



DIGITALISATION: AN ENABLING FORCE FOR THE NEXT PRODUCTION REVOLUTION IN KOREA

Better Policies Series

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FOREWORD

Since joining the OECD in 1996, Korea has made impressive progress in raising living standards. Over 1996-2016, the country closed the gross domestic product (GDP) per capita gap with the OECD average by 26 percentage points. Vibrant exports underpinned strong economic growth, with Korea becoming the eighth largest exporter in the world. The country's focus on innovation (its R&D spending is the second highest in the OECD) combined with its highly skilled population (it is among the top performers in the OECD's Programme of International Student Assessment) supported this success.

However, the convergence of Korea's living standards to those in the most advanced countries has stalled in recent years. Output growth has slowed from 4.4% annually over 2001-10 to 2.8% since 2011. The country faces strong competition from emerging economies, notably the People's Republic of China in low- and medium-end markets, and with advanced economies in high-end markets. This makes it more difficult for Korea to further expand its global market share.

Labour productivity growth, which had been the fastest in the OECD between 1996 and 2011, fell below the OECD average over 2012-15. The level of labour productivity in Korea was only about half of the average of the top half of OECD countries in 2015. This is linked to a growing productivity divergence between manufacturing sectors (dominated by large conglomerates) and services sectors (dominated by small and medium-sized enterprises, or SMEs). Rising productivity differences between sectors and firms contribute to rising wage inequality, which in turn feeds into rising inequalities in other areas of well-being.


Korea's new President, Jae-in Moon, is determined to tackle these issues by transforming Korea into a "people-centred sustainable growth economy". The fourth industrial revolution is supposed to be a key pillar of this transformation by enabling stronger and more inclusive productivity growth. Start-ups and SMEs are expected to play a central role thanks to their ability to adapt quickly to the challenges and opportunities posed by technological advances. This report has been prepared to support the government in its endeavour. It proposes policies to help ensure that all Korean people, firms and regions can fully reap the benefits of the fourth industrial revolution.

To ensure that all Korean people can participate in the transformation, everyone needs to be equipped with the right skills to succeed in the labour market of tomorrow. While the Korean population is well educated, skills mismatches are widespread. Many older workers lack the skills required in a digital world. Moreover, the potential of women is greatly underused. More flexible labour markets would help foster innovation by facilitating the reallocation of workers to the most productive firms, while also reducing wage inequality. But Korea will need to adapt and strengthen its social protection and activation systems to make sure that the future of work does not come with lower job quality and lower inclusion.

To ensure that all Korean firms can participate in the transformation, a more flexible and responsive regulatory environment is crucial. Moreover, the country needs to make more out of its very high R&D investment. Additional efforts are required to boost firms' uptake of core digital technologies, promote entrepreneurship and target public support for SMEs at start-ups.

To ensure that all Korean regions can participate in the transformation, place-based strategies are needed to develop human capital and lift innovation performance in areas that are not well positioned for the fourth industrial revolution. Moreover, linking digitalisation initiatives in various policy areas, from transport to housing and urban policies, and strengthening collaboration across levels of government, can help build more sustainable and inclusive regions.

The OECD is proud of its long-standing co-operation and policy dialogue with Korea. It looks forward to further support Korean policy making by sharing and distilling best practices in essentially all fields of public policy. Together, let us design, promote and implement better policies for better lives in Korea.



Angel Gurría
OECD Secretary-General

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INTRODUCTION



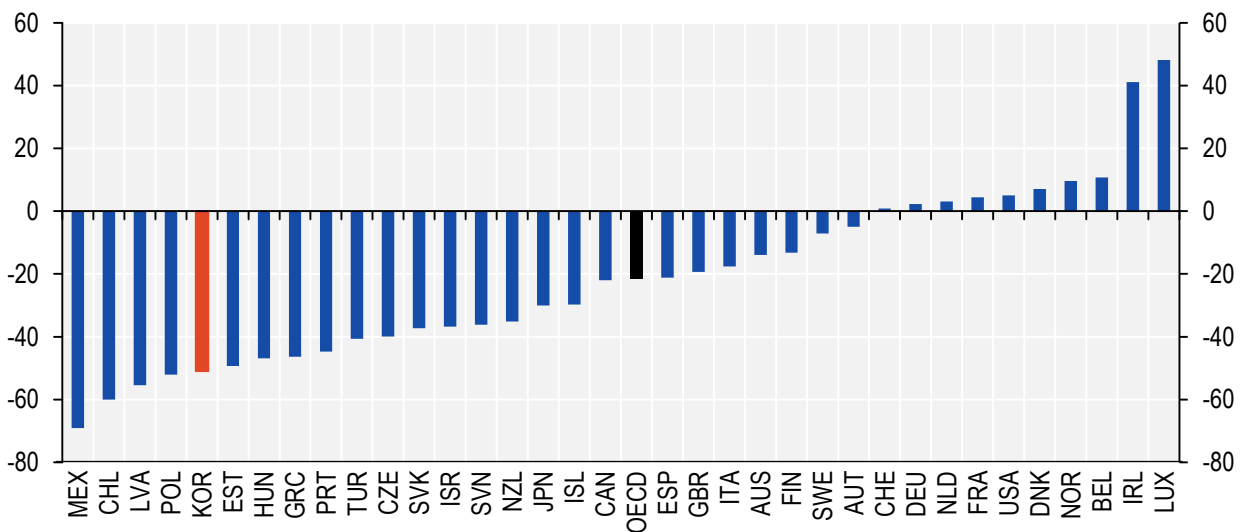
PRODUCTIVITY GROWTH IN KOREA HAS SLOWED

Productivity growth in Korea during the past 25 years has been the fastest in the OECD. However, it fell below the OECD average over 2012-15, as Korea's traditional growth model, based on exports by large conglomerates, is running out of steam. Labour productivity in Korea was only about half of the average of the top half of OECD countries in 2015 (Figure 1.1). Faced with the most rapid population ageing in the OECD, productivity remains essential to sustain output growth. Slowing productivity also has significant implications for inclusive growth by limiting the potential for further improvements in living standards. There is no guarantee that the benefits of higher levels of growth, or higher levels of productivity in certain sectors, when they materialise, will be broadly shared across the population. On the contrary, there is a risk of a vicious cycle setting in. Individuals with fewer skills and poorer access to opportunities are often confined to operate in low productivity, low quality jobs. Given the weakness of the traditional growth model, the Korean government has launched initiatives to foster innovation, with start-ups and high-growth small firms to play a leading role in the fourth industrial revolution.

Labour productivity growth in Korea has decelerated and productivity levels remain around half of those in leading OECD countries. Given the country's rapidly ageing population, reviving productivity growth is essential to sustain further increases in living standards.

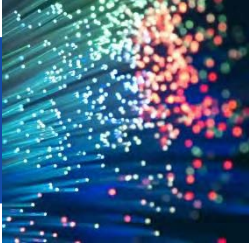
Figure 1.1. Korea's labour productivity is only around 50% of the top half of OECD countries

Output per hour worked relative to the top 17 OECD countries, in percent



Note: Using 2015 PPP exchange rates.

Source: OECD Economic Outlook: Statistics and Projections Database.



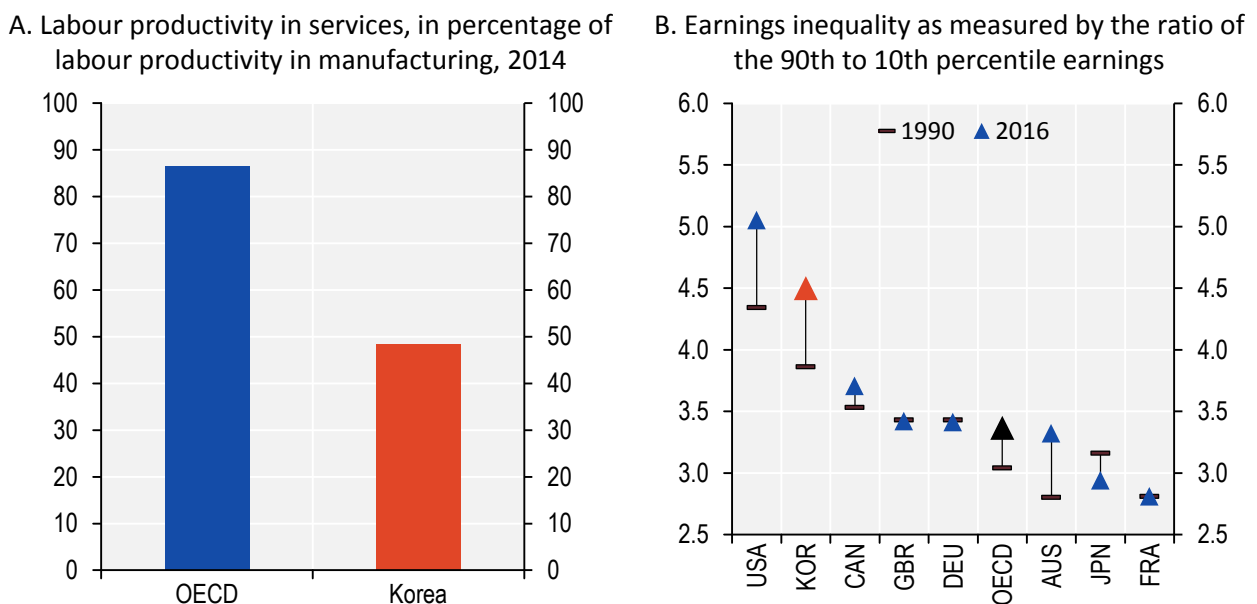
INTRODUCTION

PRODUCTIVITY DIFFERENCES BETWEEN SECTORS AND FIRMS ARE LARGE AND ARE CONTRIBUTING TO RISING INEQUALITIES AMONG HOUSEHOLDS

Poverty and earnings inequality are relatively high in Korea. This is driven at least partly by the wide productivity gap between firms, whereby more productive firms pay consistently higher wages. Many of Korea's low-productivity firms are small and operate in the service sector.

