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The Future of Labour in a Digital Economy

How Technology is Changing the Nature of Work

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This thesis examines how artificial intelligence and new technologies affect the nature of work, and explores the aspects of power, society and technology. The first part of the thesis covers the current literature on how new technologies could change work life and the way work is performed and structured at the workplace. In addition, polarization and automation effects on different skill-levels will be discussed. The second part of the thesis explores the relationship between technology labour productivity, and manufacturing growth, as well as implications to the service sector and the importance of knowledge in modern corporations.

The thesis is an extended literature review based on secondary data and uses qualitative research. There exist many published works on the topic of technology and work as well as the power relations in technology. The thesis aims to combine these to understand and analyse the causalities in them.

The thesis finds that technology in itself does not cause serious unemployment, however, increasing labour productivity together with decreasing manufacturing growth, technology will be a cause for unemployment. A sufficient growth in the economy would be needed in order to maintain a demand in labour in manufacturing. Despite the growing demand for services, the service sector does not have a similar employment and productivity boosting effect as manufacturing. Knowledge and data have an increasing importance in the economy, and the digital economy would seem to be creating work at the high and low end of skill levels, which creates polarization in society.

Keywords	Technology, Automation, Labour, Polarization

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1 Introduction

Automation and technological unemployment have received a lot of attention in the public and in research in the recent years. New technologies of artificial intelligence are introduced and presented to be able the perform tasks previously considered outside of machine capability. The central interest has been in whether these new technologies would cause unemployment not only in manufacturing but at all sectors of the economy. Technological anxieties about machines replacing labour are by no means new. In early industrialization era England, from 1811 to 1813, textile workers who suffered lowering incomes and unemployment due to large-scale machinery in factories attacked and destroyed these machines as protest (Hornborg 2014a: 129). This so-called Luddite movement is an example on how insecurity about the future and means of living can cause people to take irrational actions towards inanimate objects, that are in essence means of power. People today are also feeling the insecurity brought by automation and technologies, and it has spread to all aspects of life aspects of life affecting health and wellbeing. Technological change has been thought to be a cause for the polarization of society contributing to the creation of political populism.

The aim of the thesis is to explore the current literature on the changing nature of work in terms of new technologies and artificial intelligence, supported by different aspects of power, society and technology. The thesis will try to find answers for the following question:

How will artificial intelligence technologies affect the nature of work?

The first part of the thesis covers the current literature on how the introduction of technology innovations could change working life and the way work is performed and structured at the workplace. The discussion on technological change in the work life revolves around a few different scenarios of this time is different and that no real change will occur. A conservative scenario offering a critique of both of these scenarios is also presented. A key aspect in the discussion is the polarization of work life and how automation affects work in different categories in different income levels and on skill-intensity. Temporary and flexible employment have been further enabled to new technological platforms and have contributed to the creation of a gig-economy. While

temporary employment can provide freedom for some it can create uncertainty and irregular income for those who are forced to take on temporary employment.

As an important aspect the thesis will also explore on *how power relations affect the development of technologies*? Power relations play a significant part in the direction, form and speed of the development of new technologies and how those technologies are implemented. As technology is often viewed to be replacing work in order to reduce costs and increase efficiency, technological change is viewed from a Marxist perspective as a critique to capitalism. In the digital economy the importance of knowledge and data at the centre and in the focus point of modern corporations. Unequal exchange and feminist theories provide perspectives on the views of power structures in technology.

The second section of the thesis explores the relationship between manufacturing and technology, the growing importance of the service sector and the digitalization of the service sector. Ongoing research suggests that automation and robotization might not cause the level of unemployment feared by earlier theorists. Labour productivity has not increased rapidly despite new automation and artificial intelligence technologies. However, together with stagnating economic growth technology could lead to increasing unemployment. The importance of the service sector in the share of employment increases as living standards rise, and services have become easier to trade with digitalization. The importance of owning capital and means of production have started to shift towards the importance of having knowledge and data.

2 Literature review

The effect of technology and artificial intelligence on employment is a widely discussed topic, and the anxieties of the combination of the two goes far back into the history of industrialization. Different theories on the future of work and society vary from very little change to never before seen change. In addition to new technologies and their affect, the forces acting behind technology need to be considered, as technology does not have intrinsic agency. New technologies have brought change not only in the way people work, but also in the way companies perform research and innovate, but also the way they manage their business. First part of the theoretical framework covers the current theory on technology and unemployment, while the second part focuses on

power relations on the development of technology, technological progress, and social aspects of technology.

2.1 Artificial intelligence and unemployment

The concept of technology and technological process in this thesis are understood as automation and robots, and technologies of artificial intelligence and machine learning in particular, as replacing human workers in the workplace. Akerkar (2019: 3) explains artificial intelligence to be “manifold tools and technologies that can be combined in diverse ways to sense, cognize and perform with the ability to learn from experience and adapt over time.” Machine learning is a sub-field of artificial intelligence and can be defined as computational methods using experience to improve performance or to make accurate predictions (Akerkar 2019: 19). “Machine learning applies statistics and inductive reasoning to supply best-guess answers where formal procedural rules are unknown” (Autor 2015: 25).

There is no scientific or political consensus on the effects of artificial intelligence technologies on unemployment, with different scenarios of change varying from mass unemployment to artificial intelligence creating better future for all humanity (Pulkka 2017). However, three main scenarios of the future can be identified in the discussion of technological change. The three different scenarios are: no real change will occur, this time is different scenario, and a conservative scenario. This time is different scenario includes two different stances of optimistic and pessimistic points of views. The different scenarios will be further looked into in section 2.1.1. In addition to the different scenarios of change, it is also important to consider how power relations affect the form, direction, and outcomes of new technologies (Spencer 2017).

2.1.1 The different scenarios of change

The supporters of the no real change -scenario base their analysis on history. According to this school of thought people have been able to re-educate themselves for new work in previous revolutions when technology was feared to replace human labour (Pulkka 2017). The no real change position has been presented by economists Gordon (2014) and Cowen (2011), according to whom new technologies do not have as significant effect on productivity as steam, electricity or the internal combustion engine

(Boyd and Holton, 2018). In this line of thought, technological unemployment will occur in the short or medium term, however, in the long-term more convenient work and higher living standards will result for the majority. This is based on an economic model that in the long run productivity growth will stabilize demand for human labour (Pulkka 2019). The key policy recommendation to answer to unemployment is to invest in education (Pulkka 2017). Makridakis (2017) uses the term doubters for the supporters of this school of thought. The doubters do not believe artificial intelligence could become a threat to humans. They state that despite advanced algorithms and computer power, artificial intelligence will not be able to replicate the human mind, especially creative thinking and breaking rules in order to achieve creative breakthroughs (Makridakis 2017).

This time is different scenario is based on an analysis suggesting that the development of artificial intelligence technologies is exponential (Pulkka 2017). Recent research would indicate that at some non-routine cognitive tasks can be performed by robots and that the service sector is under considerable threat, even though these have been previously considered to be out of the reach of artificial intelligence (Boyd and Holton 2018). Two different stances can be distinguished in this time is different scenario, optimistic and pessimistic.

