users and 13 for television; it only took Facebook 1 year to reach the same number. Such speed of change requires organisations to be much more adaptive to compete than in the past.
- b. Intangible investments, including in data, software and intellectual property, are more important assets for companies' competitiveness than tangibles. These assets have different characteristics to tangibles as they are more easily scalable (allowing for massive economies of scale) and synergies with other investments differ.
- c. Service and other non-technological innovations are increasingly important for industry. Big machinery manufacturers, such as John Deere, for instance, are investing in data analytics to offer new services to help farmers optimise their crop yields. Automobile producers are similarly increasingly focusing on providing services.
- d. Survival in the new economy requires revisiting and changing business models. This is difficult both for large businesses, as they have rigid structures built around old business models, and small businesses, as change requires investing scarce resources in developing plans for the future and puts the entire business at risk.

2) Digital innovation is mostly driven by start-ups and large companies, notably (but not exclusively) Internet ones.

While the nature of digital innovation facilitates start-ups' market entry, leading companies also have advantages over competitors (such as privileged access to big data, networks, platforms and resources to invest in technology development). Large businesses dominate investment in artificial intelligence, expanding their advantage and possibly widening the gap with competitors. Moreover, not all start-ups are equipped with the competences and resources that are necessary to successfully scale up and seek to be acquired. The increasingly globalised markets for innovation and the 'winner-take-all' dynamics that characterise many of them widen the gap between 'the best' and 'the rest' because the winning idea can scale to the global market.

3) Policies can help address the challenges faced by SMEs in traditional industries facing the digital transformation.

Insufficient competences and inappropriate framework conditions prevent many SMEs from fully reaping the benefits of digital transformation. SMEs do not have the capacity to develop needed new skills in-house. Sometimes they are not even aware of the opportunities that digital transformation offers. Knowledge intermediaries, such as Digital Catapults in the UK or the SME 4.0 Competence Centres in Germany, are examples of policy initiatives aimed at addressing the challenge. They provide tailored advice and support services to firms. Innovation vouchers and programmes that support the recruitment of PhD holders by SMEs (e.g. the Horizon 2020 SME Innovation Associate Programme) may also help in that regard.

4) Strengthening “digital” capabilities is important, as is developing a digital culture within organisations – both in the public and private sectors. In particular:

- a. Beyond the traditional focus on strengthening science, technology, engineering and math (STEM) skills, and in particular digital economy-related skills such as programming and data analysis skills, efforts should be placed on strengthening the capacities of individuals to operate in multidisciplinary environments, where more complex inventions build on the combination of skills of social scientists, engineers, biologists and data scientists, among others.
- b. Managers of businesses and public institutions need the skills to recognise and manage digital processes and products that can strengthen their institution’s performance. Where managers are not acquainted with new technologies, they may not facilitate change that could enhance performance, slowing down progress even if they have the workforce in place to adapt. Raising their awareness by providing them with training opportunities and case examples is a useful way forward. This also applies to the public sector (such as healthcare) where the digital transformation can bring fundamental improvements.

5) Public research institutions and the public sector can be important drivers of digital innovation and contribute in this way to important efficiency and welfare improvements.

For instance, CSIRO’s Data 61, Australia’s public digital research centre, has developed an open platform that makes laws and regulations available in digital format, enabling any interested business to develop tools and services to help reduce compliance burdens (i.e. enabling ‘the birth of a RegTech industry’). A public sector with strong digital capabilities can better support digital transformation: first, it can manage programmes for digital transformation more efficiently (e.g. digital clusters, testbeds); second, it can act as lead adopter of new technologies or services from industry through the public procurement of innovative solutions, signalling to laggard firms the advantages of adopting new technologies.

6) Data privacy and security protection can challenge opportunities for data-driven innovation.

Access to data is key for the development of many wellbeing-enhancing innovations. For instance, the success of the *Future of Planning* programme of the Future Cities Catapult, which supports the development of data-driven and digitally-enabled products to improve urban planning, depends on innovators (e.g. businesses, individuals, planning authorities) having access to urban data (e.g. data relating to land use, energy consumption of buildings, traffic flows, levels of air pollution). Striking the right balance between privacy and security rights’ protection and data access is critical. It also matters to provide a level-playing field for all market players. The costs of providing access (in terms of impacts on security and privacy) need to be weighed against the benefits from innovations.



7) Cities are still concentrating most innovation activities, and are often living labs for data-driven innovations that address pressing urban challenges.

A concrete example of such improvements is Red Ninja's *LiFE* project which integrates ambulance route-finder applications with city traffic management systems to clear the route for ambulances responding to emergency calls for quicker medical assistance. The algorithms developed were tested in Liverpool – an urban living lab.



8) Countries have already implemented different measures to support the digital transformation.

Key messages on policy design from the discussions include:

- a. There is a need for further policy experimentation and testing (e.g. pilot programmes) to adjust to a rapidly changing context. Comparing policy initiatives from different countries can also be very valuable to gain insights in this respect (e.g. the Catapult Centres in the UK and the SME 4.0 Competence Centres in Germany).
- b. Start-ups face challenges of very different nature from those of large firms regarding digital transformation, but policies do not always consider these. The creation of spaces for start-ups to experiment in real-world conditions, containing systemic risks, can encourage innovation. Regulatory sandboxes, i.e. set of rules that allows innovators to test their products, services and business models in a 'live' environment without following some or all legal requirements, subject to predefined restrictions, and testbeds, i.e. spaces where companies can systematically test new and innovative products and services with relevant user groups, can help companies in their early stages of development.
- c. Innovation policy needs to be more human-centred, i.e. take into account the impacts of digital transformation on wellbeing. A key challenge for policy is ensuring that workers benefit from productivity gains from digitalisation, and reducing divides between those whose jobs are at risks and those whose capabilities are increasingly demanded in the labour markets. Workforce and out of work training is critical in this regard.
- d. The "4Es" approach may prove relevant as principle for innovation policy to support the digital transformation: it prescribes a policy mix that enables, encourages, promotes engagement and lets authorities lead by example.

Introduction to the workshop

Caroline Paunov, Senior Economist and Head of Secretariat for the Working Party on Innovation and Technology Policy (TIP) at the OECD, opened the workshop, presenting some of the trends that characterise the **digital transformation** and that make the transformation distinct from the recent past. New digital technologies are changing the ways in which we think about **innovation**: for example, servitisation of manufacturing industries is redefining industries and changing the mix of competences needed to innovate, making collaborations beyond firm boundaries increasingly common. Changes in the ways innovation is organised are having different impacts across individuals, firms and places, and pose distributional challenges. Digital transformation is also offering opportunities for new ways of conducting policy, as data can now inform policy making. She also linked those trends to the topics of discussion on the different panels.



