

Chapter 1. Shifting global gravity

Our world is becoming more global and interconnected. Economic growth has lifted many people out of poverty, yet challenges remain, and education has an important role to play. This chapter explores these issues through five perspectives:

Shifting economic power – focuses on the dramatic economic growth of Asian countries and the resulting expansion of the global middle class.

A global marketplace – looks at our increasingly intertwined markets, aided by rapidly expanding air transport and global exports of goods and services.

Mobility in a global world – presents trends in international mobility, migration and remittances.

The e-planet – highlights global consumption patterns and the growing problem of electronic waste.

New players, new game? – illustrates the important role innovation plays in the knowledge economy, using examples from the clean energy sector and Artificial intelligence (AI).

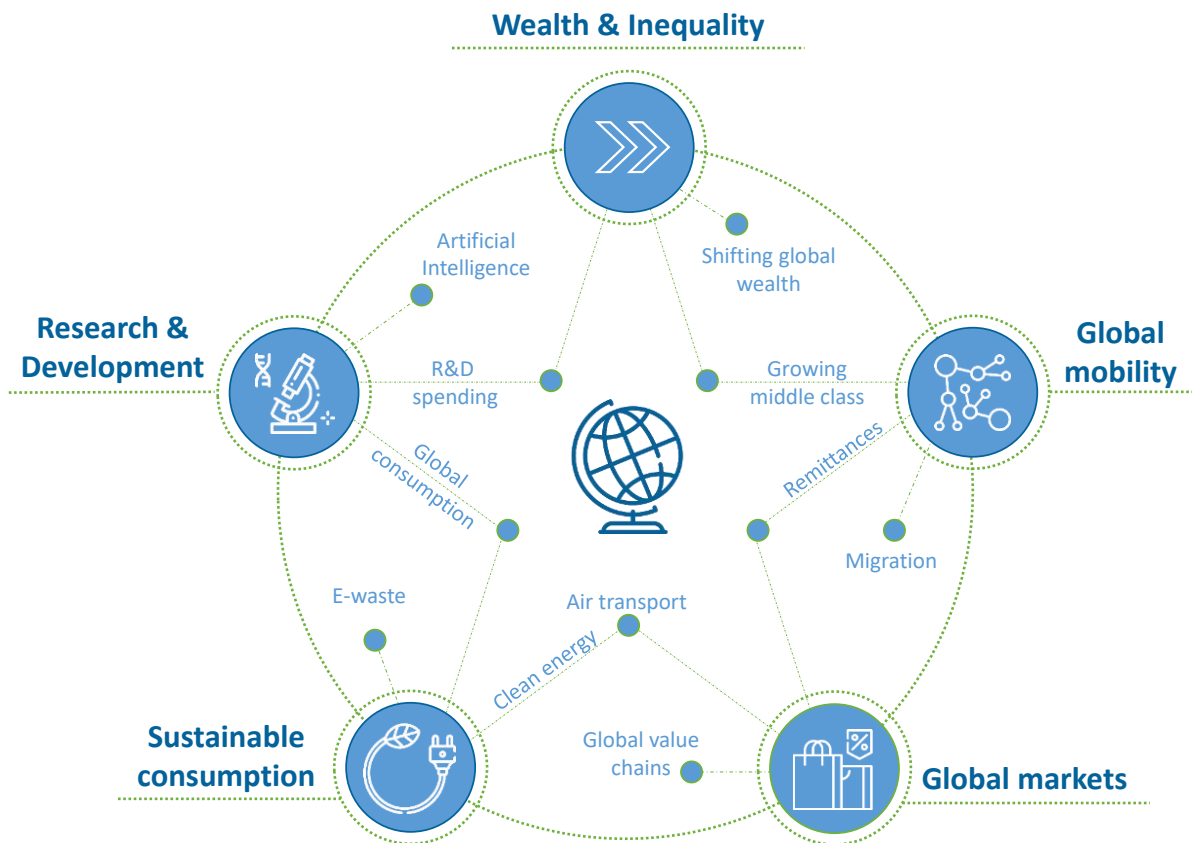
The global trends highlighted in this chapter are then linked to education. All of education is explored, from early childhood education and care to lifelong learning. The chapter ends with a look at how using different versions of the future can help us better prepare for the unknown.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

SHIFTING GLOBAL GRAVITY: A VISUAL OVERVIEW

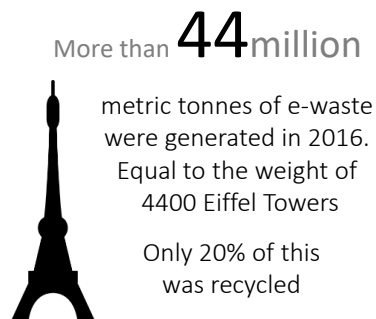
The global balance of economic power is shifting, with giant economies emerging, notably China and India. Globalisation facilitates the emergence of transnational networks and the accompanying economic growth has lifted many people out of poverty, resulting in an expansion of the global middle class. Human mobility across borders has increased with more affordable transport and communications. Yet globalisation also brings new challenges: growing consumption, unsustainable use of resources, and a sense for some of being left behind. The challenge for countries lies in the ability to enhance joint efforts to counterbalance negative trends such as the widening gap between rich and poor.