The optimist suggestion is that new technologies will create a better future for all where everyone benefits. Some optimists even predict a utopian future where the development of nanotechnology and robotics allow humans to harness the speed, memory capacities and knowledge sharing ability of computers (Makridakis 2017). Important authors presenting the optimistic point of view are Brynjolfsson and McAfee whose book *The Second Machine Age* (2014) is a popular base of reference in most of the discussion on artificial intelligence and unemployment. An important reference for the discussion for Brynjolfsson and McAfee is Moore's law, which in essence states that computing power doubles every two years (2014: 40-41). Brynjolfsson and McAfee (2014) present that technologies are like building blocks, and the exponential growth in technology is due to the fact that new technologies are built on the basis of existing technologies. Despite their overall optimistic views Brynjolfsson and McAfee (2014) acknowledge that technologies will lead to inequality and the creation of winner-take-all markets due to digitization. New technologies create historic amounts of wealth to the owners of capital who use the technologies to reduce the income going to labour, which further emphasizes the gap between the high-income and low-income spectrum

(Brynjolfsson and McAfee 2014). The building blocks of technologies allow for the creation of so called ‘superstars’ who reap larger and larger benefits from the digital economy.

Moore’s law has received critique that it is slowing down or is no longer applicable at all. This is due to that the size of transistors is becoming so small that it is becoming technically difficult to increase the number of transistors in given equipment (Tibken 2019). Critics state that Moore’s law is impossible, worrying that technological innovation in electronics will become more difficult. However, new innovations in how transistor chips are stacked is proving to keep the trend of Moore’s law ongoing, however, it might be slowing down or become more costly (Tibken 2019).

Similar to Brynjolfsson and McAfee, Mokyr, Vickers and Ziebarth (2015) present the optimistic point of view, arguing that technology and automation will create a long-term trend of greater leisure for the working population, and imagine a scenario where the people working are the ones that wish to do so. Since the introduction of industrial technologies, the amount of leisure has increased over the medium and long term and people are continuously working fewer hours per week (Mokyr, Vickers and Ziebarth 2015). The argument reflects back to human history of having a leisure class, consisted of mostly landowners, arguing that work ethics and attitudes towards work might not be universal to all humans (Mokyr, Vickers and Ziebarth 2015). Makridakis (2017) also reflects the upper-class aristocrats who spent their time in leisurely activities and goes as far back as ancient Greece where it was the slaves who did all the work while citizens enjoyed their leisure. The leisure class, being consisted of wealthy landowners, had the privilege and choice in not choosing to work.

The ideal of increasing leisure time due to technology is in no means new. In the 1930s John Maynard Keynes predicted a shorter working week with increasing leisure time, stating that increasing living standards would satisfy material needs (Elliot 2008). Despite rising living standards in the west, people have not transitioned to a four-day work week, and workers in west are working longer days to face the competition from east (Elliot 2008). Work can also be a pleasure and bring social interactions and a sense of achievement. Rising income inequality has caused a widening gap between the top earners and lowest earners as well as within income classes. People with low pay are forced to work long hours while widening gaps in income are incentivising those in higher earning groups to work longer days in aspiring to afford the living

standards of the wealthier (Elliot 2008). The low-skilled people forced out of labour due to technology will not have the same opportunity to choose leisure, as the leisure classes of history.

The pessimists of the this time is different school of thought on the other hand state that without functional policies new technologies will create mass unemployment, strong competition for the remaining jobs, declining salaries, increasing inequality, and a rise in social tension (Pulkka 2017). The pessimists also present that eventually machines will be in control of all important decisions with people dependent on them and afraid to make their own choices (Makridakis 2017: 50).

Pulkka (2017) presents his own conservative scenario which lies in the middle grounds of the previous two scenarios and emphasises the polarization of work and weakening purchasing power. The conservative scenario holds that the far ends of the two previous scenarios of overconfident optimism and speculation of mass unemployment do not provide a constructive basis for future policies (Pulkka 2019). “Given the technological possibilities, a conservative scenario suggests that there will be at the very least short- and medium-term disruption to labour markets” (Pulkka 2017: 299). Demand for high-skilled tasks will increase, as well as demand for some low-skilled tasks, however, it is the middle-skill tasks that are predicted to disappear, creating polarisation in the job market. Pulkka (2017) also suggests that whichever the scenario, the problem will be insufficient consumer demand which will have an impact at the macroeconomic level and predicts a weakening purchasing power, which needs to be taken into consideration in future policies in order to stabilize the digital economy.

Despite differences in the views on the rate of change, a commonly shared view is that the labour market will become polarised. “In some countries, the reduction in the demand for workers with middle-level skills has reinforced competition for lower-paid jobs which has held down wages in the bottom half of the earnings distribution” (OECD 2016: 4). In much of the discussion on automation and unemployment a prediction by Frey and Osborne (2013) is referred to stating that 47% of today’s jobs will be replaced by artificial intelligence (Pettersen 2018). However, the Organisation for Economic Co-operation and Development (OECD) state that only 9% of jobs are at a high risk of being automated stating that it will be certain tasks that can be automated rather than entire occupations (OECD 2016). Autor (2015) also suggests that work is consisted of tasks, that can be divided into routine and nonroutine tasks. Routine tasks are the ones

that can be automated, while nonroutine tasks that require a more sophisticated set of skills will not be in risk of automation. Autor (2015: 12) divides nonroutine tasks into abstract tasks, that require problem-solving, intuition, creativity, and persuasion, and into manual tasks, that require situational adaptability, visual and language recognition, and in-person interactions. Abstract or manual intensive routine work is usually found at opposite ends of the labour market, and the automation of routine tasks may lead to the growth of high-wage work and low-wage work on the opposite ends at the expense of middle-wage work, which could explain the polarization of the labour market (Autor 2015).

Autor (2015), however, presents a prediction that the polarization of the labour market will not continue indefinitely, and many middle-skill jobs will continue to demand skills such as mathematics, life sciences and analytical reasoning. Autor (2015) suggests that future middle-skill work combines routine technical tasks and nonroutine tasks where human workers hold comparative advantage in for example interpersonal interaction, flexibility and adaptability. Therefore, it might be that jobs today will form new job descriptions including new tasks rather than disappearing completely. New technologies are also likely to create completely new work that cannot yet be predicted. Data scientist are an example of a currently highly demanded occupation that is the result of the introduction of technological development. Mokyr et al. (2015) note that technological progress has also happened in the form of innovation through which new sectors have been created. On the other hand, managers' aim to maximize profit in the short-term may also delay or postpone the introduction of new technologies (Spencer 2017).

2.1.2 Rearranging the conditions of work

With technological advancements workers are put under a tighter surveillance with employers being able to use digital technologies to monitor worker efficiency and to increase surplus value production. As an example, Amazon has automated the firing of their warehouse workers. Each worker has a monitor that examines their speed of work and if the speed of work is not fast enough the system will give the worker a warning. As a result of a working pace that is too slow, the workers can get fired without their supervisors being involved in the process (Hiilamo 2019). This dehumanizes the workplace and places large emotional stress to the workers in addition to physical stress. An example of state level surveillance is China's Social Credit System, where

the Chinese government aims to score the creditworthiness of individuals and organizations with a computational score based on their historical and ongoing social and economic activities, which determine whether the actor can obtain benefits or punishments (Liang, Das, Kostuyk and Hussain 2018: 416). “Through this process, big data innovations and information and communication technologies (ICTs) are rapidly being instrumentalized and institutionalized by the government to surveil and govern the political, social, and commercial dominions of China” (Liang et al. 2018: 416).

Kalleberg (2009) explains that the most recent era of precarious work in the United States began in the mid- to late 1970s, which marked the start of macroeconomic changes that helped to lead to an increase in global price competition. Globalization driven by modern capitalist aims pushed for economic integration, increased the amount of competition and enabled the outsourcing of work to developing countries and opened up new pools of labour through immigration (Kalleberg 2009: 2). Increased precarious work has led to insecurity about the future, instability of income, and dissatisfaction to one’s standards of living as people are no longer able to buy what they produce. Precarious work has also effects on health and wellbeing, as insecurity increases, and people are stripped away from the social environment and encounters of a workplace (Kalleberg 2009). Kalleberg (2009: 10) states that the power imbalances between races also come into play, as minorities are more likely to be unemployed and displaced from their jobs.