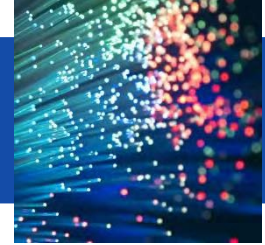
The service sector largely explains the productivity gap between Korea and leading OECD countries. Labour productivity in services was 48% of that in manufacturing in 2014 in Korea, compared to an average of 86% in the OECD. Korea's export-led development has siphoned resources away from services and towards manufacturing. In addition, competitive pressures in services are weaker, in part due to relatively stringent regulations. Moreover, research and development (R&D) investment is lower. Services are closely linked to small and medium-sized enterprises (SMEs), which account for around 90% of service-sector employment. Productivity in the SME sector has fallen from around half of that in large companies in 1988 to less than a third. OECD work on the Productivity-Inclusiveness Nexus suggests that this widening productivity dispersion may be contributing to rising inequalities (Figure 1.2). Large, higher-productivity "frontier" firms (typically part of a multinational corporation group) are better placed than SMEs to take advantage of the gains from trade in global value chains. This gives them a competitive advantage over their lagging counterparts to enhance productivity and pay consistently higher wages to their staff. In so doing, they widen the dispersion of earnings across firms. The advantage is particularly pronounced in sectors with high concentrations of knowledge-based capital and strong uptake in information and communication technologies (ICTs), characterised by network externalities. Frontier firms in these sectors may even be benefiting from "winner takes all" dynamics through the accrual of rents.

Figure 1.2. Productivity differences might be contributing to rising income inequality



Note: Panel A: Labour productivity is measured as value added per person employed. Panel B: Data from 1990 or earliest available year and 2016 or latest available year.

Source: OECD National Accounts Database; OECD STI Database; OECD Earnings Distribution Database.



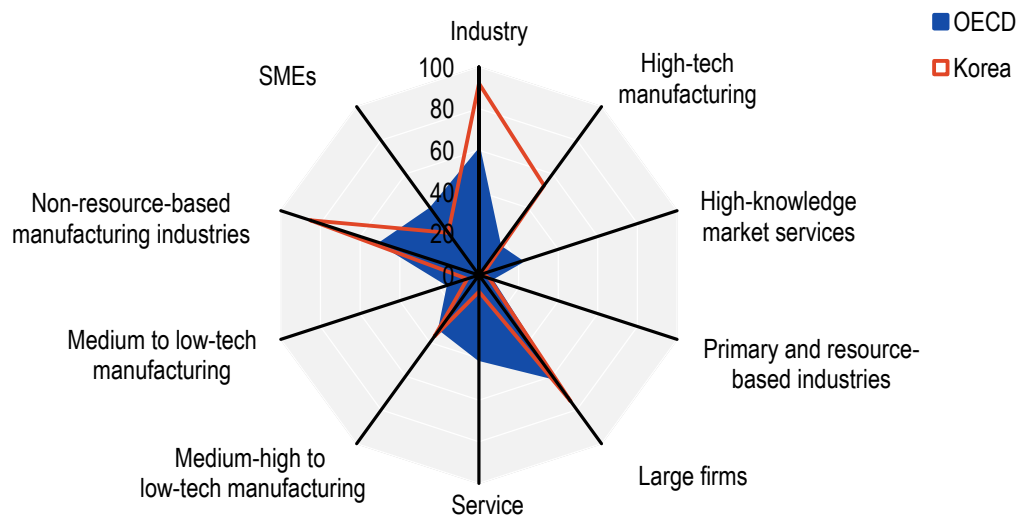
THE NEXT PRODUCTION REVOLUTION AND DIGITALISATION PROVIDE OPPORTUNITIES TO STRENGTHEN PRODUCTIVITY IN AN INCLUSIVE WAY

Korea's economic performance has much to gain from the next production revolution (NPR) and from the broader digital transformation that is reshaping economies and societies all over the world (Figure 1.3). New technologies, from 3D printing to artificial intelligence, can support productivity and inclusive growth by enabling increasingly intelligent and autonomous machines, eliminating errors in production processes, reducing the need for assembly on some production lines, making some jobs safer and more accessible to a broader range of workers, permitting a simulation-driven approach to developing new products, processes and materials, and extending goods and services in key areas (e.g. healthcare) to previously marginalised groups. In Korea, as in many countries, these technologies could contribute more to productivity and inclusive growth. Often their adoption and use are mainly by higher-income groups and in larger firms, and even then, their potential is underexploited. This can reflect incomplete understanding of a technology's potential uses and institutional inertia. It could also indicate a lack of complementary investments in process innovation, organisational change or other knowledge-based assets. By addressing such issues, Korea can move to another level in its economic development. Building adequate skills and helping workers upskill and reskill throughout their working lives will therefore be critical. It can ensure greater inclusion in the opportunities offered by NPR technologies and digitalisation. Korea will also need to adapt its social protection and labour market policies; new forms of work organisation made possible by digitalisation may further hinder the inclusion of disadvantaged groups in the labour market. This report sets out some of the key elements of a policy response. It aims to help Korea reap the benefits of the NPR and digitalisation, while ensuring inclusion of its people, firms and regions.

Korea can reap productivity benefits from the uptake of NPR and digital technologies. The country's digital transformation will have important consequences for the future of work, with profound changes expected in labour markets. By adapting skills and social protection policies, Korea can make sure the transformation works for all its people, firms and regions.

Figure 1.3. Korea could broaden its innovation performance

Structural composition of business R&D expenditure (BERD), in percentage of total BERD or sub-parts of BERD, 2015



Source: Calculations are based on OECD, Main Science and Technology Indicators Database, Research and Development Statistics Database, and OECD Analytical Business Enterprise Research and Development Database.



MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN PEOPLE

EDUCATION REFORM CAN HELP REDUCE SKILLS MISMATCHES

Many Korean workers are not well matched to their jobs. The country's education system can play an important role in reducing skills mismatch by strengthening the relationship between education and the world of work.

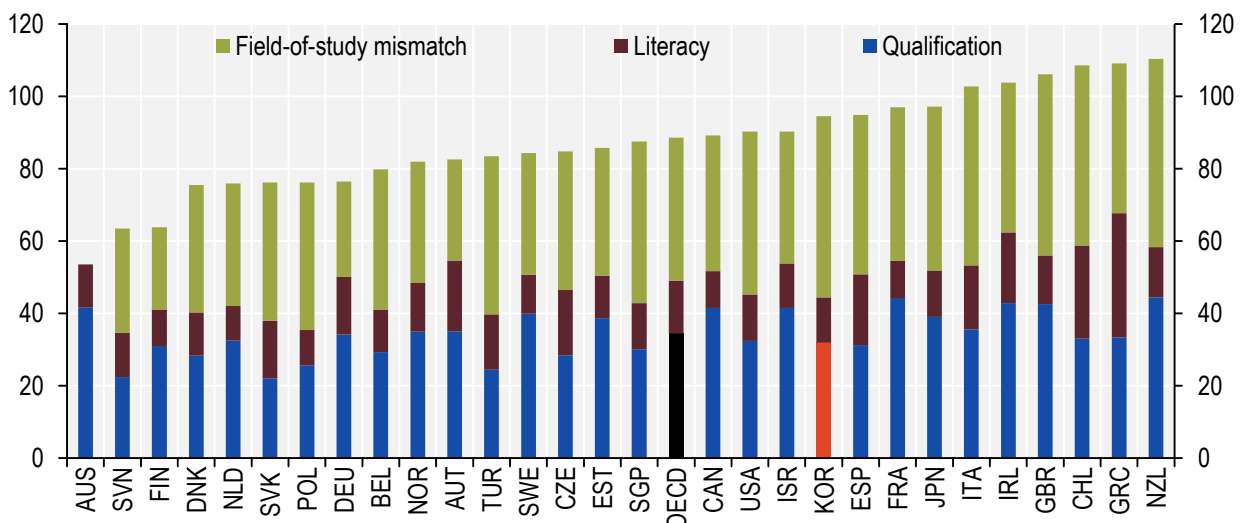
Having the right skills set will be crucial for people to participate in Korea's digital transformation and be successful in the labour market of tomorrow. Skills are especially valuable if they are visible and can be appropriately matched to job requirements. Unfortunately, in Korea, having strong skills and good qualifications does not necessarily lead to getting a high-quality job. According to the PIAAC Survey of Adult Skills (PIAAC), around 63% of Korean workers are not well matched to their jobs (Figure 2.1). This mismatch can be caused by workers being over/under-qualified, over/under-skilled or having graduated from a field of study that is different from the job sector in which they work (field-of-study mismatch). The field-of-study mismatch is especially high relative to other countries with available data. This type of mismatch does not necessarily carry a wage penalty for workers if it is unaccompanied by over-qualification or over-skilling. However, it does imply a loss in the investment made for field-specific training. As such, it could present a risk to increased productivity and innovation. Korea's education system can play an important role in reducing skills mismatch. It could strengthen the relationship between education and training institutions and the world of work so that offered courses and resulting qualifications are better aligned with the needs of the economy.

