

**INTERSESSIONAL PANEL OF THE UNITED NATIONS COMMISSION
ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (CSTD)**

**Vienna, Austria
15-17 January 2019**

Contribution of ESCAP

to the CSTD 2018-19 priority theme on 'The impact of rapid technological change on sustainable development'

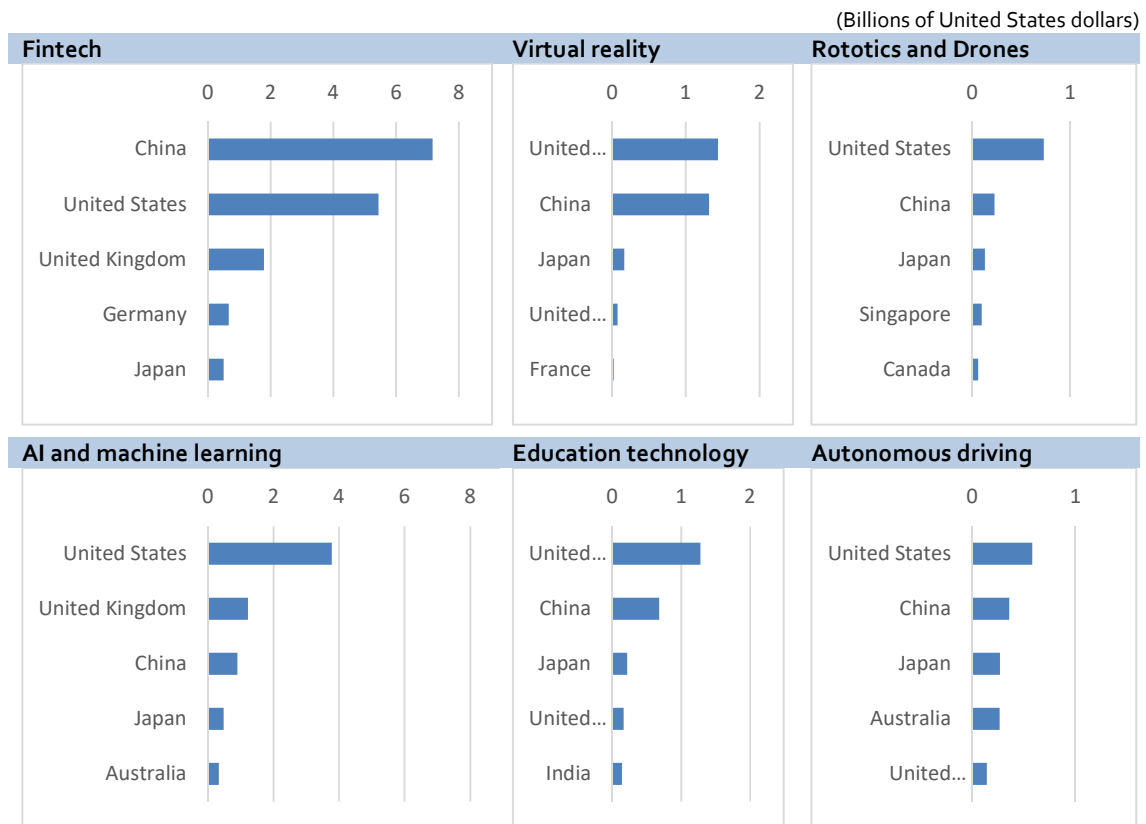
DISCLAIMER: The views presented here are the contributors' and do not necessarily reflect the views and position of the United Nations or the United Nations Conference on Trade and Development.

1.From the perspective of your region what are the key emerging technologies and their current and potential applications that could give an opportunity to solve great societal challenges and achieve the SDGs in your region?

(Kindly note: The answer to this question is taken exclusively from the ESCAP report, “Frontier technologies for sustainable development in Asia and the Pacific” (<https://www.unescap.org/publications/frontier-technologies-sustainable-development-asia-and-pacific>). Please kindly cite the work if the information provided here is included in the CSTD issue paper)

The Asia-Pacific is a leading region in the development of frontier technologies and is forecast to be a prominent market of the future. Measured by venture-capital investment, several countries in the region - including Australia, China, Japan and Singapore - are in a leading group of countries investing in frontier technologies¹ (figure 1).

