FOREWORD

This report sets the scene for the discussion of Panel 4.1 "New Market and New Jobs" of the OECD Ministerial Meeting on the Digital Economy, 21-23 June 2016, Cancún (Mexico). It provides new evidence on the effects of digital technologies on labour demand and discusses key policies to foster employment in the digital economy. The report was prepared by Vincenzo Spiezia, OECD, for the Working Party on Measurement and Analysis of the Digital Economy (MADE).

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EXECUTIVE SUMMARY

There is broad recognition that the digital economy has a great potential to enhance productivity, incomes and social well-being. At the same time, there is growing concern that successive waves of investments in digital technologies have contributed to job losses, wage stagnation and rising wage inequality.

Looking back, it is important to note that major technological innovations have always been accompanied by extensive transformations in the labour market. By increasing labour productivity, innovation enables the production of more goods and services with less labour, thus leading to the possibility of technological unemployment. At the same time, innovation creates new employment opportunities in different industries and in newly created markets. Economic history shows that, after a period of disruption, economies have continued to generate enough jobs for their workforce, although some argue that digital technologies may replace labour more than any other technology before.

While the diffusion of digital technologies in businesses is expected to increase productivity and ultimately translate into higher wages, policies have a key role to play in ensuring that this process contributes to creating more and better jobs.

For productivity growth to translate into more jobs, investments in digital technologies and knowledge-based capital (e.g. skills, organisational capital) are needed. However, investments have been historically low worldwide since the mid-2000s. Beyond cyclical factors, limited access to finance, information and skills remains an important obstacle to investment in digital technologies, notably for small and medium-sized enterprises. Policies to spur investments, particularly in innovative sectors with high growth potential, would have long-lasting effects on job creation.

The benefits from digital technologies will spread to all only if markets work well. If competition in product markets is low, productivity gains may not translate into lower prices, higher demand and more jobs. If nominal wages are not sufficiently flexible, some workers may receive higher real wages while others become unemployed. Therefore, without appropriate labour market regulations and effective competition policies, digital technologies may end up having large distributional effects and widen the income gap between different groups of people.

Whether or not overall unemployment rises due to digital technologies, displaced workers often encounter difficulties in finding appropriate new jobs. For new job opportunities to emerge, new markets have to be created, assets transferred across sectors, business know-how built up and new skills developed. Policies to speed up the transformation towards a digital economy and accompany workers along the transition to new jobs will reduce the social costs of this process. Skills and know-how are of critical importance in this respect and the approach for “Skills in the Digital World” put forward in the companion Background Report for this Ministerial Meeting (OECD, 2016b) is a key policy measure to create jobs in the digital economy.

Finally, Internet job platforms are connecting individual providers with individual customers, turning some full-time, long-term jobs into an uneven flow of “on-demand” tasks. Existing labour market programmes and safety nets, where eligibility is tied to traditional employment models, may have to evolve and adapt to ensure skills development, inclusive growth and job quality in the new work organisation enabled by the digital economy.

DIGITAL TECHNOLOGIES AND JOBS

Each major technological wave in modern economic history – the industrial revolution, the development of the assembly line, the mass production of cars or the first generation of computers in the early 1980s – has raised strong anxiety about employment. However, after a period of disruption, market economies have typically been able to continue to generate enough jobs for their workforce (Mokyr et al., 2015; Autor, 2015). There are two main reasons for this outcome.

One reason is that, while innovation may reduce labour demand and lead to unemployment, it also triggers a number of automatic market adjustments that tend to compensate for the direct decrease in labour demand (OECD, 1994; Spiezia and Vivarelli, 2002). In the case of digital technologies, market adjustments include the production of new digital goods and services; higher consumption of non-digital products following lower production costs and prices; as well as higher investment in digital technologies across sectors.

OECD analysis of information and communication technologies (ICTs) investment and employment over the last 20 years confirms these findings. ICTs had negative effects on employment for a limited period but these effects have disappeared over time. This is because higher productivity from ICTs progressively translated into lower prices and new products, higher final demand and higher employment, thus compensating for the initial job displacement (OECD, 2016a).

The other reason for stable employment rates despite fast technological progress is that, while new technologies make some jobs redundant, they also raise the demand for others (Autor, 2015). Economic history provides plenty of such examples. In the 1920s, passenger cars displaced equestrian travel and the related occupations but the roadside motel and fast food industries rose up to serve the "motoring public" (Jackson, 1993). The diffusion of automatic teller machines (ATM) resulted in raised employment in the banking sector by lowering operating costs in branches and freeing up time for clerks, who could provide a wider range of more complex services to their costumers (Bessen, 2015). Higher income generated in high-tech industries may also result in higher demand and employment in low-tech services, e.g.: restaurants, cleaning and other personal services (Mazzolari and Ragusa, 2013; Moretti, 2012).

The above market adjustments have two major implications for jobs. The first is that the skills required in the digital economy are and will increasingly be different from the old ones. Some skills are sector-specific and the sectoral recomposition triggered by digital technologies will change the balance among these skills. Secondly, and more fundamentally, skills requirements will change within both sectors and occupations.

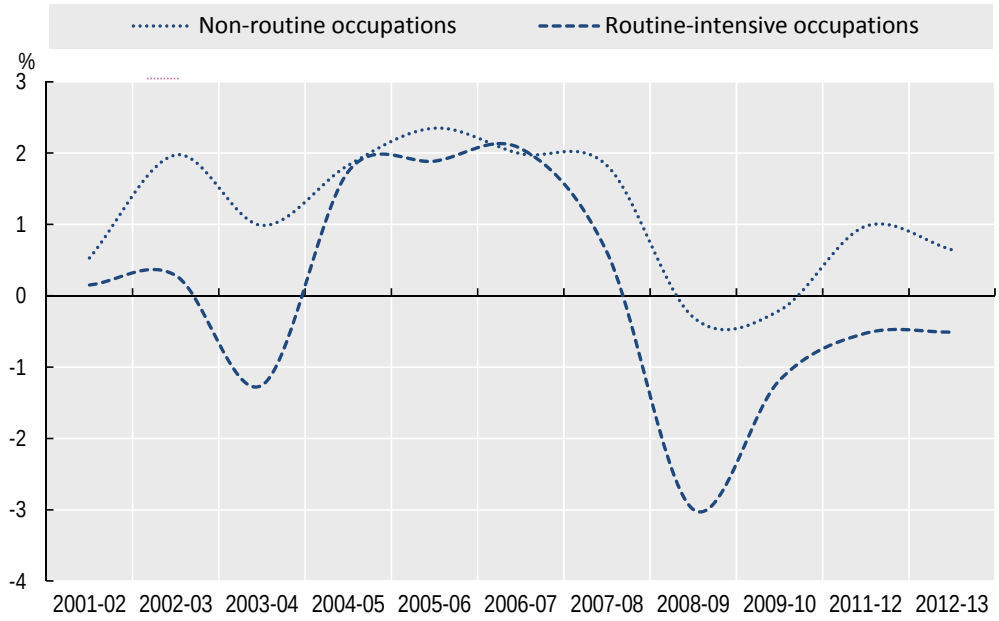
Digital technologies tend to substitute for workers in carrying out simple cognitive and manual activities following explicit rules (“routine” tasks), while computers complement workers in carrying out problem-solving and complex communication activities (“non-routine” tasks). Non-routine tasks can either be associated with conceptual jobs at the top end of the wage distribution, e.g. managerial and professional positions, or manual jobs at the bottom end of the distribution, e.g. housekeepers. Workers that perform manual or cognitive tasks that lend themselves to automation or codification (e.g. book-keeping, monitoring processes, processing information) are, in turn, concentrated in the middle of the wage distribution. Provided that routine and non-routine tasks are imperfect substitutes, the diffusion of digital technologies increases the demand for jobs with non-routine tasks at the expense of jobs with routine tasks (Autor, 2013).

It is a matter of current debate to what extent the job and wage polarisation observed in some countries in recent years is due to "routinisation". A number of recent studies find evidence that job polarisation in the United States and in Europe is accounted for by declining demand for routine tasks (Autor et al., 2006 and 2008; Goos et al., 2011; Van Reenen, 2011; Autor and Dorn, 2013; Hynninen et al., 2013) but only one of them (Michaels et al., 2014) establishes a direct link between ICT use and demand for skills.

OECD analysis finds evidence that ICTs have been a driver of rising inequality, but has – thus far – not produced an upward trend in unemployment. OECD (2016a) shows that in periods where labour demand decreased due to ICTs, the decrease was stronger for medium skilled workers than for high and low skilled ones. This finding is consistent with the job polarisation argument – ICTs raise the demand for high and low skills and reduce the demand for medium skills – but also implies that polarisation is only temporary.

Job polarisation is also affected by the business cycle, as shown by Figure 1. Routine-intensive occupations in Europe have been more affected by layoffs during downturns and benefit less from growth spells, leading to a progressive decline in the employment share of routine-intensive occupations. More analysis is needed to disentangle the effects of digital technologies on job polarisation from the effects of international trade, offshoring and changes in consumer preferences.