OECD recommendations:

- Reduce field-of-study mismatch by providing quality career counselling and facilitating the school-to-work transition so that young people can make informed decisions about their future.
- Strengthen the relationship between education institutions and the world of work by engaging employers in the design and delivery of offered courses.

Figure 2.1. Many Korean workers are not well matched to their job

Total mismatch, in percent of total employment, 2015 or latest available year



Note: The data refer to 2012 for Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom and the United States.

Source: OECD calculations based on the Survey of Adult Skills (2015, 2012).

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ADULTS NEED TO CONSTANTLY UPDATE THEIR SKILLS

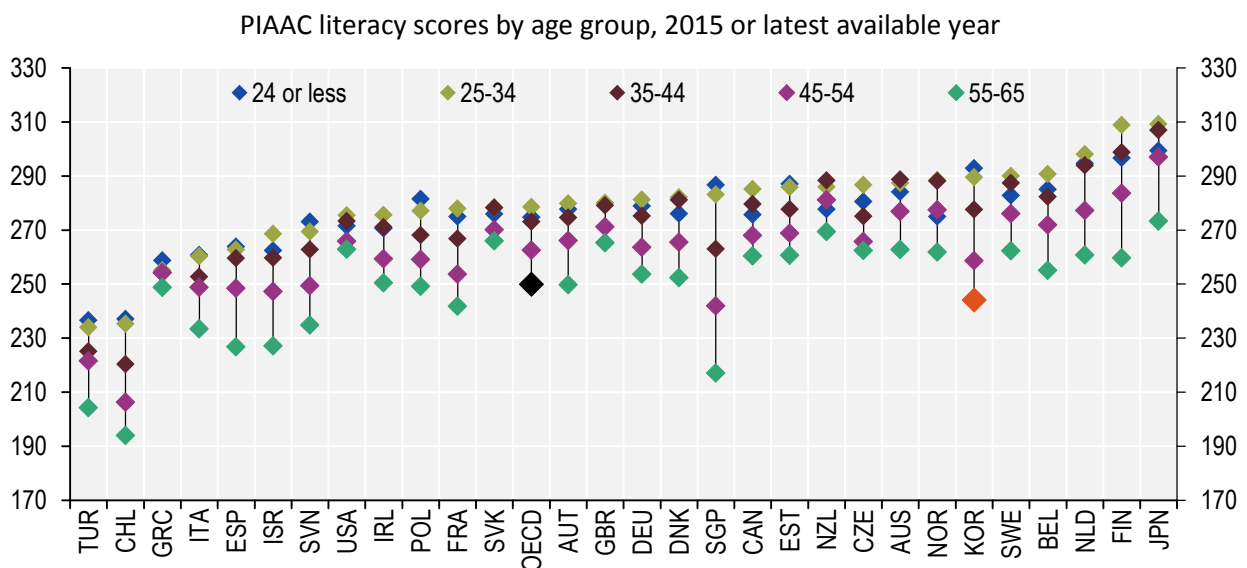
To narrow the wide productivity gap in relation to its global competitors and maintain its specialisation in technologically advanced industries, Korea needs to incentivise lifelong learning. Technology is rapidly changing the types and responsibilities of available jobs and thus affecting the skills required in the labour market. When compared to OECD countries, Korea has progressed in raising educational levels for its youth. However, it has a relatively high skill gap between young and ageing workers (Figure 2.2). The skill levels of adults over 45 years of age are well below international averages for the three skills domains assessed in the Survey of Adult Skills. Participation in adult learning is particularly low among poorer workers. Investments to broaden access to adult learning will help improve worker mobility. This, in turn, will enable Korea to allocate jobs more efficiently and enhance productivity, on top of gains in equity around both the quantity and quality of jobs. Investments in human capital would bring the wages and productivity of older workers more into line, reducing pressure on firms to force early retirement.

Korea has a relatively high skill gap between young and ageing workers. Investments in human capital would bring the wages and productivity of older workers more into line.

OECD recommendations:

- Encourage continuous learning and upskilling among adults by recognising non-formal lifelong learning and education experiences through measures such as the National Competency Standards.
- Engage employers in the design and delivery of offered courses to make lifelong learning more labour-market relevant and to support their employees' participation.
- Improve career services and counselling to help raise awareness about the importance of lifelong learning and provide information about lifelong learning opportunities.
- Put special emphasis on low-skilled adults and older workers in all efforts to enhance adult skills through lifelong learning and education.

Figure 2.2. The skill gap between younger and older workers in Korea is large



Note: The data refer to 2012 for Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom and the United States.

Source: OECD Survey of Adult Skills (2015, 2012).



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EQUIPPING EVERYBODY WITH GOOD DIGITAL SKILLS IS CRUCIAL

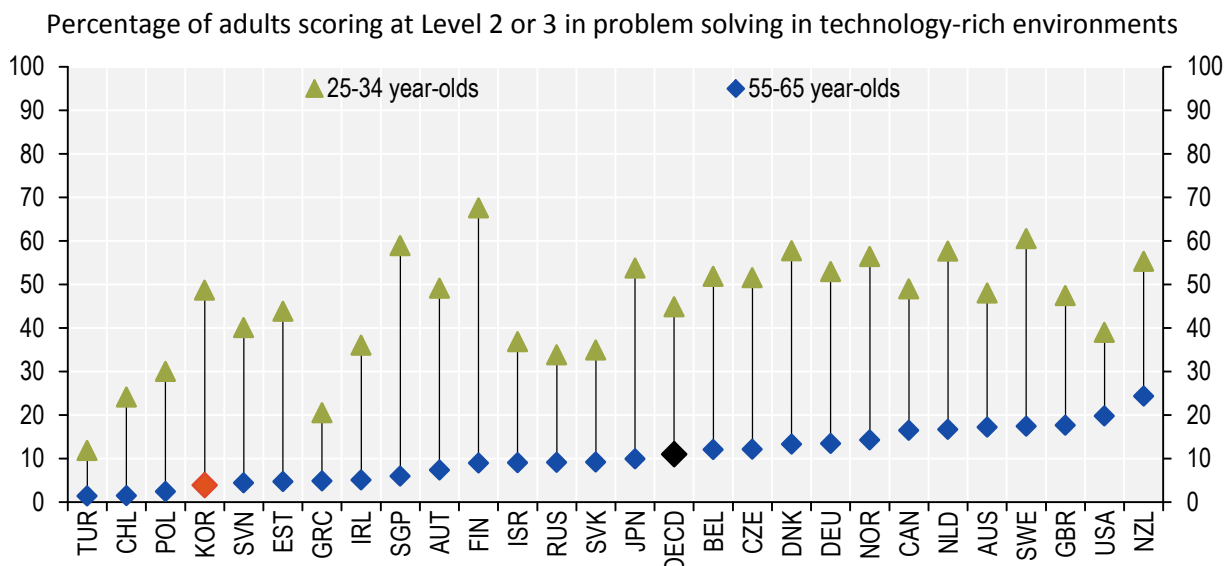
While Korea's younger generations seem well prepared for life in the digital age, this is not the case for older age cohorts. More opportunities are needed for low-skilled and older workers to develop good digital skills.

To maintain Korea's specialisation in technologically advanced industries, education and training systems must remain up-to-date. At the same time, they must equip all individuals with the right mix of cognitive (including ICT), social and emotional skills to fully harness the opportunities offered by digitalisation and globalisation. Just as a gap exists between young and ageing workers in terms of their general skills (e.g. numeracy and literacy), there is an important gap between generations in terms of digital skills (Figure 2.3). On par with the OECD average, 5% of 16-24 year-olds in Korea report having no prior experience with computers or are unable to use a computer mouse or scroll through a web page. However, the share is nearly 64% of Koreans aged 55-65 years (twice the OECD average of 32%). To make the country's digital transition truly inclusive, Korea needs to ensure that all workers – especially low-skilled and older workers – have opportunities to develop the skills needed to fully participate in the digital economy.

OECD recommendations:

- Ensure that lifelong learning programmes equip everyone with the right mix of cognitive (including ICT), social and emotional skills needed to fully harness the opportunities offered by digitalisation and globalisation.
- Promote skills policies that emphasise opportunities for low-skilled adults and older workers to ensure they can adapt their skills and are not left behind in the digital age.

Figure 2.3. The digital skills gap between younger and older workers in Korea is large



Note: The data refer to 2012 for Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Slovak Republic, Spain, Sweden, United Kingdom and the United States.

Source: Survey of Adult Skills (PIAAC) (2015, 2012).

