

# The Effect of the Fourth Industrial Revolution Economies and Management

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**Abstract** The fourth industrial era (or Industry 4.0) refer to the recent trend of massive data collection, analysis and communication with intense process automation. Massive studies have been conducted in this field, though with the main focus on technical details, hardware and software. There still remains a considerable gap in the analysis of potential effects of the Fourth Industrial Revolution on economies and management. According to recent studies from 45 to 60 percent of jobs around the globe are at risk of being automated or computerized. Despite the fact the new jobs such as automation engineers, programmers, data analysts and others are being created, the economies would get significant amount of workforce lacking necessary qualifications. A casual model that shows the effect of the increasing automation on economies has been developed and discusses potential implications. The paper suggests that economies and organisations would have to adopt “Algorithmic Management” to remain competitive in the new digital environment.

## 1 Introduction

The world is now going through a technological revolution, often referred to as the Fourth Industrial Revolution, Industry 4.0 or Industrial Internet, that will radically change the way of living, working and communicating. The transformation is already taking place in all aspects of business and it is yet to increase the pace as companies increasingly use robots in production lines or algorithms to optimize their logistics, manage inventory, and carry out other core business functions. Technological advances are creating a new automation age in which ever-smarter and more flexible machines will be deployed on an ever-larger scale in the workplace. In reality, the process of automating tasks that are done by humans has been under way for centuries. What has changed is the pace and scope of what can be automated. It is a prospect that raises more questions than it answers. How will automation transform the workplace and what is likely to be its impact both on productivity in the global economy and on employment? This paper looks at the implications for economies and management. It is important to understand potential influences of the change on economy and effectively manage it, adapt to it, be ready to embrace its benefits and to response to the negative sides.

## 2 The Current State of the Problem

Frey and Osborne (2017) analysed potential jobs at risk through estimating the probability of computerization for about 700 occupations in the US. The core outcome of their research is that almost 50 percent of US jobs are facing a high risk of being redundant due as a result of computerization. Frey and Osborne also add that robots will perform not only simple standardized actions, but sophisticated procedures as well. Bowles (2014) attempted to conduct a similar study in Europe and concluded that North European countries such as France, the UK, Sweden and Germany demonstrate highly identical situation as in US and would not be affected by

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computerization as much as South European countries, where the range of affected work force varies between 45 and 60 percent.

### 3 The Effect of Industry 4.0 on Economies and Management

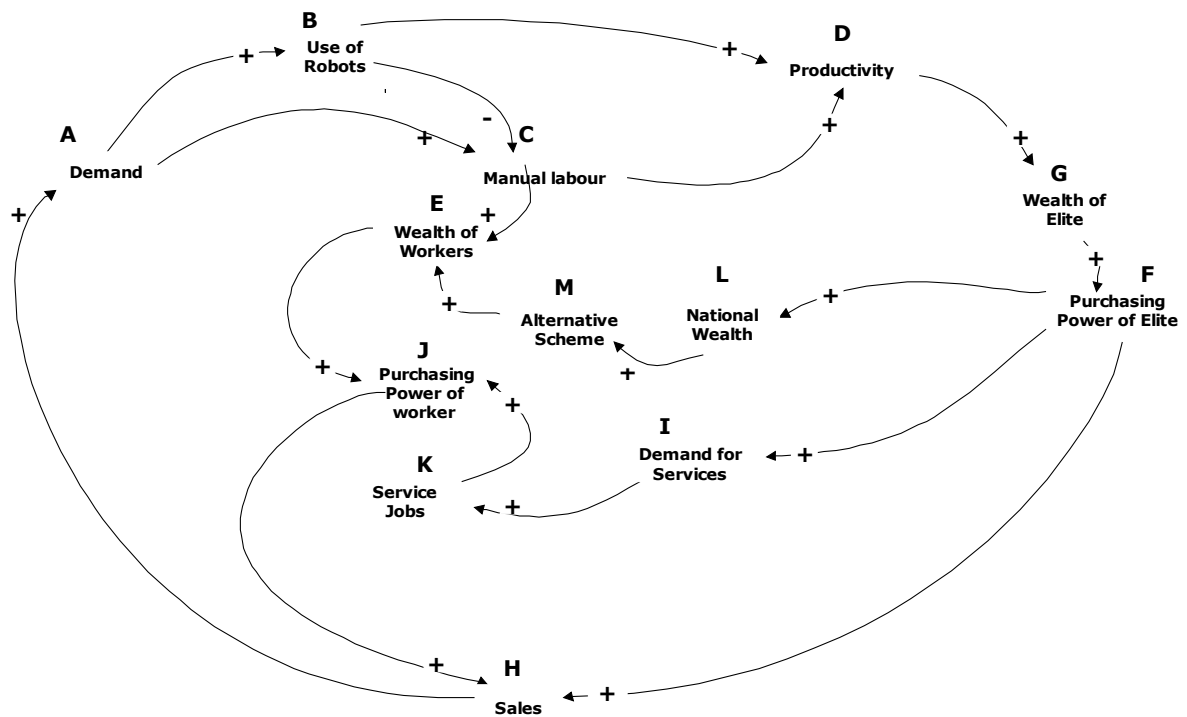
Until now, the objective that manufacturers faced was how to solve a particular problem. In many cases, Industry 4.0 has resolved this problem. What has to be decided are the moral, ethical and legal consequences of solving the problem.