Figure 1. Growth in occupations by routine intensity, selected European economies



Note: OECD calculations based on Programme for International Assessment of Adult Competencies (PIAAC) Database, and European Labour Force Surveys (EULFS), June 2015.
Source: OECD, 2015a, http://dx.doi.org/10.1787/sti_scoreboard-2015-graph11-en.

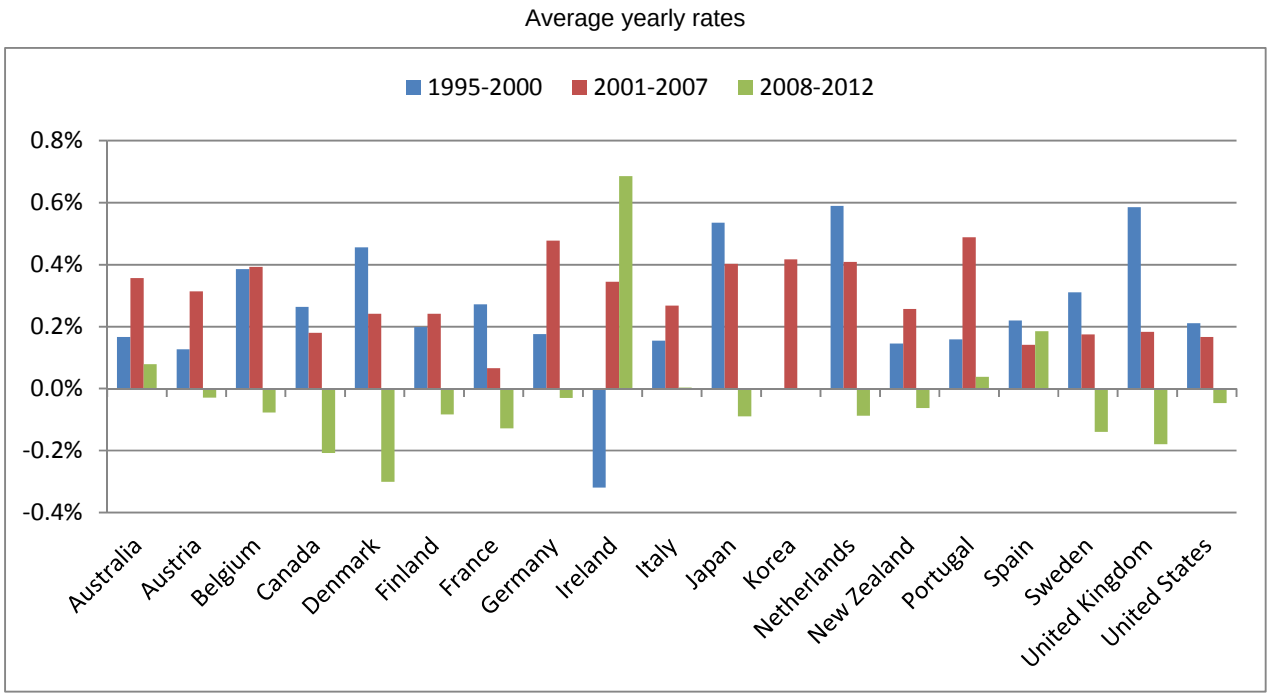
Although its effects on polarisation remain unclear, there is broad recognition that the shift from routine to non-routine tasks is likely to remain a long-run feature of labour demand in the digital economy. OECD analysis also shows that, as increasing use of digital technologies is reshaping business models and firms' organisation, complementary skills, such as information-processing, self-direction, problem-solving and communication, become more important (OECD, 2016c).

These changes in the demand for skills present major challenges to national skills development systems, including formal education, training and the recognition of skills acquired through non-formal learning. The companion Background Report for this Ministerial Meeting "Skills for a Digital World" (OECD, 2016b) discusses policies to increase the responsiveness of national skills development systems to changes in skills demand and seize the new learning opportunities created by digital technologies.

The second major implication of the labour market transformation triggered by digital technologies is that their labour-saving effects hit employment immediately while new job opportunities slowly emerge. New job opportunities are likely to appear in different industries producing for new markets, in new firms or in established firms adopting new business models, and will require different skills. Therefore, new markets have to be created, assets transferred across sectors, business know-how built up and new skills developed. All of this takes time and involves trial and error.

As Figure 2 shows, ICTs have raised labour demand in most OECD countries from the mid-90s until 2007 but have resulted in a decrease in labour demand afterwards. As investment has slowed down following the 2007 crisis, the labour substitution effects from past ICT investments has more than offset the increase in labour demand driven by new ICT investments.

Figure 2. Estimated employment growth due to growth in ICT capital (1995-2012)

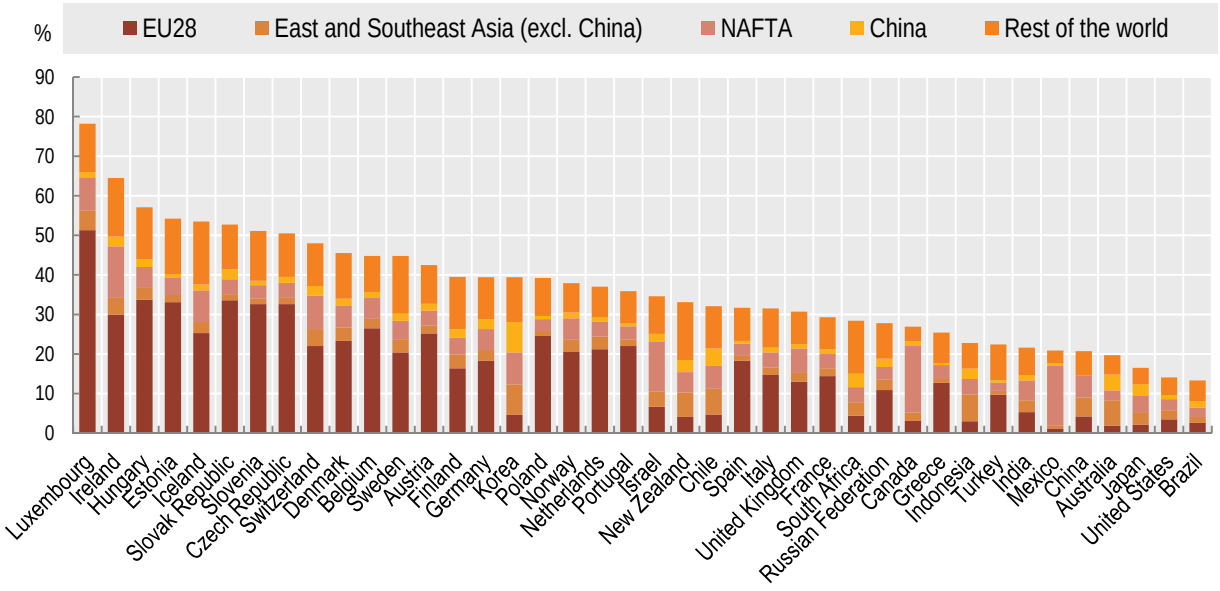


Source: OECD (2016a).

The process of job creation is further lengthened by the globalisation of production and final demand, which ICTs have in part enabled. Through offshoring and global value chains, ICTs may destroy jobs at home while creating jobs in other countries. Lower production prices at home and higher labour income abroad will stimulate exports and eventually increase employment at home as well, but this process takes significantly longer than in a closed economy. Figure 3 shows that between 30% and 40% of jobs in the business sector in most European countries in 2011 were sustained by consumers in foreign markets. In Japan and the United States shares are lower but initial estimates suggest that in 2011 the number of jobs sustained by foreign demand reached over 11 million in the United States and over 7 million in Japan (OECD, 2015a).

Figure 3. Jobs in the business sector sustained by foreign final demand, by region of demand, 2011

As a percentage of total business sector employment



Source: OECD, *2015a*, http://dx.doi.org/10.1787/sti_scoreboard-2015-graph182-en.

Furthermore, several studies suggest that the pervasive ongoing developments in artificial intelligence and big data make it possible that, in the near future, a large proportion of jobs currently carried out by workers could be performed by machines (Frey and Osborne, 2013; Elliot, 2014). Recent OECD work points to a more limited impact of automation on jobs (Arntz et al., 2016). To what extent these technological possibilities will ultimately result in job displacement depends not only on technology, but also on consumers' preferences and other market factors. For instance, most functions of bank clerks can be already performed by ICTs today but many people still prefer negotiating a loan with a human being than with an algorithm. Yet, a new wave of labour-saving ICT innovations is expected to diffuse across OECD economies and societies in the forthcoming years.

How disruptive technological developments will be for labour markets is a matter of current debate. Some argue that digital technologies have a stronger labour-saving bias than other major technologies in the past so that "digital labour…is substituting for human labour" on an unprecedented scale (Brynjolfsson and McAfee, 2011). Others (Gordon, 2012; OECD, 2015b) observe that productivity has been growing less rapidly over the last 10-15 years than in the 1960s, which was a boom period for employment, and forecast slow productivity growth in future (Gordon, 2016).

