The Digital Revolution

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Abstract

The introduction of the steam engine started the industrial age, and introduced mechanized production. Later, the power of electricity is harnessed, followed by the mass production; each resulting in increased productivity.

With the introduction of computers, and later robotics, human labourers started to give their posts to robots, so the repetitive and/or potentially dangerous process of manufacturing become automated. The rapid computing of huge data masses relieved some of the human workload in almost any industry.

With the advent of internet, the information is shared rapidly among humans and machines. The machines are fitted with sensors and actuators, enabling the machines to collect data, and perform tasks. By sharing information between themselves over internet, the machines can be controlled remotely, by a human and/or a central computer. Which in turn grants speed and flexibility to everyday actions in a ton of ways.

All these technological advances change the lifestyle of the mankind. They replace previous professions with newer professions, which require human operators to learn a new set of skills; where most of the time, the younger generation adapts quicker than the older generation. This situation, especially when the older generation is dominant in administrative and/or governmental positions, may affect the efficiency of technological advance.

This paper examines the effects of this latest technological advance, the digital revolution. Paper covers its potential usage, possible obstacles along the way, its positive and negative impact, and suggested methods for spreading its influence globally.

Keywords: 4th Industrial Revolution, Digital Revolution, Technological advances
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Introduction

There are three reasons why today's transformations represent not merely a prolongation of the Third Industrial Revolution but rather the arrival of a Fourth and distinct one (Schwab, 2016):

"Velocity, scope, and systems impact. The speed of current breakthroughs has no historical precedent. When compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, management, and

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governance… Overall, the inexorable shift from simple digitization (the Third Industrial Revolution) to innovation based on combinations of technologies (the Fourth Industrial Revolution) is forcing companies to re-examine the way they do business. The bottom line, however, is the same: business leaders and senior executives need to understand their changing environment, challenge the assumptions of their operating teams, and relentlessly and continuously innovate".

The industrial revolutions throughout the history drastically shifted how things get done, and the fourth industrial revolution is no different. In fact, the fourth industrial revolution, or the internet, provided instantaneous communication between humans and machines. It opened up so many avenues of innovation, in the end how businesses operate and how it affects humans has fundamentally changed.

In this article, we will briefly look at the history of the industrial revolutions up until the fourth industrial revolution before examining its impact to the world, and how it changes the business models.

1. The history of industrial revolutions

1.1. Powered machines and factory establishments

The invention of several machines that use steam and/or water power replaced hand-working and manpower to produce goods, and increased their productivity. While some of the smaller machines were affordable, more powerful machines were too expensive for just one individual to own. This led to the establishment of factory systems.

As a result, some smaller production units that are unable to acquire these machines started to decline from the mainstream production, as they could not keep up with the output pacing of machines and factory establishments: The machines used to produce things needed less skill to use, and could produce more units far quicker than a hand-worker.

1.2. Mass production

In the first factories, each individual worker used machines to build a single piece. While it was faster than a hand worker, each piece was still produced at the speed of an individual. With the assembly line, the work piece started to move in a line while each step added to it. Each piece comes out finished at the end of the line. Workers stood on a fixed station, and added their part to the passing work piece.

Instead of a single individual, or a small group that has a lot of skills and knowledge doing all the work; the job is broken down into smaller pieces, each done by single individual. Each workpiece required one basic, specialised skill, so the workers are trained very quickly.

1.3. Electricity and electrification

The steam engines had to be very powerful to be efficient, and its equipment needed a lot of maintenance work. These factors made them very costly and less cost-efficient as they grew in power, with alternative power sources like horses were more viable.

Moreover, especially in smaller jobs, the power demand was less than what a horse can produce, so the power produced by steam engines were far too excessive.

The introduction of electrical power provided a cheaper and more reliable source of energy. Gradually, the electrical power produced and distributed cheaper with far greater efficiency. Electrical motors, with their better efficiency and precision, found more and more use in everyday life, including production lines, trams, etc.

1.4. Computer technology and robotics

"The "brain" [computer] may one day come down to our level [of the common people] and help with our income-tax and book-keeping calculations. But this is speculation and there is no sign of it so far" according to the British newspaper The Star in a June 1949 news article about the EDSAC computer, long before the era of the personal computers.