Temporary employment and new flexible employment brought by technological platforms has created an “on-demand” economy (Mokyr, Vickers and Ziebarth 2015). Workers in the on-demand economy can be left either flexible or rootless unable to plan their present or future. Many workers have also chosen to take on temporary employment to supplement their current income (Bergvall-Kåreborn and Howcroft 2014; Friedman 2014). Technology driven changes have made the separation of work and home life more difficult (Mokyr, Vickers and Ziebarth 2015). Friedman (2014) discusses the formation of a “gig-economy” where instead of hiring permanent employees, companies hire temporary workers or independent contractors into a flexible arrangement. Friedman (2014) argues that through temporary gigs employers can adjust employment, make wages more flexible and shift the risk of economic fluctuations to the worker while driving down the cost of labour. However, despite that some workers in the gig-economy are working in jobs using advanced technology, much gig-labour is employed in labour-intensive traditional work (Friedman 2014).

Sectors with a lower level of gig workers are not defined by their technology but by having a strong work organization and strong unions (Friedman 2014).

Closely relating to the gig-economy, Bergvall-Kåreborn and Howcroft (2014) discuss crowdsourcing with the example of Amazon's Mechanical Turk, which is a platform to distribute tasks to a large number of workers with Amazon mediating and selling the work capacity. Through crowdsourcing companies can outsource their functions to a large global pool of workers over the internet (Bergvall-Kåreborn and Howcroft 2014). Bergvall-Kåreborn and Howcroft (2014: 215) state that "the most significant differences between crowdsourcing and a traditional workforce centres on flexibility, scalability, access to a broad range of skills and experiences at significantly less cost, coupled with the lack of employment regulations." In addition to lower costs, given the global nature of the platform, it can operate outside of view and sets of legislation and regulation. With crowdsourcing platforms, companies are exempt from the social responsibilities of permanent employments (Bergvall-Kåreborn and Howcroft 2014). The platform has been used for example in the manual removal of duplicates on the Amazon website, and workers being paid on the number of duplicates that they have removed (Bergvall-Kåreborn and Howcroft 2014). Amazon has highly automated warehouses and has invested in innovation on drone deliveries, therefore the platform showcases contradictions in digital technology as global workers perform monotonous click work of data processing. Decisions on which technological innovations a company chooses to invest in is motivated by economic benefits to digital companies "in the context of contemporary capitalism" (Bergvall-Kåreborn and Howcroft 2014: 214).

2.2 Power relations

In the consideration of artificial intelligence and automation, power relations need to be taken into account. Pettersen (2018) states that code and algorithms are neither objective nor neutral, and on the contrary technologies have the values of their creator embedded in them. Spencer (2017) provides a critique on Brynjolfsson and McAfee's *The Second Machine Age* (2014) stating that the authors do not consider the connections between the politics of production and digital technologies, and how digital technologies are themselves products of unequal power. "They fail to see how such technologies are used under capitalism to promote the interests of capital and how

progress in their use for emancipatory ends requires challenging the unequal power at the heart of capitalism" (Spencer 2017: 149).

2.2.1 Marxism and technology

When discussing power relations and technology it is important to reflect to the theoretical foundation of Marx and capitalist accumulation. Many authors compare to a Marxist concept in their discussion on technology, power, and society. Marxist theory highlights the class conflict in capitalist society between the owners of capital, the bourgeoise, and the workers, the proletariat (Smith, El-Anis and Farrands 2011). Marx saw that the principles of the pursuit of profit and the protection of private property allow the bourgeoise to exploit the proletariat by paying them less than what is the value of what they produce (Smith, El-Anis and Farrands 2011).

Marx wrote his major works at the time of Industrial Revolution when machinery was starting to be implemented in manufacturing (Feenberg 2009). Feenberg (2009) argues that it is in dispute how Marx saw the role of technological development in human history, but one line of interpretation sees that Marx conceived of technology as contingent on social relations. In other words, Marx appears to have argued that "the design of industrial technology reflected the requirements of capitalist production" (Feenberg 2009: 2). Technology could be then seen as a tool for the bourgeoise to increase profits in replacing human labour. Mokyr, Vickers and Ziebarth (2015: 34) present a very optimistic view of Marx and argue that despite Marx viewed technological unemployment as a serious problem in the short run, however, for Marx "technological improvement was part of a social and political process that would lead eventually to widespread prosperity."

2.2.2 Technocapitalism

Modern companies are more dependent on knowledge and creativity than the industries created by industrial capitalism. Luis Suarez-Villa (2001; 2009) contrasts the differences of the industrial corporation where the resources and processes were quantifiable and predictable to the modern technocapitalist corporation that runs on the commodification of creativity and knowledge, intangibles. Such modern corporate activities include for example the fields of software design, biotechnology and nanotechnology. Suarez-Villa (2001) states that accordingly the society is becoming

highly dependent on commodified knowledge, deployed to suit the profit motives of modern corporations. Commodification of creativity and knowledge have moved research and development departments into the centres of corporations, aiming at transforming creativity and knowledge into exchange value.

In *The Rise of Technocapitalism* (2001) Suarez-Villa explains the process of commodification of knowledge, which he states is as fundamental to technocapitalism as raw materials and the reproduction of capital were to industrial capitalism. The process is marked by two accumulation processes, the accumulation of inventions and of knowledge sensitive infrastructure. The accumulation of inventions is showcased in the rapid increase in patenting in the 20th and 21st centuries, which reflects the rising value of technological knowledge as commodity (Suarez-Villa 2001). Suarez-Villa (2001) states that the rise in public infrastructure spending contributed to the accumulation of knowledge sensitive infrastructure and the reproduction of knowledge by providing the physical resources where knowledge could be acquired, exchanged and diffused. Infrastructure is becoming more important as laboratories and equipment can often determine the success of research projects (Suarez-Villa 2001).

In *Technocapitalism: A critical perspective on technological innovation and corporatism* (2009) Suarez-Villa takes a critical stance on the research agendas and design of technologies. In the book there are three key terms that are used in explaining how research and inventions are no longer driven by individual curiosity of traditional inventors, but rather by the corporate agenda in creating new revenue streams and increase profits: corporatism, technocapitalism and experimentalism. The definition of corporatism varies from a traditional definition and is defined as the power of business corporations over society. Technocapitalism is defined as a new form of capitalism that is heavily grounded on corporate power and its exploitation of technological creativity. Experimentalism is defined as technological and scientific inquiry whose overarching objective is commercial. At the core of experimentalism is the creation of the society into a laboratory of technocapitalism (Suarez-Villa 2009).

To integrate society into the laboratory of corporate experimentalism, social mediation through networks is required. Suarez-Villa (2003; 2009) highlights the importance of networks and states that they are an important element underlying the e-economy with the process of globalization depending greatly on networks. The means of control in the networks can often determine distribution of rewards. “Internet commercial

transactions, business-to-business (B2B) communications involving supplies or coordination, the distribution of goods, and the diffusion of information rely on network structures" (Suarez-Villa 2003: 392). Networks can also lie outside the scope of corporations. Suarez-Villa provides the example of open source software, where the development work can be done by any individual anywhere in the world donating their time freely. However, it is the corporation that will eventually draw the profits that result from the combined knowledge and creativity of the network (Suarez-Villa 2001; 2003; 2009).