Referring to moral and ethical aspects, pessimistic forecast anticipates that “robotization” of humanity would eliminate intuition and creativity in the process of decision making and thus the outcome might be less beneficial. Though it all still comes down to people, their principles and values that shape the automation initiatives around the globe that, in turn, may substantially increase inequality among people. The most advantages of the Fourth Industrial Revolution would be achieved by providers of intellectual capital among which are the technological innovators and investors. Nowadays, the demand for manual workers has been replaced by highly skilled professionals and capital holders.

The first three industrial revolutions driven by technological progress have not fully eliminated human labour. Autor (2015) claims that the employment-to-population ratio rose during the 20<sup>th</sup> century even as women moved from home to market. In 2015 German manufacturing still supplied one in five jobs, despite a high level of automation (Marcolin et al. 2016). However, proponents of automation – employment interactions state that past experience cannot be taken as a base for anticipation of the effect of the transformation given by the Fourth Industrial Revolution. Appearance of significantly improved computing capabilities, robotics and artificial intelligence brings the possibility of automation to a completely different level not observed ever before.

MIT professors Brynjolfsson and McAfee (2011) claim that current rapid technological transformation is eliminating jobs at a faster rate than new ones are created. Technology development has a direct effect on productivity, one creates higher value for a given input. It can also be considered as an indicator of progress. In the post-World War II years level of employment grew along with productivity improvement. Companies produced more value from their employees, the economy was getting richer and it triggered more business activity resulting in creation of more jobs. On the edge of 21<sup>st</sup> century though people and organisation were no longer managing to keep up with the pace of technological advances and the unemployment was growing at a faster pace.

In general, a causal model is a model that depicts causal aspects of a system (Pearl 2001). The following causal model shows the effect of increasing automation on the economy. In this model, the arrows represent causal effects i.e. A causes B (all other factors being ignored). The positive sign signifies that an increase in one factor will cause an increase in the other. There is a strong positive loop ACEJHA, which one could classify as the “normal” situation. This is a positive reinforcing loop, where employment provides purchasing power to the workers who can then use that to purchase goods i.e. increase sales and satisfy demand. This then increases the employment of the worker. This has been the post war trend where, in general, demand and the work package of the employee has risen. There were increases in automation but these have resulted in minor changes to employment and overall employment has been steady. The anticipated increase in automation and its effect on what was previously regarded as safe employment (such as lawyers, drivers etc) will have two effects. It will create the negative loop ABCEJKHA which will decrease employment but at the same time this will be compensated by the positive loop ABDGFHA which can stimulate growth. But this will now be for products purchased by an elite few and thus may take different forms than before. The efficiency of the robots will mean that productivity can be maintained (without workers) and thus GNP will still increase. We have a novel situation where GNP is increasing as purchasing power of most of the population is decreasing. This may create a two-layer society of haves and have-nots where the latter will be employed to service the former. This is shown in the positive loop ABDGFIKJHA



**Fig.1** Economic Ramifications of Industry 4.0 (Personal collection)  
 Source: Own results

To prevent this occurrence, some other means must be devised to compensate for the link ACEJ. This is termed “Alternative Income” creating a link FLME. Which gives the positive link ABDGFLMEJHA. There has been much discussion about what form this “alternate Income” could take. One such idea is called the Universal Basic Income (UBI) and another that has been advocated by the likes of Bill Gates is a tax on the use of robots (RT). Weller (2017) refers to Bill Gates saying that this should not come from company profits, but from the national pot.