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REDUCING LABOUR MARKET DUALITY WOULD PROMOTE INCLUSIVE PRODUCTIVITY GROWTH

Continuous reallocation of labour within and across firms and sectors fosters innovation. Labour market flexibility can allow resources to flow to their most productive uses and help labour markets adjust to disruptive technologies. By contrast, overly rigid employment protection can negatively impact innovation. It can lower R&D expenditure, reduce the ability of innovative firms to attract talent and discourage investment in technologically-advanced innovation. In Korea, regular workers receive high employment protection due to government policies, business practices, social customs and collective bargaining. Such protection encourages firms to hire non-regular workers, primarily fixed-term employees, to enhance labour flexibility and avoid the cost of laying off regular workers. This segmentation has also resulted in high wage inequality (Figure 2.4), a key factor behind Korea's high rate of relative poverty (14.4% in 2014 after taxes and transfers, compared to the OECD average of 11.6%). Reducing labour market duality is therefore key to promoting more inclusive access to good quality jobs. But greater flexibility needs to be combined with a strengthening of social protection (see below) and activation measures, in particular training.

Labour flexibility is essential to achieve the fourth industrial revolution. Relaxing employment protection for regular workers would strengthen Korea's innovation performance, as well as reduce wage inequality and poverty.

OECD recommendations:

- *Relax employment protection for regular workers and make it more transparent to promote labour flexibility and reduce incentives to hire non-regular workers.*
- *Expand training opportunities for non-regular workers, who receive less firm-based training due to their temporary status.*
- *Raise the minimum wage and increase social insurance coverage for non-regular workers to mitigate the large gap in wage income.*

Figure 2.4. Earnings in Korea are significantly higher for regular workers and workers in large firms

Average base pay per hour of salaried workers in Korea by employment type and firm size, 2016



Note: Non-regular salaried workers exclude independent contractors.

Source: OECD calculations using MOEL Survey on Labour Conditions by Type of Employment.



MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN PEOPLE

SOCIAL PROTECTION SHOULD ADAPT TO NEW FORMS OF EMPLOYMENT

Korea's social protection system must more thoroughly expand and enforce coverage to adapt to new forms of work, while ensuring these changes do not decrease inclusion and job quality.

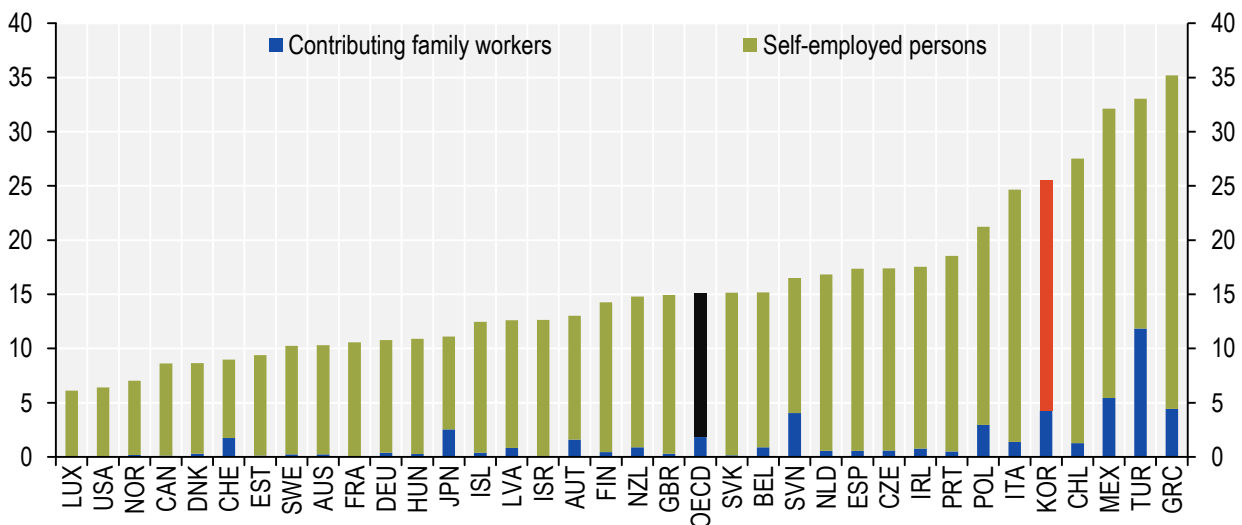
Korea's social protection system has matured over the past two decades. Roughly 10% of the working-age population receive working-age benefits – up by one-third since 2011. Yet significant coverage gaps remain for several groups of workers. Such groups include self-employed and unpaid family workers, who account for a significant share of employment in Korea (Figure 2.5). Self-employed persons may opt in for Korea's Employment Insurance System measure, though take-up is very low. Unpaid family workers are seldom legally recognised. Non-regular salaried workers are commonly overlooked by unemployment protections or go undocumented. Contrary to most OECD countries, workers in Korea who get sick have no specific support and often lose their jobs. While there may be obstacles to providing social protection to these groups, many OECD countries have overcome them by adapting their instruments. Bridging such gaps is important for reducing labour market dualities, tackling common social risks fairly and ensuring social protection measures remain fit for purpose in the future world of work.

OECD recommendations:

- Expand and enforce employment insurance coverage through compulsory inclusion of self-employed persons, stricter enforcement of existing rules, customised coverage for each category (or type) of non-typical workers and a clear legal status for unpaid family workers.
- Improve the situation of workers with health problems through employers' liability and a contributory cash sickness benefit (both with a clear focus on rehabilitation and return to work).
- Consider moving away from insurance-type benefits to those that offer broader coverage like Australia's wholly assistance-based system, the United Kingdom's Universal Credit or potentially a basic income with strong activation incentives.

Figure 2.5. Self-employment and unpaid family work are relatively prominent in Korea

Employment by status in employment, in percentage of total employment, 2015



Note: Self-employed persons encompass both own-account workers and employers. All data are for 2015 except France (2014) and Chile, Korea and the United States (2016).

Source: OECD Employment Database.

MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN PEOPLE



KOREA COULD MAKE GREATER USE OF THE TALENTS OF ITS WOMEN

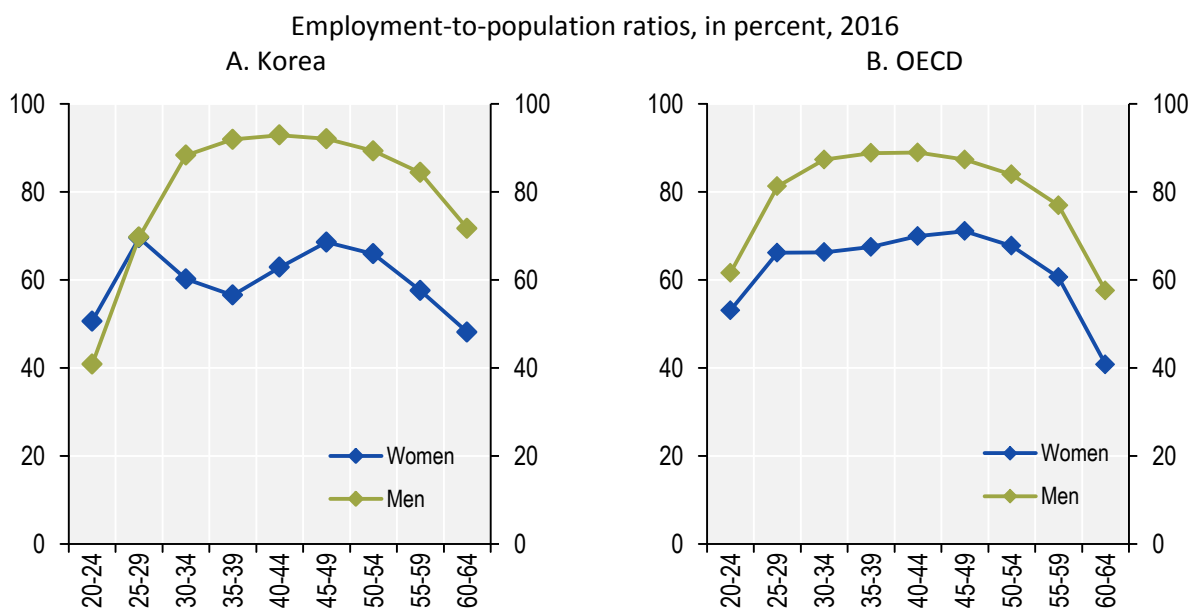
Despite having the OECD's highest share of young women with tertiary education, female employment in Korea is relatively low, particularly among women of "parenting age" (Figure 2.6). Many women in Korea still leave work after childbirth, and only return after their children grow up. This break in employment negatively affects their careers, earnings and job security. If "mother returners" go back to work, they often end up in low-paid, fixed-term jobs. Strengthening women's participation in the labour market will help Korea address the projected decline in the labour force and make the best use of its talent. This is especially important given the skills needs raised by digitalisation. Korea recently developed an extensive system of early childhood education and care, and one of the more generous packages of paid leave for fathers in the OECD. Both these policies help reduce the care burden on women and foster their participation in the labour market. However, more needs to be done to promote a better sharing of paid and unpaid work between parents and more flexible working practices.

Taking a break from paid work for childbirth hurts the careers of women in Korea more than in other countries. As its population ages, Korea should do more to ensure women can return to quality jobs.

OECD recommendations:

- Actively encourage fathers' use of paid leave entitlements and back them up with initiatives to reduce overly-long working hours and promote more flexible workplace practices.
- Break down labour market dualism, which relegates mother returners to low-paid non-regular employment, to promote the employment of mothers and close the gender wage gap.
- Consider mandatory pay gap analyses for companies of at least a certain size, and share this information with employees, government auditors and/or the public, in order to close gender pay gaps and make work more attractive for women.