The first computers were giant, room sized monoliths that guzzled up a lot of power, only to do the four basic mathematical equations. Later on, as the technology advanced, their computational power increased, while their size and cost decreased; and with the personal computers, more and more people started to use them. Computers became more than mere calculators, they became a very handy tool for handling and storing large amount, and variant of, data. Which enabled a substantial enhancement of capacity in almost all types of jobs.

As the computers advanced, so did the field of robotics. There were many early "automata" found as earlier as third century B.C. where a Chinese "artificer", which may be described loosely as a mechanical engineer, presented his king a human-shaped replica of the king himself (Needham J., 1991). The digitized robots started appearing in 1930's, with the "Elektro", a (very basic) humanoid robot that can walk, talk (using about 70 words), smoke a cigarette, blow up baloons and move its arms and legs, with a very simple set of voice commands.

The Unimate is known as the first industrial robot. Built in 1961, in General Motors assembly line in New Jersey, it was used for transporting and welding die castings into automobile bodies, effectively taking over a task that is hazardous for human workers. It followed a set of instructions recorded on a magnetic drum. Today, robots can be dynamically driven by computers, which can manipulate the robot's actions according to a set of parameters, and/or a series of sensors.

1.5. Internet, communications and remote access

With the advent of the internet, communication between multiple computers become possible. Started what was known as ARPANET, a military project to link military computers together to share information securely, the internet grow into a huge network of computers what is known as "World Wide Web" over time. More and more devices connected, expanding its capacity. Larger and larger amount of data started to travel faster and faster between computers; which allowed sharing larger information between multiple people and/or computers, independent of their real world location or time. This speed of communication, and level of accessibility

brought efficiency to teamwork across the world, especially facilitating international businesses and collaborations.

With the mobile technologies, internet become accessible anywhere. Anyone can access a private sector or governmental service provided on the internet at anytime, anywhere, instantly.

According to Schwab (2016):

"In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies" and for these purposes a "thing" is "an object of the physical world (physical things) or the information world (virtual things), which is capable of being identified and integrated into communication networks"

The mobile technology also allowed multiple devices to share information through the internet. This network between devices is also known as the "Internet of Things", or IoT. The devices could be accessed and even controlled remotely through the internet by this way, which in turn improves efficiency and accuracy of operations while making them more cost-effective and demanding less human input. Almost all jobs could be automated, facilitating their operations.

Another interesting subject of study is the advances in Artificial Intelligence, or AI. The computing power of computers has become quite strong, and with the aid of the internet, powerful computers shared their work, multiplying their powers. This amount of computing power enabled highly sophisticated artificial intelligence solutions to solve complex problems such as predicting sales, buying and selling stock, and vice versa; basically creating a virtual assistant.

2. Impact of Industry 4.0

In each industrial revolution, there were shifts in professions. Older professions evolved into newer ones, or left their place to newer types of professions. Previous industrial revolutions have shown us that if companies and industries don't adapt with new technology, they struggle. Worse, they fail (Keywell, 2017).

The fourth industrial revolution is no different: As more jobs become computerized, they replaced humans, especially in the areas of manual labour. A research done by Carl Benedikt Frey and Michael A. Osborne in 2013, predicts that the most probable job areas where computers take over major part of human work is in transportation, logistics, bulk office, administrative work and manual labour production. Jobs that require creative and social skills are the least likely to be replaced completely, however the computers assist in this job areas. The future human workers will have to learn new creative and social skills, and move into jobs that require them. (Frey and Osborne, 2013)

The communication between machines can substantially improve how humans live, by constantly providing information to where it is required. A person in need of a service can reach it in very short periods of time, which enables them to do multiple

tasks with ease. This kind of living quality requires sharing of collected information, which in fact is substantial in our present day, thanks to all our mobile devices. However, not everyone or every organization wants to share information; mostly because of privacy, or commercial concerns.