Suarez-Villa (2009) explains how the experimentalist corporation is defined through its intensive orientation towards research, where research creativity is located right at the centre. The bureaucratic corporations, descending from the industrial era are facing dismantling as creativity and design shift towards the centre of focus for modern corporations. Having creativity as a main product requires flexible structures to allow for creative work. According to Suarez-Villa (2009) networks will be a driving force in decomposing corporations. This is based on networks being more efficient in reproducing vital intangibles internally as they can through networks, they are also more effective in reproducing creativity, and they are more effective in reducing uncertainty through their interdependent relations (Suarez-Villa 2009).

2.2.3 Unequal exchange and ecological economics

Hornborg (2014a) draws from the Marxian concept of fetishism and human-object relations in assessing modern political economy. The key idea in technological progress presented by Hornborg states that efficiency created by technology is only a matter of rearranging time and space in the global scale. In other words, modern technology's capacity to locally save time and space occurs at the expense of human time and natural space lost elsewhere in the world (Hornborg, 2014a: 122).

In the considerations of what technological progress is, and can technology be fully considered as being neutral and not dominated by relations of power, the modern cultural aspects of Western countries in separating nature and society should be analysed. According to Hornborg (2006: 9) animism, fetishism, and objectivism can be understood as different ways to understand the world and to categorize people and things. Hornborg (2014a) explains capitalist fetishism to be the representation of relations between people as if they were relations between things, which is a thought

underpinning capitalist political economy. Animism on the other hand is experiencing relations to things as if they were relations to people, while objectivism denies agency and subjectivity even in living beings (Hornborg 2014a).

In separating nature to only its material properties, removing any symbolic meanings or social relations, modern humans have been able to manipulate it in ways that could not be done in pre-modern times (Hornborg 2014a). Hornborg (2006) presents the example of Amazonian Indians who have not separated nature and society from each other in their world view, and thus automatically embed their ecological practice in a moral system. “For centuries, mainstream European society has refused to be thus constrained, and this liberation of capitalist modernity has been founded on the incommensurable distinction between Nature and Culture” (Hornborg 2006: 5). Modernity, or objectivity and fetishism, has allowed for the creation of highly specialized occupations and detachment removing the moral concerns of the modern worker. The commodification of abstract human labour disassociated productive activity from all other aspects of human life, enabling people to distance themselves from they produce (Hornborg 2014a).

Hornborg (2014a: 121) also states that money, commodities, and machines represent fetishes as they mystify unequal relations of exchange by being attributed autonomous agency or productivity, even though technological rationality is never disconnected from the global distribution of purchasing power. Hornborg (2013; 2014a) presents that the Western industrialization would have never occurred the way it did was it not for the differences in price levels in labour and land in the world market, including slave labour, during the era of industrialization. The foundation of mechanization is tied with global differences in the price levels, and it should to be noted that they are dependent on global asymmetric resource flows and power relations (Hornborg 2014a).

Hornborg (2014b) argues that the developed core nations in a capitalist world-system, in the light of their historical experience, perceive technological solutions as challenges of engineering, and fail to see how social strategies are embedded in economics and ecology. This works as a ground for technological utopianism (Hornborg 2014b). The expansion of a technology will depend on the amount of world’s population who have sufficient purchasing power to acquire it. Hornborg (2013) presents that geographical dissociation has been a prerequisite for our narrative of technological progress. Not having to face the conditions of production has enabled the objective consumer

relationship to technology and other commodities, and therefore giving technology the seemingly neutral nature. Hornborg (2013: 13) also points out that the world remains highly polarized between high-tech core areas with high levels of per capita purchasing power and energy consumption, and peripheral areas with much lower levels of purchasing power and energy consumption. Access to and distribution of energy is closely connected to power, and the very concept of power can be used to denote energy as well as social dominance (Hornborg 2013: 2-3).

While modern technologies make possible a more efficient use of land for those who can afford it, they may represent losses of natural space, such as strip mines or oil fields, elsewhere on the planet (Hornborg 2014a). Technological innovations might in that way increase the efficiency in the Western economies, however, on the other hand only redistribute the weight of labour to another sector in the world society. Bieler and Morton (2014) state that free trade policies have been used as a way to open up closed economies to allow for capitalist expansion through relations of combined development, which has created a setting of uneven exchange. Bieler and Morton (2014) describe how the inner drive of capitalism to continuously improve rates of profit creates a tendency towards crisis. Bieler and Morton (2014) refer to Rosa Luxemburg (1913) in stating that in order to continue the accumulation of surplus value capitalism must push for outwards expansion and bring non-capitalist spaces into the capitalist social relations of production.

2.2.4 Feminist theories of technology

In addition to class struggle, relations of power can also be a struggle between genders. Feminist writers have explored the relationship between gender and technology, and how technology contributes to reinforcing and shaping gender relations (Wajcman 2006). During the late nineteenth century, mechanical and civil engineering, dominated by males, increasingly came to define what technology is, while today women's employment in the information technology, electronics and communications sector is much lower than their participation in the workforce generally (Wajcman 2009). These have led to the exclusion of women in the technological development and design. Wajcman (2009) explains how both socialist and radical feminism began to analyse the gendered nature of technical expertise and found that the problem was not only the monopoly of men on technology, but also the way gender is embedded in technology itself. For radical feminism women's power and culture are

regarded having been systematically controlled and dominated by men, operating through institutions such as medicine and militarism.

Criado Perez (2020) discusses a gender data gap, which Criado Perez explains to be the lack of data collected on women resulting in a world designed for men, since women have not been included in the design of technologies. The default setting of an average man in the design of technologies form into a greater issue as technology becomes more and more predominant in everyday life. Criado Perez (2020) gives an example of an AI program that was used in hiring, having to be abandoned as it favoured men over women. Algorithms reflect the biases that exist in the data from which they are created. It is important to acknowledge and understand these biases in order to correct them and to be able to avoid them in the future (Condliffe 2019).

3 Research methods

The research philosophy in the thesis is of critical realism. According to Saunders and Lewis (2012: 104) research philosophy "relates to the development of knowledge and the nature of the knowledge in relation to the research." It is related to the way the world is viewed and underpins the research. Realism Saunders and Lewis (2012: 105) explain to be "a research philosophy which stresses that objects exist independently of our knowledge of their existence." Direct realism holds that what is seen in the world around is an accurate representation of that world. Critical realism on the other hand holds that experiences are sensations, an image of the things in the real world (Saunders and Lewis 2012). Critical realism in other words aims to understand deeper structures and social relations that are not directly observable.

3.1 Research problem

The thesis will look into how new technologies and artificial intelligence change the nature of work. In addition, the thesis will try to find the relationship between power, politics and the development of technologies. The different courses of changes in the work life caused by new technologies will be analysed. The aim is to understand the different consequences of technological developments on social imbalances. The thesis will explore how different motives could drive the development of technologies and aims to understand causalities in the implementation of technologies.

3.2 The method of research

Qualitative research will be conducted in the thesis in order to gain a thorough understanding of the research problem. Research done on the thesis topic will be in the form of an extended literature review based on secondary data, such as existing literature, research papers, studies and publicly open data banks. Using secondary data saves time in the research process and allows for the processing of a larger amounts and variety of data (Saunders and Lewis 2012). The requirements for the data gathered are that it is reliable, as up-to-date as possible, and from a reliable source. The aim of the research is not to form a generalization or to come to a definitive answer, as the topic includes many uncertainties.

The thesis uses a deductive approach in the analysis of the theory. Saunders and Lewis (2012: 108) define deductive approach as involving “the testing of a theoretical proposition by using a research strategy designed to perform this test.” The thesis aims to explain causal relationships in technology, employment and the economy.