Figure 2.6. Female employment in Korea is relatively low, particularly among 30-45 year-olds



Source: OECD Employment Database.



MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN PEOPLE

DIGITALISATION CAN CONTRIBUTE TO BETTER HEALTH OUTCOMES

Allowing better access to national healthcare data would help leverage digitalisation into better health outcomes for all Korean people.

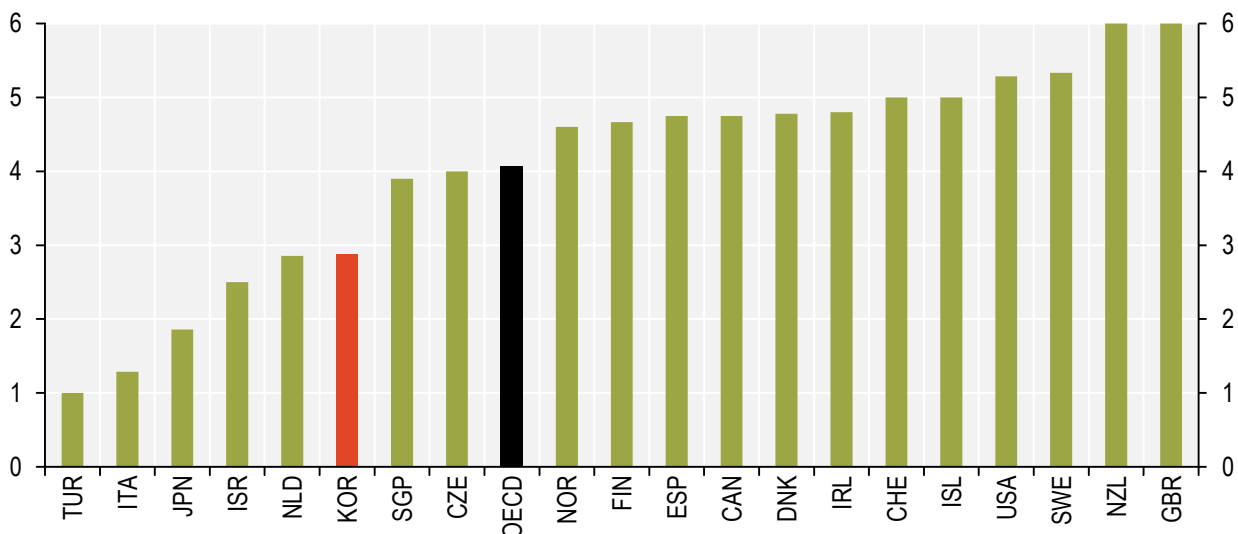
Every day, clinicians, hospitals, pharmacies, laboratories, payers, governments, statistical agencies and academia generate mountains of health data. Increasingly, individuals also produce health data through Internet browsing, social media and mobile devices. Unlocking the knowledge contained in these varied, vast and fast-flowing data can advance national policy objectives. Specifically, it can improve the management of health and disease of individuals and populations, health system governance and administration, and research to expand knowledge of health, disease and treatment. With one of the strongest health information systems in the world, Korea is a leader in leveraging data to improve health system performance and outcomes. However, it compares less favourably in making its national data accessible for research (Figure 2.7). Korea could also better exploit the potential of health data by collecting and analysing data from electronic health records and linking these data to other existing health datasets.

OECD recommendations:

- Continue to leverage a variety of data sources to publish metrics on the quality of care, potentially expanding the number of indicators.
- Allow access to national health data by healthcare providers, for-profit researchers and foreign country applicants for research with a public benefit, subject to safeguards to protect data privacy.
- Develop and implement a unified national electronic health record that captures patient data across the care continuum, to promote quality care and increase the repository of data for improved system management and research.

Figure 2.7. Korea could make greater efforts to make health data accessible for approved uses

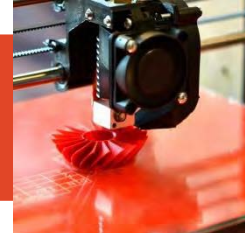
Sharing and accessibility of health data for approved statistical and research uses, index from 0 (worst performance) to 6 (best performance)



Note: The score reflects the proportion of key national health datasets that meet seven requirements of availability, maturity and use (maximum score =7).

Source: OECD (2015), *Health Data Governance: Privacy, Monitoring and Research*, OECD Publishing, Paris.

MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN FIRMS



REGULATORY REFORM CAN FACILITATE INNOVATION

A flexible and responsive regulatory environment can support innovation and technological progress. Korea's regulatory institutions, processes and tools can create such an environment. For example, a petition system alerts the government to unnecessary burdens on business and citizens, a Regulatory Reform Committee scrutinises laws and regulations, and a Committee on Emerging Industries identifies unnecessary regulatory obstacles in new sectors. A "cost-in, cost-out" system prevents a rise in costs from new or amended regulations by abolishing or relaxing regulations with equal or greater costs. But the impact of these institutions, processes and tools is yet to be felt. Korea's product market regulation is one of the most stringent in the OECD (Figure 3.1). Regulation, particularly of innovative and new technologies, will need to be more flexible and outcome-based. Also, the related institutions, processes and tools need to extend to the entire regulatory system. This must include the National Assembly, which initiated 86% of the laws enacted in 2016. Most of these bills lack regulatory quality scrutiny.

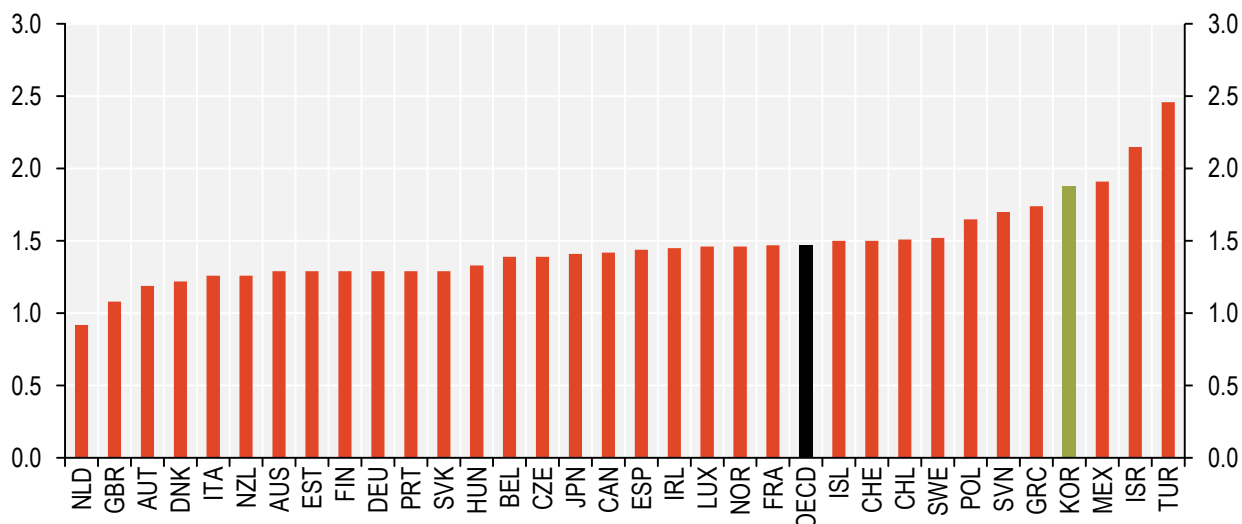
Korea's regulatory institutions, processes and tools can create an innovation-friendly regulatory environment. But their impact is yet to be felt. The regulatory system is not yet sufficiently flexible and quality scrutiny not yet applied to the entire regulatory system.

OECD recommendations:

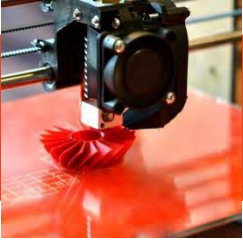
- Create a permanent legislative regulatory quality check mechanism in the National Assembly and strengthen stakeholder engagement in the legislative process.
- Ensure that relevant stakeholders are engaged early in the regulatory process and are adequately represented in consultations and consultative bodies.
- Use the "cost-in, cost-out" system to limit the burden and indirect costs of regulation on innovation, and shift from a positive (permission-based only) to a negative (prohibition-based only and permitting all else) regulatory system, enhancing flexibility and space for innovation.
- Focus regulatory reform on the service sector, which faces relatively stringent regulation, to enhance competition and productivity.

Figure 3.1. Stringent product market regulation stifles innovation and technological progress

OECD Product Market Regulation Indicator, from zero (most relaxed) to six (most stringent), 2013



Source: OECD Product Market Regulation Database.



MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN FIRMS

KOREA DOES NOT SEEM TO GET THE FULL RETURN ON ITS RELATIVELY HIGH R&D INVESTMENT

While R&D investment is high in Korea, several weaknesses limit its impact. In particular, the government should do more to promote entrepreneurship and target its support for SMEs more at start-ups.