It is far too early to foresee whether in a more or less distant future digital technologies will completely replace human labour and lead to the "end of work" (Rifkin, 1996). The idea has surfaced before in history in the writings of authoritative thinkers (e.g.: Keynes, 1963; Russell, 1935) but has not become true so far. However, it is important to note that, if such a prediction was confirmed, economies – and policies with them – would have to face a very different set of issues: from "how to make the best use of scarce resources" to "how to redistribute abundance". For instance, if robots did all work instead of humans, where would people get their income from? What incentives will drive economic activities if income produced by robots were fully re-distributed through taxes and subsidies? Who will own the robots? Clearly, these are challenging questions. However, while it is worth monitoring technological developments and trying to anticipate their implications on jobs and markets, it seems more compelling for policies to focus on the most urgent issues, which are still those arising from scarcity, i.e. high unemployment and/or low income.

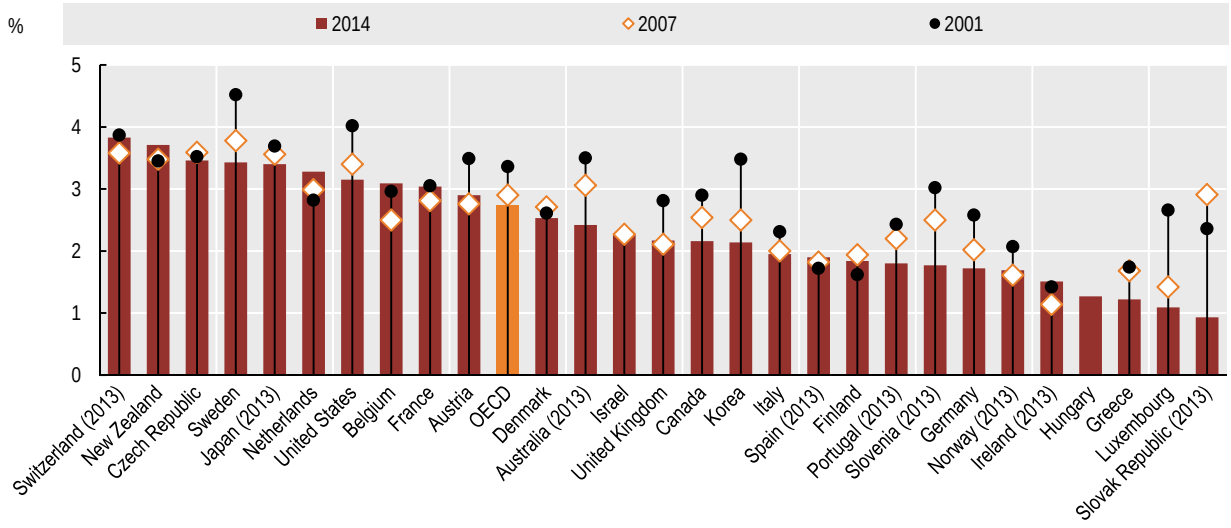
Policies have to be ready to face the challenges inherent to the digital economy and the growing public angst that accompanies them. Fostering investment in ICTs and complementary changes and innovation will sustain productivity and employment growth. Promoting competition in markets, creating favourable conditions for entrepreneurship and supporting the development of new goods and services enabled by ICTs will sustain growth in final demand and employment, including by creating new markets. Supporting workers in their transition to new jobs will speed up the process of adjustment and reduce its social costs. Active labour market policies, income support, lifelong learning and more responsive educational systems are of critical importance in this respect (OECD, 2016b).

FOSTERING INVESTMENTS IN DIGITAL TECHNOLOGIES

Despite historically low interest rates and steep rises in asset prices in many OECD countries, investment-to-GDP ratios have not recovered their pre-crisis levels. The volume of fixed investment is still well below its pre-crisis peak especially in the Euro area and Japan, where the volume of investment in 2013 was respectively 17% and 5% below its early 2008 level. In the United States, investment has already caught up with pre-crisis levels but remains short of its long-run trajectory (OECD, 2015c).

ICT investments have not escaped this trend (Figure 4). In 2014, ICT investments accounted for 2.7% of GDP in the OECD, down from 3.5% in 2001. Yet, a few OECD countries have increased ICT investment despite the crisis.

Figure 4. ICT investment as a percentage of GDP – 2001, 2007 and 2014



Source: OECD estimates, based on the OECD Productivity Database and National Accounts, February 2016.

The 2015 OECD Policy Framework for Investment (PFI) provides a coherent set of measures to mobilise private investment (OECD, 2015d). The PFI looks at 12 different policy areas affecting investment: investment policy, investment promotion and facilitation, competition, trade, taxation, corporate governance, finance, infrastructure, developing human resources, policies to promote responsible business conduct and investment in support of green growth, and lastly broader issues of public governance. Besides fiscal and other demand-side policies, supporting investment requires removing supply-side obstacles, particularly in the sectors with strong knock-on effects on other sectors of the economy, such as network industries (telecoms, electricity and transport) and trade-related services, like financial services and logistics.

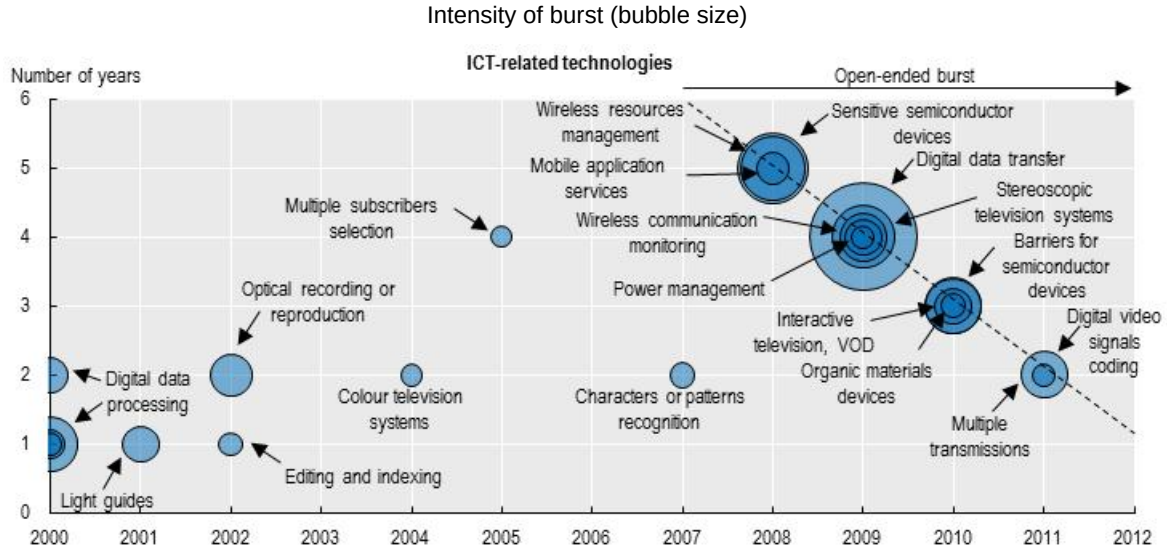
Investment in digital infrastructure remains critical to support growth and jobs in the digital economy. In OECD countries over 1990-2012, productivity growth of ICT assets is estimated to have been, on average, 50% higher than for non-ICT assets (OECD Productivity Database, 2015). High-quality and

affordable ICT infrastructure in all sectors, including high-speed fixed and mobile broadband, are needed to support the fast growing requirements of cloud applications and big data. Most OECD countries have or are putting in place national broadband plans and many have established broadband connectivity targets (speed and coverage), which generally include measures such as cost-reduction initiatives for broadband infrastructure deployment across all sub-national regions, public funding schemes, or measures to promote competition.

But it is not just ICT infrastructure that matters. The innovations spurred by the ICT sector hold great potential for boosting new growth trajectories and driving societal improvements, with the biggest impact coming with the application of ICTs across the economy and society, including in public administration, health, education and research. ICT investments, therefore, are needed throughout all economic activities.

Technological opportunities in ICTs continue to emerge (Figure 5). Since 2008 technologies related to wireless communications and improved performance of ICT devices, such as power management and data transfer, have accelerated with unprecedented intensity. And this dynamic does not show any signs of slowing down. Therefore, the challenge faced by many countries is how to channel ICT's many technological opportunities into economic growth and job creation.

Figure 5. Intensity and development speed in ICT technologies, 2000-12



Source: OECD, *2015a,* http://dx.doi.org/10.1787/sti_scoreboard-2015-graph71-en.

How to read this figure: The size of the bubble indicates the "burst" intensity, and different shades indicate the different technologies that burst. The technology bursts in the year are indicated on the X axis and the acceleration of its development ends in t years after the burst, indicated on the Y axis. Bubbles located along the diagonal line on the right hand side of the figure represent "open-ended" burst technologies (i.e. technologies still developing at an accelerated pace at the end of the sample period).

