

THE POTENTIAL IMPACT OF TECHNOLOGICAL DEVELOPMENT ON FUTURE JOBS

ȘTEFAN COSMIN-ALEXANDRU

*PhDc., Centre for Organizational Strategies and Leadership (CSOL-UB), University of Bucharest
cosmins.faa@gmail.com*

TOMA GEORGE-SORIN

*PhD, Faculty for Business and Administration, University of Bucharest
tomagsorin62@yahoo.com*

Marinescu Paul

*PhD, Faculty for Business and Administration, University of Bucharest
paulmarinescu1@gmail.com*

Rezumat

Technological developments in the last decades have reached unbelievable levels, what was once the domain of science fiction movies is now a reality, and this developments have left few areas of human life unchanged. In this paper we aim to explore the changes that technology brought to the way people work and, especially to the way people will work. While we acknowledge that any prediction about the future is almost always proved wrong from the get go, we think that the importance of the subject warrants the risk. The paper draws its routes from some of the most influential theories about how technology will impact the way people work and its main objective is to spark a conversation about the merits of lack thereof that they contain. It is by no means an extensive work, but rather the beginning of a research focus that will, hopefully bring new insights in the above mentioned field. For the sake of convenience we have grouped the predictions in three categories: “Business as usual”, “Lateral developments” and “All bets are off” based on how profound the change would be. Each of this levels offers different benefits, as well as different challenges, our hope is that throw a process of thorough consideration solutions can be generated to maximize the former while minimizing the latter.

Cuvinte cheie: future work, tehnology, artificial intelligence, inequality

Clasificare JEL: M40, M41

1. Introduction

The fact that technology has had a great impact on the development of the human civilization is universally accepted, however it is easy to, sometimes, underestimate just how great that effect was. Usually when we are thinking about the most important moments in human civilization, we tend to think about things like the domestication of animals, the discovery of agriculture and subsequently the birth of the city; of the rise and fall of great empires; of the birth of the most important religions; of ages of discovery; of great thinkers; or of great disasters, however, as Ian Morris has shown, the effect that this moments had on the overall progress of mankind pales in comparison to that of the (First) Industrial Revolution which “made mockery of all the drama of the world’s earlier history” (Morris, 2010).

The Industrial Revolution “bent the curve” in terms of population growth, social development and total GDP by almost 90 degrees (McAfee, Brynjolfsson, 2010), fueling the future progress that brought about the world as we know it today. However this great progress did not come without a price, as a lot of the skilled workers who were earning a decent life found themselves replaced with machines, and left without the possibility of making a living. This sparked a hatred against machines which culminated with the Luddite movement, a group of former textile workers who started burning down factories that used the new technology, their arrest and subsequent trial and conviction gave birth to a wave of protests against the “soulless machines” taking over people’s jobs that echoes to this day (Sale, 1995).

Recent developments in technology, especially IT&C, have seen a lot of jobs automated; from banking (Hunter *et al.*, 2011), to healthcare (Korzep, 2010), to manufacturing (Berman *et al.*, 1994), few sectors were left unaffected. The general result of this trend is that “intensive use of IT, higher service levels for customers, and organizational change all go together, and together call for higher-skilled labor” (Smith, 1995). This fact alone is enough to cause serious concern about the future of low skill employees, however, as we will show in the next sections, this might very well be only the beginning.

2. The second machine age

The general opinion amongst researchers used to be that certain jobs are “safe” from being replaced by computers, chiefly the so called “*knowledge work*” as they require skills that computers simply cannot possess, while others that are based on repetitive actions will most likely be automated in the near future (Rifkin, 1995). This meant that the solutions for “technical unemployment” were relatively straightforward: train workers to acquire new skills, improve the learning system, encourage entrepreneurship and invest in infrastructure.

“*The second machine age*” is a term coined by M.I.T. researchers Andrew McAfee and Erik Brynjolfsson, who concluded that recent advances in computer science are most likely going to trigger a new revolution. If the first industrial revolution was powered by the steam engine, this one is going to be powered, in their view, by “*machine learning*”.

Machine learning can be defined as “*programming computers to optimize a performance criterion using example data or past experience*” (Alpaydin, 2004), the main advantage of this approach is that it mimics the way humans learn, as opposed to simply executing a previously written algorithm, and while this might seem trivial, the consequences are huge.

In essence this advance helped pave the way towards Artificial Intelligence (A.I.) by helping computers “*gain senses*”: they can now see, hear and speak, as well as understand, answer and write (McAfee, Brynjolfsson, 2012).