Collis and Hussey (2013) define descriptive research as research that is conducted to describe a phenomenon as they exist and is used to identify and obtain information on the characteristics of the issue. Analytical research is a continuation of descriptive research and goes beyond merely describing the characteristics to analysing why the phenomenon being studied is happening. Analytical research aims to understand phenomena by discovering causal relations (Collis and Hussey 2013). There exist many published works on the relationship between technology and work life as well as the power relations in technology. The thesis will attempt to bring these together to understand the phenomenon and form an analysis of the effects and which are the causalities in the change. The research is therefore a mixture of descriptive and analytical in nature.

The analysis in the thesis will mainly involve the analysis of relevant literature and different theoretical perspectives combined with current discussions in technology and society. The goal is to compare different settings of power relations in addition to different views on the effect of artificial intelligence technologies on employment. The aim is to understand the future work life and the different factors affecting it. In addition, the thesis will look social implications of technology at the workplace and how changes in employment shares in the economy could affect employment.

3.3 Limitations

The topic of the thesis has many different areas, aspects and variables as it is a current and vast topic and there are many publications available on the topic. Because of these factors not all aspects of the topic can be covered in a research of this length. Using secondary data has also its difficulties. Data is not always value-neutral, and therefore it is important to critically evaluate how conclusions have been made in the referenced publications and data.

4 Technology and economic growth

Manufacturing has historically been driving economic development and success, and the countries involved in the capital owning side of Industrial Revolution are now the wealthiest economies in the world (Hallward-Driemeier and Nayyar 2018). The considered development benefit in manufacturing has been in its ability to employ large amounts of unskilled labour. Hallward-Driemeier and Nayyar (2018) state that the recent movement of East Asian countries into high-income ranks through export led-manufacturing further strengthens the thought of the role of manufacturing in the development of an economy. In the recent economic history, the countries that have reached high income levels without manufacturing led development, have had desired natural resources, such as oil, or other specific locational advantages (Hallward-Driemeier and Nayyar 2018).

Concerns on the automation of work has traditionally concerned manufacturing where technology would be in the use of capitalistic aims of increasing profits and efficiency at the expense of human labour, leaving masses of workers unemployed. More recent scenarios of labour-saving technologies are more concerned with artificial intelligence replacing labour in all fields of the economy. In the past, new technologies have also created new work and new fields in the economy; however, currently the trend would seem to be towards a greater emphasis on knowledge work as new technologies are introduced increasingly to manufacturing and the service sector.

4.1 The future of the manufacturing sector

Benanav (2019) argues that the decline in the demand for labour is not in fact a direct result of technological progress but the cause is the sum of technological change and simultaneous economic stagnation. Benanav (2019) criticises the automaton theorists who are claiming that productivity is growing rapidly, and notes that productivity only appears to be growing rapidly next to greatly stagnating manufacturing output growth. Output growth in manufacturing has been declining worldwide, despite the growth of the manufacturing sector in China (Benanav 2019). Figure 1 shows the annual growth of manufacturing worldwide during the years of 1998 to 2017 (World Bank 2020a). The figure shows how manufacturing growth took a deep dive during and after the financial crisis of 2008. In 2010 the growth spiked up due to the low starting point after the crisis decline and then stabilized to lower growth from 2011 onwards. Despite the growth being modest there still has been some growth in manufacturing.

Figure 1. World manufacturing annual growth (World Bank 2020a)

Figure 2 showcases the labour productivity growth in the OECD area, European Union and the Euro area (OECD 2019). Euro area consists of the European Union member countries that have adopted the euro as their currency (European Commission 2020). As can be seen from figure 2, according to the statistics in the OECD area, labour productivity growth has in fact slowed down during the last 25 years. Labour productivity has been steadily growing although the growth has remained rather

modest. However, as the growth of manufacturing and labour productivity are compared, it can be seen that the manufacturing growth shown in figure 1 has not been much higher that the growth of labour productivity. In other words, the growth of labour productivity is still playing a significant part in the growth of manufacturing. Therefore, it could be, that in a stagnation economy, producers are taking on labour replacing technology in order to stay competitive in the global market.

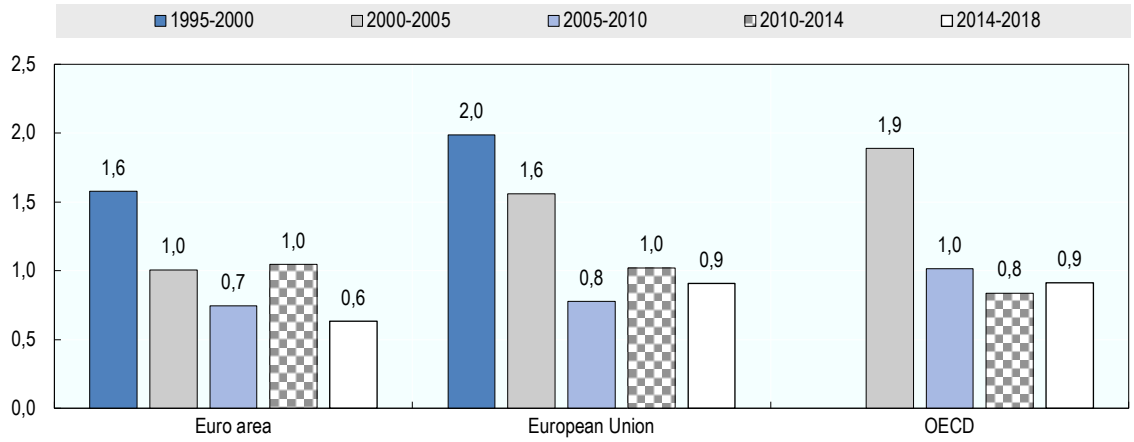

Figure 2. Labour productivity growth in the OECD area (OECD 2019)

It should be noted that the labour productivity growth is only for the OECD area and not for worldwide. Figure 3 shows the manufacturing growth in the OECD member countries (World Bank 2020a). The manufacturing growth in the OECD area has been developing in similar trend to the growth worldwide. To the OECD members the financial crisis of 2008 was slightly more devastating, as the members consist mostly of middle and high-income countries, where the effect of financialization has been stronger and the economy was struggling as large financial institutions collapsed. Manufacturing growth in the OECD member countries has been on a slightly lower level from 2010 onwards compared to the worldwide level and reached a negative percentage in 2012. This could be a sign for deindustrialization in the developed countries and a stronger direction towards services sector.