GLOBALISATION	DEMOCRACY	SECURITY	AGEING	MODERN CULTURES
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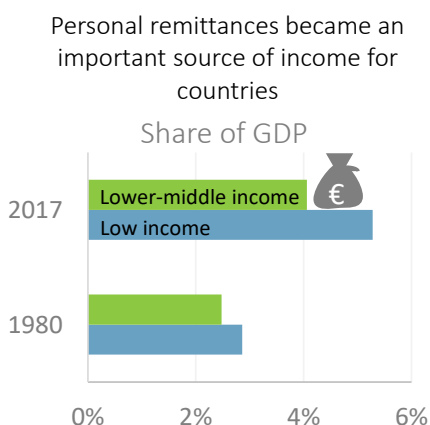


Chapter highlights

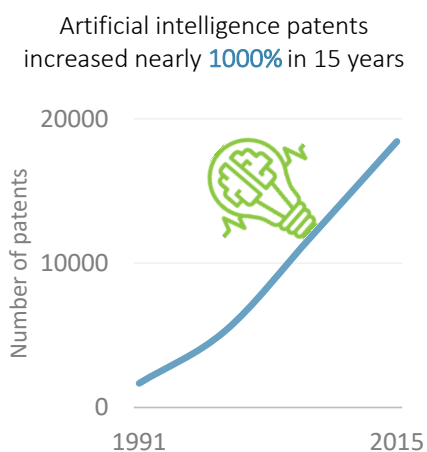
The e-waste problem



Mobility of money

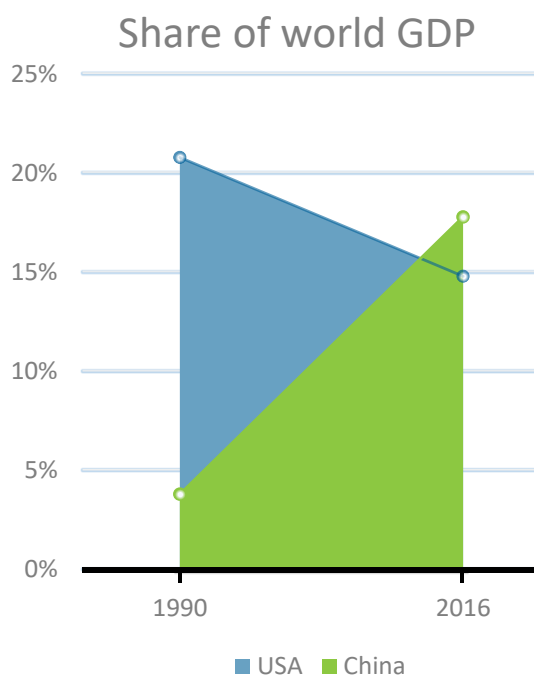


New frontiers of innovation



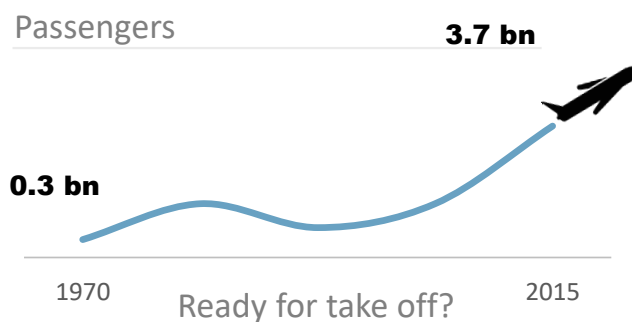
Shift in economic power

China quadrupled its share of world GDP between 1990 and 2016, while the United States' share dropped from **21%** to **15%**



More mobility in a global world

Air transport of passengers worldwide increased from just over 300m in 1970 to almost **3.7 billion** in 2016

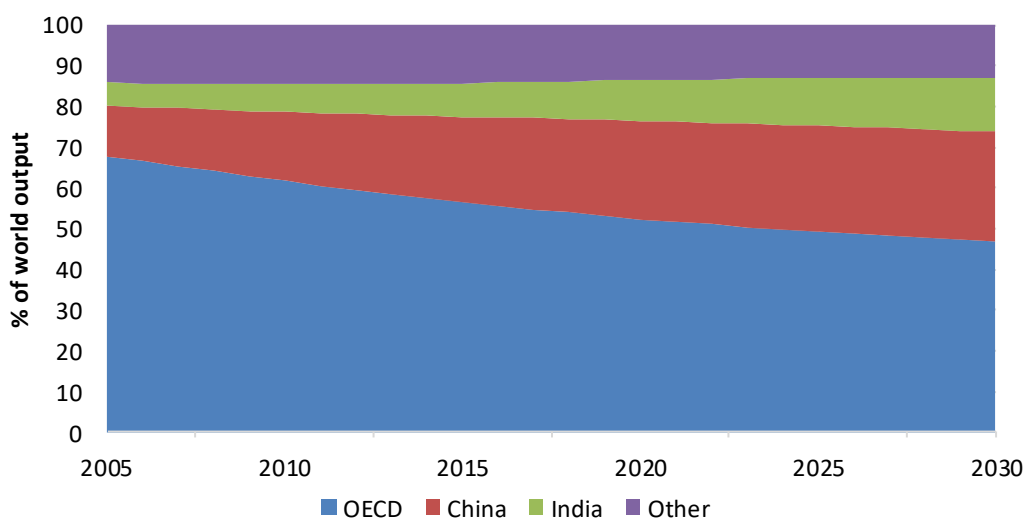


SHIFTING ECONOMIC POWER

The global economic centre of gravity is shifting, with economies such as China and India growing in economic importance. This shift has consequences for OECD countries in terms of jobs and wages, with increasing competition from Asia across the skill distribution. At the same time, the size of the Asian middle class is expanding rapidly. A growing middle class can boost economic growth through increased demand for goods and services. It may also put pressure on governments to deliver more and better public services, for example in education and health care. On the supply side, better education means more skilled workers, higher innovation potential and economic competitiveness in countries and regions.

Figure 1.1. China and India’s share of the pie

Composition of world output (%) in USD at 2010 PPPs, 2005-2030



Note: World output is comprised of the aggregated real GDP of countries based on purchasing-power-parity (PPP), measured in current international dollars. ‘World’ refers to an aggregate of the 46 countries included in the long-term model, which today account for about 82% of world output (see StatLink for full information).

Source: Guillet, Y. and D. Turner (2018), “The long view: Scenarios for the world economy to 2060”, <https://doi.org/10.1787/b4f4e03e-en>.