According to Palti (2017):

"As robots increasingly take on manual labor, we will need to foster what differentiates human from machine (at least for now): creativity. Evidence that psychological and physical well-being is paramount to creative thinking will turn the historic exchange of human health for economic growth on its head".

As Klaus Schwab, founder of the World Economic Forum writes:

"I am convinced of one thing—that in the future, talent, more than capital, will represent the critical factor of production."

As previously mentioned, the advances in Artificial Intelligence does complex decisions far easier and faster than their human counterparts. While still limited in utilization, Artificial Intelligence is mainly used by searching and recommendation engines (Kats, 2017) (Figure - 1).

Figure - 1: Distributed usage of Artificial Intelligence according to their retail uses. *(Source: Kats, 2017)*
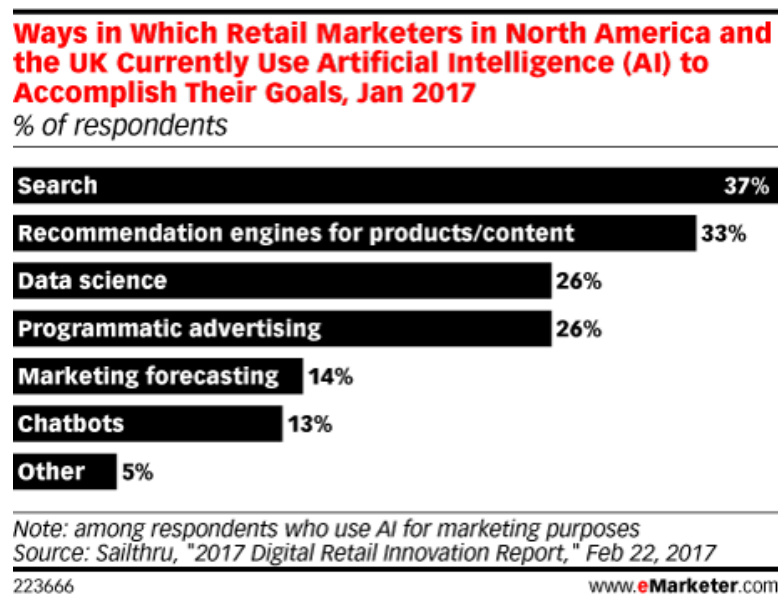
While computers, AI and robots certainly replaces humans in various jobs, it also creates more, different business opportunities: the machines work quite faster and more accurate, yet they may breakdown, and will need service (Brodie, 2017). Furthermore, software engineers has to create the computer algorithms necessary for the AI. Also, while algorithms can predict results, sometimes a human interpretation is required, especially if there is a job or even an event that requires AI to be creative; such as an emergency situation requiring fast reaction.

The world will always need human brilliance, human ingenuity and human skills. Software and technology have the potential to empower people to a far greater degree than in the past—unlocking the latent creativity, perception and imagination of human

beings at every level of every organization. In short, when the mechanic and the technology work together, the work gets done faster, with fewer errors and better results. Machines will supply us with the insight and the perspective we need to reach those solutions. But they won't supply the judgement or the ingenuity. People will (Keywell, 2017).

The digital revolution has brought immediate private benefits—easier communication and information, greater convenience, free digital products, and new forms of leisure. It has also created a profound sense of social connectedness and global community (Eşkinat R. 2016).

3. Conclusions

The fourth industrial revolution increased communication of information between humans and machines, allowing work to be done remotely. Advances in artificial intelligence enabled computers to be used as a virtual assistant in many fields that required processing complex data, while tracking multiple variables such as ever-changing economic status of the world. This lessened most of the workload for humans, allowing them to focus on the bigger picture for their work.

Since most of the menial tasks are handed over to the computers, in the future humans would gradually move to jobs that require creative and social skills, using the computer and AI technology as their assistants.

The first three industrial revolutions changed how the product been made, and increased the output and efficiency. But they focused on the production. The fourth industrial revolution is focusing more on the people, and their empowerment by the rapid communication of data. It may significantly improve the standards of everyday living. The sharing of information is essential for such a life, which isn't a desirable thing for some, for various concerns. Future societies must overcome this barrier, if they want to live in such wealth.

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