Figure 1. Venture-capital investment by technology

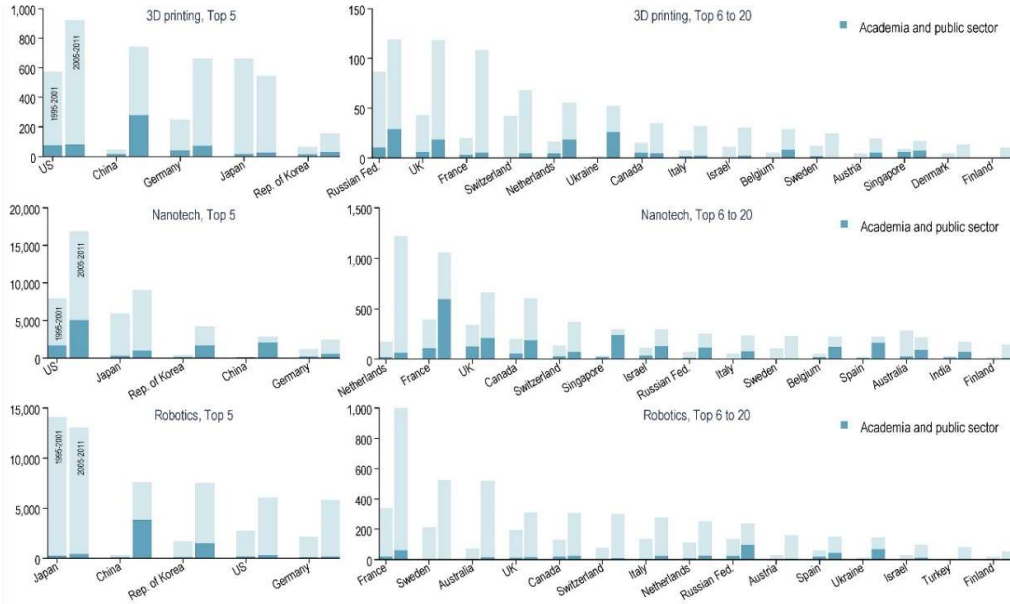


Source: McKinsey Global Institute, 2017.

Similarly, figure 2 shows that China, Japan and Republic of Korea have been among the global leaders in 3D printing, robotics and nanotechnology. The figure also shows that the patenting activity has been mostly concentrated in developed countries worldwide, with the regional exceptions being China, India and the Russian Federation.

Figure 2. Countries drive patenting in 3D printing, nanotechnology and robotics

(Numbers of first patent filings)



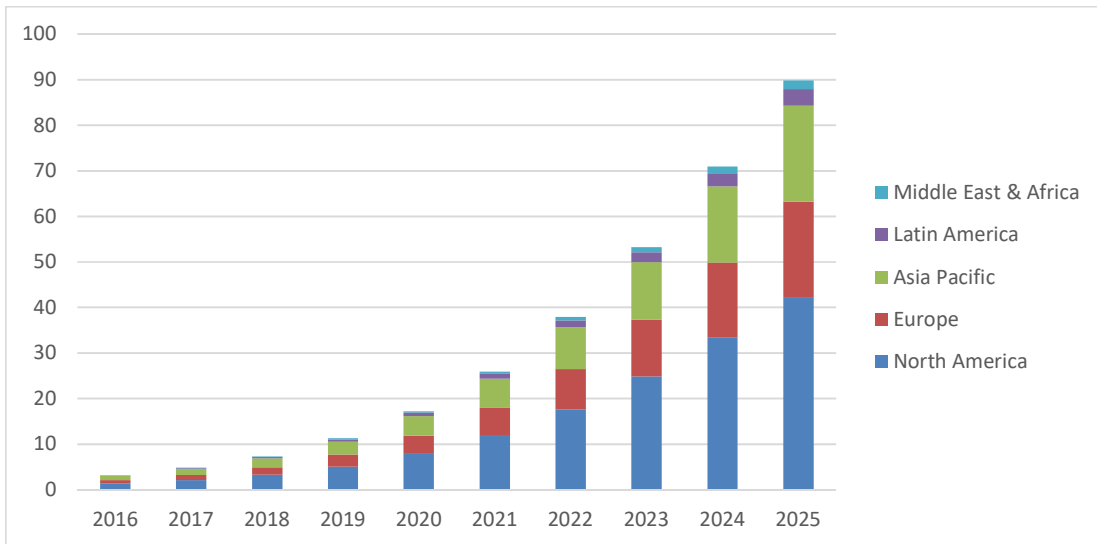
Source: World Intellectual Property Organization, 2015

