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Scholarship 2017
Geography

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RESOURCE BOOKLET

Refer to this booklet to answer the questions for Scholarship Geography.

Check that this booklet has pages 2–20 in the correct order and that none of these pages is blank.

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INTRODUCTION TO TECHNOLOGY

Technology and human life cannot be separated; society has a cyclical co-dependence on technology. We use technology, depend on technology in our daily life, and our needs and demands for technology keep on rising. Humans use technology to travel, to communicate, to learn, to produce food, and to manufacture goods. However, technology is also cause for concern. Its poor application can cause a serious threat to our lives and society. Technology can have impacts on the environment, people, and society as a whole.

Figure 1: Old meets new

TECHNOLOGY AND THE NATURAL ENVIRONMENT

World Wars I and II

During World Wars I and II, the environment began to experience the ravages of war as weapons became more sophisticated and damaging.

The New Zealand experience at Passchendaele in October 1917 was typical of that at the Western Front in World War I from 1914 to 1918. The New Zealand troops attacked the Germans following a shelling by the British artillery, in which 4 000 000 shells were fired in ten days, prior to the attack. This bombardment annihilated all vegetation, pulverised the ground, and destroyed drainage channels. The bombardment was only possible due to advances in technology and industrial output.

Figure 2: Passchendaele, Western Front, October 1917

Figure 3: Same location, October 2016

The weaponry of World War II further damaged the environment. The intense battles of World War II ended with the unleashing of the most powerful weapon ever invented by man: nuclear bombs. The air was filled with toxic pollution emanating from dust particles and radioactive fragments, polluting not only the air but surface water as well. Agricultural production was impaired as soil and water became contaminated with radioactive materials.

Post-WWII explosive growth of technology

Biologist Barry Commoner argues in his book, *The Closing Circle*, that the escalating growth of environmental problems in the USA was due to flawed technology, rather than population growth or affluence. He points out that pollution increased at a much faster rate than population or economic growth. The difference, he argued, could be accounted for by the emergence of new technologies after World War II. He notes that in the twenty-five years following the war, the production of non-returnable soft drink bottles had increased by 53 000 per cent, synthetic fibres by 5 980 per cent, and mercury used for chlorine production by 3 930 per cent. During that same period, the production of food, textiles, clothes, and metals had only increased at similar rates to population growth at 42 per cent. The new technologies also used more electric power and other forms of energy than those they replaced. At the time Commoner was writing, aluminium and chemical production alone accounted for 28 per cent of the USA's industrial electricity use. This in itself, meant more use of energy resources, and more pollution.

The use of pesticides also enabled farmers to get higher yields from smaller land areas, but at an environmental cost. Pesticides polluted waterways, and killed or harmed other insects and animals (and sometimes humans) that were not originally targeted. While artificial fertilisers depleted the soil of naturally occurring nitrogen-fixing bacteria, pesticides killed off the pests' natural predators, and the pests themselves built up resistance to the pesticides. This ensured continuing dependence on the new chemicals, and the need for ever-increasing amounts to be used.

Climate change

Figure 4: Global temperature (meteorological stations)

The evidence of rapid climate change is argued to transcend all social, economic, political, and natural environments. Everything is affected – including human health aspects, forests, sea levels, agriculture, biodiversity – the signals are coming in from right across the environment. Since 1880, the average global temperature has risen about 0.8°C , resulting in many of the weather extremes and climatic changes seen today on a global scale.

Sea level rise

Global sea levels rose 17 cm in the last century. The rate in the last decade however, is nearly double that of the last century, and NASA is predicting as much as several metres in sea level rise this century, if global warming is not addressed. With 70 per cent of the world's population living on low-lying coastal plains, and with 60 per cent of the largest metropolitan areas with a population of over 5 million located within 100 km of the coast, sea level rise is a global problem that affects far more than just small island nations.