The remainder of the document presents an overview of the discussions following the event's agenda:

- **Digital transformation in the UK:** the role of Digital Catapult
- **Panel 1:** New business models and innovation dynamics across sectors: what are the challenges and opportunities for different actors?
- **Panel 2:** Smart cities and regions in the digital transformation: how to ensure inclusive developments?
- **Panel 3:** Policies for technology development, diffusion & collaboration: What facilitates digital transformation?
- **Panel 4:** What policy instruments are needed to develop vibrant innovative eco-systems?



Digital transformation in the UK: the role of Digital Catapult

Jessica Rushworth, Director of Policy and Research at Digital Catapult, presented the UK's Catapult Centres and their role in connecting business and research. Their objective is to **bridge the gap between research and industry**; foster collaboration between organisations and sectors; get new ideas and technologies to market quicker; and anchor innovation and jobs in the UK. Each of the 10 Catapults has a different model (e.g. some are more capital intensive than others). The Digital Catapult in particular works with companies of all sizes to transform their business through digital innovation (Box 1). She emphasised that, over time, it has become clear that their main challenges are not related to the development of new technologies, but rather from the **application and use of those technologies across different sectors**.



Digital Catapult works in a variety of ways to **address barriers to innovation**, including: building, coordinating and increasing access to large scale test beds; driving engagement between small companies and large companies; participating in collaborative research and development projects; accelerating the growth of markets by supporting ecosystems and helping exports; building prototypes and testing the feasibility of technologies; helping large companies become more efficient through the introduction of digital innovation; and providing access to facilities, skills and space.

Box 1. Digital Catapult

Digital Catapult is a **market-led technology and innovation centre** that helps businesses of all sizes to use digital technologies to grow, export and increase productivity. The Catapult houses leading-edge facilities, technology insight knowledge and business expertise deployed in four technology areas:

- **Data-driven**: new ways to work with personal data with more control and trust, applications of block chain and smart contracts, cyber security
- **Connected**: the Internet of Things (IoT) and associated enabling networking technologies such as 5G
- **Intelligent**: artificial intelligence and machine learning
- **Immersive**: augmented, virtual and mixed reality and new forms of human-machine interface

These four key technology drivers can positively disrupt business models, create competitive advantage and deliver a superior experience for customers.

Digital Catapult focuses on sectors where digital innovation can make the greatest impact, to increase productivity, efficiency and scale. At the moment, it focuses on (1) **digital manufacturing** and (2) **creative industries**, and is now developing in an additional area, (3) **digital health and care**. It has centres in Brighton, North East & Tees Valley, Northern Ireland and Yorkshire in addition to its London headquarters. Each of the Catapult centres has a unique focus and is aligned with local digital innovation initiatives.

Catapults receive funding from three different sources: a core grant through Innovate UK, collaborative R&D funding and commercial income. The strategy for Digital Catapult is to maintain a balanced portfolio.

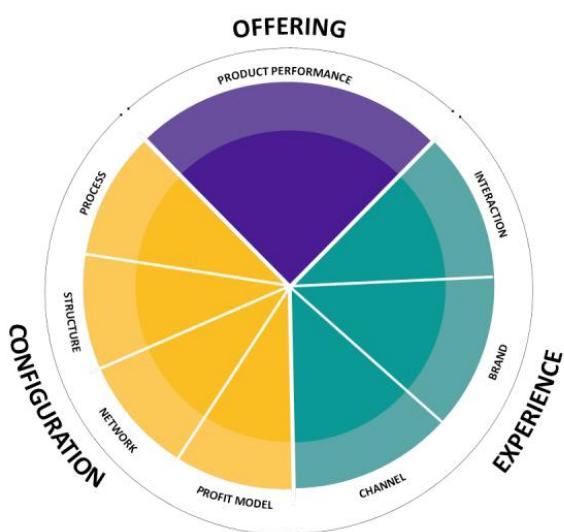


New business models and innovation dynamics across sectors: what are the challenges and opportunities for different actors?

Cristian Gherhes from Sheffield University's Management School stressed that businesses today innovate in a multiplicity of ways, going beyond innovation in their offering (i.e. improving the product, process or service). Innovation is also important for finding new channels for interaction with customers, improving business branding, expanding collaborations with external partners and better aligning skills and resources for growth (Figure 1). To encourage firms to think about business model innovation, the Innovation Caucus – a multidisciplinary research team funded by Innovate UK and the Economic and Social Research Council to support innovation-led growth and promote greater engagement between the social sciences and businesses– has developed the Business Model Innovation Tool.



Figure 1. Business model dimensions



This practical tool consists on a number of business model innovation cards with questions inviting business managers to think about their existing model and in ways to improving it (Figure 2). The BMI Tool has undergone extensive trialling with different formats and questions – including piloting with 40 companies and four focus groups with Innovate UK technologists. It has progressed from its inception as a business model innovation wheel to become a personalised self-assessment process that helps businesses understand their business model and discover potential routes for its innovation.

Source: Presentation of Cristian Gherhes

Figure 2. Examples of business model innovation (BMI) cards



Source: Presentation of Cristian Gherhes

Alistair Nolan, Senior Policy Analyst at the OECD, presented insights on changing business models from the recent OECD publication '*The Next Production Revolution*'. He argued that, in view of the decline in the rate of growth of labour productivity since the 1990s (particularly marked since 2008), the potential productivity benefits of new technologies are still to be reaped. He provided three examples illustrating how changing business models can allow reaping this potential:

- The Internet of Things (IoT) allows manufacturing companies to better monitor the use of their products and thus to provide customised pay-as-you-go services priced using real-time operational data. As a way to build on this potential, Rolls-Royce now sells engines as a service, not a product;
- John Deere uses data analytics to help farmers optimise crop yields, while autonomous vehicles enable a single farmer to plant and harvest up to 600 acres a day (compared to 150);
- 3D printing may offer opportunities for the creation of new markets (e.g. 3D printing-as-a-service; marketplace for 3D printable files) if the right business models are developed by private industry.

He then stressed that new firms play a crucial role in introducing new technologies and business models. In a paper published in 1990, Paul David gave a historical example of the importance of new firms. A major slowdown in industrial and aggregate productivity growth in both the US and the UK during the 1890-1913 era (following what is known as the 2nd industrial revolution) was stopped in the 1920s, four decades after the commercialization of electricity when businesses had redesigned production to take advantage of the new technology.

"The potential productivity benefits of new technologies are still to be reaped."

- Alistair Nolan

Prof. Margherita Russo, from the University of Modena and Reggio Emilia (Italy) emphasized the challenges that changing business models pose for SMEs, who are critical in all economies both in terms of contribution to GDP and employment. She also reminded the audience that they are essential in fostering research and innovation, as they can be better placed to think out of the box and provide innovative insights.