Successful adoption and use of ICTs by businesses require complementary knowledge-based capital (Oliner et al., 2007), particularly organisational and human capital (Bresnahan et al., 2002). Physical investment in ICTs, therefore, must be matched by complementary investments in knowledge-based capital, including employee skills, organisational know-how, databases, design, brands and various forms of intellectual property (Andrews and Criscuolo, 2013).

PROMOTING DIGITAL ENTREPRENEURSHIP

A growing number of successful business cases show that small start-ups are better placed to seize the new opportunities offered by digital technologies (CB insights, 2015; The Economist, 2014). However, a combination of market and regulatory factors act as an obstacle to the creation of small young firms.

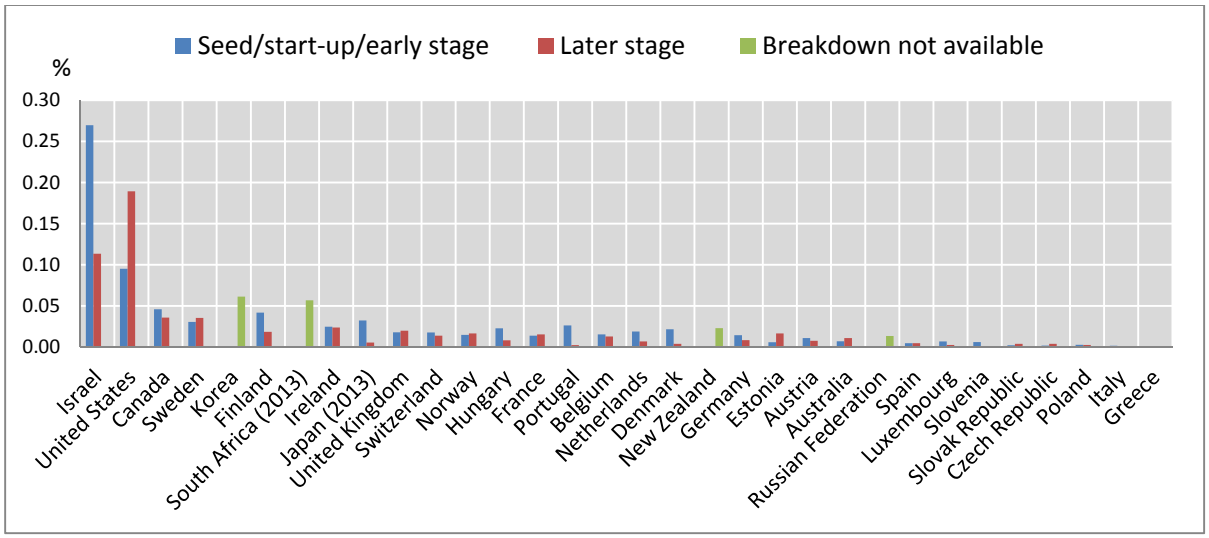
The first obstacle is financing. Debt finance is ill-suited for newer, small and innovative companies, which have a higher risk-return profile and often rely on firm-specific intangibles that are not always suitable as collateral. Concerted policy effort is needed to diversify the sources of finance for small young firms towards non-bank instruments.

Equity financing and hybrid instruments, which combine debt and equity features, are particularly relevant. Private equity investments, particularly venture capital and angel investing have been providing new financing opportunities for innovative start-ups, mainly in high-tech fields (Figure 6). In 2014, about 70% of venture capital in the United States went to the ICT sector (OECD, 2015e). In most countries, however, venture capital investments are low and still below their pre-crisis level (OECD, 2015f).

Hybrid instruments have also developed in a number of OECD countries through support of public programmes. They can provide young firms access to lower credit rates and smaller funding needs than what would be the practice in private capital markets. In addition, R&D grants, subsidies and tax incentives are considered especially effective for mitigating financing constraints in small and medium-sized innovative firms in the early stages of development. Seed funding can help entrepreneurs to gain access to finance, particularly for projects that imply higher risks (OECD, 2012).

Despite its potential, the share of small firm financing provided through capital markets remains low. High monitoring costs, low liquidity, red tape and reporting requirements act as obstacles to their development as well as cultural factors and management practices.

Figure 6. Venture capital investments as a percentage of GDP - 2014



Source: OECD, 2015f, http://dx.doi.org/10.1787/entrepreneur_aag-2015-table87-en.

ICTs themselves are creating new tools to reduce some of these obstacles. Crowdfunding platforms may provide new sources of finance for small start-ups. Peer-to-peer lending can be attractive for small businesses that lack collateral or a credit history to access traditional bank lending. Equity crowdfunding

can provide a complement or substitute for seed financing for entrepreneurial ventures and start-ups that have difficulties in raising capital from traditional sources.

Although crowdfunding has grown rapidly since the mid-2000s, it still represents a very minor share of financing for businesses. Donations, rewards and pre-selling are still dominant while regulation has limited its diffusion, especially for securities-based crowdfunding, which is not legal in some countries (OECD, 2014a). There is a need to know more about the scalability of crowdfunding to lending and equity finance, to assess its risk for borrowers and lenders and to design appropriate regulations to support its development and while reducing financial risks.

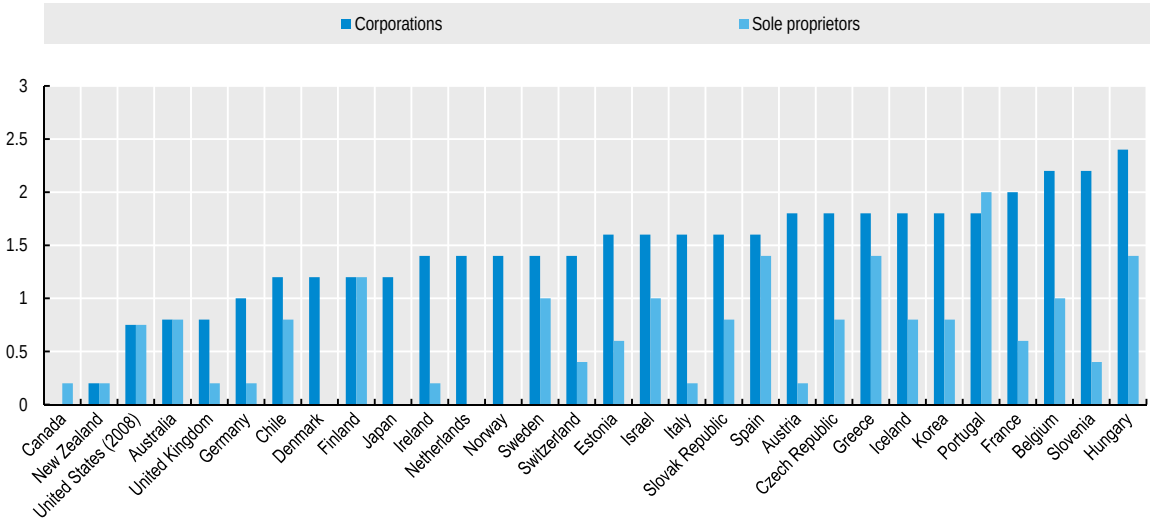
The Internet can also help to bring together small young firms and potential investors by reducing information asymmetries and increasing transparency. For instance, data warehouses with loan-level information can help investors to better assess risks in small firms and identify investment opportunities. More reliable information about risk may also help to reduce the financing costs, which are typically higher for small than for large firms. Start-ups with public listing on dedicated platforms can increase their visibility and facilitate match-making with investors. In addition, online platforms can provide training, mentoring and coaching for potential entrepreneurs and help them to improve the quality of their business plans and investment projects.

Regulation appears as the other major obstacle to small start-ups (Figure 7). While advances in ICTs have significantly lowered the cost of experimentation for frontier firms, in many countries regulations tend to favour incumbents and do not always enable the necessary experimentation with new ideas, technologies and business models that underpins the success of young firms.

Policies need to build a regulatory environment where businesses can thrive and fail. Such an environment would increase incentives to innovate by reducing the cost and the administrative burden of starting-up a new company. As innovation is risky and occurs through "trial and error", bankruptcy regulations need to be adapted as to reduce the costs of failure and ease the legal procedures to re-start a business (Adalet McGowan and Andrews, 2015). In particular, governments may want to pay special attention to small young firms that start new activities or adopt new business models enabled by ICTs. Policies can also contribute to promoting more positive cultural attitudes towards risk, where failure is not perceived as a lingering stigma for unsuccessful entrepreneurs.

Figure 7. Administrative burdens for start-ups - 2013

Scale from 0 (least restrictive) to 6 (most restrictive)



Source: OECD Indicators of Product Market Regulation 2013, www.oecd.org/eco/reform/indicatorsofproductmarketregulationhomepage.htm.

In order to support innovation, regulation has to strike a fine balance between preserving adequate economic returns for innovative risk-takers, on the one hand, and ensuring information sharing, cumulative learning processes and open innovation, on the other (OECD, 2015g). To assess the appropriateness of targeted regulatory policy, regulators need to ask whether the market would introduce the right technology in the absence of the regulation. Close attention is needed to the precise form that regulation takes. For example, uncertainty in the duration of a regulation could reduce its strength or influence demand conditions. OECD analysis suggests that it is helpful to take account of the specific design characteristics of different instruments (market- or regulation-based). Design characteristics that require attention include stringency, predictability, flexibility, incidence and depth. Furthermore, as the future development and effects of ICTs are unknown, caution is required to not "over-regulate". Setting simple guidelines, principles and codes of conduct, to be adapted and developed based on the evolution of technologies and markets, seems a better strategy that trying to regulate 'into the future' (van Welsum et al., 2013).