Shrinking ice sheets

Figure 5: Total Arctic Sea ice volume has collapsed to one-fifth of its level in 1980

Compared to the rest of the world, average temperatures are rising twice as fast in the Arctic region, and three times as fast in Western Antarctica, which is one of the fastest-warming regions on Earth. Every year, Arctic ice is getting thinner, melting, and rupturing, as seen in the total Arctic Sea ice volume, which has been reduced to one-fifth of its level in 1980. Similarly, Greenland is losing 200 billion tonnes of ice every year. Since 1979, the volume of summer Arctic Sea ice has declined by 75 per cent and the decline is accelerating, while the Greenland ice melt has increased nearly five-fold since the mid-1990s, and Antarctica's ice loss increased 50 per cent in the past decade.

Ocean acidification

Since the beginning of the Industrial Revolution, the release of carbon dioxide (CO_2) into the atmosphere has increased exponentially. The ocean absorbs about half of the CO_2 we release into the atmosphere every year, so as atmospheric CO_2 levels increase, so do the levels in the ocean – making them more acidic.

Figure 6: Ocean acidification

Glacial volume is shrinking

Figure 7: The cumulative decline in glacier ice worldwide 1960–2000

Warming temperatures lead to the melting of glaciers and ice sheets. Glaciers have been retreating worldwide for at least the last century; the rate of retreat has increased in the past decade. The Himalayan glaciers, which are melting faster than anywhere else in the world, and are the sources of Asia's biggest rivers, could disappear by 2035 as temperatures rise.

Human-made environmental disasters

Chernobyl disaster (1986): Russia

On 26 April 1986, a major accident occurred at an atomic reactor plant in Chernobyl, Ukraine (former Soviet Union). About 1 000 people were affected by radiation burns, and another 140 000 people were evacuated from the vicinity of the explosion to safer places. The explosion in the atomic reactor was caused by the failure of emergency cooling in the light water graphite reactor, due to human error.

BP oil spill (2010): USA

The BP oil spill (also referred to as "Deep Water Horizon") occurred on 20 April 2010, in the Gulf of Mexico. The explosion killed 11 workers and injured 17. The oil spill spread over an area of 10 000 km². The spill followed an explosion on an oil rig. The oil was leaking at 5 000 barrels per day from a point about 1 500 m below the surface. Three basic approaches were adopted for removing the oil from the water – burning the oil, filtering off-shore, and collecting for later processing.

Record smog levels in 2016

Figure 8: Industrial malaise – a Beijing highway is enveloped by thick smog as China's pollution worsens, and spreads

Smog in China has reached alarming levels as its rapid industrialisation spews ever-more toxic particles into the air. The problem has become particularly acute, raising health concerns in neighbouring parts of Asia, including Japan. The beginning of China's air pollution problem affecting Japan has been traced back to Beijing and areas east of the capital. As smoke from coal-burning power plants combines with vehicle exhaust and factory emissions, it produces a toxic smog that becomes especially bad in winter. This smog may contain nitrates, sulphates, organic chemicals, metals, soil, and dust particles, as well as pollen fragments and mould spores. In recent years, the smog has been getting worse because of the rising popularity of driving in China, which is adding about 15 million cars to its roads each year.

THE IMPACTS OF TECHNOLOGY ON THE CULTURAL ENVIRONMENT

Is technology improving our standard of living?

Technological developments such as the use of computers and automation in the workplace have assisted in work hours dropping to 40 hours per week in the 21st century, compared to the common 60 hours per week in the early 20th century. The use of technology in a factory makes a job much easier to do, and much safer for those with certain health concerns. Some technological tools such as the light bulb and cell phone have improved our standard of living, while advances in technology are also linked to an increased level of income, which certainly can improve perceived wealth and lifestyle.

Figure 9: Average life expectancy at birth over 186 countries between 1960 and 2015

Figure 10: Distribution of life expectancy changes over 186 countries between 1960 and 2010

Technology and changes in the 21st century workplace

Technology makes it possible to telecommute, work from virtual offices, and communicate with businesses and individuals across the globe. Flexible work schedules are now popular because so many duties and responsibilities can be accomplished from an employee's home, or while the employee is travelling. Having team members who live and work in different cities, and even different countries, is becoming more common.

Careers in computer science and information technology continue to grow. Students in colleges, universities, and technical institutes seeking careers in this industry, will likely be recruited upon graduation. Jobs in this field are among the top 10 careers in developed nations. The work of designing, building, maintaining, and integrating those increasingly complex systems continues to be one of the fastest-growing corners of the job market. The US Bureau of Labor Statistics reports indicate that occupations in computer science and information technology are adding more than 785 000 new jobs from 2008 to 2018.