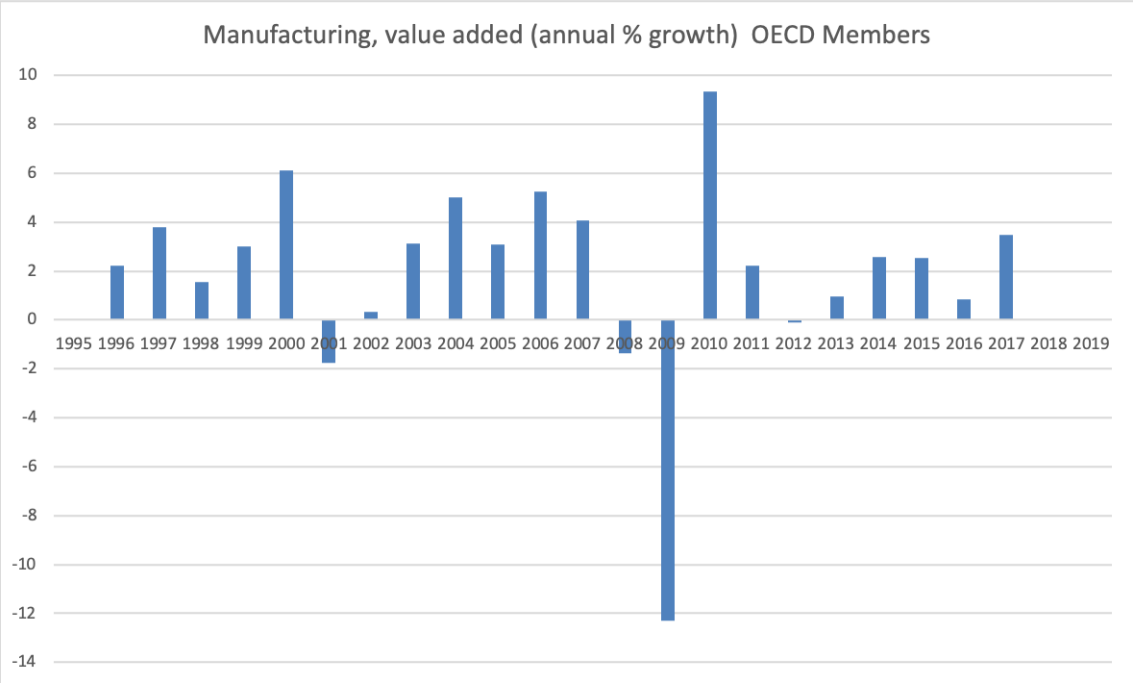

Figure 3. Manufacturing annual growth, OECD members (World Bank 2020a)

World Bank Global Economic Prospects (2020b) also notes that a slowdown in the trade intensive manufacturing sector has continued to weigh down global trade. Growth in global goods and services slowed from 4 per cent in 2018 to 1.4 per cent in 2019, which is the weakest pace since the global financial crisis in 2008. The growth is projected to reach 1.9 per cent in 2020 (World Bank 2020b). The global pandemic COVID-19 pandemic will likely affect the global economic prospects and activity to slow down further.

The slowing growth of the output rate of production together with the increasing efficiency of production will create a stage for unemployment in the manufacturing sector. As the efficiency of production increases, with the introduction of new technologies, sufficient economic growth will be needed to create enough demand for manufactured goods to supply for employment in the manufacturing sector. Despite the economic stagnation possibly being the main reason for the lowering demand for labour in the manufacturing sector, if the world economy does continue its slow growth technological advancements will threaten to destroy jobs. Benanav (2019) states that in the context of economic stagnation and slower rates of job creation technology and automation will act as a secondary cause of low labour demand.

Benanav (2019) states that global economic downshift has been devastating for low- and middle-income countries because the downshift has taken place at the same time with rapid increase in labour force. The amount of working population has increased by 75 per cent from the 1980s (Benanav 2019: 36). In the modern society most have to work in order to live. With the working population globally increasing and employment simultaneously decreasing due to economic stagnation, many are facing unemployment. The problem faces especially the global south where people have moved to the labour market from traditional lifestyle of producing themselves what they need (Benanav 2019).

Globalization has opened the world market and allowed for an abundance of manufactured goods, while creating an interdependent world economy but also a fierce competition. Companies are faced with a situation where the only way to grow is to take market share from their competitors. In an effort to save costs in increasing competition companies have taken on labour-saving technologies in their manufacturing. Technology could thus increasingly matter for manufacturing competitiveness (Hallward-Driemeier and Nayyar 2018). Benanav (2019) highlights that the countries that have the highest levels of robotization are the ones that have avoided deindustrialization, with Germany, Japan and South Korea having the highest levels of robotization and largest trade surpluses in the world. Robotization has thus been a way of keeping manufacturing in the country at the expense of decreasing manufacturing labour.

In the past few decades, manufacturing activity has shifted from wealthier nations to low income countries through globalization. Globalization has been a driver for export led manufacturing, however, protectionist measures have been taken in countries attempting to reindustrialize and strengthen their manufacturing industry (Hallward-Driemeier and Nayyar 2018). New technological advancements could also shift the interest of which locations are attractive for production, not only in advanced goods but also in traditional manufacturing (Hallward-Driemeier and Nayyar 2018). The success of China, also having one of the highest trade surpluses, is due to lower wages, strong infrastructure and moderate to advanced technologies (Benanav 2019). Chinese companies are now seeking to robotize in order to prevent the loss of their competitive position due to a rise in wages (Benanav 2019; Hallward-Driemeier and Nayyar 2018). According to Hallward-Driemeier and Nayyar (2018: 83) Chinese wages in manufacturing rose by 281 percent between 2003 to 2010. In China there has been a

transfer of workers from industry to services sector, which has increased the demand for labour. The Chinese working-age population has started to decline, and together with the rising demand for labour, wages have been rising faster than the GDP since 2010 (Zhao et al. 2019). It is worth to note, however, that the distribution of disposable national income is highly unequal in China (Zhao et al. 2019).

Deindustrialization, and premature deindustrialization, has received increasing interest in economic reports. Deindustrialization is the decrease of the relative importance of manufacturing in the economy (United Nations Industrial Development Organization (UNIDO) 2015). Premature deindustrialization is a phenomenon described to take place in developing countries where manufacturing is beginning to shrink at an income level that is comparatively low compared to the level where advanced economies started to deindustrialize (Rodrik 2015). The developing economies that are going through premature deindustrialization are transforming into service economies despite not going through a process of industrialization (Rodrik 2015).

The attempts to reindustrialize require the demand for manufactured goods. Changes in consumption behaviour have an effect on the demand for manufactured goods as well as services. Digitalization has changed the way people consume goods. Consumers use digital platforms to not only purchase goods, but also consume services, such as streaming services like Netflix and Spotify. Many trends can cause changes in consumption behaviour. World Trade Report 2019 recognizes four trends in consumption that will be playing a role in the services sector: digital technologies, demographic changes, rising incomes, and the climate change. Digitalization leads to a specific decrease in the cost of entry on the supply side, and on the demand side digitalization makes it easier for the consumers to find different services, but also increases the amount of services available (WTO 2019). One significant aspect is the increased use of platforms in new businesses removing the middleman. An example of such a platform business model is Uber. Generational differences also bring changes in consumption preferences and are significant in the context of digitalization. Millennials (born between 1980 and 1996) and Generation Z (born between 1997 and 2012) are the largest groups consuming digital services (WTO 2019). The world's population is constantly growing, and population growth is concentrated to developing economies. In the developed countries where the population is not growing and birth rates are stagnating, the demand for services is for example in the field of health care, while the demand in the developing countries is more towards educational services due

to the large young population and fast-growing working-age population (WTO 2019). Demand in the service sector increases as the level of income increases in the economy, and the share of services in gross domestic product (GDP) and employment rises as the income per capita rises (WTO 2019).

It could be thought that the future of manufacturing could be in new green technologies and sustainable manufacturing. The climate change is affecting the behaviour of many to consume less and specially to avoid products manufactured in low income countries and distributed in long global supply chains, as well as switch to energy efficient technologies. In attempts to fight global warming and the climate change people have started to look for ways to reduce their emissions and adopt new ‘green technologies’. However, the advancements in new green technologies can also cause the effect of shifting the burden of production to low income countries, that have the necessary metals needed in the batteries of modern technologies. An example is the mining of cobalt that is used for the production of batteries for such technologies as smartphones and electric vehicles. Over 60 per cent of the cobalt in the world market comes from the Democratic Republic of the Congo. The cobalt mines have been connected with the use of child labour as well as unhealthy working environments, and the collapsing of mining tunnels (Mikkonen 2020). The local workers living in poverty are forced to take on work in the cobalt mines as it is the only source of labour in the area. In addition, extreme poverty is driving families to have their children working in the mines (Mikkonen 2020; Kelly 2019).