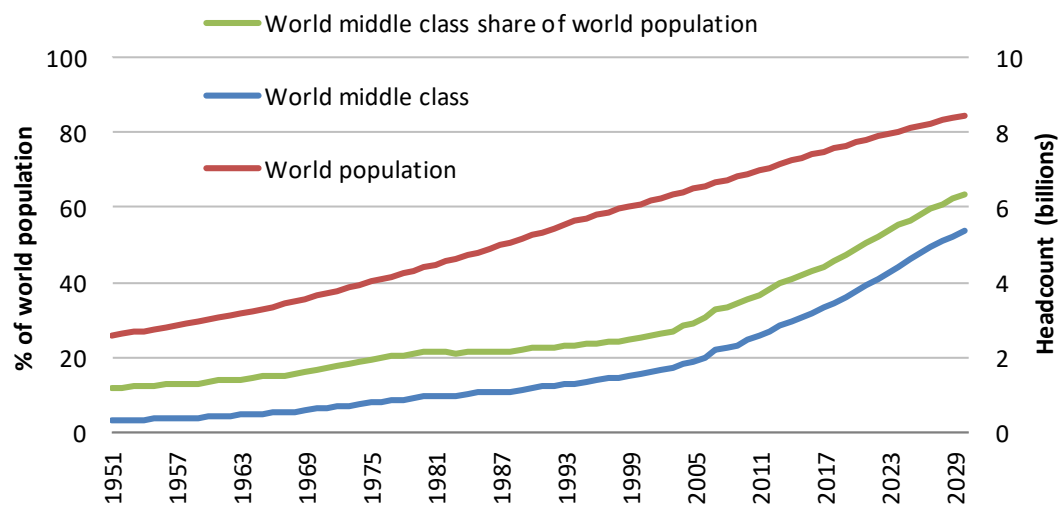
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The centre of the world’s economy is shifting towards Asia. China and India have been among the fastest-growing economies in recent decades, making them two of the largest economies in the world today. Together they account for almost a quarter of world GDP. The speed of change has been dramatic: China increased its share of world GDP from almost 4% in 1990 to 18% in 2016, while India’s share doubled from just over 3% to 7%. At the same time, the United States’ share of world GDP dropped from 21% to 15% and Japan’s share declined from 8% to 4%. The shift of economic power to Asia is clear and expected to continue.

Global economic growth has lifted hundreds of millions of people out of poverty, expanding of the global middle class (defined by those with a daily income between \$10 and \$100). Between 1961 and 2016, the world population almost tripled. The size of the middle class, however, increased more than tenfold, reaching about 3.2 billion people. This growth is expected to accelerate in the coming decades. In the next ten years, the majority of the world's population will consist of the middle class. This growth is largely driven by China and India: 90% of the next billion new entrants into the middle class are expected to come from Asia. In contrast, the European and North American middle class is stagnating.

Figure 1.2. The global middle class on the rise

Estimates of the size of the global middle class, percentage of the world population (left axis) and headcount (right axis), 1950-2030



Source: Kharas, H. (2017), “The unprecedented expansion of the global middle class, an update”, www.brookings.edu. Kharas, H. (2010), “The emerging middle class in developing countries”, www.oecd.org/dev/44457738.pdf.

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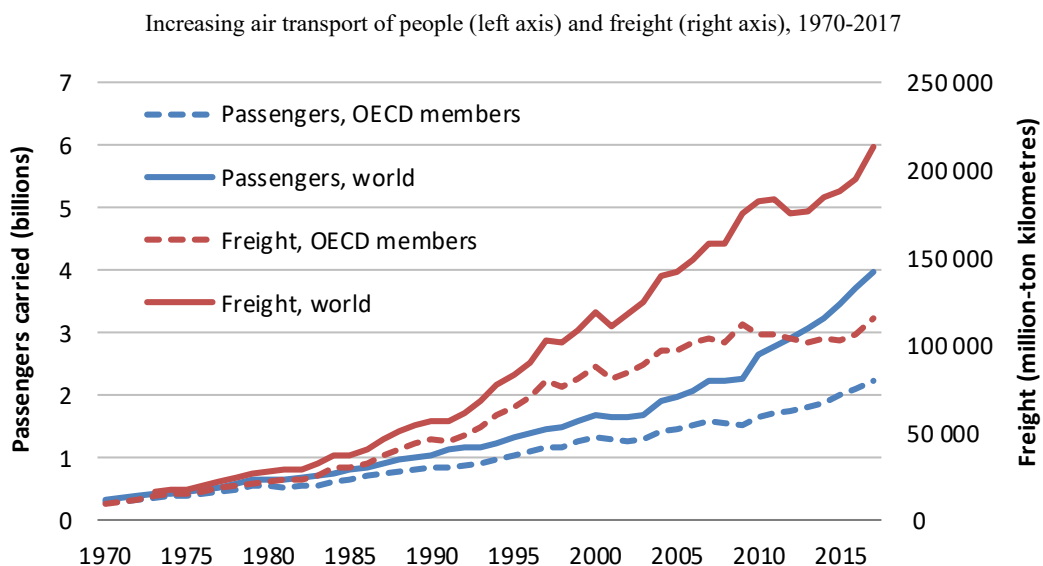
And education?

- Initial education and lifelong learning play a role in lifting people out of poverty by, for example, providing them with the right kinds of skills for the labour market. What can be done to improve this function of education? And what is the role of non-formal learning in this process?
- How can access to high quality education be assured despite growing differences in the socio-economic status? Is the answer different for higher education than early childhood education?
- Should schools and universities be aware of global labour market demands in order to prepare their students to work abroad and in multinational companies? In addition, what elements of inter-cultural sensitivity and co-operation can be taught?

A GLOBAL MARKETPLACE

Countries and economies are becoming more intertwined and interdependent as restrictions on global trade and labour flows decrease. Aided by more affordable international transport and digitalisation, the movement of goods and services along international supply chains reflects the global nature of economic markets and the mutually beneficial opportunities that come with it. Yet openness alone is not enough for the benefits of trade to materialise for everyone, and governments also need to act domestically to encourage opportunity, innovation, and competition. How can education systems help citizens contribute to fair and sustainable global economic governance? How can education help build the skills required in a global marketplace?

Figure 1.3. Ready for take-off?



Source: World Bank (2018), “Air transport, passengers” and “Air transport, freight” (indicators), <https://data.worldbank.org/>.