Data on the level of investment of AI in the region is limited. According to McKinsey, corporations invested between \$20 billion and \$30 billion globally in 2016. Tech giants such as Alibaba, Amazon, Baidu, Facebook and Google account for more than three quarters of total AI investment to date. From 2011 to February 2017, these companies were behind 29 of 55 major merger and acquisition deals in the United States of America (USA) and 9 of 10 major deals in China.³

Globally, revenue generated from the direct and indirect application of AI software are projected to grow from \$3.2 billion in 2016 to nearly \$89.8 billion by 2025⁴ (figure 3). While any forecasted data should be viewed with caveats given the uncertainties with regards to the economic impact of frontier technologies, it nevertheless shows the AI market will grow exponentially.⁵

Figure 3. Artificial intelligence software revenue, world markets, 2016-2025

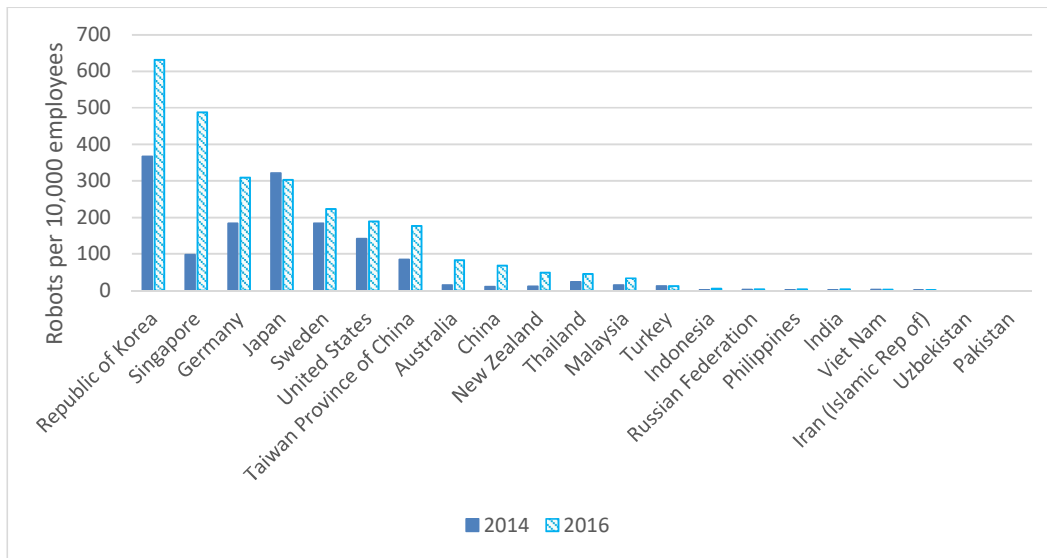
(Billions of United States dollars)



Source: Tractica, 2017.

Worldwide, since 2010, the Republic of Korea has by far the highest robot density in the manufacturing industry. Its robot density increased from 367 in 2014 to 631 in 2016. Singapore was ranked second in the world in 2016, with a rate of 488 robots per 10,000 employees (figure 4).

Figure 4. Estimated robot density in manufacturing, 2014 and 2016



Source: data of year 2014 were taken from UNCTAD, Trade and Development Report 2017, data of year 2016 were taken from International Federation of Robotics (<https://ifr.org/ifr-press-releases/news/robot-density-rises-globally>).

Note: 2016 data for Turkey and Viet Nam were missing, as reflected in the figure.

Japan ranked fourth in the world. In 2016, 303 robots were installed per 10,000 employees in manufacturing. In addition, Japan is the world’s predominant industrial robot manufacturer. The production capacity of Japanese suppliers reached 153,000 units in 2016 – the highest level ever

recorded. Today, Japan's manufacturers deliver 52 per cent of the global supply. The development of robot density in China is the most dynamic in the world. Due to the significant growth of robot installations, particularly between 2013 and 2016, the density rate rose from 25 units in 2013 to 68 units in 2016.^{13,14} Robot density in manufacturing in other developing countries in the region remains generally at a low or negligible level.