In the United States a congressional resolution called the Green New Deal has been under debate. The Green New Deal would constitute a goal in reducing carbon emission levels by means of for example changing to electric vehicles from, using green energy such as wind and solar, and would in addition address poverty, income inequality and racial discrimination (Friedman 2019). Many of the goals the Green New Deal would aim for would rest on new technologies and the required resources should be sourced from the United States, reducing the ecological footprint from outsourcing raw materials from developing countries. Dizard (2019a) criticises the Green New Deal arguing that the issue in the initiative is not a question of what is technologically possible, but a matter of resource availability. If all traditional fossil-fuelled vehicles were to be replaced, the increase in electric vehicles alone would increase the demand in metals remarkably even if some were to be recycled from the replaced vehicles, and it would not be feasible if it was to be fulfilled by metals from the United States.

Reducing carbon emissions would therefore lead to an increased demand in metals, and dependence on imported metals from developing countries (Dizard 2019b). According to Dizard (2019a) this would constitute a power concentration on state structures and super profits for suppliers.

The rise of electric vehicles and their increasing demand have led to a power play in the extraction of not only cobalt but metals in general. This could be seen as only the shift in geopolitical power from the producers of oil to the producers of metal. The popularity of electrical vehicles is an example of the disassociation effect described by Hornborg (2013) where the perceiving of technological progress requires geographical disassociation. The consumers in developed countries do not have to face the conditions of production of the raw materials of batteries, that give electric vehicles their neutral climate saving nature. Similar to the effect of moving manufacturing plants to low income countries through the process of globalization, the mining of metals in low income countries shifts the dirty work out of sight, while the consciousness of the consumers in the developed countries is eased as they battle to minimize their pollution levels.

In the countries where the share of manufacturing in the economy has not decreased has been due to a high level of manufacturing technology and robotization. These countries have taken on robotization to be able to keep manufacturing. In this case the importance of who owns the means of production is increasingly important, as the profits accumulate into the hands of the few and the redistribution process is minimal or even non-existent.

4.2 Service sector as the engine of growth

According to the World Trade Organization (WTO) (2019) the services sector is the fastest growing economic segment. Services have become easier to trade with digitalization, since instead of having to deliver services in person they can be delivered digitally, making the main driver of growth technology (WTO 2019). Technology has allowed for the development of different service sectors, such as medicine and education, through online information banks and online platforms such as Massive Open Online Courses (MOOCs). This represents the accumulation and diffusion of knowledge discussed by Suarez-Villa as a process of technocapitalism.

The technological advancements and changes are exposing the services sectors to similar processes of specialization, competition and scale economies through technological advancement, that drove productivity growth in the manufacturing sector (WTO 2019). Emerging economies are becoming more service based as well, and even China's economy is shifting towards services, where services account for 52 per cent of the GDP (WTO 2019). Services have also become more embedded into manufacturing. Services in manufacturing can be inputs, such as design and marketing, or enablers, such as e-commerce platforms that help the trade to take place (Hallward-Driemeier and Nayyar 2018).

The service sector is an important employer in the working population employing 74 per cent of workers in high-income countries and 52 per cent globally (Benanav 2019). In the case if the growth in the manufacturing sector stagnates, the importance of the service sector in employment further increases. Having a more non-routine manual nature and requiring in-the-moment adaptation, the service sector has been considered to be out of reach for automation to destroy jobs. However, automation has also made its entrance into some service sectors in the form of labour-saving technologies. For example, in fast food restaurants self-service screens have become increasingly popular where customers place their own orders, and self-service checkouts are also increasingly common in supermarkets.

The slowing of the manufacturing sector has led to a build-up of financialized capital, as the owners of capital are investing into liquid assets instead of investments in fixed capital, since there are no more profitable targets in the real economy (Benanav 2019). Financial activities have become a new way of generating corporate profits. Ansari (2018) explains that the phenomena of financialization refers to many different factors, such as the internationalization of financial markets, and the rise of shareholder value as a dominant corporate strategy. The financial markets have emerged into all aspects of everyday life. The growth of the financial sector and financialization of everyday life was an important factor in the events that led to the 2008 financial crisis. The economy has still not recovered since the financial crisis of 2008 with many countries struggling in seemingly continuous economic stagnation. In addition, similar signs of a financial crisis can be seen in the economy forecasting the next blow for the economy. Ansari (2018) argues that within the Marxian perspective the shift to financial activities and the outbreak of the 2008 financial crisis can be understood as symptoms of stagnation

tendencies in the real economy that derive from the capitalist tendency of the rate of profit to fall.

According to the WTO (2019: 7) “distribution and financial services each account for almost one-fifth of trade services.” The growth of the financial services might increase the amount of capital in an economy and might increase the gross domestic product of a country. However, a growing financial sector will not create work for the masses that will end up unemployed from the decline of manufacturing employment. The growth of the financial sector has the effect of wealth growing and concentrating at the high-income end of the income spectrum. Financial industry, together with many quantifiable fields, is under a significant threat to have many jobs automized. Many tasks in the financial industry include quantifiable calculations on which decision are based on. These types of predictions are not difficult for artificial intelligence technologies to program and learn, and such software already exists. People might not be confident leaving their funds to be managed by automation completely, however, using it as augmenting technology is an extremely possible scenario. As the financial sector has very limited employment growth opportunities and employs only highly educated people, financialization will further create polarization in the labour market. In addition, being based on the process of capital creating more capital, financialization drives inequality in the society.

The process of globalization has created long supply chains and has created a large market for transportation and logistics networks. Distribution has been a significant employment creator in the service sector, including people with low-level education. Automation in storage houses has already removed jobs, and self-driving vehicles could remove many jobs out of the distribution field, logistics and transportation in particular. In addition to labour costs in manufacturing, distribution is one sector where companies might aim to cut costs as the competition in the global markets gets tighter. Automated and artificial intelligence solutions would then act as a labour-saving mechanism, leaving people without work.

Hallward-Driemeier and Nayyar (2018) note that most service sectors that have a boosting effect for productivity are less likely to create employment for unskilled labour, while the services that are likely to create employment for unskilled labour are less likely to increase productivity. Information technology could be a service sector where people from manufacturing could find employment as it includes skills that can be

learned by doing. However, sufficient human capital would be needed for low skill labour to be trained for the work and then to be absorbed into high productivity service sector (Hallward-Driemeier and Nayyar 2018).

Due to digitization, the wage growth in the economy has concentrated for the few at the top of the income spectrum. The profits from the increased efficiency in production from new technologies end up in the hands of owners of capital. The service sectors that have productivity boosting capabilities are also skill intensive. This further highlights the polarization of work life.

5 Commodification of knowledge in the service sector

The commodification of knowledge is creating new economic models for the service sector. Modern companies are built around business models of selling knowledge in the forms of intangibles, such as software or consultancy services. Creativity can be sold in the form of for example design and marketing campaigns. The new ways digital services are consumed have created new work for the competent in the digital industry. Content creators are for example crucial for modern companies trying to reach out for the Millennials and Generation Z. The new work created by the digital economy highlights type of tasks described by Autor (2015) that require adaptability, creativity and interpersonal communication which are hard for artificial intelligence and machine learning to mimic.