She argued that the 4th Industrial Revolution requires organisational changes SMEs do not always have the competences to implement. Providing specialised advice to SMEs in this transition is particularly important, as SMEs cannot recruit individuals with all different competences. Higher education

institutions often fail to offer training to allow SMEs to acquire the competencies needed to compete in the digital economy. Similarly private training offers fail to do so. There is consequently a need for policy interventions and intermediary agents to work in this direction. Successful intermediary institutions need adequate business models to their local context and subsidised activities should not crowd out private initiative. Catapult Centres in the UK and Competence Centres in Germany provide relevant examples to understand better the competences intermediaries need to be effective in articulating networks connecting SMEs, research institutions, government and civil society to support innovation.



Dr. Zsolt Szalay, from the Budapest University of Technology and Economics, spoke about the challenge faced by the **Hungarian automotive sector** and the policy approach taken in Hungary to build a competitive industry for automated driving. The Hungarian automotive sector accounts for 10% of GDP and 20% of exports. There are now more than 600 automotive companies and suppliers, with a total of around 100,000 employees, and the sector is in continuous need for qualified engineers.

The Hungarian Research Centre for Autonomous Road Vehicles (RECAR) aims to promote the development of autonomous vehicle technology, including through special research funding programmes and targeted educational programmes. The Centre works in close cooperation with industry, which has strong capacities in the fields of connected and automated vehicles.



Figure 3. Multi-level testing environment for autonomous vehicles



Source: Presentation of Dr. Zsolt Szalay

Charles Carter, Senior Intelligent Mobility Specialist at the Transport Systems Catapult, discussed the fundamental changes to transportation systems brought by the digital transformation. He referred specifically to new opportunities the Transport Systems Catapult aims to foster, as it functions as a technology and innovation centre to drive and promote intelligent mobility using new and emerging technologies (including Internet of Things, Artificial Intelligence and blockchain). He emphasised specifically the changes brought by “**Mobility as a Service**” and “**sharing economy models**”. These, he argued, are changing the way people engage with different transport solutions. He raised the question whether governments should intervene to make mobility as a service happen, or leave market forces drive the changes. The extent to which platforms are competitive or hold market power is an important question to address in this regard.



The panellists and the audience identified different policy priorities and instruments to address the challenges faced by SMEs in search of new business models in the context of digital transformation. This includes well-known barriers for SMEs to engage in innovation such as access to finance and knowledge from public research. It also includes factors that are more critical with digitalisation such as:

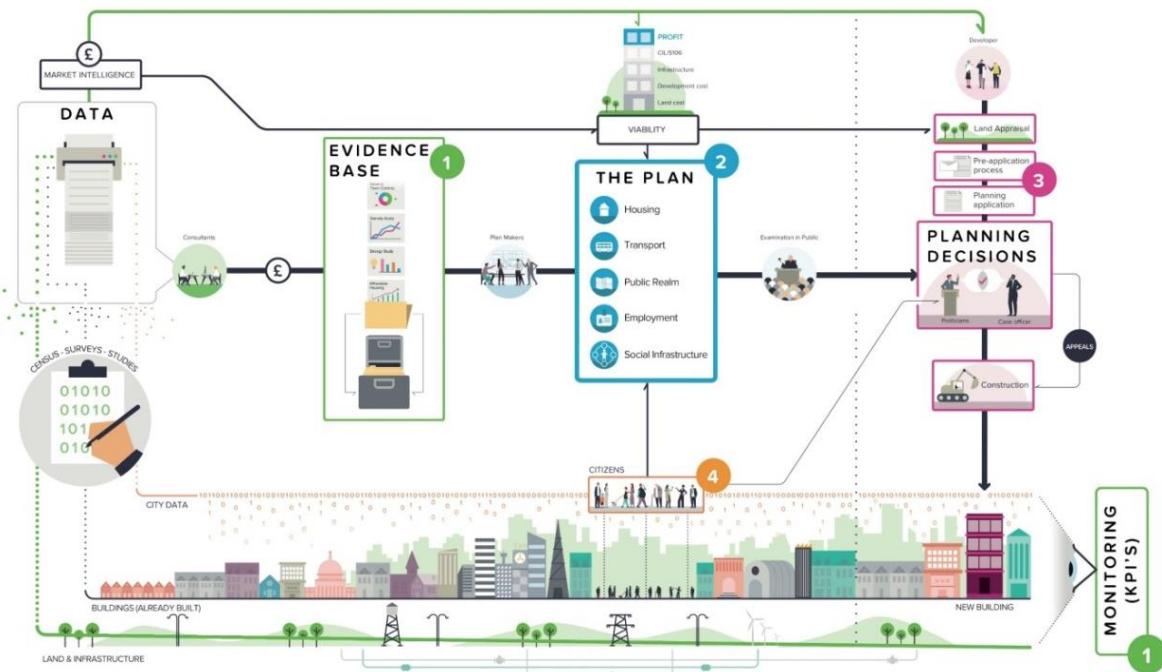
- a greater need for awareness-raising activities to help SMEs identify new business models;
- an increased importance of knowledge intermediaries as providers of tailored advice and the competences needed by different types of SMEs (e.g. to adopt digital technologies or to implement business model innovations),
- facilitating access and use of data by SMEs
- competition policies to provide for a level playing field for SMEs and larger firms

Smart cities and regions in the digital transformation: how to ensure inclusive developments?



Nicola Yates, Chief Executive of the Future Cities Catapult, stressed the need of using digital technologies to improve the processes of **policy making**. She explained that digitalisation provides a unique opportunity to increase citizen's participation and influence in policy making, and to make the system more transparent. Future Cities Catapult has launched the *Future of Planning*, a programme exploring how digital innovation, urban data, and user-centred design can improve the UK planning system (Figure 4). The *Prototyping the Future of Planning Open Call* sponsors good ideas to create a **more data-driven and digitally-enabled planning system**. More than 80 firms and organisations competed for funding, demonstrating the potential of digital technologies in the planning sector. Some are already being implemented.

Figure 4. The Future of Planning,



Source: Presentation of Nicola Yates

Dr. Ed Manley, a researcher on smart cities at the Centre for Advanced Spatial Analysis of the University College London, emphasised the importance of **big data in building smart cities**. Access to data (e.g. GPS data, tweets, urban sensors) and **new analytical techniques** (e.g. data mining, scenario testing, and visualisation) allow getting a much richer picture of what happens in cities. This requires also more **training**. To expand the knowledge base in this regard, UCL offers two masters specialised in data analytics in urban contexts: one on smart cities and urban analytics, and one on spatial data science and visualisation.