One great example to illustrate this revolutionary leap is Google cars. For a long time one of the things that was considered impossible for a computer to do was driving (McAfee, Brynjolfsson, 2010), so when Google announced that it had cars driving on a highway in normal traffic, virtually without incident, people were astonished (Markoff, 2010).

Another field that saw surprising developments was professional writing; recently algorithms that can generate content have been presented, and while they will not replace novelists or columnists any time soon, they are able to generate reports based on financial reports and sport results, a job traditionally done by junior newspaper and magazine staff (Finley, 2015).

Perhaps the biggest blow for the theory that knowledge workers are safe from being replaced by computers was given by IBM’s Watson supercomputer in February 2012 when it won the “*Jeopardy!*” quiz show, by defeating the most successful two players in the games history by a huge margin. While winning a TV show might not sound as a big deal, the complex tasks needed to achieve this (understanding metaphorical meanings and idioms, balancing aggressiveness and prudence, mastering a huge number of fields, some of them completely trivial, to name just a few) make it anything but that for a computer, and would have been unthinkable even a few years ago. As former champion Ken Jennings put it “*«Quiz show contestant» may be the first job made redundant by Watson, but I’m sure it won’t be the last*”.

If we include tasks like instant translation, voice recognition and picture recognition into the mix, all of which are possible today, even if not perfect, the number of jobs affected by these developments, and by their various possible combinations has the potential to be game changing, and we might be very well heading towards “*a second machine age*”.

As we will show in the next chapter, some theorists go even further.

3. Towards superintelligence?

If we accept the assumptions made before, and there certainly seem to be enough reasons to do so, we are heading towards a period of profound transformations in almost all aspects of human endeavor, a period that might have an impact comparable to that of the first Industrial Revolution, with one substantial difference: first time around, machines replaced human muscle force, this time they will replace the human mind (McAfee, Brynjolfsson, 2010).

While this assertion that an AI will surpass human intelligence might seem to belong to the realm of science fiction novels, and not scientific research, it has a few characteristics that make pursuing it a worthwhile endeavor: it would be almost unpredictable (by the majority of people at least), it would have tremendous consequences, and its occurrence cannot be deduced by prior events; it would essentially be a *Black Swan* (Taleb, 2010).

The term generally used to describe such an A.I. is *Superintelligence* which is defined as “*any intellect that greatly exceeds the cognitive performance of humans in virtually all domains of interest*” (Bostrom, 2014), and this definition alone is enough to show the huge significance it would have on the world.

Not even the most optimistic theoreticians expect the emergence of such an A.I. in the immediate future, the general opinion being that this will occur around 2030 or 2050 (Müller, Bostrom, 2014), however the trends that we discussed in the previous chapter, and the speed with which they occurred, make dismissing it altogether impossible.

The main implication of such a discovery, is that it has the potential to be “*the last invention mankind will ever make*” (Barrat, 2013), such an A.I. does not “*stop at the human station*”, meaning that after it reaches human level intelligence, it will surpass it almost instantaneously (Bostrom, 2014), this gives it the potential to make all human jobs obsolete.

While such a development is theoretical, belongs to the future and seems more like a movie scenario, the mere fact that it is possible makes considering its potential consequences a worthwhile exercise, as we will discuss in the next section.

4. Implications

We have introduced three possible scenarios about the potential implications of technological development on the future of jobs:

- **“Business as usual”** In this scenario, things will continue to evolve pretty much as they have always done. Technology replaces low skill jobs, but also gives birth to new king of jobs, in which case *“there’s never been a better time to be a worker with special skills or the right education, because these people can use technology to create and capture value”* (Levy, Murnane, 2004). While attention has to be given to the low skilled workers, so as to ensure that they can remain productive members of society, and investing in education should be a priority, so that future workers accumulate the required *“higher”* skills, there is no need for great concern. After all, following the Industrial Revolution, and a relatively short period of turmoil, people were able to work in new factories, and the general level of wellbeing increased dramatically.
- **“Lateral developments”** In this scenario, the new technologies have a more complex effect, while replacing some of the *“blue collar”* jobs (as expected) their combinations also affect *“white collar”* workers in a surprising way. On one hand we have drivers replaced by automated vehicles, warehouse workers replaced by self-navigating robots, on the other customer service representatives, call center staff, even medical diagnosticians replaced by machines. This development would require questioning some of the basic assumptions that society operates on, because it is unlikely that enough new jobs can be created to absorb the workforce surplus on the middle term. Alternative solutions should be taken into consideration, like, for example, a basic guaranteed income in order to ensure that inequality does not reach an even higher level.
- **“All bets are off”** In this scenario a *Superintelligence* is born, and all job become obsolete as even the very best of the top skilled workers cannot compete with the machines. Far from being a dystopian future, the fuel of science fiction movies, this scenario has the potential to be a true utopia, however because as Voltaire stated *“work saves us from three great evils: boredom, vice and need”* (Voltaire, Constantine, 2005), the basic elements of how human societies function has to be rethought.