Relating to Suarez-Villa's technocapitalism is the process of open innovation. In industrial corporations, research and development have been conducted internally in a model of closed innovation (Chesbrough 2003). Companies generated their own ideas, developed them and then brought them to the market. Companies were self-reliant and the process of successful innovation required control (Chesbrough 2003). Chesbrough (2003) notes that several factors started to erode the foundation of closed innovation, factors like increased mobility of knowledge workers and private venture capital funding new firms. Such factors led to a situation where if a company did not pursue an innovation enough soon, the people involved in the discovery could pursue it on their own with outside investment from venture capital. Chesbrough (2003: 36) discusses an open innovation model where "firms commercialize external (as well as internal) ideas by deploying outside (as well as in-house) pathways to the market."

Through open innovation companies can have access to knowledge and resources outside of the company. Modern technologies have allowed for the diffusion of knowledge, and with open innovation companies can save the time and costs in the research and development process. The openness of digital systems is making the innovation process non-linear, where the user of a service or a product is able to give feedback on innovation needed (Bogers, Chesbrough and Moedas 2018: 10). An ecosystem of co-creation can be created, fostered by people, organizations and sectors (Bogers, Chesbrough and Moedas 2018: 10).

Open innovation can also be used as a strategy to gain market share in order to maintain a competitive edge against competitors, as larger corporations can acquire smaller companies and start-ups with competitive products or services. For start-ups and small companies, the benefit of open innovation comes from allowing for the exploration and development of ideas that would be otherwise outside of their financial capability without outside investment. Through open innovation they can also access human talent and experience that might be missing in a new and small company. In a model of open innovation intellectual property becomes a trading good between companies, showcasing the process of commodifying knowledge observed by Suarez-Villa.

Using mergers and acquisitions as a way to acquire new technologies, knowledge and people is a strategy used by many big technology companies. In the United States, the Federal Trade Commission (F.T.C) has requested Amazon, Apple, Facebook, Alphabet and Microsoft to provide more information on their smaller acquisitions that are not required to be reported under law (Kang and McCabe 2020). Acquisition of other companies and competitors has been used as a strategy for large technology corporations to protect their market dominance, bring in key talent in the form of “acqui-hirings” and to expand into new markets. The aim of the F.T.C is to look into smaller deals of so called “killer acquisitions” where large technology companies buy competitors in order to remove competition from the market (Kang and McCabe 2020).

Large technology firms form an increasing share of the economy while employing a fraction of the number of people that traditional industrial firms employ. The amount of people employed by technology firms is minimal in comparison to their share of the market. This leads to a concentration of wealth in the hands of few at the top end of the income spectrum. This phenomenon echoes the creation of superstars in the digital

economy described by Brynjolfsson and McAfee (2014) in the *Second Machine Age.* The success of large technology firms has also increased the size of intellectual property and intangibles in the economy in comparison to tangibles (Foroohar 2019).

Foroohar (2019) presents a critique towards large technology firms comparing big tech to big finance and large banks that drove the economy into the financial crisis of 2008. Foroohar (2019) points to large financial holdings of technology companies such as Apple and Google that are significant enough to become systematically significant. After the financial crisis of 2008, large technology companies issued vast amounts of cheap debt and used them for share buybacks and dividend payments boosting share prices but not the real economy. Because the assets of these companies are in the form of data, software and patents their assets can be moved around freely abroad in order to reduce tax liabilities (Foroohar 2019). These big tech companies use their market power in a lightly regulated field to trump competition and in order to keep collecting freely personal data of users and selling them for profit.

Chesbrough (2017) recognizes the shifting importance of the service sector, and states that services are the next development in open innovation. The modern corporations' commodification of knowledge and creativity has allowed for the development of the digital service sector. The new business models around selling creativity and knowledge are transforming the working life. Increasingly people can work remotely from the official place of business, or even from the customers. As work is no longer necessary to perform at a certain place, the work is also possible to outsource to a more distant location in a country where labour is cheaper, as is the model of crowdsourcing and Amazon's Mechanical Turk. This could result in work being relocated to countries where labor is cheaper and not perhaps as regulated. Digital platforms and software services are shaping the future of work life. The platform economy is creating new forms of employment while creating a gig-economy structure into the economy.

As the significance of information and knowledge in the economy and the society increases, there will be a shift in power. The power is no longer in the hands of the one who owns the means of production, but who has the knowledge and data. This phenomenon can be seen from the success and domination of companies like Google and Facebook.

6 Conclusion

The future of the nature of work is uncertain, however it is reasonable to conclude that there will be at least some disruptions to work life and the way in which work is conducted. New occupations will be created, and some work will be destroyed. The trend seems to be that the employment share of manufacturing is decreasing, and the movement is towards the service sector. An emphasis is on knowledge intensive work, and new work is created with an emphasis on high-skill level. The main reason in the declining demand for labour in manufacturing has been stagnating economic growth together with technological change. The growth of labour productivity has not been significant during the last decades, however, in a stagnating economy technology is a way of increasing efficiency in a more cost-effective way, which in turn decreases the employment share of manufacturing. Globalisation has pushed for global competition and companies are forced to push for ways to stay competitive. The developed countries that have been able to hold on to manufacturing are the ones that have taken on robotization. Sufficient economic growth would be needed to drive the demand for manufacturing and support manufacturing employment. There has been however a trend of deindustrialization in the developed countries, and a phenomenon of premature deindustrialisation has started to take place in the developing countries.

Rising living standards increase the demand for services and the importance of the service sector as an employer has grown. Despite the growing demand for services, the service sectors that drive productivity do not have a similar employment effect that manufacturing had, especially for unskilled people. The consumption of goods and services have changed with new technologies, and generational differences also affect consumption preferences. Digitalization has made the trade of services easier. Technologies have made the barrier of entry lower into the service sector. New companies and start-up are able to enter the market easier and at lower costs. Their capital is knowledge and information.

The digital economy has contributed to the creation of a gig-economy. Temporary work, while being a choice for some, causes insecurity about the future for those forced to take on temporary employment. The gig-economy causes fluctuating income, might not be properly regulated and does not give the employees the same rights that permanent employees receive.

Open innovation drives for openness and development through networks and cooperation. Together with digitalization it drives for faster innovation. However, open innovation sets the scene for research and development through mergers and acquisitions. This could be a working strategy for large companies to expand into new markets and bring in new talent, and for smaller companies it could allow access to resources they would not have access to. However, it can also lead to a setting of few dominant players using acquisitions to protect their market dominance and remove competition from the market.

When before the ownership of capital and access to it played the key role, in the modern digital economy an importance is laid to the ownership of data and knowledge. In a data intensive society, the power is concentrated to those who own the data. Technology is not neutral as often the values and the aims of the creator is embedded in the technology and its systems. The share of intangibles in the economy is growing in comparison to tangibles and is transforming the structure of the economy, and the amount of people employed by technology companies is smaller in comparison to large industrial companies. The digital economy can be seen driving polarization not only in the work life but in the society as whole.

The objective of the thesis was to find out how artificial intelligence technologies affect the nature of work. As a subsidiary question was how power relations affect the design and the implementation of technologies. As the field of the topic is very vast, some aspects of it cannot not be considered and are thus left outside of the research. The thesis was able to form a picture of the current literature on artificial intelligence and employment. It also found main implications of technology in manufacturing and the service sector using reliable sources of data. The thesis also explored aspects of power in the use of technology and how technological efficiency is perceived in the developed nations. The relationship between technology and the gig-economy could have been studied further as an important part of the changing nature of work. Recommendation for future research would be the effect of technology and digitalization on the gig-economy, and how the gig-economy affects to wellbeing of workers and the polarization of the society.

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