Around 65% of children starting primary school today will end up working in jobs that don't yet exist …

Technology's huge impact on globalisation enables companies of all sizes to do business with customers all over the world. In addition, businesses can establish satellite offices in practically any country no matter how remote, as long as there is Internet access. The competition for providing Internet access to developing nations will proliferate, enabling growth in areas previously deprived of business opportunities, due to lack of communication devices.

Technology and loss of employment

Technological unemployment is the loss of jobs caused by technological change. Such change typically includes the introduction of labour-saving "mechanical-muscle" machines, or more efficient "mechanical-mind" processes (automation).

That technological change can cause short-term job losses is widely accepted. The view that it can lead to lasting increases in unemployment has long been controversial. Participants in the technological unemployment debates can be broadly divided into optimists and pessimists. *Optimists* agree that innovation may be disruptive to jobs in the short term, yet hold that various compensation effects ensure there is never a long-term negative impact on jobs. Whereas *pessimists* contend that at least in some circumstances, new technologies can lead to a lasting decline in the total number of workers in employment. The phrase "technological unemployment" was popularised by economist John Maynard Keynes in the 1930s. Yet the issue of machines displacing human labour has been discussed since at least Aristotle's time.

Already in this second decade of the 21st century, a number of studies have been released, suggesting that technological unemployment may be increasing worldwide. Further increases are forecast for the years to come. While many economists and commentators still argue such fears are unfounded, as was widely accepted for most of the previous two centuries, concern over technological unemployment is growing once again.

A common view among those discussing the effect of innovation on the labour market has been that it mainly hurts those with low skills, while often benefitting skilled workers. While 21st century innovation has been replacing some unskilled work, other low-skilled occupations remain resistant to automation, while white collar work requiring intermediate skills, is increasingly being performed by autonomous computer programmes.

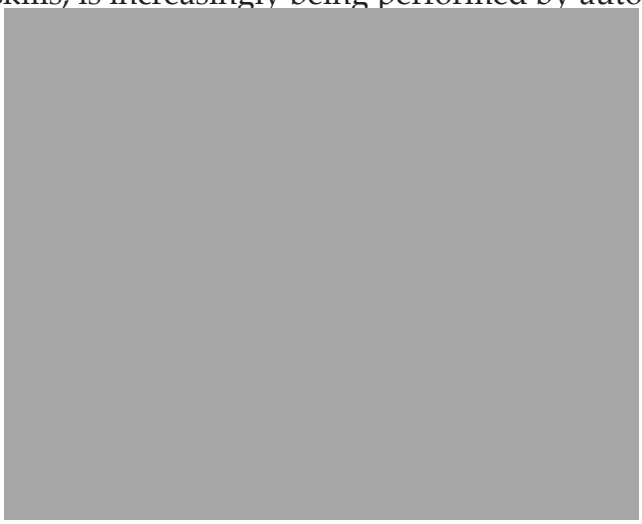

Figure 11: Computerised takeover

Some recent studies have found, however, that in the area of industrial robots at least, innovation is boosting pay for highly skilled workers, while having a more negative impact on those with low to medium skills. Innovation has been disruptive mostly to middle-skilled jobs, yet it is predicted that in the next 10 years, the impact of automation will fall most heavily on those with low skills.

An American economist, Professor Robert J. Gordon, suggests that there have been three industrial revolutions since 1750. The first was the invention of steam engines and machines for cotton spinning, culminating in the development of the railroads. The second, running from 1870 to 1900, saw the invention of electrical power, the internal combustion engine, and indoor plumbing; all with huge effects on the economy for the subsequent 100 years. The third revolution was based on the computer and the Internet. While this was important, in the following quote he argues that it was not more important than the previous two.

> "Many of the inventions that replaced tedious and repetitive labour by computers happened a long time ago, in the 1970s and 1980s. Invention since 2000 has centred on entertainment and communication devices that are smaller, smarter, and more capable, but do not fundamentally change labour productivity, or the standard of living in the way that electric light, motor cars, or indoor plumbing changed it."
>
> Professor Robert J. Gordon (American economist best known for his work on productivity, growth, the causes of unemployment, and airline economics).