Intellectual property regimes are a key component of entrepreneurship-friendly regulation. The digital economy, combined with increasing globalisation of research and invention, has created both new challenges for intellectual property, e.g. pervasive piracy and industrial espionage, and new opportunities for it to stimulate inventions and creativity as well as to distribute knowledge. Countries must ensure that their intellectual property regimes, including patents, copyrights, trademarks, etc., are fit for this new context, ensuring the right balance between protection for right-holders as an incentive for creation and invention, and the public benefits that flow from dissemination of knowledge and inventions into the marketplace (OECD, 2015g, 2015h and 2010).

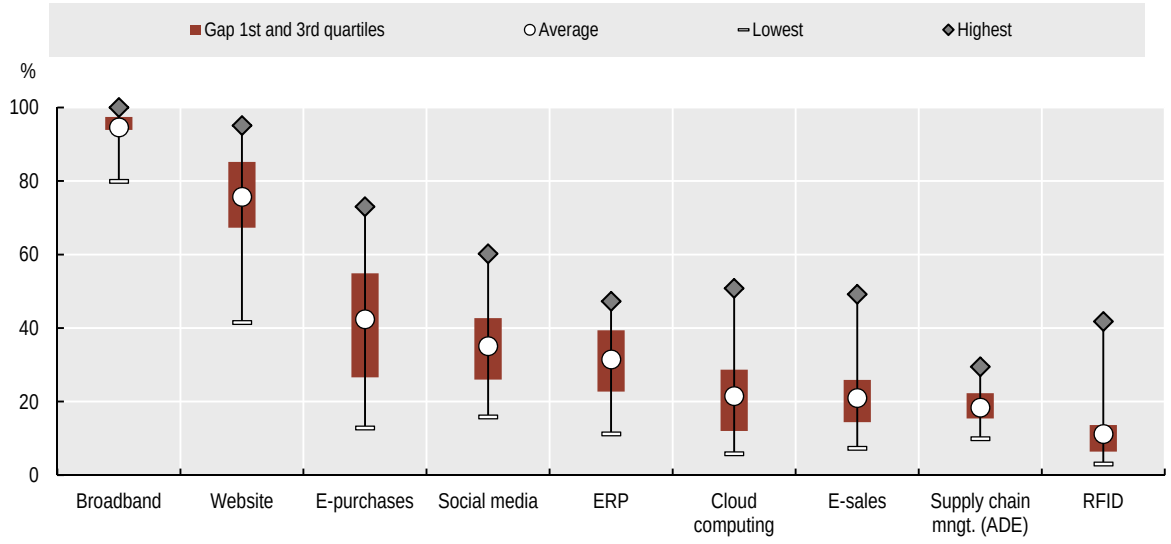
SUPPORT THE DEVELOPMENT OF NEW MARKETS ENABLED BY ICTS

The continued technology developments in ICTs and the generation of massive volumes of data have the potential to transform virtually all economic activities (van Welsum et al., 2013). On the supply side, the main technology trends in connection to ICTs include:

- The convergence among ICT-related technologies, which lowers the cost of business, increases access to high-quality specialised services, and transforms businesses from an assets ownership model to a leasing or "pay per" model.
- The increasing performance of devices and apps with a widening range of functionalities, which changes the relationship between firms and consumers as well as firms and employees.
- The Internet of Things, which provides access to new analytic and data mining capabilities, transforming existing business processes and creating new business opportunities.
- The integration of ICT with other technologies, in particular robotics, 3-D printing, nanotechnology and molecular biology, which dramatically enlarge the scope of ICTs applications in research, the economy and the society.

Despite its high potential, business adoption of ICTs remains limited. While most firms have a broadband connection and a webpage or a website, advanced ICT applications such as enterprise resource planning (ERP) software, cloud computing and Radio Frequency Identification (RFID) are used in just a minority of businesses (Figure 8). In general, larger enterprises are more likely to use advanced ICT applications, partially due to higher complexity of their internal business processes but also because of stronger barriers to ICTs adoption by small firms. These might include a lack of awareness of, and skills in, ICTs for business process re-engineering, and higher financial pressures that reduce the scope for experimenting with new technologies.

Figure 8. Diffusion of selected ICT tools and activities in OECD enterprises, 2014
As a percentage of enterprises with ten or more persons employed



Source: OECD, 2015a, http://dx.doi.org/10.1787/888933274447.

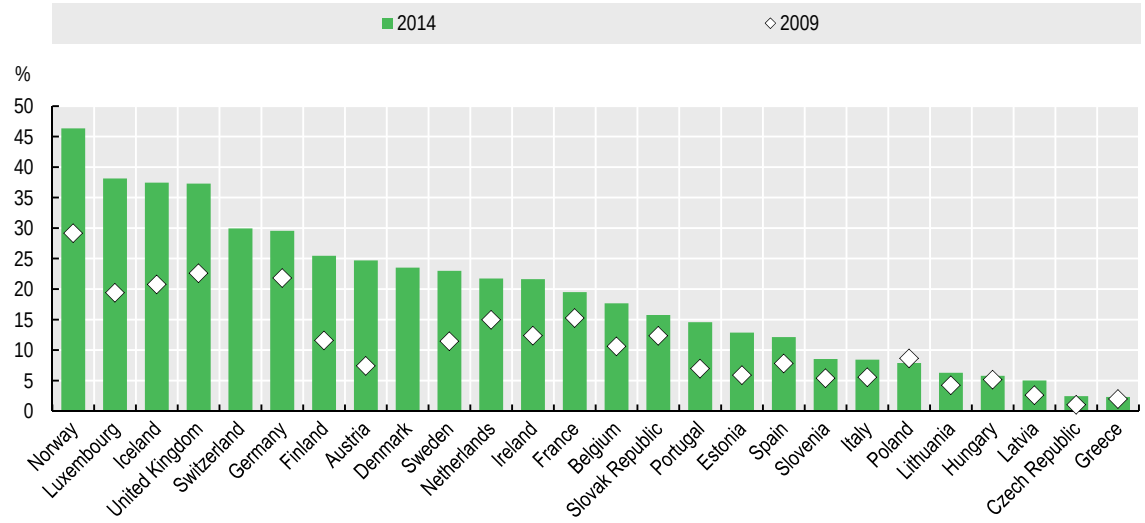
On the demand side, product customisation enhanced by ICTs is probably the single most important factor. Mass production typically delivers standardised products with a fixed bundle of characteristics. A consumer interested in only some of these characteristics has to pay the price for all the others and may buy less than they would have liked. Digitalisation permits sellers to break this fixed bundle and to sell customised products that meet the specific preferences of each consumer, thus leading to higher consumption. For instance, local content meets the demands for information and entertainment specific to certain communities better than traditional mass media targeting the average customer in a much broader audience.

The diffusion of ICTs, therefore, will not simply substitute existing production methods with new methods requiring less labour. By increasing the variety and the quality of goods and services available to consumers, ICTs raise the demand for existing products and create demand for new ones.

In the health sector, for instance, ICTs will not simply replace nurses and doctors with computers. They will offer new and better healthcare services not available before, so that patients will consume more of these services. Similarly, Massive Online Open Courses (MOOCs) are not simply about replacing teachers with online courses. They provide access to education and training to a much larger number of people over longer hours. As a result, people are likely to consume more educational services than before.

The development of digital markets, however, remains short of its potential. For instance, less than 20% of Internet users in Europe bought digitised products, e.g. e-books, music online, etc. in 2014 on average. Even in countries with the highest diffusion, this proportion stayed well below 50% (Figure 9).

Figure 9. Internet users having purchased digitised products (%), 2009 and 2014



Source: OECD, 2015a, http://dx.doi.org/10.1787/sti_scoreboard-2015-graph211-en.

To seize the employment opportunities created by the digital economy, governments should enlarge the range of their policies to a coherent set of general and sectoral measures combined with both supply and demand-side instruments (OECD, 2015i).

While most governments still focus on supply-side measures, countries that have been able to combine demand and supply-side policies for ICTs are those where the digital economy has grown and diffused faster (van Welsum et al., 2013). Demand-side policies can help to achieve the critical mass that is necessary for new digital markets to emerge. Such policies include ICT-oriented public procurement, regulations and standards as well as trade agreements to enlarge the potential market size across national boundaries.

Public procurement, in particular, can be used as a tool to attract innovative ideas, skills and capital (Lazonick and Mazzucato, 2013). Governments may issue calls for innovative projects that address societal problems, e.g. traffic congestion, energy consumption or elderly care, through the use of ICTs. For example, technology prizes are being used increasingly and have been central to the emergence of some significant breakthroughs, such as autonomous vehicles. A variety of platform models – collaborative innovation, crowdfunding and work sharing – can support this approach. Governments can also simplify their procurement procedures and make them more accessible to small businesses. Yet, understanding the cost-effectiveness of alternative measures often needs to be improved.