The UBI would be a guaranteed income for every resident of a society or economy which would provide enough for living i.e. food, housing and sick care. There are various ways that this could be paid for. It is argued that simply by abolishing all means testing (a very expensive exercise) enough money would be available to fund such a policy. It would not require major changes in taxation and people would be free to work and earn as much as they desired above this basic payment. It is hoped that many people would devote their activities to cultural enterprises and recreate a common sense of identity. It would get rid of so-called “poverty traps” and contribute towards a more caring society. Professor Zwolinski (2010) of the Cato Institute enumerates four libertarian arguments for a UBI. He places them under the banners of: i) reduced bureaucracy, ii) reduced cost, iii) reduced rent-seeking (i.e. under a universal program there is less space for political exploitation or benefit fraud), and iv) a reduction in the state’s ‘invasive/paternalistic’ tendencies, as there is no longer a need to categorise beneficiaries as the deserving poor.

Varoufakis (2017), a former finance minister of Greece, is Professor of Economics at the University of Athens, and futurist Gada (2016), on the other hand, have each suggested that the labour savings from automation could (and should) pay for UBI. Varoufakis’ proposal is one-part wealth tax and one-part ownership restructuring: a small tax is levied on shares from every initial public offering put into a Commons Capital Depository that in effect grants citizens property rights over new technologies that yield financial returns. The Commons Capital Depository would then pay out a UBI to all citizens. Varoufakis sees this as potentially alleviating “irreconcilable political blocs, while [...] reinvigorating the notion of shared prosperity,” largely due to reframing understandings of when wealth is a result of hard work vs. context and luck especially in the face of technological unemployment.

Another way that is being proposed is the Robot Tax. Robots are a capital investment, such as a blast furnace or a computer. Economists have traditionally opposed to tax things that allow the economy to produce more goods. It is believed that the taxes that inhibit investment, make people poorer, because it does not bring a lot of extra money. However, from the standpoint of Weller (2017), investment in robots cannot be compared to investments in operating coal-fired generators: they increase the industrial production, but also increase social costs, which economists call a negative externality. Perhaps the rapid automation can lead to the fact that many people lose their jobs, and new sectors will not be able to employ all of them. This can lead to high social cost and long-term unemployment, as well as potentially destructive to support government policy. Tax on robots could be likened to a tax on emissions of blast furnaces, writes the British magazine *The Economist* (2017). The

money could be spent on retraining workers on health and education, or to help the elderly and the sick. Slowing the introduction of robots in healthcare and service sector may seem like a reasonable way to maintain social stability. But if it would increase the cost of the medicine, which "eats" extra income workers, it will be a victory, tantamount to defeat.

## 4 Training and Industrial Development

As Industry 4.0 will radically transform the competence profiles for workers, it will be necessary to provide the appropriate training strategies. The rise of 3-D printing will negate the need for manufacturing skills that workers needed in the past. 3-D printing is now used for creating human organs to use as a test bed for drugs, all different types of materials (glass, metal, brick) and also is being used to create chocolate. In response to this was is needed by workers will be what has come to be known as "soft skills"

'Soft Skills' is the term given to people's ability to handle the human side of business such as influencing, communication, team management, delegating, appraising, presenting and motivating. This is now recognised as key to making businesses more profitable and an essential skill for new employees. Increasingly, companies aren't just assessing their current staff and future recruits on their business skills. They are now assessing them on a whole host of soft skill competencies around how well they relate and communicate to others.

In the most advanced and developed companies' employees are required to possess an ability to communicate clearly and openly as well as listen carefully and react empathetically. Besides the mentioned skills, writing is important to ensure proper corresponding to communicate the required information. Another highly valuable soft skill is the ability to adapt to the dynamically changing conditions while applying more creative and non-standard thinking.

In the modern world, which is more stressful than ever before, it is essential that future workers acquire these skills. This will include: Assertiveness Skills (key techniques to deal with Bullying, Confrontations and Difficult People.) Business Networking Skills (being at ease in the networking arena and build the relationships). Communication Skills ( preparing slides, corresponding correctly, making oneself understood) Conflict Management, Interview Skills , Stress Management Training, Planning and organisation, Budget and Cost Control and Work Life Balance.

Personal Development Planning (PDP) is a continuous development process that enables people to make the best use of their skills and helps advance both the individual's plans and the strategic goals of the organisation. It is a working strategy, which helps identify development needs. The process is continuous by its very nature. It benefits both the individual and the organisation. It also benefits the individual's line manager, his or her colleagues/peers and other staff with whom he or she works.

Participation in PDP is voluntary and is driven by the individual. It is a four-step process comprising: preparation; personal evaluation including the completion of a PDP workbook; the PDP meeting with one's line manager; continuous review. PDP ensures that employees receive recognition for their work through a process which acknowledges their achievements and provides them with as much information as possible about what they do and what is required in order to do better.