Health effects of technology

Figure 12: All that googling can cause anxiety

Staring at screens can affect sleep. Research shows that excessive tech use – particularly right before bedtime – can have an adverse impact on our sleep cycles, due to the glowing light that's emitted from screens.

Loneliness and Facebook browsing are inextricably linked. Previous research found that the popular social networking site can cause feelings of loneliness, but a recent study is suggesting a slight variation: lonely people just turn to Facebook more often. Regardless of the research, experts conclude that this Internet paradox is a very real phenomenon. Our social networks are linked to feelings of loneliness, as well as a decrease in happiness and satisfaction.

Too much tech is literally changing your brain. Research shows the technology we process each day is actually rewiring our brains, between the multitasking, and the addiction we feel when we're without it. "We are exposing our brains to an environment and asking them to do things we weren't necessarily evolved to do," Adam Gazzaley, a neuroscientist at the University of California, San Francisco, told *The New York Times*. "We know already there are consequences," he says.

Negative effects of technology on youth

1. *Technology changes the way youth think*

   Using technology can change a youth's brain. Technology can alter the actual wiring of the brain. More than a third of children under the age of two use mobile media. That number only increases as children age, with 95 per cent of teens from 12 to 17 years spending time online. The time spent with technology doesn't just give children new ways of doing things, it changes the way their brains work. Children who always use search engines may become very good at finding information, but not very good at remembering it. In addition, children who use too much technology may not have enough opportunities to use their imagination, or to read and think deeply about the material.

2. *Technology changes the way youth feel*

   Using technology can affect a youth's ability to empathise. Youth who had no access to electronic devices for five days were better at picking up on emotions and non-verbal cues of photos of faces, than the group that used their devices during that time. The increased face-to-face interaction that the test group had, made students more sensitive to nuances in expression.

   Overuse of technology can also affect a child's mood. A report from the United Kingdom revealed that children who use computer games and their home Internet for more than four hours do not have the same sense of well-being as those who used that technology for less than an hour. One expert explained that with less physical contact, children might have difficulty developing social skills and emotional reactions.

3. *More use of technology with less physical activity leads to obesity*

   Childhood obesity is on the rise, and technology may be to blame. Paediatricians also say that severe obesity is increasing among young people. Although one traditional focus is on the amount and type of foods kids eat, one study says that obesity is on the rise not just because of food, but because as we use more technology, we exercise less. With technology that includes cars, television, computers, and mobile devices, the amount of time we spend sedentary has increased, and our time in physical activity has dropped.

Technology and indigenous people

Many indigenous communities see telecommunication and computer technologies as a way to improve, rather than hinder self-sufficiency, preservation of culture, real sovereignty, and general economic conditions. The tools recognised by tribes as essential to their future growth are telecommunications and information technology, and tribes are looking for opportunities to acquire the level of technological infrastructure that will ensure their place on the information superhighway.

Currently, indigenous peoples are utilising tools such as video conferencing technology, digitisation of documents, and radio broadcasts over the Internet. The majority of these technologies are used to preserve and promote indigenous culture, tradition, history, and human rights advocacy.

Effects on African cultures

Africa is witnessing the effects of western technology with its accompanying blessings and curses. The reality is that Africa lags behind in accelerating appropriate indigenous scientific knowledge to solve their problems (needs). Therefore, they depend on western technology. These dependency syndromes pose an enormous challenge to African cultural values. Some of these western technologies (devices) are not congenial to the African context, and have helped to erode (reduce) African cultural values.

In the traditional African society today, children are losing the ability to play properly because of the influx of western technological devices, like toys and computer games. In many higher institutions across Africa, indecent dressing has become the emblem of modernity. African society is now grappling with many behavioural problems such as dishonesty, drug abuse, assault, insult, violent demonstrations, vandalism, examination malpractices, robbery, and secret cult activities, due to exposure to other cultures through technology.