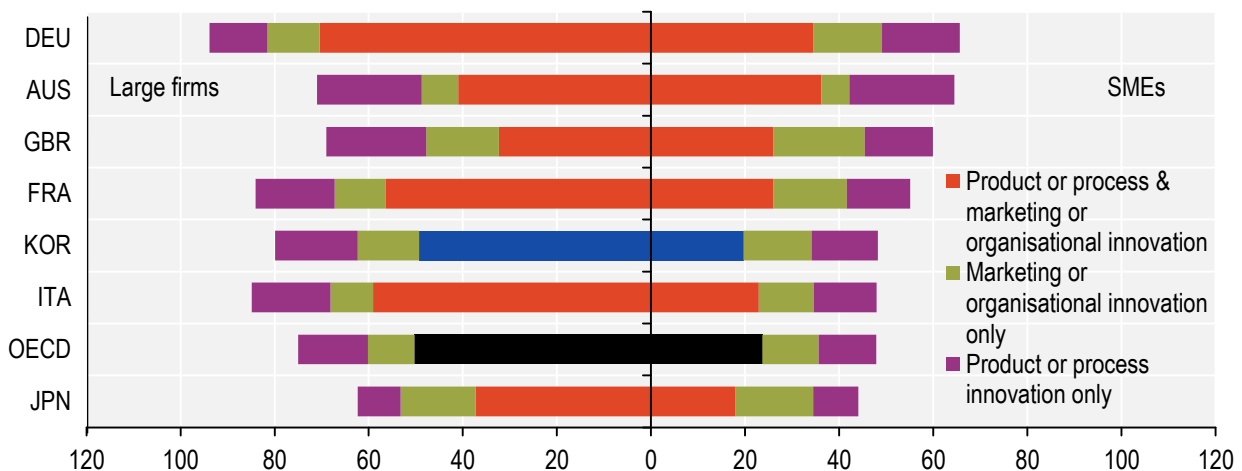
R&D investment in Korea is among the highest in the OECD. However, since large manufacturing firms drive R&D activity, the number of innovative firms is smaller than in other countries. This limits Korea's innovative potential (Figure 3.2). Links between firms, universities and government research institutes are weak, slowing the transfer and commercialisation of technology in other parts of the economy. Korea is not well integrated into global innovation networks, as its levels of international co-authorship and co-patenting are among the lowest in the OECD. The creation of new firms, which often take the lead in innovation, is hindered by the negative view of entrepreneurship and the lack of necessary skills. The government provides large-scale support directly to SMEs and guarantees loans from private financial institutions to SMEs. However, much of the aid goes to mature firms rather than start-ups. Moreover, there is considerable evidence that government support does not improve SMEs' qualitative performance. Policies that increase the survival rates of low productivity firms are detrimental to productivity growth.

OECD recommendations:

- Accelerate firm creation by expanding venture capital, focusing on start-ups, and by teaching students the skills needed by entrepreneurs.
- Lower the share of loans to SMEs that are guaranteed by the government, put time limits on their length and focus more on young firms.
- Reduce the generosity of SME support to weaken the disincentives for small firms to grow into larger enterprises, thereby increasing their productivity through economies of scale.
- Increase the return on R&D investment by strengthening links between academia, business and government and by relaxing barriers to trade and investment to help firms better connect to global innovation networks.

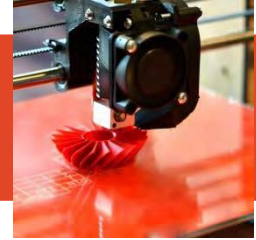
Figure 3.2. Korea does not have a lot of innovative firms

Innovative firms, in percent of all firms in the given size category



Source: OECD (forthcoming), OECD Science, Technology and Industry Scoreboard 2017, OECD Publishing, Paris.

MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN FIRMS



KOREAN FIRMS LAG IN THEIR UPTAKE OF DIGITAL TECHNOLOGIES

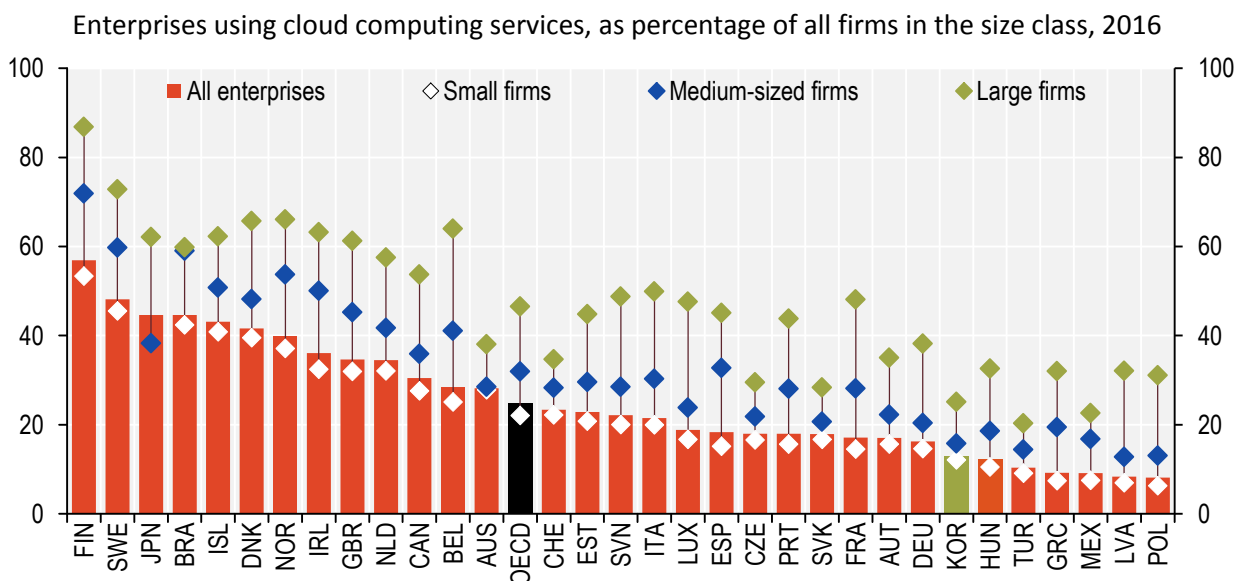
Korean firms need to use digital technologies more effectively to fully harness their potential for value creation and productivity growth. This implies more sophisticated usage than basic connectivity, such as cloud computing services, enterprise resource planning and big data analytics (Figure 3.3). Such technologies have multiple benefits. For example, they can help firms overcome barriers associated with the high fixed costs of ICT investment. Further, they can enable more efficient business processes and provide new services for customers. Korean firms are among the OECD leaders on broadband connectivity (over 99% for both small and large firms). However, only 60% of firms have a website (compared to over 90% in Nordic countries). In addition, only 36% use enterprise planning software (compared to 56% in Germany). A mere 13% use cloud computing services (in comparison to 57% in Finland). Strengthening skills, as noted above, is critical. However, firms (especially SMEs) also need to invest in complementary knowledge-based capital to help them use the powerful digital technologies on offer more effectively.

If Korean firms are to thrive in the digital world, additional efforts are required to boost their uptake of core digital technologies that would spur productivity and generate new business opportunities.

OECD recommendations:

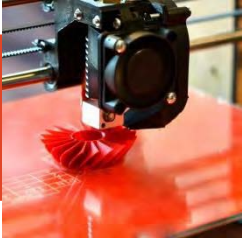
- Encourage the use of digital technologies and organisational change, including investments in data and other knowledge-based capital, to realise the full potential of the digital transformation.
- Ensure sound competition to facilitate entry of new technologically-savvy firms and exit of poorly-performing firms with low levels of ICT use.

Figure 3.3. Korean firms lag significantly in the uptake of key digital technologies



Note: Cloud computing refers to ICT services used over the Internet as a set of computing resources to access software, computing power, storage capacity and so on. Data refer to manufacturing and non-financial market services enterprises with ten or more persons employed, unless otherwise stated. Size classes are defined as: small (10-49 persons employed), medium (50-249) and large (250 and more).

Source: OECD (2017), *OECD Digital Economy Outlook 2017*, OECD Publishing, Paris.



MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN FIRMS

DIGITALLY ENABLED PROFESSIONAL SERVICES HAVE GREAT POTENTIAL

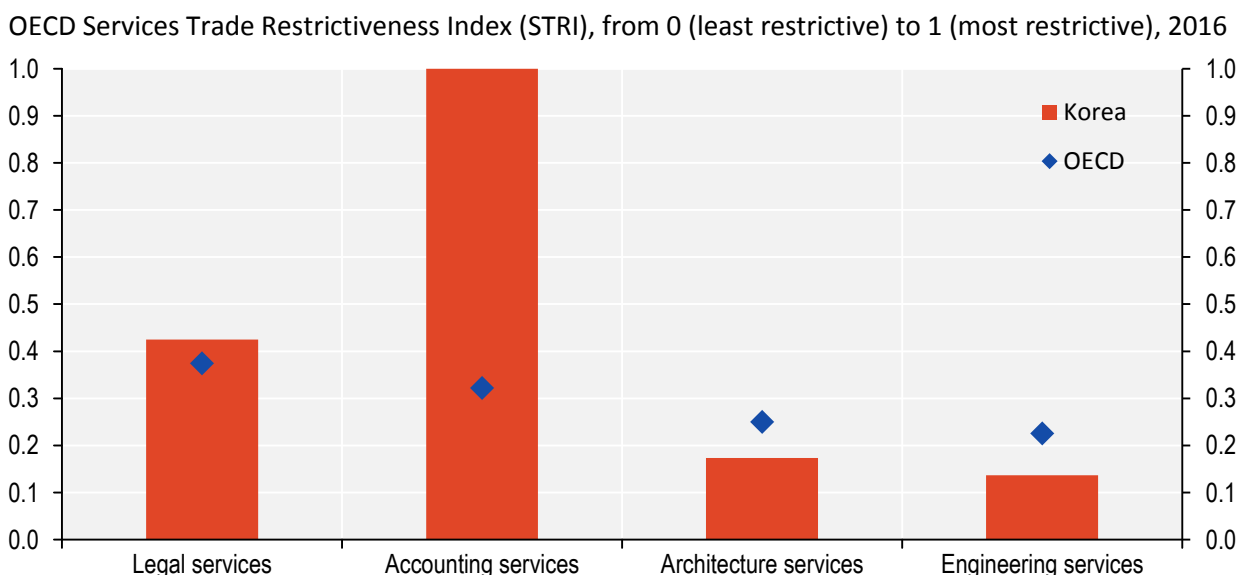
A high level of protection reduces the incentives for professionals to innovate. Regulatory reforms could unleash Korea's potential to gain international competitiveness, particularly in accounting.