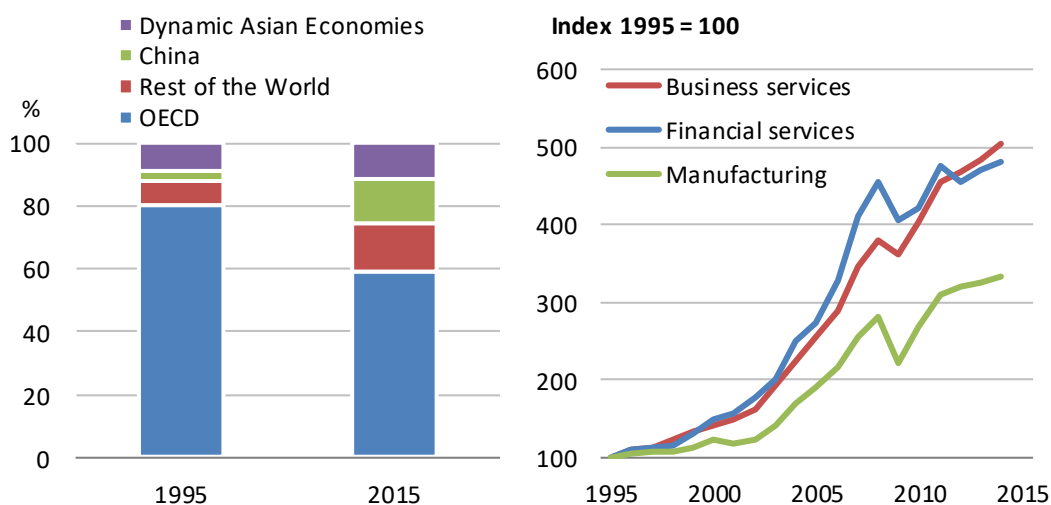
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Global mobility of people and goods is on the rise due to more affordable and accessible modes of transportation, especially air transport. Liberal air regulations and the rise of low cost carriers have facilitated the expansion of air networks. As a result, air transport of passengers worldwide has steadily increased from just over 300 million in 1970 to almost 4 billion in 2017. These numbers are expected to double by 2030 and quadruple by 2050, with the strongest growth coming from Asia. Air freight (shipment of goods by plane) has similarly increased by over twelve-fold since 1970. Although OECD countries still account for over half of all air transport, their share of the total has declined over time. Newly advanced economies, including those of Brazil, Russia, India and China, have contributed massively to the recent growth of air transport.

Global mobility is facilitated by the integration of trade systems worldwide. Many goods and services are designed, developed and delivered across borders through global value chains. While the cross-border movement of people does not account for a large share of services trade, it is essential for international business operations. As a result, many trade agreements today cover aspects that go beyond import tariffs to address essential issues such as human mobility and labour standards. Nevertheless, barriers to open trade remain, and international co-operation is required to ensure global trade rules are fair, transparent and respected. Policies at home are needed as well—including in education—to encourage innovation and job creation, and help all people benefit from the opportunities that trade openness brings.

Figure 1.4. Interconnected global trade

World's exports by origin (left) and type (right), 1995-2015



Note: Business services includes R&D, ICT, real estate and other business activities. Financial services includes financial intermediation, insurance, pension funding and other financial activities.

Source: OECD (2017), “Global trade, policies, and populism”, www.oecd.org/tad/policynotes/Global-Trade-Policies-and-Populism.pdf.

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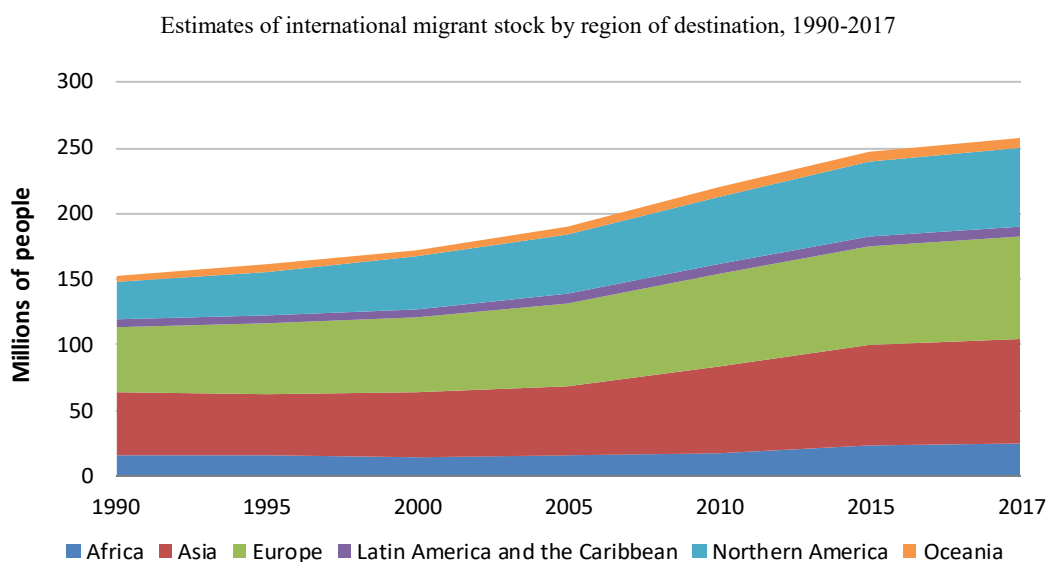
And education?

- Transferability of skills and experience is one of the big challenges for a diverse and mobile world. Are our educational and labour systems able to adequately recognise prior learning and qualifications?
- The world is becoming increasingly mobile and flexible. How well do initiatives such as online learning, MOOCs, and lifelong learning deliver on their promises? How can they be strengthened?
- Nowadays, migration is increasingly temporary or circular rather than permanent. What does this mean for teaching citizenship and identity? Can one be a global citizen with a national identity, or vice-versa?

MOBILITY IN A GLOBAL WORLD

Information technology and decreasing transport costs have facilitated the global mobility of people, goods and services. Human mobility supplies talent and ideas to both high- and low-skilled occupations, fostering knowledge transfer and economic opportunity. In addition, mobile workers are sending more money back to their birth countries, boosting those economies in the process. Yet increasing globalisation also brings new challenges. For education, greater mobility means more diversity in classrooms, as well as a more global market in higher education. Education has an important role to play in equipping students with the skills needed for a global future.