More generally, the public sector should take a stronger stance in favour of digitalisation, including better integration of ICTs in the back office and a broader offer of services online. Better access to e-government will also raise uptake of these services among firms and citizens.

On the supply-side, "new industrial policy" should focus on building networks, fostering public-private partnerships and improving co-ordination, with less reliance on direct support to specific sectors. The "smart specialisation" approach is one application of new industrial policy, aimed at helping entrepreneurs identify their knowledge-based strengths at the regional level. Key to this is increased use of diagnostic and indicator-based tools, to monitor and evaluate performance and policies, so that efforts can be more quickly redirected when outcomes are below expectations. While the uncertainty inherent to innovation highlights the dangers for governments using industrial policies to promote national champions, governments must make strategic choices.

Governments may also favour the development of digital markets in activities where clear growth opportunities remain underexploited, including health and energy.

The use of ICTs in the health sector is expected to create large employment and productivity opportunities in the forthcoming years. Ageing populations are raising the demand for healthcare while the convergence between ICTs and medical sciences – big data analytics, wearable technologies, advanced materials and robotics - leads to fast progress in the scope and quality of health services (OECD, 2013a). These developments will increase employment for ICT developers and big data analysts in the field of health. They will also create new jobs for healthcare professionals, who can use high-frequency data to identify opportunities to improve health services. Not least, the use of ICTs will raise the productivity of nurses and caring professionals, thus leading to an increase in their wages.

The diffusion of ICTs in the health sector, however, remains short of its potential. Lack of interoperability of systems and standards for the exchange of digital health records as well as some degree of organisational inertia and cultural resistance among both healthcare providers and patients have slowed down the adoption of e-health. In addition, the increasing volume of health data - for instance, digital imaging, remote monitoring via mobile devices and e-health records - combined with increasing capability for big data analytics, raises concerns about data ownership, privacy and security. In order to grasp the potential benefits from ICTs, governments should provide all actors in the health sector with the right incentives to adopt e-health – in particular, by making the public administration of health records and invoices fully digitalised – and should set an effective regulatory framework for the protection of the security and privacy of e-health information. The OECD has taken stock of existing measures and has developed an international measurement framework (Ronchi et al., 2013). However, further assessment of policy initiatives is necessary to build successful e-health policies in OECD countries.

Energy is another sector with clear employment potential in the forthcoming years. The digital economy will generate more jobs only to the extent that increases in productivity translate into higher final demand and more production. However, the scope for faster economic growth is limited by binding environmental constraints on energy consumption and gas emissions.

The very development of ICTs is setting the basis for green growth. ICTs are a crucial component of some key environmental technologies that improve the operation of electric vehicles, reduce their own energy use, improve the carbon footprint of end-users, e.g. via smart grids, and contribute to mitigation of GHG emissions.

Renewable energy accounted for 7.7 million jobs in 2013-14 (RENZI21, 2015). But green investments are not following at the same speed. Global clean energy investment fell by 20% over 2011-13. Efficient and low-carbon technologies, which include some key ICT technologies like smart meters and energy storage devices, accounted for just 2% (USD 3.9 billion) of G20 investment in clean energy in 2013. Cumulative investment in energy supply and efficiency will need to rise by 300 times – from USD 188 billion to USD 53 trillion - by 2035 to keep global warming below 2^0C (The PEW Charitable Trusts, 2014).

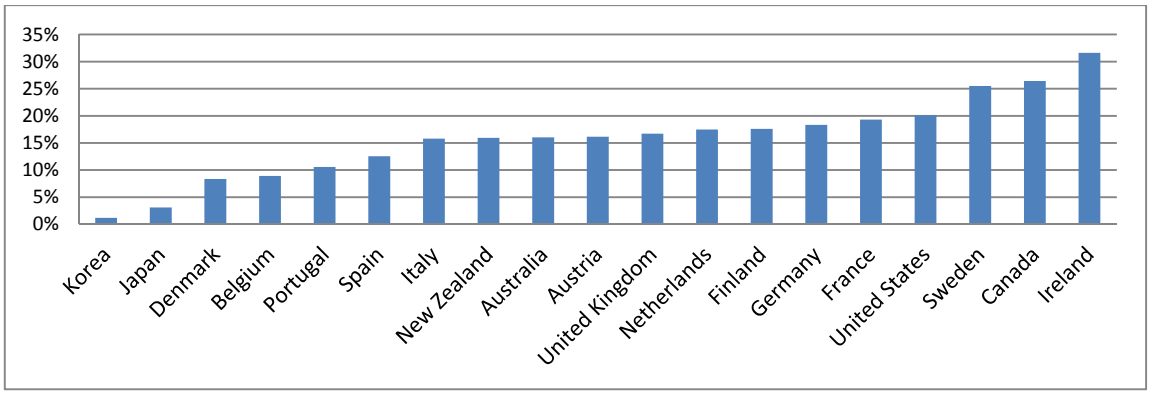
There seems to be scope for policies to speed up the translation of booming technological opportunities into investments. Big data are called to play a crucial role. Reliable, timely, and regularly updated data are essential for establishing energy plans, defining targets, designing and continuously evaluating policy measures, and attracting investment.

BUILDING COMPETITIVE MARKETS

Low competition in product markets may hamper the adoption of ICTs and slow down productivity growth (Conway et al., 2006; Arnold et al., 2008). In addition, in non-competitive markets the decrease in production costs due to ICTs is not fully transferred into lower prices, leading to a smaller increase in final demand and employment.

Price mark-ups on production costs remain high in many OECD countries, suggesting that prices are above their competitive level (Figure 10). Mark-ups are known to be higher in services (Høj et al., 2007; Bottini and Molnár, 2010), where ICTs have the largest potential to generate product innovations and job opportunities in the coming years.

Figure 10. Average price mark-ups on production costs – total economy (2012)



Source: OECD, based on the OECD Productivity Database, http://dotstat.oecd.org.

Entry barriers may also discourage innovative start-ups and slow down employment growth. Indeed, a large majority of jobs are generated by small young firms (Criscuolo et al., 2014). The dynamism of small start-ups is particularly high in services, where young firms also represent a higher share of total employment compared to manufacturing (Figure 11).

The Internet itself has affected competition in a range of markets. E-commerce tends to raise competition by lowering search costs for consumers and distribution costs for producers, while expanding the geographic scope of markets. At the same time, open source software or cloud computing may reduce entry barriers in some digital markets although network externalities from ICTs may favour market concentration, posing risks of "winner take all" situations (Koeske et al., 2014). Competition policy faces particular challenges in digital industries, where, unlike traditional manufacturing sectors, competition takes place at the level of business models.

Figure 11. Small start-ups' contribution to job creation and destruction

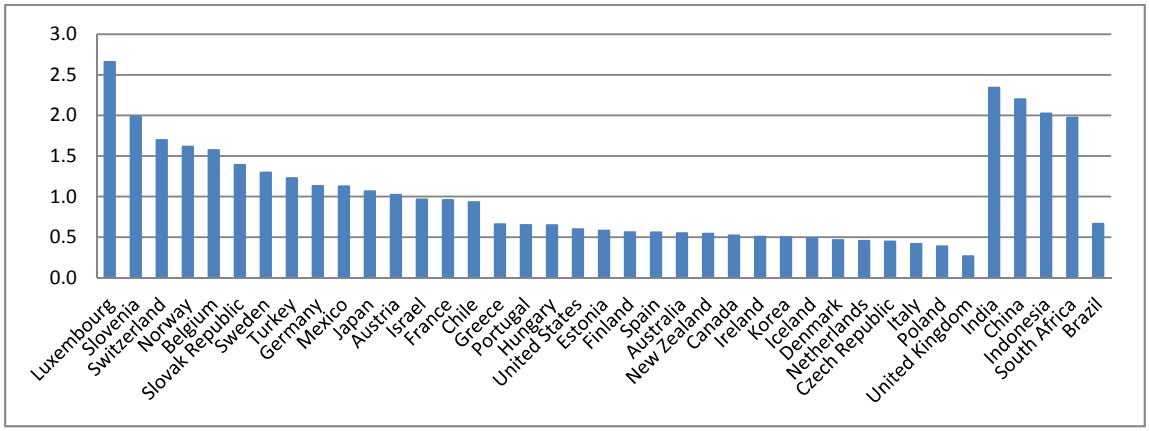
2001-2011 or latest available year

Source: Dynemp Database. Figure 15. http://www.oecd.org/sti/DynEmp_DATA.xlsx.

