The impact of robotics on future societies

Humans and technology go hand in hand. The discovery of fire, for example, has affected the history of mankind dramatically. Not only has it allowed humans to exercise more control over their living environment, it also functioned as a catalyst in the development of humanity.

Inventions such as the eyeglass and the printing press had an enormous impact. The development of vaccines and antibiotics allowed humans to reduce mortality rates significantly from the late 18th century onwards. Fossil fuel use, electricity, the internet, the computer and many other robotics have improved efficiency and productivity in the past centuries.

Further inventions must thus be considered when thinking about the future. Technology offers considerable advantages, but it also has the capacity to have a negative impact. Population growth would cause crises that will force us to develop technologies that harm our environment. The use of robotics will also increase unemployment levels among humans. Technology could however, also be used to help falling populations create a sustainable society. Robotics could fill in the gaps in the workforce and assist where necessary, while scientific research could focus on sustainable improvements.

Inventions through the ages

The impact an invention has on society is largely dependent on how it affects productivity rates and efficiency. The discovery of fire allowed humans to exercise control over their habitat for the first time. Through time, they discovered fertilization methods and started to breed plants and livestock selectively. This allowed an increasing number of people to specialise in other tasks.

Various life-changing inventions emerged in the Middle Ages:

• The eyeglass allowed humans to extend their working life by overcoming eyesight deterioration, and led to the discovery of microorganisms.

• The water wheel made industrial processes, such as grinding grains, less labour-intense, and facilitated the discovery of the steam engine.

• The printing press enabled more humans to access knowledge directly.

• The mechanical clock enhanced punctuality and fostered precision and accuracy.

It was not until the late 18th century that mankind started to make rapid progress in the medical field, which increased longevity:
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• In 1796 Edward Jenner started experimenting with vaccinations and found a way to control small-pox.⁶

• In 1928 Alexander Fleming accidently discovered penicillin, which opened the door for the discovery of other antibiotics.⁷

These medical advancements allowed humans to improve individual productivity. Inventions from the Industrial Revolution era onwards have furthermore increased mass productivity:

• The steam engine, and later the internal combustion engine, increased production speed and made industries less dependent on natural resources.⁸

• Electricity has made automatization easier; it improved long-distance communication, and artificial light elongated the working day.⁹

• The invention of powered flights has made it easier than ever before to physically connect with people far away.

• The discovery of the synthetic resource plastic reduced production costs, providing a bigger part of the population with access to new goods.¹⁰

• The internet offers access to knowledge for many, and allows humans to rely less on their natural memory.

• Computers compute faster than the human brain and are more accurate.

• Domestic appliances have taken over many chores. This has given women more time for paid employment.¹¹

Likely scientific developments

Mankind will keep innovating. While new inventions will probably be less tangible than before, artificial intelligence is expected to progress rapidly. It is also forecast that existing products will be optimised.¹²

Robotics

Robotics could be utilised in a wider range of areas:

• The Bank of England believes that 15 million British jobs might be taken over by machines in the next two decades, as robots could become more intelligent, and could thus outperform humans.¹³

• Technalysis Research LLC predicts that the car industry could move closer towards developing a fully autonomous car equipped with driver-assistance improvements to make it safer.¹⁴

• According to the World Economic Forum, robots could be developed further to relieve people from the burden of mundane domestic chores.¹⁵

• Drones will likely be used more extensively. Consulting firm Deloitte predicts that commercial drones could become a billion-dollar industry by 2020.¹⁶ Amazon has already
stated that it expects to use drones in the future to speed up the delivery of goods.17

• The healthcare industry already uses 3D printing, and production industries increasingly do so. Gartner, known for its technological forecasts, predicts that the printing of transplantable organs might be achieved in five to ten years.18

**Medicine**

Physicians could rely more on robots to perform medical procedures to reduce the chance of errors and to speed up procedures. At the same time, scientific researchers will continue to develop cures and vaccines to eradicate the most life threatening illnesses of our time, such as cancer and malaria. Furthermore, they will continue with the development of artificial organs, presumably using 3D printers as predicted by Gartner.19,20 They will also improve nanotechnology to treat illnesses more locally, thereby reducing the potential for wider-ranging side effects.21

**Resources**

In response to an increasing demand for resources, technicians will probably aim to develop the equipment necessary to make the extraction of natural resources easier and cheaper than would otherwise be the case. At the same time, research could be conducted to find viable alternatives to fossil fuels. Biofuels using microbes and solar energy generators in space and on earth may be improved.22

**General implications**

Increasing the use of technological advancements in society has major implications for our environment and for the functioning of our societies. While many impacts are positive, others are not.