Figure 1.5. More people on the move



Note: Northern America includes Bermuda, Canada, Greenland, Saint Pierre and Miquelon, United States and Mexico.

Source: United Nations (2017), “International migrant stock: The 2017 revision”, www.un.org/en/development/desa/population/migration/data/.

StatLink  <https://doi.org/10.1787/888933888317>

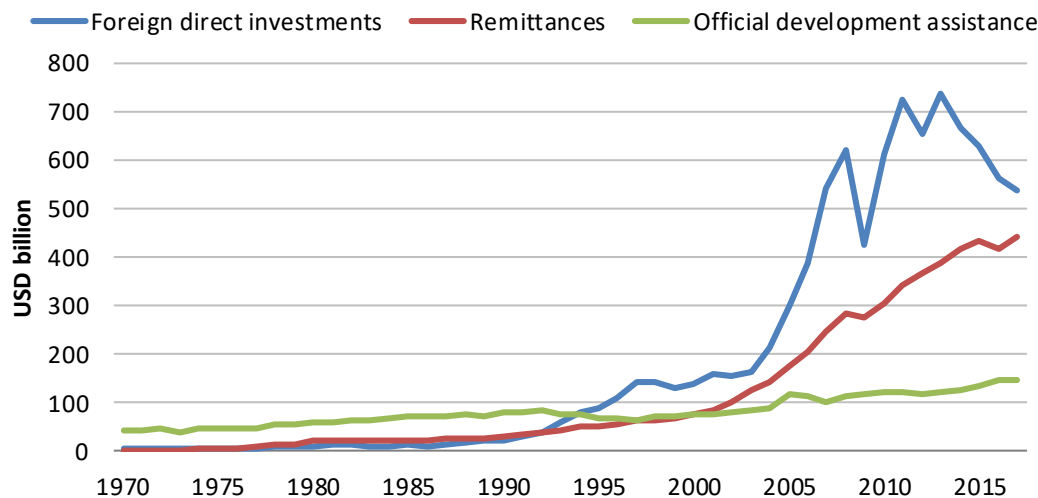
Between 1990 and 2017, the total number of international migrant stock grew from 153 to 258 million people, an increase of 69%. Today, international migrants account for just over 3% of the world’s population. International human mobility is on the rise worldwide, with most migrations occurring between developing countries. Asia has replaced Europe as the most popular region of destination, attracting about 2 million migrants each year between 2000 and 2017 for Europe’s 1.4 million. Over the 1990-2017 period, Asia added over 31 million international migrants, followed by Northern America (30 million) and Europe (29 million).

Increasing migration has been accompanied by growing remittance flows to low- and middle-income countries, amounting to 439 USD billion in 2017. Remittances

represent a large proportion of national income for low-income countries—about 5% of average GDP in 2017—and help people invest in education, business and reducing poverty overall. Over time, remittances have surpassed official development assistance (ODA). Now, the amount sent by remittances is over three times larger than official development aid. Innovations such as cryptocurrencies and blockchain technologies have the potential to improve the remittance environment by significantly reducing the cost and time of sending money internationally.

Figure 1.6. Sending money home

Remittances compared with other resource flows to developing countries, 1970-2017



Note: Data for low and middle-income countries used for Foreign Direct Investments (FDI) and remittances. ODA data refers to government aid of OECD Development Assistance Committee (DAC) countries, and excludes loans and credits for military purposes.

Source: World Bank (2018), “Foreign direct investment, net inflows” and “Personal remittances, received” (indicators), <https://data.worldbank.org/>; and OECD (2018), “Net ODA” (indicator), <https://doi.org/10.1787/33346549-en>.

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And education?

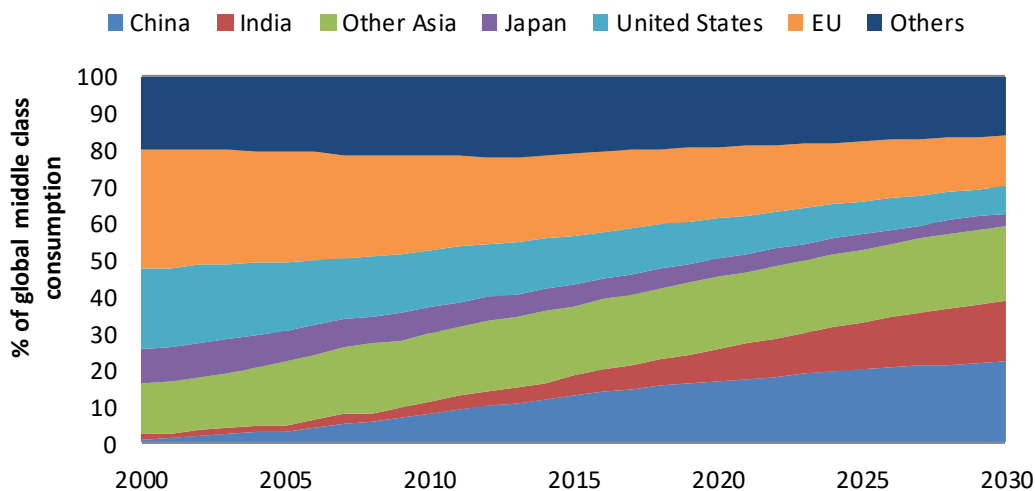
- How can education systems better serve students from various backgrounds, socio-economic classes and cultures? How can they better distribute their resources to aid students who need extra help?
- Do international students have a responsibility to return to their home countries to transfer knowledge back to their nations and peers? What role do OECD countries have in minimising brain drain?
- What responsibility do schools have in teaching the values of society? How can teachers be supported in this task?

THE e-PLANET

Technological revolutions have changed global consumption patterns. Declining production costs allow more people to afford electronics and participate in a digital world. However, rising consumption also has its downsides. For example, electronic products like smartphones and tablets become quickly outdated due to rapid technological advances, requiring ever-newer versions. This results in a rapid increase in electronic waste containing toxic materials that can be very damaging to the environment as well as human health. Emerging countries appear particularly vulnerable to the unsustainable cycle of production and consumption of electronic products. Education has a role to play in developing the skills needed for a sustainable future.