Lee Omar, the Founder and CEO of Red Ninja Studios, presented with several examples the potential of digital technologies for fostering wellbeing. Red Ninja Studios is a design-led technology company based in Liverpool that focuses on developing products for smart cities, mainly in the fields of digital health and transport. For example, the *LiFE* project aims at reducing the time it takes emergency vehicles to reach patients in a critical condition. It uses **artificial intelligence** to control traffic light management systems in order to **manage traffic flow**. In the advent of an emergency call, the system allows clearing **the route for the ambulance** in real time.

The algorithms developed were tested in Liverpool - an urban living lab. This can have crucial **direct wellbeing effects** on congested city streets. Support from the Catapults and financing from Innovate UK helped develop these projects. Other instruments such as support to access to foreign markets had also been helpful.



Source: Presentation of Lee Omar

"Open access to city data is critical for innovators to explore new ways to address pressing urban challenges."

- Ben Hawes



Ben Hawes, Smart Cities Policy Lead in the Department for Digital, Culture, Media and Sport (UK), focused in his intervention on the need to push further the digital transformation of local government services. He explained that the UK Digital Strategy provides a good framework to promote **local digital innovation**. A lot has been done to digitalise government services, but much less to digitalise local government services. Local governments, he emphasised, could better support digital businesses if they operated more digitally and had stronger digital capabilities, particularly in two ways: first, they would be able to **manage digital programmes more efficiently** (e.g. testbeds for 5G, local digital clusters); second, they could be a **good informed customer for digital services offered by the local industry**.

Several issues were raised by the audience, including in particular the issue of **open access to data** as key for innovators to explore new ways of addressing pressing urban challenges using digital technologies. Examples include increasing the efficiency of the transport system, improving services for an aging population and reducing greenhouse gas emissions. At the same time, **cybersecurity** has become a main concern in many cities and there is growing need for experts in this field. The Academic Centre of Excellence for Cyber Security Research, based at UCL, aims at extending knowledge and enhancing skills in cybersecurity.

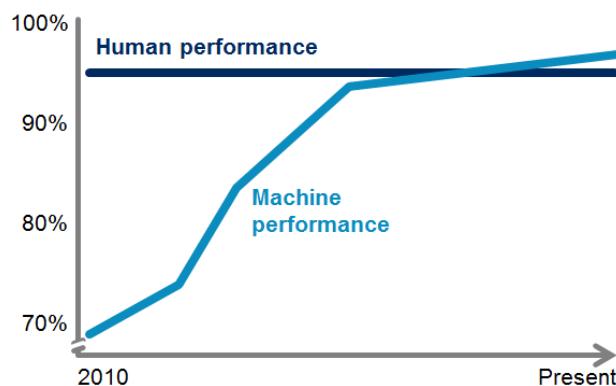


Policies for technology development, diffusion & collaboration: What facilitates digital transformation?

Tera Allas, Senior Fellow at McKinsey Center for Government, discussed how digitalisation, automation and AI are transforming all sectors of the economy: machines can now match and even exceed human performance in tasks that were previously considered ‘uniquely human’ (Figure 5); by 2019, machine-to-machine connections are expected to account for more than 40 percent of global connections. The speed of technology development and consumer adoption is much faster than before (Figure 6). This is disrupting some firms, sectors, and established business models.

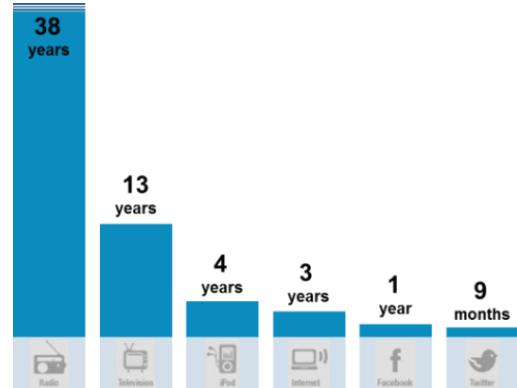


Figure 5. Image recognition accuracy rate



Source: Presentation of Tera Allas.

Figure 6. Time to reach 50 million users



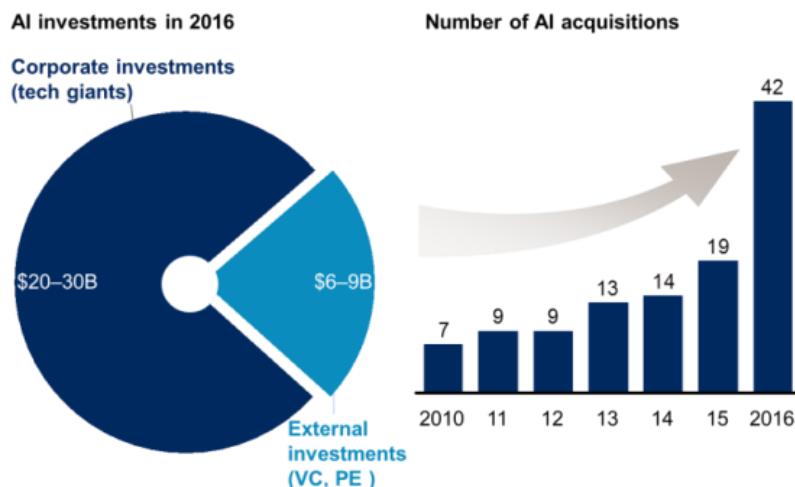
Source: Presentation of Tera Allas.

In this new context, much innovation happens within a few firms, leading to a rising productivity gap between ‘the best’ and ‘the rest’ (even within the same sector and size category) and the gap may be growing over time. For example, tech giants currently dominate investment in artificial intelligence (Fig. 7). Moreover, AI adoption is occurring faster in more digitized sectors across the whole value chain, and these are also the sectors that intend to grow their investment the most (Fig. 8).

“There is a rising productivity gap between the best and the rest”