The PDP workbook provides a clear framework that allows people to identify in terms of personal development where they have come from, how they are getting on in their job at present, where they would like to be in the future and how they propose to get there. The questions to be completed are framed as follows:

- 1) where have I been?
- 2) where am I now?
- 3) where would I like to be?
- 4) how do I get there?

The workbook contains detailed guidelines to answering these important PDP questions. Answers that are accurate and comprehensive enable the individual to form an agreed personal development plan that will deliver the development objectives identified.

Careful preparation for the PDP meeting between the staff member and his or her line manager is crucial from both the participants' point of view. It is vital that line managers read this guide and be fully informed of what personal development planning is, what its benefits are, what should happen before starting the process, the process itself, who the key stakeholders are and what are their roles. The more information gathered by the line manager before the meeting the richer the outcome. For example, the line manager should review the staff member's job description and be prepared to provide constructive feedback based on past performance.

At the meeting itself the line manager should be in a position to validate feedback comments with actual examples of behaviour, and should encourage the staff member to openly discuss his or her personal development plan and any specific job advancement expectations. The meeting should be structured into two parts. The first part should focus on the job objectives and the second part should concentrate on an

identification of development needs. At the end of the meeting the line manager should clarify what has been agreed and both line manager and staff member should agree dates for review as part of the continuous process of PDP. The line manager has an obligation to keep the staff member's personal development plan and all details of discussion at the PDP meeting confidential.

It is equally important that staff members prepare fully and carefully for their PDP meetings. They should complete the first three questions in the workbook prior to the meeting. They should also review their job descriptions and assess their skills in the light of the organisation's objectives. They should invite others to provide them with feedback – line manager, colleagues/peers and any staff which they themselves manage. It is important that they obtain as much data about themselves as possible.

At the meeting itself they should focus first on job objectives and then on development needs. They should have their key questions prepared and well-rehearsed, their development objectives clearly identified and the options that best suit their needs listed. In the light of this information their developmental needs can be analysed and appropriate developmental activities (such as formal training, coaching or mentoring) can be agreed. At the end of the meeting they should clarify what has been agreed, and fix timelines and dates to the PDP process. They should meet again with their respective line managers not later than six months into the process and they should have a final review not later than twelve to eighteen months following the initial PDP meeting.

Laloux (2014) presented how management has evolved over the ages showing several stages, where each stage is identified by a colour. The first stage was described as a "Wolf Pack" characterised by division of labour and command authority. The last stage was referred to as a "Living Organism" that has an evolutionary purpose, is self-managed and is holistic. In our view, there is now a further addition to this list which can be termed "Algorithmic Management". This is the type of management exhibited by companies such as Uber, Airbnb and Deliveroo and is being adapted by many more. Whereas classic manufacturing would be ensuring competitive advantages through the extensive utilization of self-controlled, knowledge-based and sensor enabled production, operations would be getting "smarter", employees would have to possess new skills for adopting new technologies within human-machine and human-system environment. The organisational driver for business management is the ability of a factory to self-organise virtually without human input. This is a form of extreme decentralisation. In the last 40 years a trend towards decentralising factory control has been clearly recognisable and this is now being pushed to the extreme, Scheer (2015).

## 5 Conclusions

To summarise, the Industry 4.0 does not only lead to job cuts, but it provides an opportunity to increase levels of global income and raise standards of living. Until now, regular consumers have mostly benefited from the 4<sup>th</sup> Industrial Revolution gaining a chance to become a part of "new digital world" while using technologically advanced products and services. Yet to come, technological advances will revolutionize production processes and supply chains in terms of significant productivity and efficiency improvements.

Whereas some economists, including Brynjolfsson and McAfee (2012) claim that the revolution would also cause even greater inequality, especially in forms of disrupted labour markets. Klaus Schwab (2016), Founder and Executive Chairman of World Economic Forum, anticipates that as robotization substitutes for work force across the entire economy, the net displacement of workers by machines might exacerbate the gap between returns to capital and returns to labour. For all that, automation should gradually decrease injuries gained at dangerous jobs.

Despite the fact that Industry 4.0 is also referred to as the Fourth Industrial Revolution, it is rather an evolutionary process. Available technologies are already able to provide stable performance for a relatively low price that is still going down. They still lack wide application experience and have to be adjusted for the application in particular solutions within manufacturing and service settings.

Moreover, success of Industry 4.0 highly depends on management approaches and attitudes to new digital solutions. We suggest that "Algorithmic Management" would be a core of any organisation willing to be competitive in the digital environment. At the same time manufacturing would strive to apply the technological advances to make the operations "smarter" – self-learning, more predictable and efficient. Over the decades, a clear trend of factory decentralization has taken place and nowadays it is being proliferated.

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