Figure 1.7. China and India consuming more

Shares of global middle class consumption, 2000-2030



Source: Kharas (2017), “The unprecedented expansion of the global middle class, an update”, www.brookings.edu. Kharas (2010), “The emerging middle class in developing countries”, www.oecd.org/dev/44457738.pdf.

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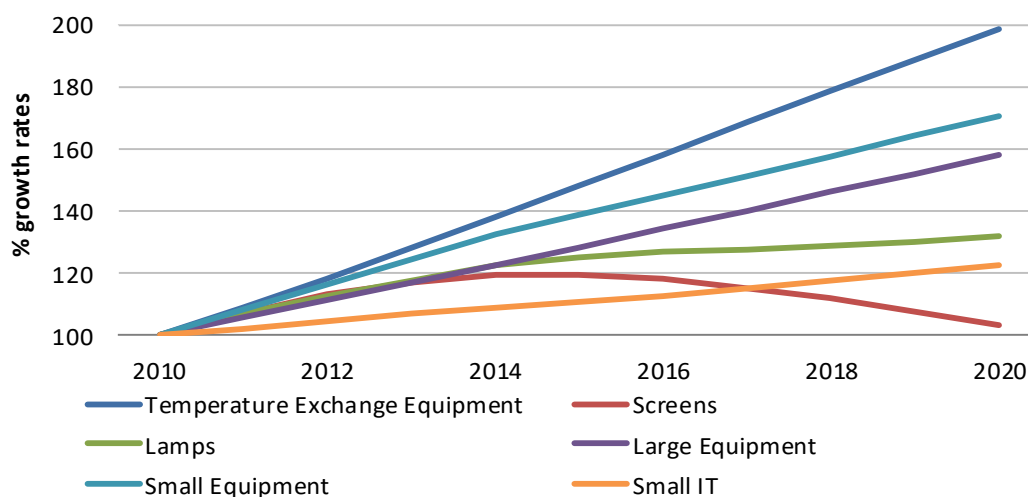
The geographical distribution of middle class consumption is changing. This growth is largely driven by China and India, where new entrants into the middle class use their rise in purchasing power to buy new commodities. Between 2000 and 2030, China’s share of global middle class consumption is expected to increase from 1% to 22%, while India’s share will rise from 1% to 17%. Consequently, as these are relative shares, a significant decrease is expected in the United States and, to a lesser extent, the European Union. The global middle class is an important driver of economic growth, accounting for one third of global consumption expenditures.

Global consumption of electronic equipment is on the rise. This has resulted in an alarming increase in e-waste, or discarded electronic devices. Waste from temperature

exchange equipment, such as refrigerators and air conditioners, is expected to almost double between 2010 and 2020. Only screen waste is likely to decline, as bulky screens are replaced by flat panel displays. E-waste can be damaging to the environment and health if not treated correctly. In 2016, the world generated almost 45 million metric tonnes of e-waste, of which only 20% was recycled through appropriate channels. Particularly emerging countries, which often function as dumping yards and informal recycling centres, appear to be vulnerable to the negative effects of poor e-waste management. These issues raise tough questions about potential tensions between research, innovation and sustainability. What is the role of education in addressing this?

Figure 1.8. World's fastest growing waste problem

E-waste volume growth rates in percentage by category, 2010-2020



Note: Large equipment includes washing machines, large printing machines and photovoltaic panels. Small equipment includes vacuum cleaners, microwaves, and calculators. Small IT includes phones, personal computers and printers.

Source: Baldé, C. et al. (2017), *The Global E-waste Monitor 2017: Quantities, Flows and Resources*, <http://ewastemonitor.info/>.

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And education?

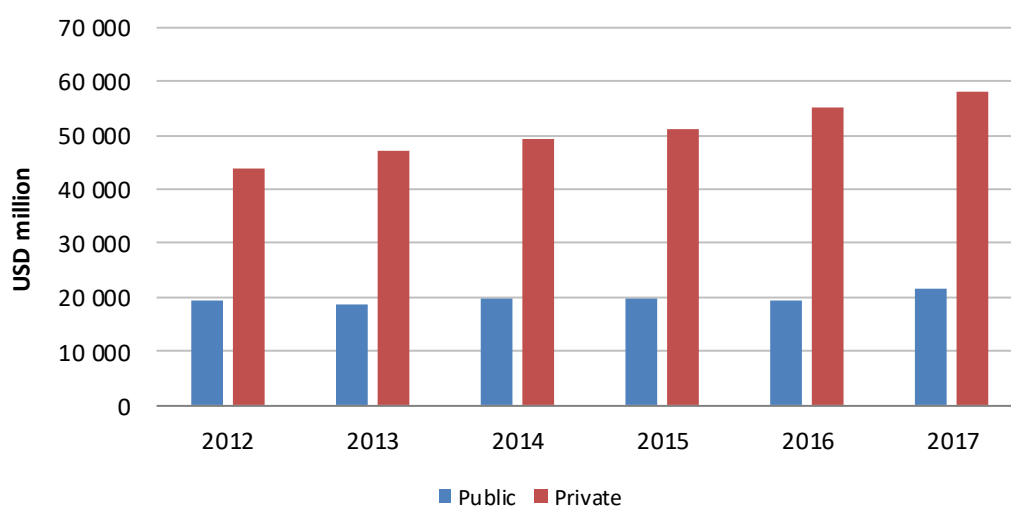
- Environmental challenges are fundamentally global in nature. How can education systems help countries to achieve the Sustainable Development Goals?
- Reducing the amount of e-waste being produced could require a change in behaviours as well as learning new skills. What kinds of skills (e.g., engineering, entrepreneurship, recycling, waste management etc.) could be useful?
- Consumption habits are key to sustainability. But, what happens when new and better products enter the market? Are we to keep outmoded equipment to limit e-waste? How should education address such trade-offs?

NEW PLAYERS, NEW GAME?