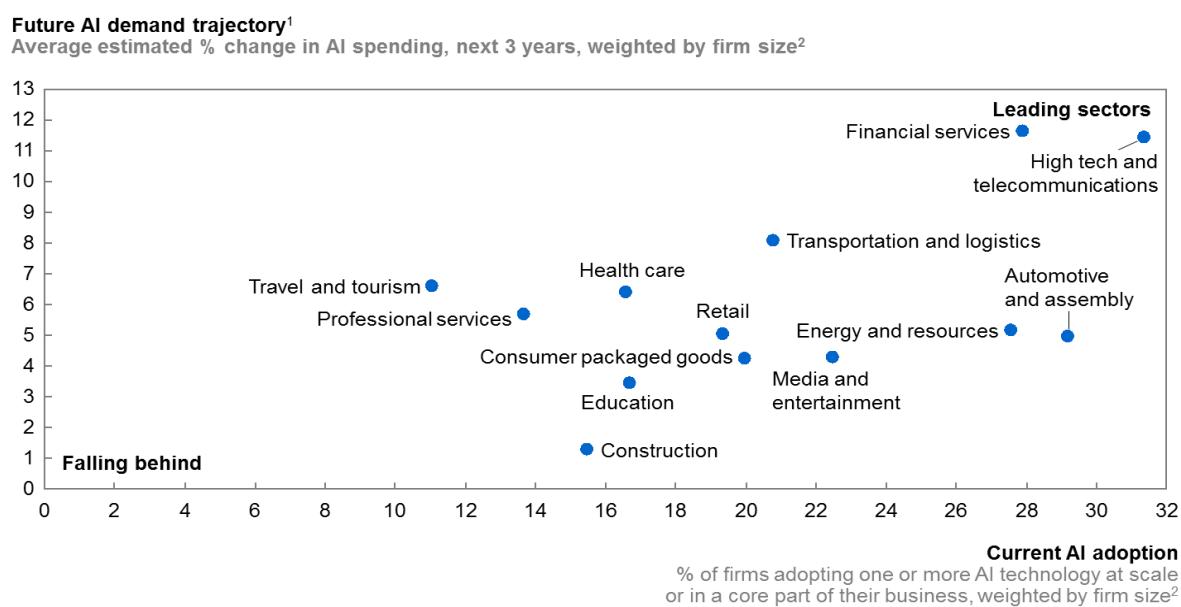
- Tera Allas

Figure 7. Artificial Intelligence: investments and acquisitions



Source: Presentation of Tera Allas.

Figure 8. Future AI demand trajectory



1 Based on the midpoint of the range selected by the survey respondent.

2 Results are weighted by firm size. See Appendix for an explanation of the weighting methodology.

Source: Presentation of Tera Allas.

Tera Allas also commented that while one could think that in a digital world place matters less, evidence shows this is not the case, and there is a **winner-take-all dimension** in cities

Tera Allas stressed that **governments can accelerate developments through broad-based support** (e.g. providing skills, support and incentives; improving regulation), but a **segmented approach** will be required to better address the needs of 'the best' and 'the rest' (Figure 9).

Figure 9. Illustrative segmentation of the business population

Relative competitiveness potential ¹	Very high	N/A [unlikely to exist]	N/A [unlikely to exist]	Holistic scale-up support, e.g., patient capital, export support, innovation grants, skill building, networks	Science collaboration, R&D support, enabling regulation	
		Holistic training, funding and collaboration to embed best technology and practices	N/A [rely on competition or markets to address]	N/A [unlikely to exist]	N/A [unlikely to exist]	
Very low		N/A [encourage exit or change in management, e.g. by changing taxation]	N/A [ensure competitive markets, incl. for corporate control]	N/A [unlikely to exist]	N/A [unlikely to exist]	
Growth and size		Stagnant, small	Stagnant, large	High growth, small	High growth, large	

1 Small, young firms tend to be less productive than 'the average firm' due to lack of economies of scale but they could still be highly competitive or have significant potential relative to firms in their sector

Source: Presentation of Tera Allas.

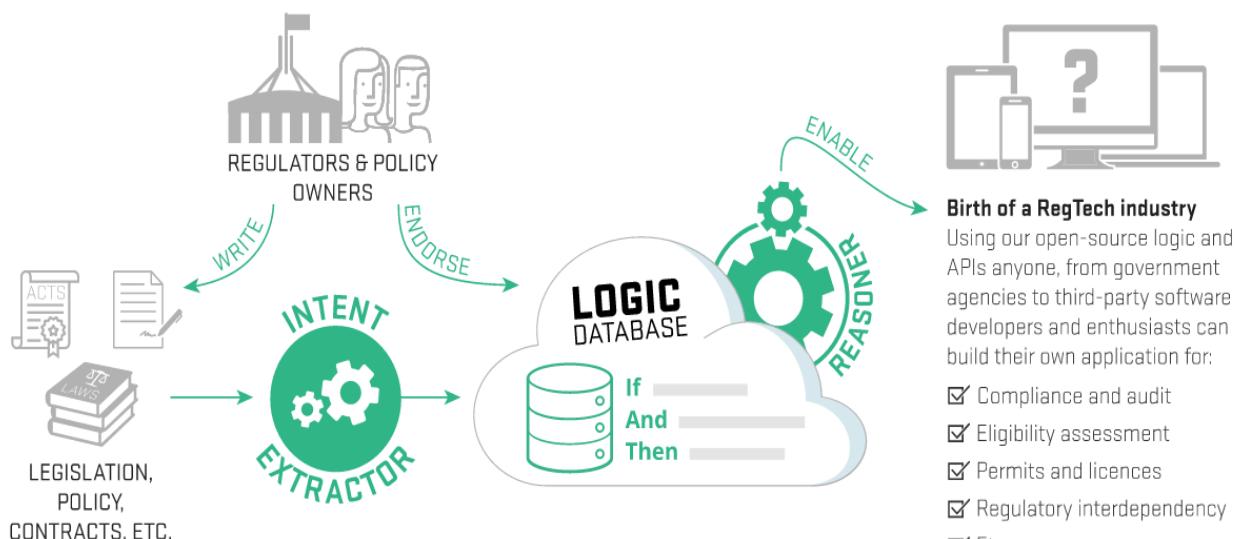
Peter Leihn, Business Development and Commercial Director at Data 61, presented the policy approach in Australia to **promote data-driven innovation**. Data 61 is part of a federal government research agency (the Commonwealth Scientific and Industrial Research Organisation, CSIRO), and constitutes Australia's leading digital research network that aims to help create new data-driven industries that can reach global scale. It is currently working on 193 data-driven projects, and owns 172 patents. It has four axis of collaboration:

- **Academia**, with research partnerships with 29 universities and scholarship programmes for students;
- Collaboration with the **government** in the area of digital service transformation and policy analytics;
- Programmes for **SMEs and start-ups** (technology licensing, R&D partnerships, innovation accelerators, and access to expertise);
- Collaboration with **industry** to convert ideas into data-driven businesses.



He highlighted two areas of work of CSIRO's Data61. One consists in the development of an **open platform** that **makes laws and regulation available in a digital, machine-readable format**, enabling any third party to develop their own compliance application (Figure 10). Another one consists in supporting the Australian Government's Cyber Security Strategy, for which it has stimulated the development of more than 70 cyber security collaborative research initiatives across academia, business and government.

Figure 10. Regulation as a Platform concept diagram



Download the [one-pager concept diagram.pdf](#)
(220 Kb)

Source: <https://digital-legislation.net/>

Joe Scarboro, founder of company Touchpaper, discussed about the relevance of implementing policies to facilitate collaboration between startups and big firms. Touchpaper has created a good practice toolkit to make it much easier for startups and established firms to work together. The toolkit covers strategy; communications and buy in; engagement and decision making; legal and procurement. He argued that such collaboration is critical in the context of the digital transformation. Startups can provide big businesses with the competences and agility to adopt new practices. To illustrate the negative consequences of trying to fight change, he referred to the example of investments in lobbying. It is much more efficient to invest those resources in innovation.



