

Technological Change and Innovation
BMSP5001

Assessment 1

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'The Internet, like the steam engine, is a technological breakthrough that changed the world.'

(Singer, 2010)

Introduction

The purpose of this essay will be to critically evaluate the impact of technology and innovation on the development of economies and societies, with consideration given to the above quotation throughout. The first topic to be discussed is the impact of the internet on the world, followed by that of the steam engine. Theories linking these technological innovations will then be drawn upon for a critical analysis of their impact on societal and economic development.

The Internet - its nature and its impact

Singer's quoted article, found on the Project Syndicate website, contains some interesting points regarding the internet, its nature and its impact that are worth a mention. The first point to be brought up is a rather eloquent description of the power that an internet user holds;

'you have at your fingertips an amount of information previously available only to those with access to the world's greatest libraries ... and it is incomparably easier to find what you need.'

This quote aptly explains that widespread use of the internet has given rise to an unparalleled information revolution. To put this into perspective, the 'big four' companies - Google, Amazon, Microsoft and Facebook - stored 1,200 *petabytes* of data between them as of 2014, much of which is at the disposal of the user within milliseconds. (Mitchell, 2014) In comparison, the Library of Congress holds approximately 171 million items which can only be viewed at its physical location. (Library of Congress, n.d.)

The second point to be raised is a testament to the freedom of expression that the internet harbours. What the internet stands for today was not born out of central planning or tight control but combined grassroots efforts. As Eric Schmidt once said, the internet is the 'largest experiment in anarchy that we have ever had.' (Quote Master, n.d.) Naturally, the effects of this so-called 'largest experiment in anarchy' have been profound on the economy - the internet has become a giant digital marketplace of sorts, and one only needs to look at Silicon Valley, banking megacorporations and modern home computer use to see the change that it has brought about.

Last is an attestation to the viral nature of the internet, even in censored areas such as China. After a website reported on the aggressive actions of the governor of China's Hubei province against a journalist, the page was up for only 18 hours before being censored - despite this, the news of this event was already widely dispersed by the time that it had been taken offline and his actions were widely condemned. If the internet has expanded the avenues of expression for people living in one of the world's most authoritarian and restrictive countries, then it's safe to say that this effect is present in other countries too. In fact, we need not rely on assumption for this because we can look at the social media giants Facebook, TikTok, Twitter and Instagram - with just the right content pushed out at just the right time for optimal engagement, one can game the system and create a new viral trend. Popular trends over the last decade include the 2014 ALS ice bucket challenge, which ultimately increased The ALS Association's funding by 187 percent (ALS Association, 2019); the TikTok tooth filing trend which lasted throughout 2020 (Chiu, 2020) as well as a challenge involving people jumping out of moving cars and dancing to music by Drake. (Lyons, 2018) It is clear that social media has the potential for both good and bad, either through helping to raise funds for research into ALS or through getting young people to DIY-file their teeth and jump out of moving vehicles and put themselves at risk.

A critical point about Singer's quote appears only once interpreted through a modern lens. As of writing in 2021, the internet has been extremely commercialised. Cutting edge research into the humane psyche has allowed for subconscious manipulation of consumer reactions to generate the most engagements. Companies can appeal to their audience's emotions; they can use persuasion, whether it be through celebrity endorsement or the classic '9

out of 10 doctors support...'; they can even use colours, owing to their distinct subconscious effects. (Glint Advertising, 2017) In short, the modern internet has been driven much closer to perfection as an economic tool. Compare this to the internet of the 2000s, the decade as a lens through which Singer interpreted the internet. This decade in the internet was defined primarily by exploration and community, and it could very much be said that the internet was still 'finding itself' - the following articles found on The Daily Edge (Loftus, 2014) and CNN (Kim & Hare, 2018) allow for greater understanding into internet subculture in this regard. It can therefore be said that Singer's quote was based on an internet that had not yet reached its full commercial potential - perhaps Singer might not have known just how much it would change the economy.

The steam engine

Singer also mentioned the steam engine in his quote. He is correct in saying that the steam engine changed the world. Other innovations that the steam engine led to include the reciprocating engine, the steam turbine, and most importantly, but perhaps indirectly, the internal combustion engine as the primary means of locomotion in vehicles. (Britannica, 2020) Examples of the influence of the steam engine are that it permitted the building of factories anywhere, regardless of local wind and water resources; it drove forward the revolution in automation which caused a major demographic shift; and most importantly, led to the creation of the steam locomotive and the railway, which revolutionised the world economy and is still in use today. (Holevas, 2016) As with the internet, the world would be unrecognisable if the steam engine had not been invented: factories would still be forced to locate next to areas with plentiful natural resources, the revolution in automation would have been hindered and the railway and its revolutionary effects on locomotion likely would not have come about.

However different the steam engine may seem to the internet, there is one similarity between the two: the fact that both *were* technological breakthroughs, and that both changed the world. While their impacts were different in both time period and area of change - the internet revolutionised the way humans communicate, obtain information and do business and is regarded to have been 'born' in 1983 (University of Georgia, 2001), while the steam engine revolutionised locomotion, trade and production and was invented in 1698 with a hand-operated pump (Britannica, 2020) - they both *had* an impact and this is what unites them.

Kondratieff cycles - what are they, and what are their relevance?