With more knowledge-intensive economies, research and development (R&D) capacity is a key policy and business priority. Improved technology works in a virtuous cycle with innovation in areas as diverse as renewable energies and artificial intelligence (AI). The challenge for countries lies in the ability to transform R&D into social and economic benefits. For education, students need to learn advanced skills and qualifications required to fully participate in more knowledge-intensive and faster changing labour markets, including social and emotional competence. There is also a question about partnerships and the role and responsibilities of the private sector.

Figure 1.9. Supporting clean energy technologies

Public and private spending on R&D, 2012-2017



Note: USD refers to 2017 US dollars. Clean energy includes nuclear as well as renewables, energy efficiency, electro-mobility and smart grids. Private sector figures based on corporate reporting.

Source: IEA (2018), *World Energy Investment*, <https://doi.org/10.1787/9789264301351-en>.

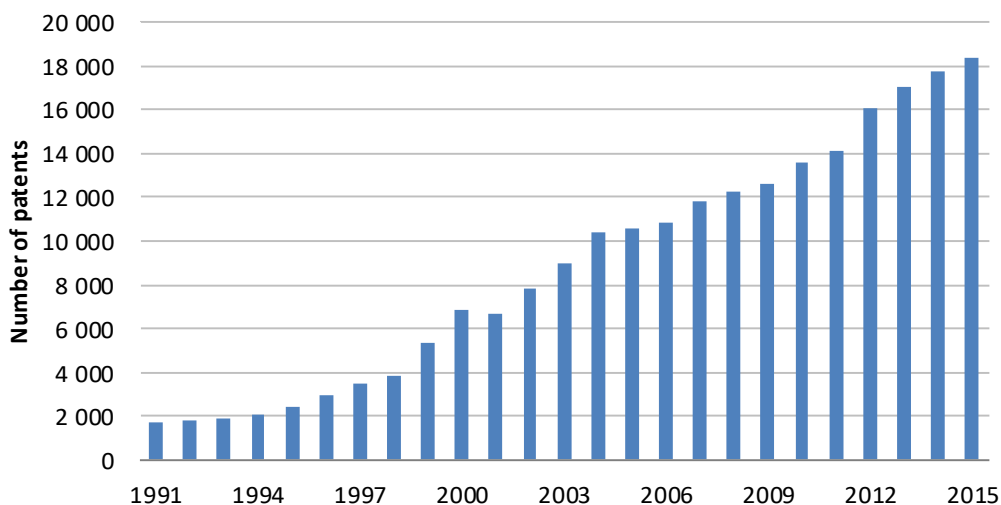
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Investment in clean energy innovation is an essential strategy to combat climate change as well as a savvy bet on a potentially expanding market. Private spending on low-carbon energy R&D has been steadily increasing, with the largest expenditures in Europe and Asia. In the public sector, spending increased by 13% in 2017, a change from stagnation and even decreases in recent years. Both of these sources of funding are important: across OECD countries, growth in R&D expenditure for all fields is largely driven by the private rather than the public sector, but they play different roles. Government R&D tends to focus on earlier-stage and collaborative research, whereas private sector spending includes substantial product development and problem solving, including for existing, commercialised technologies.

Artificial intelligence (AI) – the revolution of intelligent machines able to perform human-like cognitive tasks – is expected to become especially important in key sectors such as healthcare (cancer detection), transport (driverless cars) and the environment (smart energy consumption). The growth of AI technologies, measured by interventions patented in the top five intellectual property offices worldwide (IP5), increased yearly by an average of almost 11% between 1991 and 2015. Japan, Korea and the United States are the top filers in AI patents: together they contributed to over 62% of AI related patent applications between 2010 and 2015. China has also been increasingly focusing on this area. Education can ensure that students have the competences needed to compete in an innovative world.

Figure 1.10. The growth of AI technologies

Number of patents in artificial intelligence technologies, 1991-2015



Note: Data refer to the number of IP 5 patent families in AI (see StatLink for full information).
Source: OECD (2017), *OECD Science, Technology and Industry Scoreboard 2017: The digital transformation*, <http://dx.doi.org/10.1787/9789264268821-en>.

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And education?

- Public funds are growing scarcer, potentially impacting R&D. Will decreases in government spending have an impact on national and international innovative capacity? What is the role of the public sector in supporting innovative research, and where will the funds come from?
- With the rise of artificial intelligence, big data and sophisticated search algorithms, do learners need to learn facts anymore? What consequences would there be if they would not?
- Increasing competition in global research fuels the push for countries to constantly innovate to maintain their competitive position. Does education foster and value the creativity necessary to be innovative?

SHIFTING GLOBAL GRAVITY AND EDUCATION: MOVING FORWARD

What are some of the ways global trends interact with education, and how can education affect these trends? Some answers are obvious and immediate, for example the impact of technology on learners, and conversely, the potential for educators to harness the possibility of technology. Others operate on a longer term, for example the need to establish awareness for sustainability and global connectedness.

Connecting education and globalisation

Global competence

- Supporting students' capacity to examine local, global and intercultural issues and developing their understanding and appreciation of the perspectives and world views of others
- Fostering the knowledge, skills, values and attitudes that encourage students to take action for collective well-being and sustainable development
- Providing opportunities to connect through open and appropriate multi-cultural interactions

Mobility

- Providing support and targeted skill development (e.g., language training) for recent arrivals, both students and parents
- Adapting the curriculum, instruction and assessment methods as well as organisational culture of educational settings to reflect cultural diversity
- Recognising prior learning and qualifications of migrants and refugees
- Fostering international mobility and collaboration of students, teachers and researchers

The knowledge economy

- Reinforcing R&D capacity by attracting and retaining top researchers in tertiary institutions and supporting their international networks
- Encouraging innovation in youth through strong science, technology and arts, teaching creativity and collaboration, and providing activities for young scientists and innovators
- Supporting partnerships between start-ups working with tertiary institutions and other innovation actors

Inequality

- Working to translate international education goals and aims to the national context, with the aim of making globalisation work for all
- Developing a national strategy to build and retain human capital through education and skill systems and addressing issues of brain drain
- Providing high-quality early childhood and care, especially for low-income households

Future thinking: preparing for uncertainty

Despite the best laid plans, the future is inherently unpredictable. This section explores some examples of uncertainties surrounding the trends discussed in this chapter.