Professional services are among the fastest growing business services sectors in OECD countries. They play an important role in the functioning of modern economies. In Korea, professional services have benefited from recent economy-wide reforms. Although subject to licencing, architecture and engineering services in Korea have a relatively liberal regulatory framework (Figure 3.4). While accounting and auditing are only open to free trade partners, lawyers working in international law and legal advice have access to the Korean market (whereas domestic law requires a Korean degree). Efficient services will lower trade costs for goods and open new opportunities for digital services exports. As they do, countries like Korea can benefit from continuing to pursue market openness in these sectors. At the same time, many professional services activities lend themselves readily to automation. Professional services automation (PSA) software is increasingly used as a tool to increase productivity. PSA digitises and automates the more routine parts of professional services. Once digitised, they can be transmitted over the Internet and downloaded by clients anywhere.

OECD recommendation:

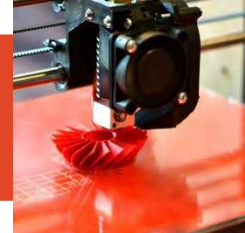
- *Continue pursuing market openness in services, for example, by liberalising cross-border trade in accounting, engineering and architecture services, and recognising credits earned from foreign universities in accounting, auditing and law.*

Figure 3.4. Korea is relatively open to trade in technical professional services, but less so in accounting services



Source: OECD (2016), *Services Trade Restrictive Index Database*.

MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN FIRMS



DIGITALISATION CHANGES THE WAY INTERNATIONAL TRADE TAKES PLACE

Digital trade holds potential both for new services trade in digitally-delivered services and new goods trade enabled through growing digital connectivity (Figure 3.5). Digitalisation is also changing how we trade: more bundled goods; growing trade in small packages; and greater demand for just-in-time delivery. Staying ahead of these changes will be important for Korea's highly competitive manufacturing sector. The digitalisation of many trade logistics services and regulatory border controls increases the ease of trading. In so doing, it paves the way for effective identification of risks and management of global supply chains. Yet seamless transfer of data places new demands on digitalisation of information and processes, as well as co-ordination and co-operation among institutions. This is particularly true for the interoperability of data exchange systems and the harmonisation of e-certificates. Korea has made significant progress in automating and streamlining border formalities, and is a star performer in most areas covered by the OECD Trade Facilitation Indicators. But there are a few areas that Korea could target for even better performance.

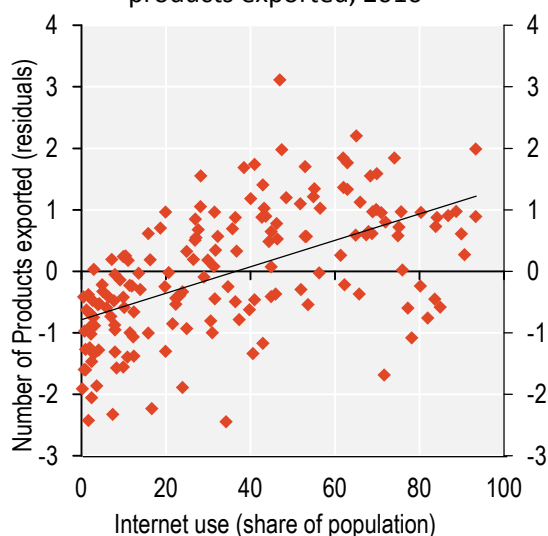
Digitalisation brings new opportunities for countries and firms to participate in trade. Data flows underpin the digital trade environment, as a means of enabling production, an asset that can be traded and a means to deliver services.

OECD recommendations:

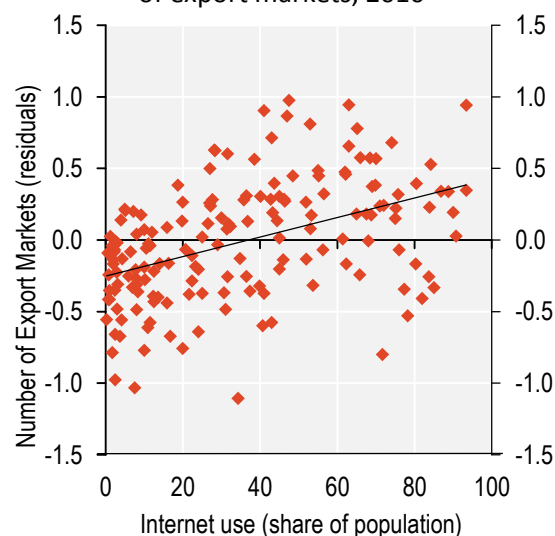
- *Consider reforming appeal procedures to enhance efficiency in trade facilitation.*
- *Increase cross-border co-ordination and harmonisation of different computer systems to support the exchange of electronic documentation and real-time border information.*
- *Improve risk management by strengthening co-operation between cross-border agencies and systematically sharing control results among neighbouring countries at border crossings.*
- *Ensure that policies facilitate the movement of data across borders and avoid measures that unduly restrict their movement, while respecting the need for privacy and data protection.*

Figure 3.5. Internet use is linked with exporting more products to more destinations

A. Correlation between Internet use and number of products exported, 2010



B. Correlation between Internet use and number of export markets, 2010



Note: To avoid correlations arising through other variables, the residuals are taken from a regression of the trade outcomes on per capita GDP, the size of markets, country-specific fixed effects and time dummies.

Source: OECD (2017) "Digital trade and Market Openness – a Scoping Paper."



MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN REGIONS

ALSO RURAL REGIONS BENEFIT MOST FROM THE FOURTH INDUSTRIAL REVOLUTION

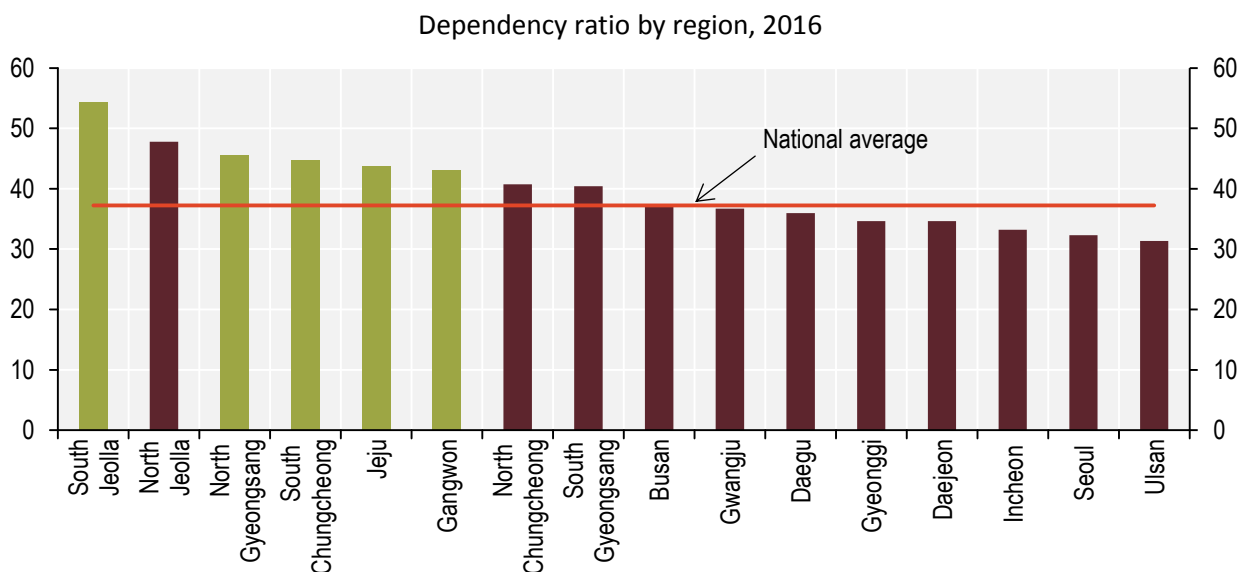
The next production revolution presents both opportunities and risks for Korea's rural areas. Place-based strategies to develop human capital and promote innovation are needed to ensure that communities are better positioned for the NPR.