In the 1920s, Nicolai Kondratieff - the then-director of the Institute of Conjecture in Moscow - studied the history of the largest capitalist countries. His findings that capitalist economies often fall and recover over long periods (45-60 years per wave) led to the discovery of a new model, named Kondratieff Waves. (Nefiodow, 2014) This model, although disregarded as unorthodox by the mainstream, dictates that continuous technological innovation causes a long-term economic cycle of ups and downs. (Ganti, 2021)

Economists have plotted five Kondratieff waves of importance; the first began in the 18th century with the steam engine, lasting until 1830; the second came about as a result of the steel industry and the rise of the railroad, lasting until 1880; the third gave rise to two new industries, those being the electrotechnical and chemical industries, running until 1930; the fourth wave was brought about by the petrochemical and automobile industries, continuing until 1970; and, lastly, the fifth wave was a result of modern information technology. Each Kondratieff wave revolutionised both societies and economies worldwide in different ways, bringing about different ways of working, living and communicating, although no Kondratieff wave has revolutionised the world to the degree that the fifth has; thousands of years of the same traditions were disrupted when information technology gave rise to globalism and the idea of a 'global village'.

An important point to note is that Kondratieff waves tend to end in a large economic downturn; (Ganti, 2021) if this is to be regarded as predictable for each cycle, then one can look to the bursting of the dot-com bubble from 2000 to 2002, or perhaps the 2008 financial crash, as a potential kickstarter for a new wave. The implications of a healthcare and biotechnology-related upturn on society would be enormous - science fiction pipe dreams such as specification-produced limbs; accurate and rapid machine-based diagnoses, or potentially even readily accessible cures for previously incurable conditions of the brain, such as Alzheimer's, Parkinson's and et cetera. Not only will

societal demographics such as average life expectancies, retirement ages and childbirth mortality rates drastically change, but the potential for new markets and ways of making money through provision of products and services will also open up to a massive extent.

On the other hand, a balanced and critical analysis demands that we stay grounded and do not stray into the unreasonable. In the interest of pursuing an empirical insight into the possibilities brought by a sixth wave, we will draw from an article by Simone and Leo Nefiodow - the pair collected evidence which told of a newly emerging healthcare sector, primarily involving biotechnologies and environmental sustainability, while also shining the spotlight on self-medication and alternative treatments such as acupuncture and homeopathy. (Nefiodow & Nefiodow, 2014, p. 339) The implications of these findings mean that these science fiction pipe dreams will likely stay pipe dreams for the foreseeable future.

McLuhan's interpretation of technology

Marshall McLuhan (1911-1980) is best known for his studies into the effects of mass media on thought and behaviour; in addition to one of his works, *'The Medium is the Message'*. (Zingrone & Reeves, 2012) The aspect of his work that will be covered is the relation of technology to the human.

McLuhan argued that every medium represents an extension of a human faculty - clothing of the skin, the wheel of the foot and electric circuitry of the central nervous system. He noted that the extension of any one sense displaces the other senses; this alters the way in which we perceive and interpret the world around us.

(matsutakneatche, 2009) This interpretation can also be applied to the development of society and economies; the innate human faculty of connecting has been enhanced by social media and businesses have, in many cases, played on this innate faculty as a way of making money. Hence, an extension of an existing faculty brings about new ways of doing things in society as well as new ways of making money by taking advantage of these things - thus technological innovation results in the development of societies and economies.

McLuhan also devised the 4 laws of media; the foundation of this theory is that, in today's postmodern culture, new technology is our world in which we live and our atmosphere in which we breathe. These 4 laws are enhancement, which is what the media extends or improves; obsolescence, which is what the media replaces or renders unneeded; retrieval, which is what old idea the new media revives; and reversal, which are unintended opposite effects that the media creates.

Looking at the car as an example of McLuhan's 4 laws, it enhances our mobility, allowing for much faster and further movement; it replaces the horse and carriage as the primary mode of transportation as it is faster; it retrieves the charm of a knight or paladin with the implied masculinity behind owning a flashy, sporty car; and lastly, the unintended effect (reversal) of the car is the traffic jam, as the enormous uptake of cars led to the thing designed for getting somewhere faster ironically getting stuck in gridlock. (Farrar, 2014) Based on this example, it is shown that the car has led to the development of societies and economies by replacing a previous technological innovation and reviving an old, chivalrous social tradition of a knight in shining armour through the glamour of owning a flashy car.

Conclusion

Throughout this essay, thought has been given to how different technologies and innovations have led to the development of economies and societies. The Kondratieff Cycle model has been referenced to plot six innovations of importance (the steam engine, the steel industry, the electrochemical industry, the petrochemical and vehicle industry, the information technology boom and the up-and-coming healthcare boom) and their impact on the development of societies and economies. Moreover, McLuhan's theories about media as extensions of human faculty have been covered as a way of understanding the impact of technology and innovation from a unique perspective.

Overall, the findings of this essay are that technology and innovation impact on the development of economies and societies in many ways. Linking McLuhan and Kondratieff's work together, with each wave came a new series of innovations which would alter humanity's experience in the world and shape the world forevermore. Technological innovation has occurred since the dawn of humanity and will occur for as long as the species lives on, owing to our curious nature and thirst for understanding. With each innovation, economies and societies adapt and change.

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