SHOCKS & SURPRISES

Cutting communications?

- Much of the communication technology that supports our globalised world is made possible by undersea cables that connect countries and continents. These cables are not infallible, and could be severed by hostile governments or other actors. What if an attack on the undersea cables cut a number of countries off from the rest of the world?
- *What are some of the vulnerabilities of education systems that could be exposed if online communication was lost?*



CONTRADICTIONS

Artificial emotional intelligence?

- Automation of jobs is generally expected to primarily affect manual and routine tasks. As AI becomes increasingly capable, it is quite plausible that it could also take on many of our most human capabilities such as intuition, empathy, and creativity. But experts disagree on the number and quality of jobs that could be created, changed or made obsolete as a result of these developments.
- *What would humans still need to learn in such a world, if anything at all? How quickly would we be able to adjust amid an unknown level and pace of change?*



DISCONTINUITIES

Stateless digital citizenship?

- In a connected world, technologies such as digital payments and face recognition could support the development of personal digital identities, for which individuals and virtual communities could be in total control given their peer-to-peer nature. Is this a first step towards a truly borderless world? Could online communities start providing services traditionally provided by the state, such as education?
- *Will the 'public vs. private' education provision debate be stronger than ever in the context of rapid and drastic societal change?*



COMPLEXITY

Brain gain?

- As some countries grow in global influence, their rapidly improving education systems could have a considerable impact on the global markets for jobs, research, and innovation. This combined with increased geographic mobility could continue to shift the global centre of gravity for leading education and research.
- *Will students from OECD countries opt for studies in emerging-country universities in much greater numbers? What would it mean for students if global centres of excellence for research and innovation moved to very different places from today?*

FIND OUT MORE

Relevant sources

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Glossary

- **Artificial intelligence (AI):** An advanced computer programming language aimed at enabling computers to emulate the human mode of reasoning.
- **Blockchain:** General-purpose distributed ledger technology that authenticates the ownership of assets, makes them traceable, and facilitates their digital transfer. It therefore allows direct trading of assets by providing trust in the transaction and reducing uncertainty (through its use of trustworthy self-executing code).
- **Cryptocurrencies:** A digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank.
- **e-Waste (or electronic waste):** All electrical and electronic equipment and components that have been discarded without the intent of re-using them.
- **Globalisation:** The widening, deepening and speeding up of connections across national borders. It is generally used to describe an increasing internationalisation of markets for goods and services, the means of production, financial systems, competition, corporations, technology and industries.
- **Global middle class:** Households with per capita income between 10 USD and 100 USD per person per day, adjusted for the purchasing power in each country as of 2005.
- **Global value chain:** The full range of activities that take place to bring a product from its conception to its end use and beyond. A value chain can include a single firm or be divided among different firms, can produce goods or services, and can be in a single geographical location or spread over wider areas (hence the term “global”).
- **Greenhouse gases:** Greenhouse gases (for example, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorinated compounds (PFC) and sulfur hexafluoride (SF₆)) absorb energy from the sunlight that reaches the Earth’s surface, slowing or preventing it from being released back into the atmosphere, causing the Earth’s temperature to rise.
- **Gross domestic product (GDP):** Standard measure of the value of the goods and services produced by a country. Gross means that no deduction has been made for the depreciation of machinery, buildings and other capital products used in production. Domestic means that it is production by the residents of the country. As many products in a country are used to produce other products, GDP is calculated by summing the value added for each product.
- **Gross national income (GNI):** Previously known as gross national product (GNP), is the total domestic and foreign output claimed by residents of a country, consisting of gross domestic product (GDP), plus factor incomes earned by foreign residents, minus income earned in the domestic economy by non-residents.
- **International migrant stock:** The number of people born in a country other than that in which they live. It also includes refugees.
- **IP5:** The five largest intellectual property offices worldwide. The members of IP5 are: the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO) and the United States Patent and Trademark Office (USPTO).
- **Low-income country:** The World Bank defines low-income countries as countries whose gross national income (GNI) per capita is 995 USD or less in 2017. No OECD member country is categorised as a low-income country.
- **Middle-income country:** The World Bank defines middle-income countries as countries whose GNI per capita is more than 996 USD but less than 12 055 USD in 2017. The 3 896 USD GNI per capita threshold separates lower-middle-income and upper-

middle-income countries. Of the OECD members, Mexico and Turkey are classified as upper-middle-income economies.

- **Patent:** A right granted by a government to an inventor in exchange for the publication of the invention; it entitles the inventor to prevent any third party from using the invention in any way, for an agreed period.
- **Personal remittances:** Financial transfers usually sent by national or international migrants to support recipients from their country or region of origin. Remittances include the transfer of both cash and non-cash items through both formal and informal channels.
- **Purchasing power parity (PPP):** Data shown in PPP terms is a different concept than data derived using market exchange rates. Because exchange rates do not always reflect international differences in relative prices, PPP rates provide a standard measure allowing the comparison of real price levels between countries.
- **Research and development (R&D):** Research and creative work conducted by either the private and/or the public sector to develop new goods, techniques and services, and to increase the stock of knowledge and the use of this knowledge to devise new applications.
- **Sustainable Development Goals (SDGs):** The SDGs comprise 17 global goals set by the United Nations Development Programme. The SDGs build on the Millennium Development Goals and are part of the 2030 Agenda for Sustainable Development set out by the UN. They cover social, economic and ecological issues such as poverty, health, education, energy or environment.
- **Temperature exchange equipment:** Temperature exchange equipment is more commonly referred to as cooling and freezing equipment. Typical equipment includes refrigerators, freezers, air conditioners and heat pumps.



From:
Trends Shaping Education 2019

Access the complete publication at:
https://doi.org/10.1787/trends_edu-2019-en

Please cite this chapter as:

OECD (2019), "Shifting global gravity", in *Trends Shaping Education 2019*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/trends_edu-2019-4-en

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