Cell phones in Africa

In Africa, ignorance is a far more major obstacle, and those aware (mostly the educated and literate people in the private sector) say, as much as they appreciate the need and importance of information and communication technologies (ICTs), the economic situation in their countries, and general poverty, make it difficult for people who need these ICTs to acquire them. In Ghana, for example, the per capita income is US$400, and the average cost of a computer (plus modem and telephone line) is US$1500. Also, in Nigeria, to acquire a computer / modem, an Internet service provider (ISP) subscription, and a telephone line would require the total annual income of a graduate.

Gender and new technologies

While examining the role of gender in new communication technologies, it can be argued that although research into ICTs has largely ignored or marginalised gender issues, the active involvement of women in the design of the new technologies may lead to creative and empowering uses for emerging communication technologies. Women can develop new software that is more woman-friendly, as well as change the policy priorities of development, to help the Internet move away from a 'toolcentric' approach. Among the strategies being developed for creating a 'communicative age', is the greater involvement of women in alternative designs for communication and information technologies, relearning the art of conversation, and using action learning and foresight.

Technology aiding in disaster protection and recovery

A more economically developed country (MEDC) can afford to help decrease the damage from an earthquake by spending money on technology to improve the country's stability. An example of a MEDC's earthquake is the magnitude 9.0 Tohoku earthquake on 11 March 2011, which occurred near the north-east coast of Honshu, Japan. A less economically developed country (LEDC) country could not afford to spend money to protect their country from earthquakes in the same way. An example of an LEDC's earthquake is "The Great Chilean Earthquake", which occured on May 22, 1960, near Valdivia, Southern Chile, and was assessed to have a magnitude of 9.5.

Technology impacting education

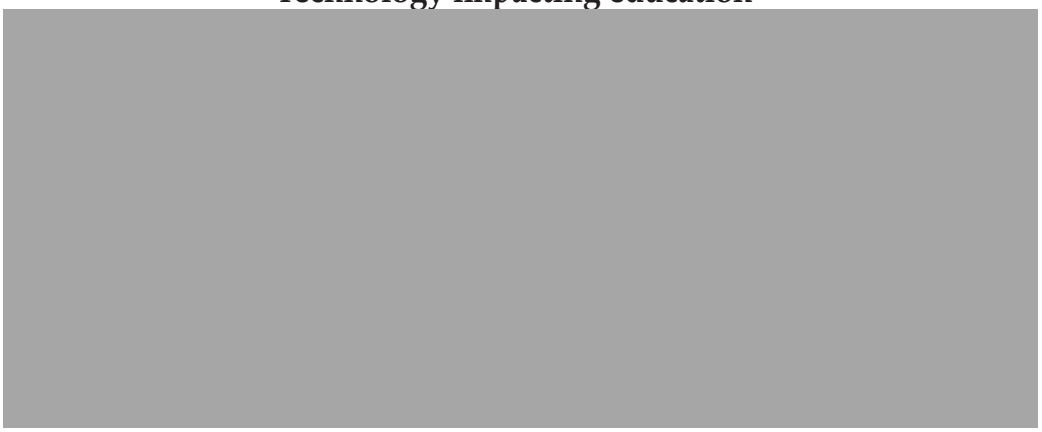

Figure 13: The effects of technological advancements on the quality of education in the USA of adults 18+

Computer education is now part of school. We live in a 'technology age', and hence, it is important for us to be abreast of the latest innovations in the field. With education, we acquire knowledge of the functioning and use of different pieces of technology. Also, with the application of technology, we can educate ourselves better. This is the impact that technology and education have on each other. Education boosts the use of technology, and technology aids education. The introduction of technology in the educational field has made the process of learning and knowledge-sharing, a more interactive and pleasurable experience. Perhaps the greatest impact of technology on education is the change in perspective. The paradigm shift in thinking from local to global can be attributed to technology.

Online education and distance learning have given a new dimension to education and higher learning. Even if students are geographically far away from each other, they can be a part of one classroom.

