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## Economies and Management as A Result of The Fourth Industrial Revolution: An Education Perspective

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### ABSTRACTS

The fourth industrial era (or Industry 4.0) refers 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 remains a considerable gap in the analysis of the potential effects of the Fourth Industrial Revolution on economies and management. According to recent studies, from 45% to 60% of jobs around the globe are at risk of being automated or computerized. Although new jobs such as automation engineers, programmers, data analysts, and others are being created, the economies would get a significant amount of workforce lacking the necessary qualifications. A causal model that shows the effect of increasing automation on economies has been developed and discusses potential implications. The paper suggests that economies and organizations would have to adopt "Algorithmic Management" to remain competitive in the new digital environment. This paper can be a reference, especially from an education perspective.

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## 1. INTRODUCTION

The world is now going through a technological revolution (Drucker, 1966), often referred to as the Fourth Industrial Revolution (Ross & Maynard, 2021), Industry 4.0, or Industrial Internet, that will radically change the way of living, working, and communicating (Xu et al., 2018). 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 (Preuveneers & Ilie-Zudor, 2017) and more flexible machines will be deployed on an ever-larger scale in the workplace (Harvey et al., 1997). In reality, the process of automating tasks that are done by humans has been underway 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 the potential influences of the change on the economy and effectively manage it, adapt to it, be ready to embrace its benefits, and respond to the negative sides.

In the current state of the problem, Frey and Osborne (2017) analyzed potential jobs at risk by estimating the probability of computerization for about 700 occupations in the USA. The core outcome of their research is that almost 50% of US jobs are facing a high risk of being redundant as a result of computerization. Frey and Osborne also add that robots will perform not only simple standardized actions but sophisticated procedures as well. Study in Europe and concluded that North European countries such as France, the UK, Sweden, and Germany demonstrate highly identical situations as in the USA and would not be affected by computerization as much as South European countries, where the range of affected workforce varies between 45 and 60%.

## 2. METHOD

This study was a literature survey. The data were obtained from literature, analyzed, and discussed to get a conclusion.

## 3. RESULTS AND DISCUSSION

### 3.1. 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 David (2015). Referring to moral and ethical aspects, the pessimistic forecast anticipates that the "robotization" of humanity would eliminate intuition and creativity in the process of decision-making and thus the outcome might be less. Though it all still comes down to people, their principles and values that shape the automation initiatives around the globe, 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 labor. Autor (2015) claims that the employment-to-population ratio rose during the twentieth 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.

However, proponents of automation employment interactions state that experience cannot be taken as a base for anticipation of the effect of the transformation given by the Fourth Industrial Revolution. The appearance of significantly improved computing capabilities, robotics, and artificial intelligence bring the possibility of automation to a completely different level not observed ever before. Technology development has a direct effect on productivity; one creates higher value for a given input. It can also be considered an indicator of progress.

In the post-World War II years, the 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 the creation of more jobs. On the edge of the twenty-first century, though people and organizations were no longer managing to keep up with the pace of technological advances, unemployment was growing at a faster pace. In general, a causal model is a model that depicts causal aspects of a system (Pearl, 2009). 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 have 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 the 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 (Figure 1). 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).

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 toward 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:



costs and long-term unemployment, as well as potentially destructive to support of 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 in health and education or to help the elderly and the sick. Slowing the introduction of robots in the 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.

### **3.2. Training and Industrial Development**

As Industry 4.0 will radically transform the competence profiles of 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 testbed for drugs, all different types of materials (glass, metal, brick), and also is being used to create chocolate. In response to this, what 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, communicating, team management, delegating, appraising, presenting, and motivating. This is now recognized 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 dynamically changing conditions while applying more creative and non-standard thinking.

In the modern world, which is more stressful than ever before, future workers must 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 in building the relationships), communication skills (preparing slides, corresponding correctly, making oneself understood), conflict management, interview skills, stress management training, planning and organization, 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 organization. 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 organization. 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, a PDP meeting with one’s line manager, and continuous review. PDP ensures that employees receive recognition for their work through a process that acknowledges their achievements and provides them with as much information as possible about what they do and what is required 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:

- (i) Where have I been?
- (ii) Where am I now?
- (iii) Where would I like to be?
- (iv) How do I get there?

The workbook contains detailed guidelines for 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' points of view. Line managers must 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 behavior 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 the 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.

An agreed date for review as part of the continuous process of PDP. The line manager should keep the staff member's 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 before the meeting. They should also review their job descriptions and assess their skills in the light of the organization's objectives. They should invite others to provide them with feedback – line manager, colleagues/peers, and any staff they manage. They must 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 identified, and the options that best suit their needs list. In the light of this information, their developmental needs can be analyzed, and appropriate developmental activities (such as formal training, coaching, or mentoring) can be agreed upon. At the end of the meeting, they should clarify what has been agreed upon and fix timelines and dates for the PDP process. They should meet again with their respective line managers not later than 6 months into the process, and they should have a final review not later than 12–18 months following the initial PDP meeting.

Wade (2014) presented how management has evolved over the ages showing several stages, where each stage is identified by a color. The first stage was described as a "wolf pack" characterized by division of labor 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 adopted 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”, and employees would have to possess new skills for adopting new technologies within human-machine and human-system environment. The organizational driver for business management is the ability of a factory to self-organize virtually without human input. This is a form of extreme decentralization. In the last 40 years, a trend toward decentralizing factory control has been recognizable, and this is now being pushed to the extreme.

#### 4. CONCLUSION

To summarise, 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 4th Industrial Revolution gaining a chance to become a part of the “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. Some economists, the revolution would also cause even greater inequality, especially in the form of disrupted labor markets. Founder and executive chairman of the World Economic Forum, anticipates that as robotization substitutes for the workforce across the entire economy, the net displacement of workers by machines might exacerbate the gap between returns to capital and returns to labor.

For all that, automation should gradually decrease injuries gained at dangerous jobs. Although 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, the 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 organization 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.

#### 5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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