"It is critical to facilitate collaboration between startups and big firms"

- Joe Scarboro



Jerry Sheehan, from the US National Library of Medicine (NIH) and chair of the TIP Working Party, addressed the following question: **What can research institutions do to facilitate digital transformation?** There are unprecedented volumes of data available, and systems should be developed to make better use of them (i.e. exploring possibilities for new combinations of data, new analytical methods, and new uses). He argued that research funding institutions should: (1) require accessibility to data from research that they found; (2) ensure appropriate data use (i.e. data privacy and security); (3) build the infrastructure needed to store data and make them accessible, reusable and transparent; and (4) set data standards. In the new context, it is critical that scientists are well trained in the fields of data management, manipulation and analysis and that they have the right incentives to provide access to data they created.

"All scientists should be trained in the fields of data management, manipulation and analysis" - Jerry Sheehan



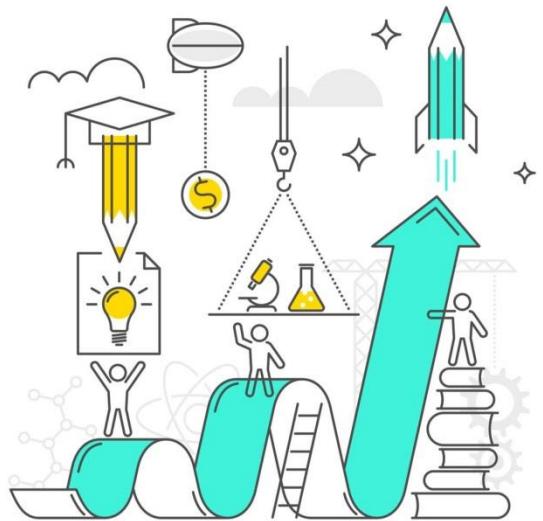


Christopher Haley, head of New Technology and Startup Research at NESTA, emphasised the need of designing tailored policies to support startups. He explained that the recent wave of business model innovation has been mainly driven by startups using digital technologies. These often have the possibility to outsource part of their activities and focus on business model innovation. Other actors have been slow to react to the new trends. This is often the case of university technology offices, conceived to commercialise new technologies, but not to support business model innovation.

He highlighted that there is no conflict between innovation driven by startups and big corporations – they can both coexist. Moreover, there is increasing willingness among big firms to work with startups and experiment. In this context of rapid change, business leaders aim at partnering with potential disrupters rather than being affected by them. Collaborations, however, remain difficult to manage. And it is precisely the ability to collaborate effectively that is likely to make companies more competitive.

He then shared some views that are relevant for policy:

- **It has become easier to start a (digital) business:** one the one hand, there is a lot of support via accelerators and other programmes; on the other, the ready availability of cloud services means that the physical/infrastructure component of many digital startups is now trivial. Scaling, however, is often more challenging, among others because many of those startups compete internationally from the start, which raises the competitive bar. Access to capital remains another important barrier.
- **The challenges faced by startups and SMEs are often of very different nature,** but policy makers do not always have a good understanding of those differences.
- It is important to create spaces for start-ups to experiment in real-world conditions, containing systemic risks. Regulatory sandboxes and testbeds can be key for companies in their early stages of development. Relevant examples include the Fintech Regulatory Sandbox in the UK and the Digital Health Valley in Belgium.
- Further efforts are needed to support diffusion, among others through innovative public procurement.



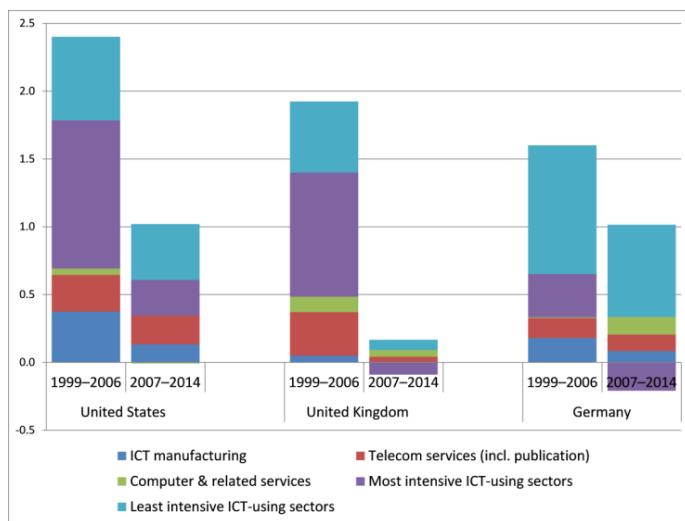
During the panel discussions, participants agreed that in this new context of the digital transformation, regulation and policy needs to keep changing – policy making needs to be forward looking, and not only constantly reacting to changes. It is important to build approaches that allow for agile adjustments over time. Pilot programmes and roadmapping can be effective tools in this context.

What policy instruments are needed to develop vibrant innovative eco-systems?

Prof. Jonathan Haskel, professor at Imperial College London, gave a keynote speech where he provided evidence on the increasing role of intangibles in the new digital economy (based on his recent book *Capitalism without Capital*). He showed that there has been (and continues to be) a decrease in ICT prices, a decline in the contribution of ICT-using and producing sectors to productivity growth (Figure 11), and a decline in the pace of intangible investment. There has also been a slowdown in communication technology investments, which seems to lower productivity growth via network effects.



Figure 11. Contribution of ICT-producing and using industries to labour productivity growth, 1996-2006, 2007-14



Source: Presentation of Prof. Jonathan Haskel

He put forward four characteristics that differentiate intangible investments from traditionally predominant tangible investments (or the four “S”): they tend to represent a sunk cost, while tangible assets can be sold if needed; they generate spillovers (i.e. knowledge investment can be used by others); they are more likely to be scalable; and they tend to have synergies with other intangible and human capital investments. Given these different nature of investments, an economy dominated by intangibles can be expected to behave differently: intangible capital owners increase their gains and intangible-intensive companies become relatively larger, which leads to widening productivity gaps between frontier firms and laggards – both due to scale and the inability of laggards to take advantage of spillovers.