**Natural resources**

Given that the Earth has finite natural resources and that these face rapid depletion, it is of paramount importance that we use technology to relieve pressure on resources.

**Positive developments**

Technological developments could allow us to reduce certain resource requirements:

• Access to digital music and video would reduce the demand for physical CDs and films.

• E-readers may lead to a lower demand for physical books, thus saving trees.

• Communications software such as Skype allows humans to interact without the need for travel.

• New knowledge could be used to develop clean sources of energy, and clean industries. It would allow for further development of the
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Negative developments
Technological improvements could, however, provide humans with the tools to extract as much from the planet as possible, leaving less for future generations:

• Fossil fuels in areas that are currently too expensive to access might be exploited. This would both deplete natural resources further, and lead to an increase in environmental degradation.

• Agricultural advancements may enable more efficient farming, but such success has so far been accompanied by a reduction in biodiversity.24

• The use of radar will allow the fishing industry to fish more efficiently. Already, over 70 per cent of marine species are overfished due to these methods.25 This number would increase.

• Humans would use technology to control nature. More artificial islands akin to those in Dubai may appear, and mountain tunnels would be created with greater ease. While this may increase efficiency, it also increases the risk of natural hazards, such as flooding, landslides and earthquakes.26

• Humans may continue with the deforestation of rainforest globally to obtain resources and to create better infrastructure. This not only adversely affects the climate, it also reduces biodiversity and the number of medicinal plants that humans could use to develop medicines, many of which remain undiscovered.27,28

Society

Positive developments
Technology could offer more people access to public society and has the potential of extending our social lives:

• Robotics could support the elderly, the disabled and those who are sick. Moreover, technology can reduce loneliness by providing opportunities to connect with others more easily through Skype and other social media.

• Social media, the internet and Skype allow humans to broaden their horizons.

• Technology would make it progressively easier for people to work together and to share ideas. YouTube and TEDx are examples of this.
• It is progressively easier for people to provide services to others through the internet. This includes service providers such as Uber and Airbnb, and online trading platforms like Etsy.

Negative developments

The use of robots in industries and daily life could adversely affect social life:

• When robots replace humans in social jobs, a sense of alienation in humans may be induced. This could cause depression.

• The use of robots in the workplace could cause employees stress. Not only do employees risk replacement by robots, robots also have the capacity to track their movements. This dehumanises the workplace and creates mental and physical problems. 29

• Currently, many companies in the Western world have factories elsewhere. Whilst the circumstances in which many labourers work are a constant topic of concern, replacing all those who work in those factories with robotics would eliminate the livelihoods of many.

• Robots are faster and generally more accurate than humans in the jobs they perform. When various countries can afford to use robots, whilst others cannot, new inequalities would appear between developing and developed nations.

Ethics

• The increased use of advanced robots has created new morality debates. Among these are:

• There is no universal consensus on what is right and wrong. Robotics do not have the capacity to make moral judgements; these need to be programmed into them, and this can cause difficulties. A robot could make a choice on your behalf that you feel is ethically wrong. A robot car might choose to save you at the expense of a young child, but you might disagree with that decision. 30

• Robots are already used in warfare. An increasing number of armed drones have participated in wars since the Balkans conflict. 31 The existence of lethal robots creates a security threat should this type of robot fall into the wrong hands. What is more, it has been argued that the use of drones makes it easier for people to kill without being hindered by their conscience. 32 Loss of a sense of responsibility has enabled many humans to make morally abhorrent choices in the past, most notably during the Second World War.

• It is generally accepted that the life of a human is more valuable than the life of a robot. Yet, when society replaces humans with robots for increased efficiency and productivity at the expense of that human, an ethical dilemma emerges.
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Consequences for population growth

While the relationship between technology and population has been proven to be successful in the past, this will not always be the case.

Depletion

Exponential population growth leads to the faster depletion of natural resources. Population increase will lead to a higher resource demand, and it is likely that crises arising from scarcity will arise. Technology will surely create new sources of supply but, because people in crisis cannot wait until sustainable energy sources are developed, technology will likely focus on the development of less sustainable ideas. The combination of additional industries and additional people will heighten the strain that humanity already places on the environment.

Unemployment

In the industrial revolution, machines replaced simple human jobs and helped humans with more difficult tasks. This forced humans to upgrade their skills and turn to more sophisticated work. Robotics today are more intelligent than previously and are expected to replace humans completely in a wider range of mid-skilled jobs.