TECHNOLOGICAL INNOVATIONS AND SUSTAINABILITY

Investment in technology

Global leaders have made little progress in cutting greenhouse gas emissions, which continue to increase as rapidly developing nations such as India and China use coal to power economic growth. Here are five technologies that are being invested in:

1. **Solar geo-engineering** includes blasting sulphate aerosols into the stratosphere to reflect sunlight away from Earth, or spraying fine sea salt into the sky to whiten clouds. "One powerful country could do it by itself, if desperate enough for a quick, but temporary fix", says climate scientist, Ken Caldeira, of the Carnegie Institution for Science. He notes how Mount Pinatubo's 1991 eruption in the Philippines, which fired sulphur particles high into the air, cooled global temperatures by nearly one degree Fahrenheit in 1992 and 1993.
2. **Carbon capture**, which traps emissions from fossil fuels and power plants, and removes them from the atmosphere. Due to high costs, no commercial, coal-fired facility has yet employed this technique. The first effort is designed to capture 65 per cent of carbon emissions. Massachusetts Institute of Technology (MIT) developed a simpler scrubbing system that it says can be added relatively easy to existing facilities.
   The US Department of Energy is funding research on how to capture industrial emissions and either store them underground, or use them to make products such as fuel, plastics, cement, and fertiliser. Klaus Lackner, a Columbia University geophysicist, is working on synthetic trees that absorb carbon dioxide about a thousand times faster than natural trees. A Calgary-based start-up, Carbon Engineering, is developing industrial-scale technologies to capture carbon from the atmosphere, and use it to produce low-carbon transportation fuels.
3. **Artificial photosynthesis** could yield an entirely new, emissions-free energy source. In 2011, Professor Daniel Nocera from MIT unveiled his "artificial leaf", a credit card-sized silicon solar wafer that, when placed in a glass of tap water and exposed to sunlight, generates hydrogen and oxygen bubbles that can be stored and when needed, recombined in a fuel cell to generate electricity.
4. **Solar and wind power** have surged in recent years, and research is finding new applications. MIT and Sandia National Laboratories have developed ultralight, atom-thin solar cells that can be embedded in flexible products like drapes, or harder structures like a tablet's outer shell, to produce power. Similarly, they're developing transparent cells that can be placed on windows.
5. **Nuclear power**, disliked by many environmentalists because of safety and waste disposal concerns, is welcomed by climate scientists as a major energy source that does not emit carbon. The US Department of Energy has offered $8.3 billion in loan guarantees to help build a nuclear power plant in Georgia, and is funding efforts by two companies to develop small modular reactors. These school bus-size versions of current light water reactors could be made in US factories, and moved from site to site.

The use of drones in agriculture

Figure 14: A drone in action

Around 9.6 billion people are expected to call Earth home by 2050. All of them need to be fed. Experts expect agricultural consumption to increase by nearly 70 per cent by then. Agricultural producers must embrace revolutionary strategies for producing food, increasing productivity, and making sustainability a priority. Drones are part of the solution. If the inputs can be reduced – water and pesticides – and the same output maintained, a central challenge will be overcome.

What drones mean to a growing number of farmers is simply a low-cost aerial camera platform. These aircraft are equipped with an autopilot, using GPS and software on the ground, that can stitch aerial shots into a high-resolution mosaic map. A low-altitude view gives a perspective that farmers have rarely had before. Compared with satellite imagery, it's much cheaper, and offers higher resolution. Farmers can buy the drones for less than US$1 000 each.

Drones can provide farmers with three types of detailed views. Firstly, seeing a crop from the air can reveal patterns that expose everything from irrigation problems to soil variation, and even pest and fungal infestations that are not apparent at eye level. Secondly, airborne cameras can take multispectral images, capturing data from the infrared, as well as the visual spectrum, which can be combined to create a view of the crop that highlights differences between healthy and distressed plants in a way that cannot be seen with the naked eye. Thirdly, a drone can survey a crop every week, every day, or even every hour. Combined to create a time-series animation, that imagery can show changes in the crop, revealing trouble spots, or opportunities for better crop management.

Green building

Green building refers to both a structure and the use of processes that are environmentally responsible and resource-efficient throughout a building's life cycle: from siting to design, construction, operation, maintenance, renovation, and demolition. In other words, green building design involves finding the balance between building and the sustainable environment.

The common objective of green buildings is to reduce the overall impact of the built environment on human health and the natural environment by:

- efficiently using energy, water, and other resources
- protecting occupant health and improving employee productivity
- reducing waste, pollution, and environmental degradation.