To a significant extent, low competition and entry barriers in product markets are associated with strict regulation (Wölfl et al., 2009). The rapid development of the digital economy has brought about new regulatory challenges. Regulating the Internet is complicated by the multitude of players, activities and media involved as well as by the rapid shifting of the economic and technological landscape and the virtual absence of geographical boundaries. The lines between the different types of players are not always clear-cut, as companies might simultaneously engage in several activities. In addressing these challenges, governments need to reconcile competition objectives with the need to preserve the capacity of the Internet to develop and stimulate innovation, while ensuring that security and privacy for consumers, enterprises and citizens are adequately protected. The Background Reports for this Ministerial Meeting "Stimulating Digital Innovation across the Economy" (OECD, 2016d) and "Protecting Consumers in Peer Platform Markets" (OECD, 2016e) discuss a large set of policy recommendations to achieve these objectives.

Figure 12. Regulation in the telecom sector, 2013

Scale from 0 to 6, from least to most strict



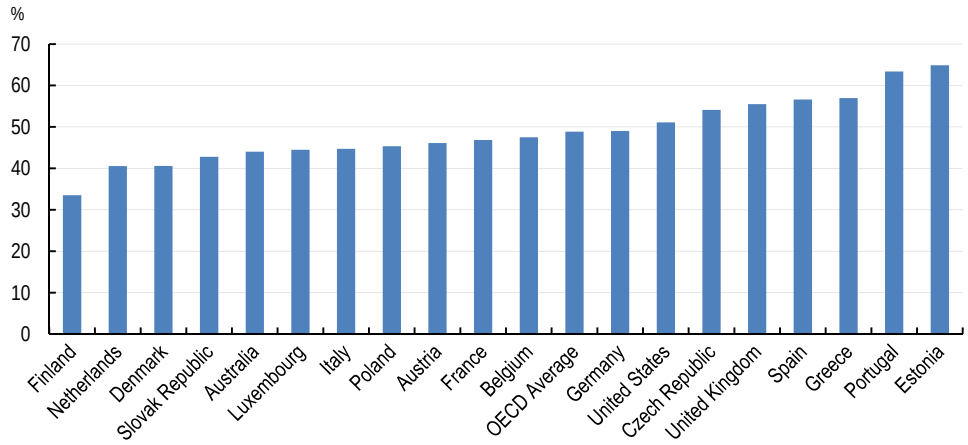
Source: OECD Indicators of Product Market Regulation 2013.
http://www.oecd.org/eco/reform/indicatorsofproductmarketregulationhomepage.htm.

Developing appropriate competition models in the telecommunications sector is critical. The presence of vertically integrated players requires a coherent policy framework linking the telecom sector to IT services such as software applications, content development and computing. Low competition in one link

of this production chain acts as an obstacle for the development of the others (Figure 12). The companion Background Report for this Ministerial Meeting "Improving Networks and Services through Convergence" (OECD, 2015e) provides a set of policy recommendations on regulatory entry and exit barriers as well as horizontal and vertical regulations.

Rigidities in wage setting may also hamper innovation and result into higher unemployment. However, real wages have shown significant flexibility in the aftermath of the crisis (OECD, 2014b). On average, about a half of workers in the OECD countries for which data are available experienced a reduction in their real earnings in 2010 (Figure 13).

Figure 13. Full-time workers who experienced real wage cuts in 2010 (%)



Source: OECD, 2014b, http://dx.doi.org/10.1787/888933132051.

ENHANCING JOB QUALITY IN NON-TRADITIONAL WORK ARRANGEMENTS

Over the last few years, Internet platforms have emerged as major actors in the digital economy, providing digital marketplaces for information, goods and services. Among them, Internet jobs platforms are providing new ways to match demand and supply for labour services.

Some job platforms, such as TaskRabbit, Handy or Youpijob, provides a marketplace for low-skill physical tasks, mostly carried out by young people on an occasional basis. Others, like Upwork, Freelancer or Nubelo, enable digital services online, matching demand and supply across different countries and over a wider range of tasks, from low-skill tasks like data entry or administrative support to high-skill ones like programming, legal advice or business consulting.

Internet job platforms bring the potential to dramatically change traditional work arrangements and labour market relationships. Some full-time, long-term jobs are being turned into an uneven flow of "on-demand" tasks for a large global pool of "virtual workers". While these changes create opportunities for workers, jobseekers and firms, they also raise major challenges for job quality, taxation and social security.

Platforms have contributed to job creation in a time of economic crisis and may create further job opportunities in lagging regions while mitigating skills shortages in dynamic areas. In addition, as platform-based jobs require little investment and training by employers, they seem suitable for small and medium-sized enterprises, local governments and social entrepreneurs and may contribute to more inclusive labour markets. At the same time, however, increased outsourcing of tasks to other regions and countries may result in job losses in local and national labour markets (Eurofund, 2015).

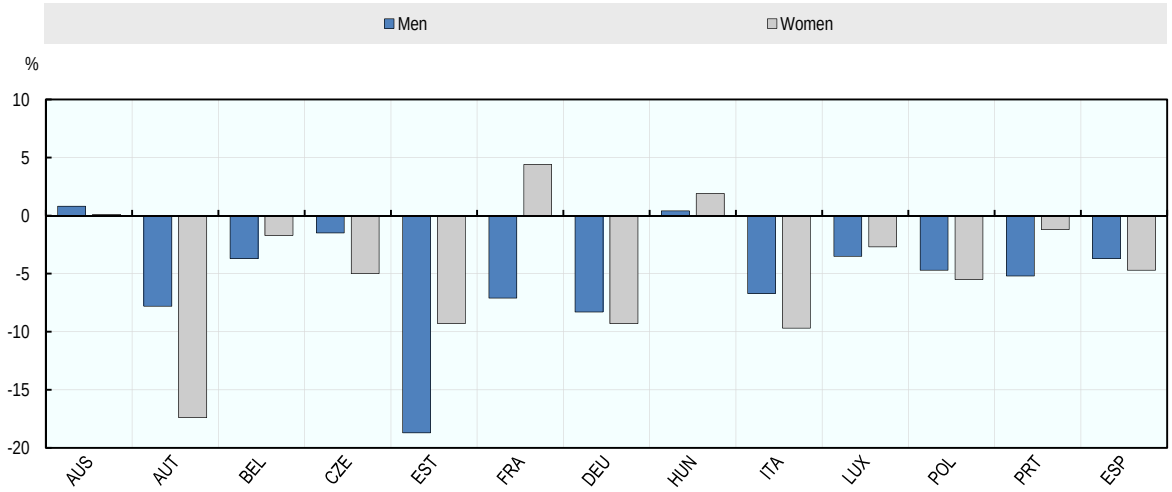
The main advantages for platform employers are the access to a larger pool of skills and experience, faster execution of the tasks contracted out and lower costs for hiring, administration and facilities. The risk of losing in-house competences as well as poor control over the process and the quality of the service provided are reported as the main drawbacks.

Among the main reasons for working via an online platform workers report, is the ability to manage working time independently (Hall and Krueger, 2014), to choose the place of work (Nubelo, 2014), and to achieve a better work-life balance (Eurofund, 2015). These benefits tend to be higher for certain groups, notably single parents, students and seniors.

The benefits from higher flexibly, however, do not come without costs. Platform-based workers may have to do many tasks in parallel, working longer hours and under higher stress. Other negative aspects include the information asymmetry between employers and workers, the lack of a reliable dispute resolution system, the possibility of privacy violation, and the lack of support from colleagues and managers. Work satisfaction also tends to be low as tasks are often low skilled and trivial (Eurofund, 2015).

Figure 14. Wage penalty for non-regular employees

Estimated wage difference between full-time non-regular and permanent employees



Source: OECD, 2014b, http://dx.doi.org/10.1787/empl_outlook-2014-graph58-en.

Under the existing labour market programmes and regulations, platform-based workers are likely to face some of the same problems as those in non-standard work, such as temporary, part-time or short-term jobs. Non-standard workers tend to experience lower wages than standard workers as well as greater job insecurity and earning losses between contracts (Figure 14). The self-employed are more likely to have fewer work-related benefits, in particular for unemployment, work injury, sickness, maternity and retirement (OECD, 2015o). Non-regular workers are also less likely to receive employer-sponsored training in most OECD countries but have a higher probability of becoming unemployed or leaving the labour force (OECD, 2014b). Policies, regulations and social dialogue are called to play a key role to prevent these risks while ensuring that the potential benefits from Internet job platforms are fully grasped.

Although platforms' remunerations are often low – 90% of the tasks outsourced by Amazon Mechanical Turk are valued at less than USD 10 cents (Irani and Silberman, 2013) - some platforms have put in place mechanisms to avoid a "race to the bottom", including an independent evaluation of the quality of the proposed services (Boblr), a minimum wage (TaskRabbit – Inc., 2015) and the employers' obligation to pay for worker's overtime, health insurance, vacation, severance and termination costs (Upwork, 2015).

Setting workers' representation and dispute resolution mechanisms is also difficult in an environment where workers work alone and are separated by different geographies, languages and legal contexts. Union movements have started to emerge in some countries, notably in the United States, where the Freelancers Union has become an important platform and voice, including for platform-based workers, currently counting 275 000 members. The Freelancers Union, however, cannot engage in any collective bargaining, call for labour inspectors or get involved in any decision about the firms they provide services for. In 2015, the Seattle City Council voted to give taxi, for-hire and Uber drivers the ability to unionise and to bargain for agreements on issues such as pay and working conditions. Various national trade union initiatives aim at opening up to independent workers, e.g. IG Metall (www.faircrowdwork.org/) and ver.di provide legal and support services for crowd-workers. Governments should set up a favourable legal and regulatory framework to enable workers representation and promote social dialogue.