The UKs unemployment rate is forecast to fluctuate between 5 – 5.5 per cent between now and 2020. Should robots indeed start replacing humans on a wider scale, this number could rise dramatically. Given that the UK population is projected to rise from 64.4 million in 2014 to 70 million by 2027, it seems inevitable that society will face higher unemployment when more robots are utilised.

Consequences for population decline

The fact that inventions have allowed humans to increase productivity and efficiency throughout the ages offers falling populations a hopeful outlook.

Workforce decline

Falling populations generate a fear of a shrinking Gross Domestic Product (GDP) due to a smaller available workforce. While GDP decline is a realistic fear, there is evidence that the current workforce is not utilised efficiently:

- A third of all employers in the UK report that they have employees whose skills are underused.
- The percentage of highly-educated individuals in the UK increased from 26.8 per cent to 37.5 per cent between 2003 and 2013, and is projected to reach 46.5 per cent by 2020. Yet employers claim that the UK faces serious skills shortages.

More efficiency and productivity can be achieved when skill supply and skill demand are more in line with one another. This will require humans to train themselves in highly-skilled jobs, in which they hold a comparative advantage over
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Given the projected increase of highly-educated individuals, this seems possible. Robots can then fill the gaps that emerge in lower-skilled occupations.

The UK currently uses 190,000 industrial robots. While this is but a tenth of the number of industrial robots utilised in Germany, it is expected that an investment of £1.2bn in robotics automation will add £60.5bn to the UK’s economy.

Access to employment

Technological advancements can enable a larger proportion of the population to access the workforce. They can do so in the following ways:

• Technology could support humans when their careers are threatened by their own physical deterioration. Robots could perform physically-demanding jobs, which would allow humans to focus on more intellectual tasks.

• People with disabilities often experience difficulty when accessing the job market. Robotics could improve their mobility and offer them a voice. Assistive technologies, such as the Intel communicative system used by scientist Stephen Hawking, would be developed further, for example.

• Inventions such as Skype would allow those who are either incapable of traveling, or work remotely, to attend meetings regardless of geographical barriers.

• Robotics could help humans with an increasing number of domestic chores.

Consequences for ageing societies

At present, the proportion of elderly people is growing in many developed nations, including the UK. It is expected that these societies — followed by developing nations — will face further ageing in future years. Ageing societies would also benefit from the improved ease with which people can access the workforce. Furthermore, ageing societies can use robotics to lessen the strain on healthcare services and to combat loneliness among the elderly.

• The development of improved medication and vaccines would allow humans to live longer, healthier lives. It has so far been the case that most health costs occur in the last years of people’s life. This would then likely remain unchanged.

• Robots could assist medical staff during operations and check-ups. This would reduce both costs and the number of errors, whilst increasing efficiency and speed.

• In the UCSF Medical Center (USA), robots are used to carry out easy tasks such as delivering meals and medicine. This has allowed the hospital to reduce costs and enable staff to spend more time on the social aspects of their job.
Robots may similarly assist elderly people in their homes, which would allow them to live independently for longer. Japan and Germany — both facing ageing and falling population numbers — are currently experimenting with the use of such robots. So far, most elderly people are happy to let robots carry out impersonal mundane tasks. 49

Technology could also reduce loneliness amongst the elderly. On the one hand it would improve mobility, allowing elderly people to remain socially active for a longer time. On the other hand, software such as Skype makes it easier for people to keep in touch with one another without needing to leave the house.

Conclusion

Human progress and technology are interlinked. While this type of progress has been positive in many regards, it is far from certain that this will always be the case. In order to create a sustainable society, it is imperative that scientific research focuses on improvements that positively impact human societies and our natural environment.

In order to allow such developments to take place, there must be ample space and time. Population growth will intensify the crises that the world already faces, and people in crisis do not have time to wait for the development of sustainable technologies. This will force technicians to focus on the development of technologies that solve a crisis quickly, but these are often damaging to the environment. Anything that causes rapid environmental depletion will ultimately fail to provide a durable solution. It merely buys time.

A falling population would offer scientific researchers more time to develop new sustainable technologies, as it would increase the longevity of finite natural resources. The use of robotics in the workforce would compensate for any productivity challenges a shrinking population might cause, without increasing unemployment levels.

Whilst the incorporation of robotics into society will certainly create serious ethical discussions, it appears that a falling population, through technical stimulation, could ultimately lead to a more sustainable society and living environment.

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