2. Can you provide examples of policies/projects/initiatives that promote rapid technological change in your region and mitigate their potential negative effects? Are there any of these policies/projects/initiatives directed to women, youth or other groups of the society? How have the policies targeted inequalities? What are the challenges confronted in implementing these projects?

(Kindly note: The answer to this question is taken exclusively from the ESCAP report, "Frontier technologies for sustainable development in Asia and the Pacific" (<https://www.unescap.org/publications/frontier-technologies-sustainable-development-asia-and-pacific>). Please kindly cite the work if the information provided here is included in the CSTD issue paper)

In Singapore, the government recently set up a new agency, GovTech, to create an enabling environment for frontier technologies. GovTech's objective is to drive digital transformation across government. It will work with public sector organizations, the ICT industry and citizens to apply technologies such as AI and machine learning to government services.¹⁹ Setting up such agencies should support the evolution of next-generation public services. Moreover, by hiring staff with technological skills, the government is supporting the development of a new wave of civil servants fit for the twenty-first century.

Governments are using technologies to reduce inequalities and support inclusion. For example, Aadhaar technology enabled the financial inclusion of 1.2 billion people in India. The Aadhaar programme in India is a government-led, technology-based financial inclusion system. The system includes a unique identification number (based on biometric and demographic data) linked to a mobile phone number, a low-cost bank account, and an open mobile platform. The combination of those elements enabled public and private banks to establish an open and interoperable low-cost payment system that is accessible to everyone with a bank account and a mobile phone. More than 338.6 million beneficiaries have now received direct benefit transfers, saving the Government \$7.51 billion over three years.²¹

In 2017, China published a comprehensive AI development policy with the overarching goal to make the country "the front-runner and global innovation centre in AI" by 2030.⁴

Japan's Artificial Intelligence Technology Strategy Council was launched in April 2016.⁵ The Council subsequently developed the Artificial Intelligence Technology Strategy, which was published in 2017.⁶ The strategy outlines some of the priority areas for Japan in the areas of AI research and development, and promotes collaboration between relevant government agencies, industry and academia in order to further AI research. Japan has also proposed setting up an international set of basic rules for developing AI (to be further elaborated in Section 5.5).⁷ The Government has also devised Japan's Robot Strategy⁸ recognizing the need for robot regulatory reform.

In Republic of Korea, the Ministry of Science and ICT has laid out the "Artificial Intelligence Information Industry Development Strategy", which aims to strengthen the foundation for AI growth.¹⁰ In 2016, the government also published their "Intelligence Information Society Fourth Industrial Revolution Medium- to Long-term Comprehensive Response Plan".¹¹

Countries in the Asia-Pacific region are also developing roadmaps, plans and standards for Internet of things. These include:²²

- The ASEAN ICT Masterplan 2020 and ASEAN Smart Network Initiative: One of five outcomes of the Masterplan focuses on "Sustainable Development through Smart City Technologies" which includes the deployment of Internet of Things technologies.
- Australian authorities freed up additional spectrum bands dedicated to the use of Internet of Things in December 2015.
- India's Internet of Things Draft Policy, 2015: The government is driving adoption of Internet of Things by investing in smart cities and promoting start-ups. In collaboration with the private sector, it established a Centre of Excellence for Internet of Things.
- Japan's General Framework for Secured Internet of Things Systems, 2016.
- Republic of Korea's Master Plan for Building the Internet of Things, 2014
- Malaysia's National Internet of Things Strategic Roadmap, 2014.
- New Zealand's Business Growth Agenda 2017 includes initiatives to accelerate the adoption of Internet of Things technologies through market research and the establishment of an Internet of Things Alliance, a collaboration between industry and government.
- Singapore's Internet of Things Standards Outline in Support of the Smart Nation Initiative, 2015.