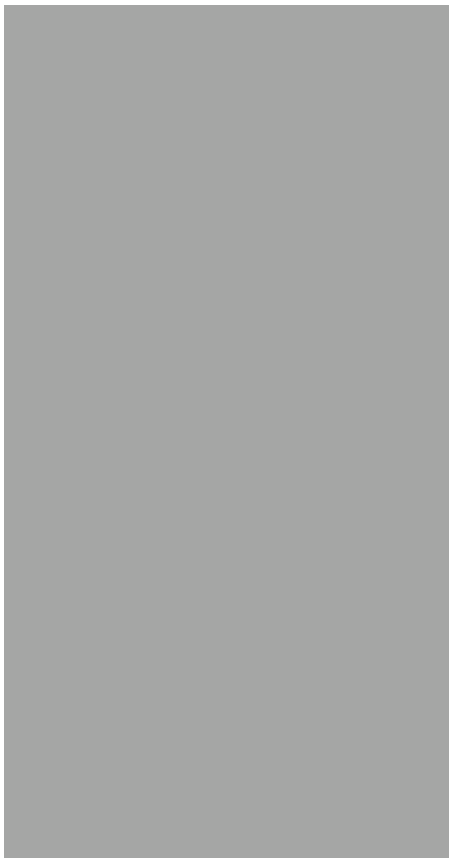

Figure 15: Taipei 101 – the tallest and largest green building in the world since 2011

Globally, buildings are responsible for a huge share of energy, electricity, water, and materials consumption. The building sector has the greatest potential to deliver significant cuts in emissions at little or no cost. Buildings account for 18 per cent of global emissions today, or the equivalent of 9 billion tonnes of CO_2 annually. If new technologies in construction are not adopted during this time of rapid growth, emissions could double by 2050, according to the United Nations Environment Programme.

Cutting out animal-based foods

Figure 16: Plant vs beef burger patties

It takes more power to make one burger than to fully power seven iPads. Beef alone requires 28 times more land, and uses 11 times more water to produce, than pork or chicken. Cows produce up to 25 per cent of methane emissions, which is a huge part of greenhouse gas emissions. Methane traps heat 21 times better than CO_2. Grazing livestock accounts for 40 per cent of the privately held land in the US, or 613 million acres.

Technology is making it easier to cut out animal-based foods. To feed a rapidly growing population and cut down on these emissions, biotech companies are making lab-grown meat. Modern Meadow is engineering tissue to make meat and leather, and they are using 3D printers to do it. Beyond Meat takes plant-based proteins from vegetables to structure what resembles meat, in order to replace animal proteins, and to reach their goal of reducing meat consumption by 25 per cent by 2020.

Slow steam vessels

Figure 17: A Maersk Line Triple-E

The Maersk 'Triple E' class container ships comprise a family of very large container ships with a length of 400 m. The name Triple E is derived from the class's three design principles: 'economy of scale, energy efficient and environmentally improved'. These ships are expected to be not only the world's longest ships in service, but also the most efficient container ships. While only 3 m longer and 4 m wider than previous ships, the Triple-E ships are able to carry 2 500 more containers.

The Triple E class uses a strategy known as slow steaming, which is expected to lower fuel consumption by 37% and carbon dioxide emissions per container by 50%. The Triple E design helped Maersk win a "Sustainable Ship Operator of the Year" award in July 2011. Maersk plans to use the ships to service routes between Europe and Asia, projecting that Chinese exports will continue to grow. European-Asian trade represents the company's largest market; it already has 100 ships serving this route. Maersk hopes to consolidate its share of this trade with the addition of the Triple-E class ships.

Electric vehicles

Figure 18: A Tesla charging station

Today's electric vehicles promise several advantages over gas-powered cars. For commuters, there are no trips to the gas station—all you need is an outlet at home or work—and a full charge costs only a few dollars. What's more, electric cars use no petrol so emit no pollution. Even when you factor in the carbon emissions and pollution from the power plants that produce the electricity to power the cars, and from manufacturing and disposal, electric cars produce about 40 per cent less CO_2 and ozone than conventional cars. Also, electric motors, which need only a single gear for all speeds, can be surprisingly responsive and powerful.