Wolfgang Crasemann, from the Federal Ministry for Economic Affairs and Energy, presented Germany's support programmes for the digital transformation of SMEs (*Mittelstand-Digital*), which constitute one of the pillars of the Digital Strategy 2025:



- The **Mittelstand 4.0 Competence Centres** aim to increase awareness and provide information to SMEs on various subjects regarding digitalisation.
- The **Go-Digital programme** provides grants to SMEs (of less than 100 employees) to cover 50% of the costs of consultancy services in IT security, digital market penetration and digital processes.
- The **Central Innovation Programme** provides grants for innovative projects of SMEs (of less than 500 employees) in all technology fields, including those conducted in cooperation with research institutes or other companies, covering up to 55% of the costs. Digital projects constitute around 20% of the total.

Felicity Burch, head of Innovation and Digital at the Confederation of British Industry, the largest business organisation in the UK, presented her views on what are the current priorities for innovation policy. She argued that it is necessary that innovation policy: (1) focuses **not only on high-technology businesses**; (2) is more adaptive to **quick technological changes**; and (3) is more **human-focused**, that is, takes into account the impacts of new technologies on people's lives. To that end, it is crucial to bring together academics, businesses and citizens to decide what are the best policy approaches.

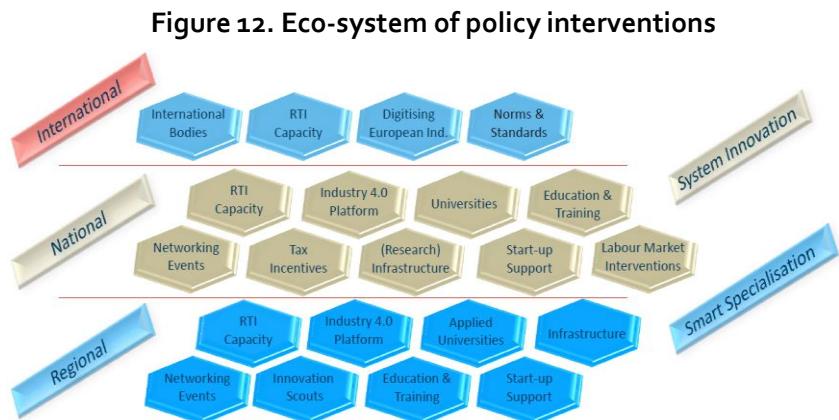


Roland Sommer, managing director of the Association Industry 4.0 in Austria, presented his views on what makes digital transformation different and challenging for companies. He emphasised that companies that invest more in digital technologies tend to be more successful on the market, which raises the gap between leaders and laggards. **Access to data is key for innovation**. The context also requires managing complexity, ensuring that new technologies are socially acceptable, and coping with emergence of new business models with disruptive (non-technology) elements and winner-take-all market dynamics.

All these factors require adapting the management to the new business environment, provide individualised training to workers and change the approach to human resource management. The challenges can only be addressed by the **combination of policy instruments at the regional, national and international levels** (Figure 12).

Marnix Surgeon, from the European Commission, raised a set of key unanswered questions for innovation policy in the context of digital transformation. He explained that we are in an age of uncertainty: as policy makers, we approach digitalisation from a general perspective, but we still know little about how it is penetrating and impacting different sectors.

- Are traditional rationales for innovation policy still relevant? Are there different rationales? Is there a role for public policy to move away from addressing market failures to guiding markets (e.g. encouraging action to address specific social challenges)?
- What is the right innovation policy mix in the context of the digital transformation? Can the current complexity of interactions for innovation across sectors and technologies be funded? What is the correct balance between direct and indirect funding (e.g. R&D funds versus R&D tax credits)? Is open data the best way to enhance innovation diffusion?
- Today, traditional measures of innovation, such as the number of publications, patents, etc. still dominate. Are there better ways to measure innovation more adequately? What are other possible measures of impact of policies?



Source: Presentation of Roland Sommer





Tim Page, from the UK's Trades Union Congress (TUC), presented the main messages of the TUC's recent discussion paper *Shaping Our Digital Future*, which draws on evidence from the US and Germany. He emphasised that technological change was very much welcomed by TUC and emphasised the need for the UK to address two key public policy challenges in this regard: (1) Introducing digitalisation in a way that **reduces rather than widens divides between those whose jobs are at risks and those whose jobs are not**; and (2) Ensuring that **workers share the productivity gains from digitalisation through higher wages**. He specifically emphasised the importance for policy to support investing in workforce and out of work training, doubling the proportion of female STEM graduates in the next ten years, and supporting the expansion of collective bargaining.

David Legg, from Innovate UK, referred to the '4E s model', developed by Defra to describe the types of actions necessary to stimulate pro-environmental behaviour change. These actions are grouped and categorised by the "4Es" of enable, encourage, engage and exemplify. The model can be used as a tool to ensure a balanced mix of policy interventions to catalyse change also in the field of innovation:

- **Enable**, i.e. make it easier to innovate, for example by opening data;
- **Encourage**, i.e. provide the right incentives, for example R&D grants;
- **Engage**, i.e. stimulate collaboration and trust, for example by working with trusted intermediaries, creating spaces for actors to collaborate such as the Catapult Centres;
- **Exemplify**, i.e. lead by example, for example by using digital tools in the process of policy-making and the provision of public services.



The panel discussed about the appropriateness of different policy instruments for the digital transformation, and the role of impact assessment. Several instruments were considered important for the digital transformation, particularly:

- **Education and training in STEM fields and beyond** (including social sciences). Strengthening soft skills (e.g. problem solving, critical thinking) and capacities for interdisciplinary research and innovation were also considered key;
- **Instruments to foster collaboration** among different actors in the ecosystem;
- **Innovative public procurement** to increase governments' use of digital technologies.

Panel participants agreed that there was a need to rethink innovation policy and its core principles in the context of the digital transformation and to reconsider the policy mix. An evaluation is also closely linked to finding ways to conduct adequate impact assessments. Further policy experimentation and testing was also proposed as a way forward, together with exchanging different practices across government and countries



List of speakers

Tera Allas, Senior Fellow, McKinsey
Felicity Burch, Head of Innovation and Digital, Confederation of British Industry (CBI)
Charles Carter, Senior Intelligent Mobility Specialist, Transport Systems Catapult
Wolfgang Crasemann, Head of Unit, Federal Ministry for Economic Affairs and Energy
Cristian Gherhes, Sheffield University Management School
Dominique Guillec, Head of Division, Directorate for Science, Technology and Innovation, OECD
Christopher Haley, Head of New Technology and Startup Research, NESTA
Jonathan Haskel, Professor of Economics, Imperial College London
Ben Hawes, Department for Digital, Culture, Media & Sport
David Legg, Lead Specialist for Evaluation and Evidence, Innovate UK
Peter Leihn, Commercial Director, Data61, Australia
Brian Macaulay, Lead Economist, Digital Catapult
Ed Manley, Lecturer and Director of Research, Bartlett Centre for Advanced Spatial Analysis, University College London
Alistair Nolan, Senior Policy Analyst, OECD
Lee Omar, Founder and CEO, Red Ninja Studios
Tim Page, Senior Policy Officer, Trades Union Congress (TUC)
Caroline Paunov, Senior Economist, OECD
Margherita Russo, Professor of Economic Policy, Università degli Studi di Modena e Reggio Emilia
Joe Scarboro, Founder of Touchpaper, Co-founder of 3beards & Unicorn Hunt
Jerry Sheehan, TIP Chair and Assistant Director for Policy Development, National Library of Medicine, NIH, United States
Roland Sommer, Director General, Association Industry 4.0, Austria
Marnix Surgeon, Deputy Head of Unit, European Commission
Zsolt Szalay, Associate Professor and Head of the Department of Automotive Technologies, Budapest University of Technology and Economics (BME), Hungary
Nicola Yates, Chief Executive, Future Cities Catapult



Further reading

David, P.A. (1990), 'The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox', *American Economic Review*, Volume 80, Issue 2, pp.355-361.