5. Conclusions

One of the major problems that have plagued economists and state men alike in the recent past is the increasing level of inequality. It has long been assumed that technological progress is one of the surest ways to ensure to improve the overall wellbeing of societies, however recent trends seem to disprove this theory.

If this is indeed the case then the way the future of technological progress unfolds will have a big impact on the way people live and work, which makes further research in the possible outcomes the more relevant.

Any exercise in predicting the future is almost sure to fail, that is why this article does not make any assumptions about which of the three scenarios is most likely to actually occur, nor does it claim that this is an extensive list of possible outcomes. Its aim is to present some of the theories about what *“might happen”* as a bases for further discussions about the implications to the way people work, the jobs they will have and how the current socio-economical system will have to adapt to this changes.

It also forms the basis for further research in the way work evolved during the last decades in different countries, as well as how this lead to the inequality levels we are currently experiencing, the highest ever recorded.

The dangers in ignoring these problems, and focusing on *“business as usual”* are so great, that we don’t think they can be ignored.

6. Bibliography

1. **Alpaydin, E.**, Introduction to machine learning, MIT Press, Mass., [2004]
2. **Barrat, J.**, Our Final Invention: Artificial Intelligence and the End of the Human Era, St Martin’s Press, NY, [2013].
3. **Bostrom, N.**, Superintelligence: Paths, Dangers, Strategies, Oxford University Press, Oxford, [2014].

4. **Berman, E., Bound, J., Griliches, Z.,** Changes in the Demand for Skilled Labor within U.S. Manufacturing Industries: Evidence from the Annual Survey of Manufacturing, *Quarterly Journal of Economics*, pp. 367-397, May [1994]
5. **Bresnahan, T. F., Brynjolfsson, E., Hitt, L. M.,** Information Technology, Workplace Organization, And The Demand For Skilled Labor: Firm-Level Evidence, *The Quarterly Journal of Economics*, MIT Press, vol. 117(1), pages 339-376, February, [1999].
6. **Brynjolfsson, E., Hitt, L. M.,** Beyond Computation: Information Technology, Organizational Transformation and Business Performance, *The Journal of Economic Perspectives* 14.4, 23–48, [2000].
7. **Finley, K.,** In the Future, Robots Will Write News That’s All About You, *Wired Magazine*, 03.16, [2015]
8. **Hunter, L. W., Bernhardt, A., Hughes, K. L., Skuratowicz, E.,** It's Not Just the ATMs: Technology, Firm Strategies, Jobs, and Earnings in Retail Banking, *ILR Review* January, vol. 54 no. 2 402-424, [2001]
9. **Korzep, K.,** The future of technology and the effect it may have on replacing human jobs, *Technol. Health Care* 18, 353-358, [2010].
10. **Levy, F., Murnane, R. J.,** *The New Division of Labor*, Russell Sage Foundation, NY, [2004]
11. **McAfee, A., Brynjolfsson, E.,** Race against the machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy, *Digital Frontier Press*, Mass., [2012].
12. **McAfee, A., Brynjolfsson, E.,** *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W. W. NortonW&Company, NY, [2010].
13. **Markoff, J.,** Google Cars Drive Themselves, in Traffic, *New York Times*, 9 [2010].
14. **Morris I.,** *Why the West Rules—For Now: The Patterns of History, and What They Reveal About the Future*, Farrar, Straus and Giroux, NY, [2010].
15. **Müller, Vincent C. and Bostrom, Nick,** Future progress in artificial intelligence: A Survey of Expert Opinion, in Vincent C. Müller (ed.), *Fundamental Issues of Artificial Intelligence (Synthese Library; Berlin: Springer)*, [2014]
16. **Rifkin, J.,** *The end of work*, Putnam Publishing Group, NY, [1995].
17. **Sale K.,** *Rebels Against the Future: The Luddites and Their War on the Industrial Revolution*, Addison-Wesley Publishing Company, Boston, Mass., [1995].
18. **Smith, M. J., Carayon, P.,** New technology, automation, and work organization: Stress problems and improved technology implementation strategies. *Int. J. Hum. Factors Manuf.*, 5: 99–116, [1995].
19. **Taleb, N. N.,** *The Black Swan: The Impact of the Highly Improbable*, Random House, NY, 2010.