Benefiting from the next production revolution

by
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The production of goods and services has been transformed in many ways over recent years. First, production increasingly takes place across borders, in global value chains (GVCs). Second, production is increasingly knowledge-based and involves a mix of goods and services, a phenomenon also known as the “servitisation of manufacturing”. Third and closely related, a growing part of production, in particular in the services sector, is affected by digitalisation and can sometimes be delivered through digital means. Finally, a new wave of technological change is now fundamentally altering the nature of production, heralding what has been referred to as a next production revolution. Ensuring that these transformations support overall growth and well-being requires sound policies in many areas and is a current focus of OECD work.

**Global value chains.** Over recent decades, the world has witnessed a growing movement of capital, intermediate inputs, final goods and people. Technological progress and innovation, notably in transport and communication, alongside trade liberalisation, have led to the fragmentation of production across borders and across tasks. Goods and services, and their components, are produced and assembled in different locations, often geographically clustered at the local and regional level, before reaching their target markets. This partitioning of production in GVCs has drawn attention to the role of different stages in a GVC to overall value creation. Indicators derived from the OECD-WTO Trade in Value Added (TiVA) database point to the growing importance of GVCs for international trade and production, and point the heterogeneity and complexity of trade flows in these GVCs. Whether for domestic or international consumption, the increasing reliance of production on intermediate inputs produced elsewhere stresses the need for countries to act so as to exploit their comparative advantages and fully benefit from GVCs.

**Knowledge-based capital (KBC).** At the same time, sustained competitive advantage in production is increasingly based on innovation, which in turn is driven by investments in R&D and design, software and data, as well as organisational capital, firm-specific skills, branding and marketing, and other knowledge-based assets. Generating higher value-added largely hinges on the (continuous) development of superior and often firm-specific
capabilities and resources. These are frequently intangible, tacit, non-tradable and difficult to replicate. Investment in KBC has become an important driver of success in GVCs. Much value creation occurs in upstream activities, such as R&D, design, and the manufacturing of key parts and components, as well as in downstream activities, such as marketing, branding and customer service. OECD countries increasingly specialise in developing ideas, concepts and services that are related to the production of physical goods, and less on the production of physical goods as such. As physical production has increasingly relocated to emerging economies, manufacturers in OECD countries rely more on complementary non-production functions to create value, using KBC to develop sophisticated and hard-to-imitate products and services.

The digitalisation of the economy and society. Important as they are, KBC and GVCs would not have provided the opportunities they have without the rise of digital technologies. These have triggered deep changes in economy and society and enable strong productivity gains. It is not just the digital sector which makes a difference, the Internet and other digital technologies are now ubiquitous and underpin economic activities in all sectors. The innovations spurred by digital technologies hold huge potential for boosting growth and driving societal improvements, including in such areas as public administration, health, education and research. For example, the creation of large volumes of data and the ability to extract knowledge and information from them (“big data”) is initiating a new wave of (data-driven) innovation and productivity gains. The analysis of these data (often in real time), increasingly from smart devices embedded in the Internet of Things, opens new opportunities for value creation through the optimisation of production processes and the creation of new services. This is what some dub the “industrial Internet” as empowering autonomous machines and systems that can learn and make decisions independently of human involvement generate new products and markets.

The Next Production Revolution. As the global economy continues to transform, new technologies mix and amplify each other’s possibilities in combinatorial ways. Many potentially disruptive
production technologies are on the horizon and some are already starting to have an impact, e.g.:

➤ Data analytics and big data increasingly permit machine functionalities that rival human performance.
➤ Robots are set to become more intelligent, autonomous and agile.
➤ Synthetic biology, still in its infancy, could become transformative, for instance allowing petroleum-based products to be manufactured from sugar-based microbes, thereby greening production processes.
➤ 3D printers are becoming cheaper and more sophisticated. Objects can now be printed (such as an electric battery) that embody multiple structures made from different materials.
➤ Bottom-up intelligent construction and self-assembly of devices might become routine, based in part on greater understanding of the principles of biological self-construction.
➤ Nanotechnology – which uses the properties of materials and systems below the 100 nanometre scale – could make materials stronger, lighter and more electrically conductive, among other properties.
➤ Cloud technology is enabling the rapid growth of Internet-based services.

The precise economic implications of these and other near-term technologies are unknown. But they are likely to be large. These new production technologies will be able to significantly boost productivity, particularly if they can be diffused across less productive firms and support an inclusive growth process. New technologies could also make production safer, as robots replace humans in the most dangerous manufacturing tasks. New production technologies also hold the promise of cleaner production and the creation of an array of products that could help meet global challenges. For instance, facilities producing bio-based chemicals or plastics could help to address environmental and waste issues and generate new jobs.
Challenges for policy. At the same time, various barriers might hinder the potential impact of the next production revolution on productivity, growth, jobs and well-being. For one, there is still a low level of digital technology adoption in most businesses, preventing realisation of their full potential. And enabling the next production revolution is not only about technological change: benefiting from new technology also rests on the ability of firms, workers and society to adjust to change, and on government policies that ensure that this transformation is inclusive and yields broad-based gains across the population. Organisational change, workplace innovation, management and skills are some of the areas where firms will need to invest to support rapid technological change, supported by complementary public investments in education, research and infrastructure. Enabling resources to flow to the most productive and innovative firms is also essential. Trust will also be critical to maximising the social and economic benefits of the digital economy. And, as our dependency on digital technologies increases, so too do our vulnerabilities, making on-line security, privacy, and consumer protection ever more essential.

The more governments and firms understand the implications of new technologies for production, the better placed they will be to prepare for the risks, shape appropriate policies, and reap the benefits. The OECD is therefore undertaking work on possible developments in production technologies, and their risks and opportunities, so as to help policy makers and business leaders realise the benefits and minimise the costs of the next production revolution.

Useful links


OECD work on innovation in science, technology and industry: www.oecd.org/sti/inno