Haskel, J. and S. Westlake (2017) *Capitalism without Capital: The Rise of the Intangible Economy*, Princeton University Press.

Mocker, V, S. Bielli and C. Haley (2015) *Winning Together: A guide to successful corporate-startup collaborations*, NESTA, Founders Intelligence and Startup Europe Partnership, <http://www.nesta.org.uk/sites/default/files/winning-together-june-2015.pdf>

NESTA (2016) *Digital Entrepreneurship: An Idea Bank for Local Policymakers*, https://www.nesta.org.uk/sites/default/files/digital_entrepreneurship_an_idea_bank_for_local_policymakers.pdf

OECD (2017), *The Next Production Revolution: Implications for Governments and Business*, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264271036-en>

TUC (2017) *Shaping Our Digital Future: A TUC discussion paper*, <https://www.tuc.org.uk/sites/default/files/Shaping-our-digital-future.pdf>

The organising team

The workshop was organised and coordinated by Brian MacAulay (Digital Catapult), David Legg (Innovate UK), Caroline Paunov and Sandra Planes-Satorra (OECD).



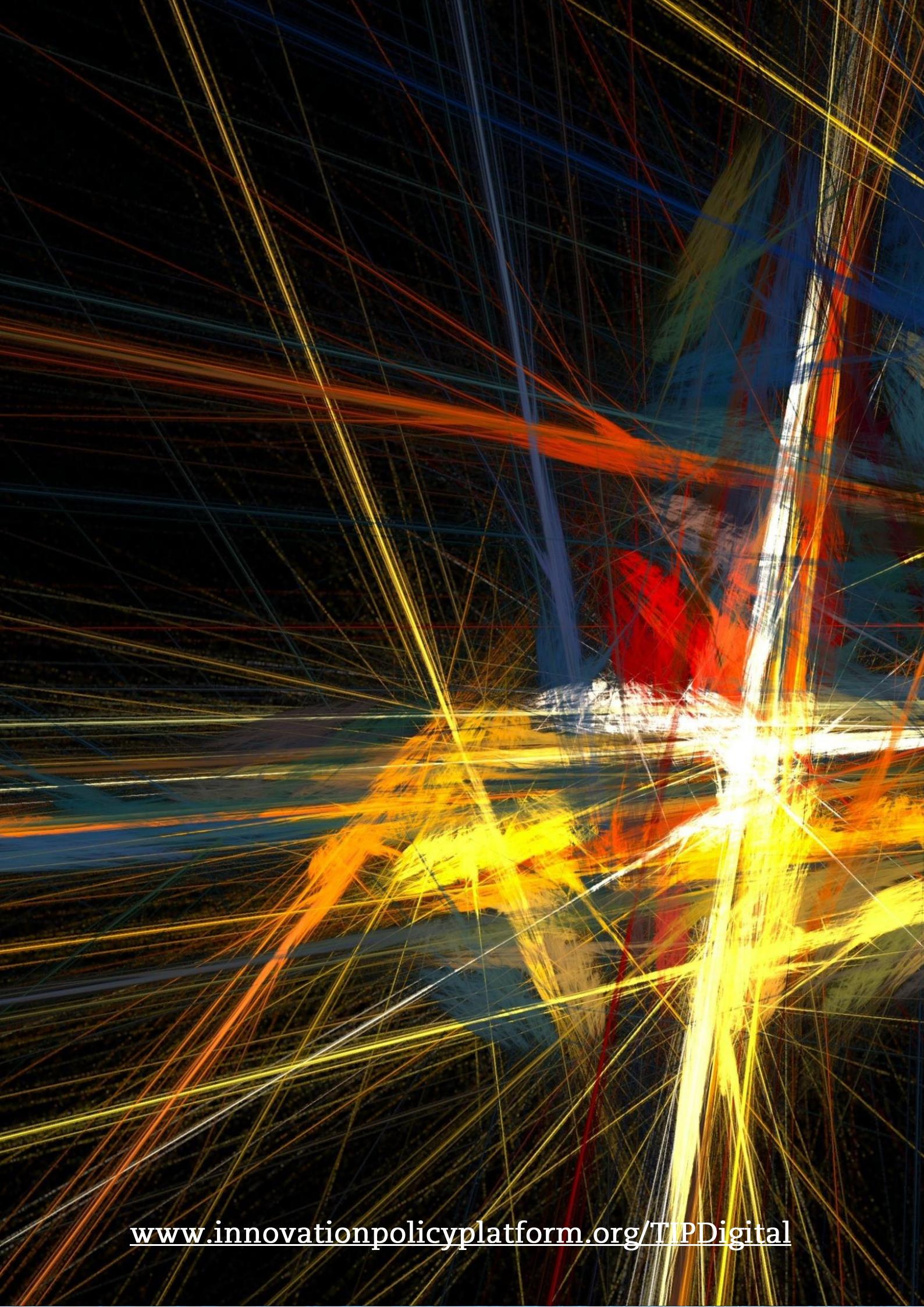
OECD Digital and Open Innovation project

The digital transformation has changed the way economies work and how innovation is organised. The OECD project ‘Digital and Open Innovation’ investigates whether and, if so, how digital transformation changes the rationales for innovation policy and identifies the most appropriate instruments to foster innovation and inclusive and sustainable growth in the new context. To identify practical policy implications, the project reviews changing business models and new forms of innovation across sectors and different actors, including SMEs, start-ups and research institutions. It also analyses new forms of collaboration in innovation at local, national and global levels.

Find more information about the project at:

www.innovationpolicyplatform.org/TIPDigital



The background of the image is a dense, abstract network of intersecting lines in various colors, primarily yellow, orange, red, and blue, set against a dark, almost black, background. The lines are thin and appear to be moving or intersecting at various angles, creating a complex web-like structure.

www.innovationpolicyplatform.org/TIPDigital