Box 1. The artificial intelligence research and development principles / guidelines proposed by Japan to the Group of Seven countries and the United Kingdom

The intention of the guidelines was to enhance the benefits and minimize the potential risk of artificial intelligence, in order to ensure the artificial intelligence research and development is human-centred and protects the interests of users. Given the rapidly developing nature of artificial intelligence technology, the guidelines should not to be perceived as regulations, but rather proposed guidelines to be shared internationally as non-regulatory, non-binding soft law. The draft artificial intelligence research and development guidelines include:

1. Principle of collaboration – Developers should pay attention to the interconnectivity and interoperability of artificial intelligence systems.
2. Principle of transparency – Developers should pay attention to the verifiability of inputs/outputs of artificial intelligence systems and the explainability of their judgements.
3. Principle of controllability – Developers should pay attention to the controllability of artificial intelligence systems.
4. Principle of safety – Developers should take it into consideration that artificial intelligence systems will not harm the life, body, or property of users or third parties through actuators or other devices.
5. Principle of security – Developers should pay attention to the security of artificial intelligence systems.
6. Principle of privacy – Developers should take it into consideration that artificial intelligence systems will not infringe the privacy of users or third parties.
7. Principle of ethics – Developers should respect human dignity and individual autonomy in research and development of artificial intelligence systems.

8. Principle of user assistance – Developers should take it into consideration that artificial intelligence systems will support users and make it possible to give them opportunities for choice in appropriate manners.
9. Principle of accountability – Developers should make efforts to fulfil their accountability to stakeholders including artificial intelligence systems' users.

Source: 1). Draft AI R&D GUIDELINES for International Discussions, http://www.soumu.go.jp/main_content/000507517.pdf;

3. What are the actions that the international community, including the CSTD, can take to contribute to maximize the benefits and mitigate the risk associated to rapid technological change? Can you give any success stories in this regard from your region?

- **Enhance awareness and build capacity of stakeholders.** Frontier technologies are still at their early stage of development, especially in terms of application of frontier technologies in many countries in Asia and the Pacific. ESCAP has played an active role in promoting the development of frontier technologies. For instance, during the 74th Session of the Economic and Social Commission for Asia and the Pacific (<https://www.unescap.org/commission/74/>) and Committee on Information and Communications Technology & Science, Technology and Innovation, Second session (<https://www.unescap.org/intergovernmental-meetings/committee-information-and-communications-technology-science-technology-and-innovation-second>), sessions dedicated to frontier technologies brought together policy makers, industry representatives such as Google, and other stakeholders to discuss the nature and implications of frontier technologies, which effectively help the policy makers to deepen their understanding of frontier technologies, and the policy implications.
- **Build a platform to share information and promote collaboration.** Under the auspices of ESCAP, the Asia-Pacific Research and Training Network on STI Policy (ARTNET on STI Policy) supports research to design policies that can leverage science, technology and innovation as powerful engines for sustainable development in Asia-Pacific. (<https://artnet.unescap.org/sti>)
- **Work with multiple partners and stakeholders to support countries to advance understanding and application of frontier technologies.** Currently, ESCAP is working with different partners such as Google to promote the application of Artificial Intelligence to the Asia-Pacific region.

4. Could you suggest some contact persons of the nodal agency responsible for policies related to rapid technological change and its impact on sustainable development as well as any experts (from academia, private sector, civil society or government) dealing with projects in this area? We might contact them directly for further inputs or invite some of them as speakers for the CSTD inter-sessional panel and annual session.

- Mr. Steve Leonard, Founding Chief Executive, SG Innovate, Singapore,
- Mr. Arvind Gupta, Former Co-Founder and Head, Digital India Foundation - CEO MyGovIndia, India
- Ms. Duo Liu, President of China Academy of Information and Communications Technology, China

5. Do you have any documentation, references, or reports on the specific examples on the priority theme in your region?

- ESCAP report titled “Frontier technologies for sustainable development in Asia and the Pacific” (<https://www.unescap.org/publications/frontier-technologies-sustainable-development-asia-and-pacific>).
- ESCAP report titled “Artificial Intelligence in Asia and the Pacific” (<https://www.unescap.org/resources/artificial-intelligence-asia-and-pacific>).
- The 74th Session of the Economic and Social Commission for Asia and the Pacific covered a session on frontier technologies: <https://www.unescap.org/commission/74/statements> (see the session on 16 May 2018).
- Report of and Committee on Information and Communications Technology & Science, Technology and Innovation, Second session: https://www.unescap.org/sites/default/files/CICTSTI_2018_9%20Report%20Eng.pdf.