Only a few years ago, early electric cars were disadvantaged by two factors: high purchase costs and less-than-optimal batteries. Yet, innovative battery and charging technology is continually making electric car batteries cheaper, and their recharge quicker.

Acknowledgements

Material from the following sources has been adapted for use in this examination (accessed 8 May 2017).

Page	Source
3	Text found on http://www.useoftechnology.com/technology-society-impact-technology-society/. Figure 1 found on http://cdn.mos.cms.futurecdn.net/47eb4bb023903b6dc63a4bf25abf8363.jpg.
4	Text found on http://www.brighthub.com/environment/science-environmental/articles/87675.aspx. Figure 2 found on https://nzhistory.govt.nz/files/styles/fullsize/public/pill-box-mud_0.jpg?itok=jGLvyEu1.
5	Text found on https://www.uow.edu.au/~sharonb/STS300/technology/environment/importance.html. Text and Figure 4 found on http://www.everythingconnects.org/evidence-of-rapid-climate-change.html.
6	Text and Figure 5, Figure 6, and Figure 7 found on found on http://www.everythingconnects.org/evidence-of-rapid-climate-change.html.
7	Text found on http://www.brighthub.com/environment/science-environmental/articles/84002.aspx. Text and Figure 8 found on http://www.japantimes.co.jp/news/2013/02/08/reference/chinese-smog-bomb-floats-toward-japan/#.WQ_VxDZ95Bw.
8	Text and Figure 9 found on http://www.nytimes.com/2012/12/24/science/earth/west-antarctica-warming-faster-than-thought-study-finds.html Text found on https://technologyaffectstheeconomy.blogspot.co.nz/2012/12/how-does-technology-improve-our.html. Text, Figure 9 and Figure 10 found on http://www.openpop.org/?p=695.
9	Text found on http://smallbusiness.chron.com/technology-impacting-changes-21st-century-workplace-3357.html, http://money.cnn.com/2016/01/18/news/economy/job-losses-technology-five-million/, and https://en.wikipedia.org/wiki/Technological_unemployment.
10	Text found on https://en.wikipedia.org/wiki/Technological_unemployment, and http://business.time.com/2012/09/04/is-u-s-economic-growth-a-thing-of-the-past/.Figure 11 found on http://lowres.jantoo.com/business-technological_advancementcomputerized-takeover-replaced-unemployed-07600891_low.jpg.
12	Text and Figure 12 found on http://www.huffingtonpost.com/2014/12/05/health-effects-of-technol_n_6263120.html. Text found on http://www.edudemic.com/the-4-negative-side-effects-of-technology/.
13	Text found on http://www.ecoliteratelaw.com/09_DigitizationIndig.cfm?sect=text, http://www.iosrjournals.org/iosr-jhss/papers/Vol8-issue4/F0842628.pdf?id=6071, and http://www.metafuture.org/Articles/icts.htm.
14	Text found on http://www.metafuture.org/Articles/icts.htm, and http://malough.weebly.com/comparison-of-medc-and-ledc-destruction.html. Text found on http://www.buzzle.com/articles/iompact-of-technology-on-education.html. Figure 13 found on https://bigconsumerblog.files.wordpress.com/2012/06/blog1206-education-img3.jpg
15	Text found on https://www.usatoday.com/story/news/nation/2013/12/30/climate-change-technologies/4041931/.
16	Text found on https://www.technologyreview.com/s/526491/agricultural-drones/.Figure 14 found on https://www.technologyreview.com/s/601935/six-ways-drones-are-revolutionizing-agriculture/.
17	Text and Figure 15 found on https://en.wikipedia.org/wiki/Green_building.
18	Text found on https://www.businessinsider.com.au/one-hamburger-environment-resources-2015-2/?r=US&IR=T, and http://www.techrepublic.com/article/10-foods-that-technology-has-transformed/. Figure 16 found on http://beyondmeat.com/products/view/beyond-burger.
19	Text and Figure 17 found on https://www.wikiwand.com/en/Maersk_Triple_E_class.Text found on https://www.technologyreview.com/s/516961/how-tesla-is-driving-electric-car-innovation/Figure 18 found on https://www.wired.com/11/tesla-grows-gives-free-charging/.