Rural regions may benefit from the next production revolution for several reasons. This transformation can increase flexibility where work can take place. Advanced manufacturing may require closer proximity to Internet servers, which in turn require the availability of land and reliable energy sources. And there will be further scope for increased productivity in industries such as agriculture. More mobile production processes, including home-integrated design-make environments, may also increase the scope for more distributed forms of production. However, technological shifts usually give an advantage to places with an existing endowment of skills and technology. Rural areas generally have an older population profile with lower skills (Figure 4.1). Further, population ageing over 2015-50 in Korea is projected to be the fastest in the OECD. In addition, rural areas tend to lack formal science-based innovation systems and the density of economic activity, which is central to the innovation process. Positioning rural communities for the NPR will require proactive strategies to develop human capital and lift innovation performance in these places.

OECD recommendations:

- Improve broadband and transport infrastructure in rural areas to facilitate improved public service delivery and linkages to cities.
- Ensure that SMEs in rural areas can absorb new technologies, and provide support for the development of local clusters linked to areas of absolute advantage.
- Support the performance of local labour markets in rural areas by addressing skills shortages, providing support to entrepreneurs and improving job search mechanisms.

Figure 4.1. Rural areas in Korea have an older population profile



Note: Rural areas are coloured in green. The dependency ratio is the population aged 14 or less plus the population aged 65 or above, divided by the population aged 15 to 64.

Source: OECD Regional Database.

MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN REGIONS



DIGITALISATION OFFERS MANY OPPORTUNITIES TO IMPROVE SMART AND INCLUSIVE TRANSPORT PLANNING

Korea has been at the forefront of digitalisation in public transport. It introduced an integrated mobility and payment card, enabling users to ride most public transport systems with a single pass or most credit cards. Users also benefit from discounts when transferring between modes. This system, which encourages public transport use and multimodality, was initially developed in Seoul. It later expanded to almost all of Korea, underscoring how the sharing of ideas and resources across levels of government can bring valuable benefits. Some cities are also running smart transport information services. However, Korea registers the longest average commuting time among the OECD countries where comparable data are available (Figure 4.2). The Ministry of Land, Infrastructure and Transport is developing a system to analyse big data from fare payment devices and better respond to travellers' needs. It also plans to expand the use of intelligent transport technologies, particularly in buses and taxis, to monitor driver behaviour and promote road safety. Korea is also using digital technologies in fields such as urban regeneration and smart cities. Aligning goals, sharing collected data and linking programmes across policy streams could help design more accessible and demand-responsive transport networks. This, in turn, could promote mixed-use neighbourhoods and reduce the carbon footprint.

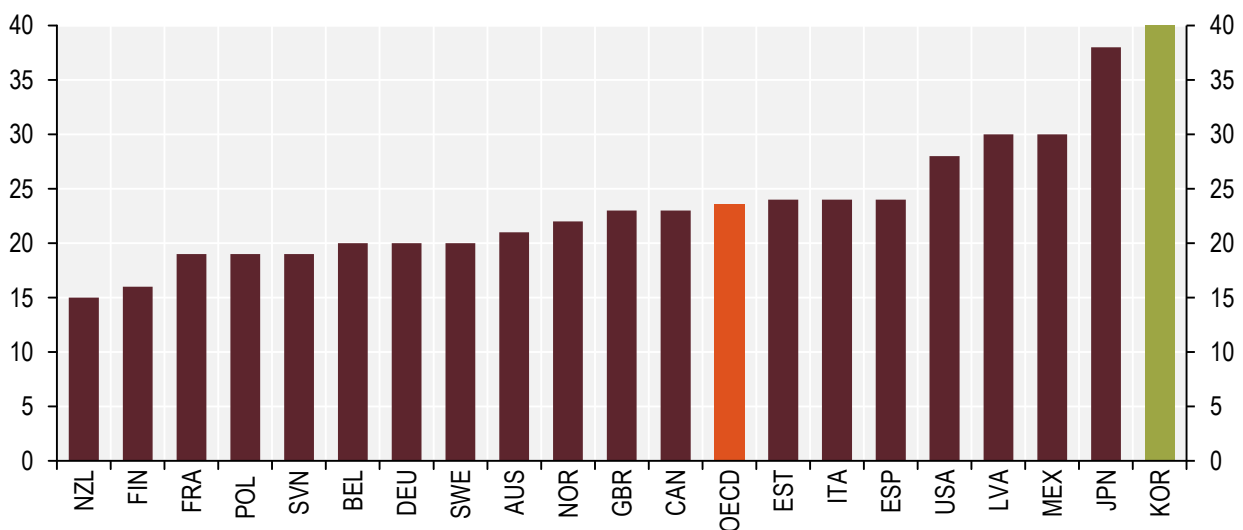
Korea has been a frontrunner in using digital technologies in public transport. Linking digitalisation initiatives in transport, housing and urban policies and strengthening collaboration across levels of government can help build more sustainable and inclusive regions.

OECD recommendations:

- *Seek synergies in the use of smart technologies in transport, housing and other policies to reduce commuting time and improve well-being outcomes.*
- *Improve local governments' financial capacity to invest in public transport systems according to the specific needs of their residents.*

Figure 4.2. Korea has the longest commuting time in the OECD

Average number of minutes spent travelling to and from work, per weekday



Source: OECD (2017), *Urban Transport Governance and Inclusive Development in Korea*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264272637-en>.



MAKING THE MOST OF DIGITALISATION FOR ALL KOREAN REGIONS

ICT CAN PROMOTE SMART MANAGEMENT OF WATER

ICT-driven Smart Water Management can improve Korea’s resilience to water risks, minimise costs, and increase revenues. Still, SWM would benefit from private investment and water tariffs that reflect true costs of water management and services.

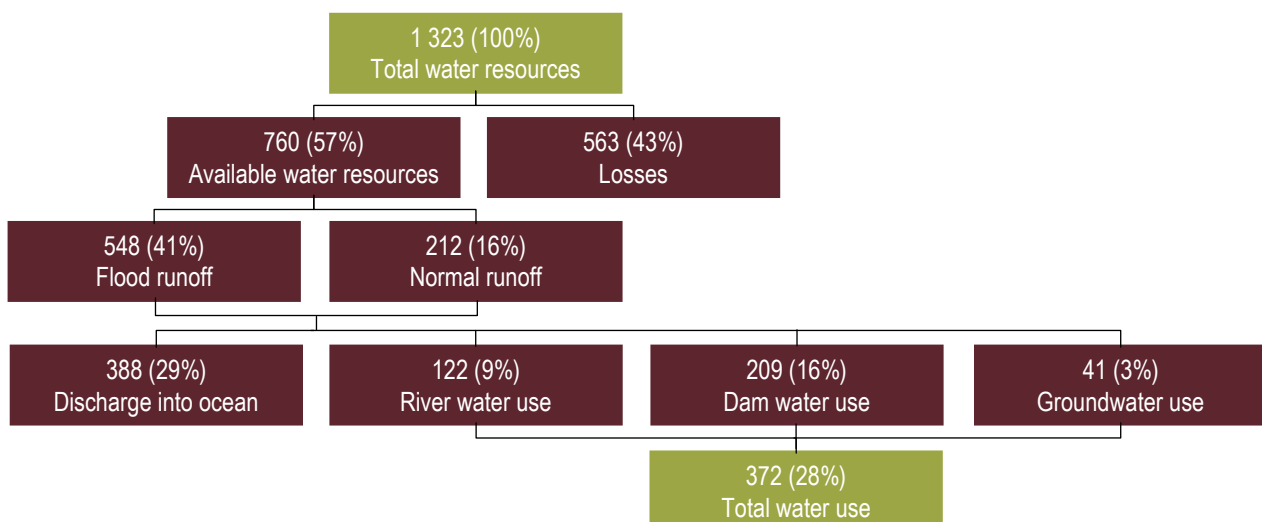
With increased risk of water scarcity, flooding and pollution, and limited options to augment supply in the face of growing demand, ICT is crucial to support Smart Water Management (SWM) in Korea. ICT-driven SWM can improve Korea’s resilience to water risks, enabling real-time production of large volumes of data on everything from water use, quality and leakages to expected rainfall and reservoir space. With a sizable share of water resources lost, this is crucial for Korea (Figure 4.3). Such real-time information can support effective management of flood and drought risk and promote water efficiency in homes. The ability of SWM to generate efficiencies in supply (i.e. making the best use of built reservoirs and minimising leakage) can minimise infrastructure needs. Real-time information on water quality can increase demand in cities, increasing revenues for service providers. K-Water began introducing ICT into water management in 2015. Further roll-out of SWM would benefit from water tariffs that fully reflect scarcity and opportunity costs of using water and operating water services. This could also incentivise private investment in SWM innovation.

OECD recommendations:

- *Develop value-adding services built on the new data available and consider some competition for the development of services that add value to final water users.*
- *Gradually introduce water pricing instruments that reflect the value of water (scarcity and opportunity costs of using water) and for water tariffs that reflect the full costs of supplying water and sanitation services.*
- *Streamline water governance, strengthen know-how of local authorities, and engage more systematically with water users, particularly at basin and city level, to promote a paradigm shift towards smart water management that couples technological advancements with social innovations.*

Figure 4.3. A sizable share of Korea’s water resources is lost every year

Water resources status, 100 million m³/year, 1986-2015 average



Note: Flood runoff is measured between June and September.

Source: MoLIT (2017), *The 4th Long-term Comprehensive Plan of Water Resources (2001-2020)*, 3rd revision.

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