Policy discussions on online platforms have mostly focussed on specific sectors so far. Cross-cutting policy issues, such as the ones relating to work, consumer protection, taxation, competition, or privacy and security, have been addressed less systematically. A few countries have started to develop a more comprehensive approach though. The US Federal Trade Commission held a hearing and public consultation earlier this year while the UK government has issued recommendations in response to an independent review of the sharing economy (UK-BIS, 2015).

Existing regulations, which were set for markets where most producers are firms, should evolve to fit markets where an increasing number of service providers are individuals. As individuals may not be capable of complying with a high level of complex regulations, applying existing regulations might limit job opportunities via Internet platforms or discourage innovative ways of providing labour services altogether (OECD, 2016f).

With the increasing number of platform-based workers, questions about the liability of Internet intermediaries have resurfaced. In relation to work, liability mainly refers to whether an online platform should be regarded as an employer or not. While the answer will depend on the type of platform, its business model and the market it operates in, governments should address the issue as part of the broader question about building efficient regulations in platform-driven markets (OECD, 2015f).

In some areas, platforms have moved ahead of regulators and have put in place some type of self-enforcing regulation, based on ratings and reviews. Such a system creates transparency about behaviours in the marketplaces, facilitates ex-post quality control and enables trust. As online reputation has become a central element for providers and users, regulators may want to explore real time reputational mechanisms as a complementary tool to regulate markets (Thierer et al., 2015). Access to sound data and credible cross-country assessments would be crucial steps towards building innovative regulatory tools.

To meet these challenges, governments, employers and trade unions should improve their capability to detect emerging labour market trends and explore ways of developing existing labour market programmes and safety nets, where eligibility is tied to standard employment models, so as to ensure inclusive growth and job quality.

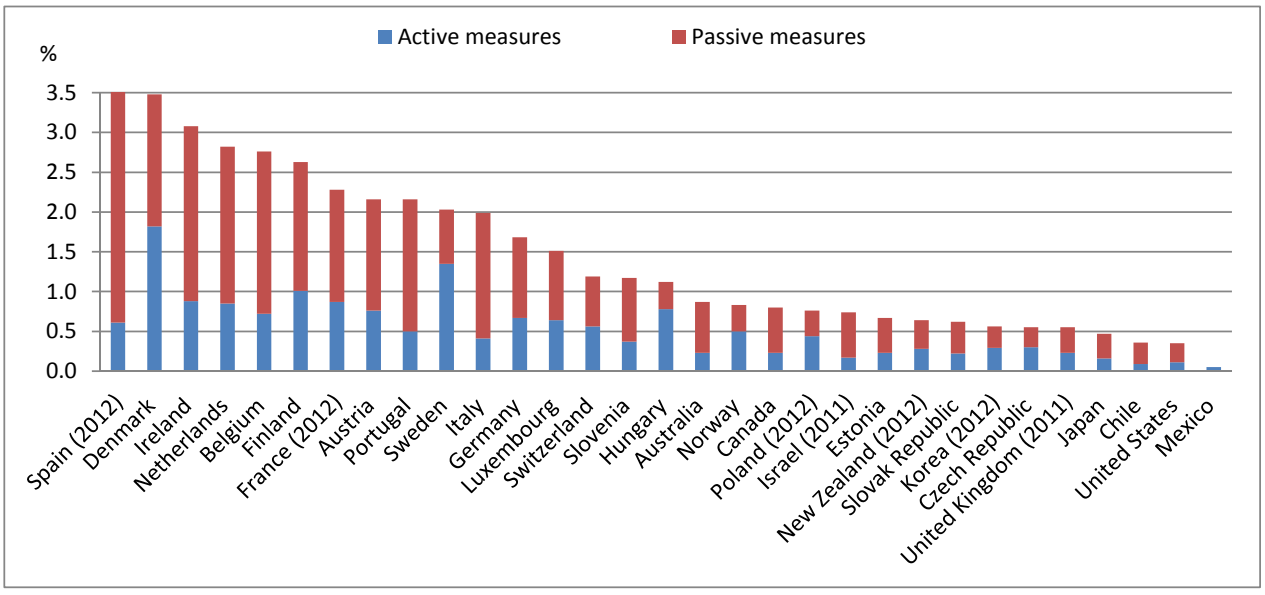
ACCOMPANYING WORKERS IN THE TRANSITION TO NEW JOBS

The process of creative destruction fuelled by the digital economy will take several years to loose its benefits on employment. New markets have to be created, assets transferred across sectors, business know-how built up and new skills developed. All of this takes time and involves trial and error. The negative distributional effects and the increase in unemployment for some workers, although temporary, may last for several years. Policies to accompany workers along the transition to new jobs would reduce the social costs of this process.

The surge in unemployment following the subprime crisis in 2007 has raised new interest in the role of active labour market policies (ALMPs) to help ease youth unemployment and persistent joblessness among displaced adults (Figure 15). While "passive" labour market policies provide income support for those out-of-work, e.g. unemployment benefits or early retirement, ALMPs aim "to bring more people into the effective labour force, to counteract the potentially negative effects of unemployment and related benefits on work incentives by enforcing their conditionality on active job search and participation in measures to improve employability, and to manage employment services and other labour market measures so that they effectively promote and assist the return to work" (OECD, 2013b). These measures include public employment service (PES) and administration, training, employment incentives, sheltered and supported employment and rehabilitation, direct job creation and start-up incentives.

Figure 15. Expenditure on active and passive labour market policies, 2013 or latest available year

Percentage of GDP



Source: OECD, based on the OECD Employment and Labour Market Statistics, http://dx.doi.org/10.1787/data-00312-en.

Although ALMPs have been in place for a long time, credible assessments of their effects have only become available in recent years. The main findings from these assessments are that ALMPs have a positive impact on employment two to three years after completion of the programme and that such an

impact is stronger in a recession and for programmes focused on human capital accumulation. In addition, the benefits are larger for females and the long-term unemployed (Card et al., 2015).

According to a recent OECD review of activation strategies, countries can benefit from a strong employment-focused activation system, which assists with job search, matching and reducing barriers to employment, backed up by mandatory referrals to employment and training programmes. However, the success of these measures depends on the design and implementation of employment and training programmes as well as of employment service arrangements (OECD, 2013b).

Institutional reforms are a critical component of activation strategies. Reforms should include organisational mergers or co-location of services that combine employment assistance with benefit administration. The effectiveness of public and private employment services should be improved through performance management. Ensuring enough staff to monitor benefit claims, register client details, set up individual action plans and interview clients at regular intervals is crucial to the success of these programmes.

Focused measures promoting a rapid return to regular work should be expanded, including job-search training, short vocational or remedial training, job clubs, work trials and internships. These interventions can help to ensure some continuing contact with the labour market and job readiness during a potentially lengthy unemployment spell.

Activation strategies should include specific programmes for the long-term unemployed to enter a gateway process and active benefit period. Public employment creation can provide a backstop measure for the long-term unemployed but the experience of OECD countries suggests that it may be rather ineffective and costly unless strictly time bound and associated with training to provide useful skills to find work in the open labour market (OECD, 2013b).

Big data may help to identify job opportunities and training priorities. For instance, the analysis of online vacancies provides timely and detailed information on job opportunities, their geographic location and the skills requirements. ICTs can also reduce the administrative burden for job counsellors and improve the match between the characteristics of jobseekers and the content of training (OECD, 2016b).

While ALMPs appear a useful tool to accompany workers along the transition to new jobs in the digital economy, there remains a great need for further comparative high-quality information about these policies, involving better access to administrative statistics and policies reviews in a larger number of countries.

TOWARDS A JOB STRATEGY IN THE DIGITAL ECONOMY

The digital economy has great potential to enhance productivity, incomes and social well-being. However, while creating new job opportunities, the digital economy is also destroying jobs in sectors with larger scope for automation and slower growth in demand. This process affects both low- and high-skilled jobs in routine occupations and may lead to wage polarisation.

While the diffusion of digital technologies in businesses is expected to increase productivity and ultimately translate into higher wages, policies have a key role to play in ensuring that this process contributes to create more and better jobs. In particular, policies should:

- Spur ICT investments, particularly in innovative sectors with high growth potential, e.g.: health, energy and education.
- Enhance digital entrepreneurship to speed up the transformation towards digital services.
- Support the development of new markets enabled by digital technologies ICTs through a coherent set of macro, sectoral, supply- and demand-side measures.
- Set appropriate labour market regulations and effective competition policies to ensure that the benefits from the digital economy spread to all.
- Promote social dialogue to grasp the potential benefits from Internet job platforms while ensuring job quality and social protection.
- Accompany workers along the transition to new quality jobs with appropriate activation policies.

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