

FOURTH INDUSTRIAL REVOLUTION AND THE RISK OF PLANNED OBSOLESCENCE IN EDUCATION

Patricia Caratozzolo¹, Gabriela Sirkis², Clara Piloto³

¹*Tecnologico de Monterrey (MEXICO)*

²*Universidad del CEMA (ARGENTINA)*

³*Massachusetts Institute of Technology (USA)*

Abstract

The thrust of the Fourth Industrial Revolution and the pressure of stakeholders in the industry make employers require new workforce strategies. Both the OECD and the WEF, in their 2018 reports, have presented the situation as a global challenge: meeting the new demands requires heavily focus on the nature of future jobs and on the skills required from workers to secure those jobs. In the field of engineering, these requirements must also deal with an additional difficult situation; planned obsolescence in technology represents a triggering risk of other obsolescence of labour: market frictions, vertical and horizontal mismatch, skill gaps and shortages and skill obsolescence.

To overcome the problems related to the skill-biased technological change, several initiatives have been addressed: (i) from an economic point of view, companies make decisions considering the costs to choose between reskilling or upskilling; (ii) in the educational market, attempts are made to alleviate the problem with an excessive number of degrees and programs; finally, (iii) in the field of Continuing Engineering Education, most institutions offer all kinds of trainings: MOOCs, webinars, micro-credentials courses and workshops. The current landscape is frantic and especially harmful to universities in developing countries, as in Latin America, to such an extent that the maelstrom of the worst facet of planned obsolescence –the systematic- causes a kind of planned “mirror” obsolescence in higher education institutions in engineering, which are not flexible enough to respond quickly in the preparation of their syllabus and programs.

Our work in progress study will take advantage of the extensive literature related to planned obsolescence in the technological field, to analyze the panorama of education in developing countries and propose possible dynamic models of how technological changes induce skill obsolescence and how this is related with engineering education and lifelong learning.

Keywords: skill obsolescence, lifelong learning, continuing education in engineering, higher education.

1 INTRODUCTION

The 21st century surprised us with irreversible transformations: feminist struggles, the relevance of sustainability and technological changes. The last one produced substantial changes in the development of the workforce. This paper introduces the problem considering OCDE's and World Economic Forum's annual reports. Both organizations present analyzes, based on surveys, on job transition opportunities for workers who currently have jobs that are very likely to be affected by structural changes in the labor market, but also provide a method for anyone looking to upskilling and improve their wage prospects and job satisfaction. In the analysis, it is also necessary to consider the drivers of change, the renewal of the demand for skills, and the influence on different industries and, consequently, that the workforce should be upskilled or reskilled to accompany the interruption of technology. However, false expectations should not be created: What are the realistic work transition options? How to choose the tailored training plan among the multiple market options? This work in progress study aims to expose the difficulties of the circular economy to reskill workforce and what could be the role of the different stakeholders: workers, industries, educational institutions and government.

2 PLANNED OBSOLESCENCE, TECHNOLOGY AND WORKFORCE

Oxford Dictionaries define **planned obsolescence** as “a policy of producing consumer goods that rapidly become obsolete and so require replacing, achieved by frequent changes in design, termination of the supply of spare parts, and the use of non-durable materials”.

Several types of planned obsolescence can be considered [1]:

- The Aesthetic Obsolescence: wear&tear and fashion.
- The Social Obsolescence: Society stops doing something and something is made obsolete by law.
- The Economic obsolescence: when repair or maintenance is too costly to be justified.
- The Technological obsolescence: when a functioning product is made obsolete by a newer model.

In either case, discarding a product when it still works implies economic costs, unsustainable practices and environmental pollution. In these cases, it is inevitable tempted to demand that all products last longer, even forever. In reality this would be counterproductive: if a product can become obsolete due to a technological change, a fashion trend or customer expectations, manufacturing it to last forever will not help. That is why it is necessary to plan obsolescence, to design the products in such a way that the impact on the environment is minimized, carefully thinking about how it will be used, how long it will be needed and finally, how it will be discarded (Recycle? Reuse? Reduce?).

A few decades ago, discussions about the economic theory of planned obsolescence used to focus on the impact of such a design strategy on manufacturers, consumers and markets. A few years later, the concept of obsolescence also included workers - such as human resources - and the skills and competencies of human capital that market forces left obsolete unpredictably and unplanned. Currently, the incorporation of new technologies in the framework of the Fourth Industrial Revolution is causing unexpected *domino effects* on the socio-economic and technological drivers of change, the shortening of product life cycles, the increase in environmental costs and finally the imperative need for the development of circular economy strategies.

3 SKILL & KNOWLEDGE OBSOLESCENCES

Skills obsolescence is an integral part of technological progress that has become more worrying as jobs have become more demanding and complex. As technology advances exponentially in the Fourth Industrial Revolution, this trend is expected to accelerate in the coming years [2]. In the 70s Kaufman had already defined the skill obsolescence as the "degree to which professionals lack the up-to-date knowledge or skills necessary to maintain effective performance in their current or future job roles" [3]. At that time -when technological advances were incremental- the *Physical skill obsolescence* or the *organizational forgetting* were the types that received the most attention. Currently, with disruptive technological advances, greater attention should be given to the *Economic skill obsolescence* (skills previously demanded are no longer required or have declining in importance) or even to *Perspective's obsolescence* (obsolete opinions and beliefs about work and the work environment).

In their latest reports, both, the Organization for Economic Co-operation and Development, OECD, and the World Economic Forum, WEF, introduced a comparison of today's skills with those demanded of future professionals to face the challenges of the Fourth Industrial Revolution [4,5]. Table 1 shows the skills expected to be trending or declining by 2022:

TABLE 1. World Economic Forum Report

		<i>Comparing skills demand</i>
<i>Today, 2018</i>		<i>Increasing, towards 2022</i>
1	Analytical thinking and innovation	Analytical thinking and innovation
2	Complex problem-solving	Active learning and learning strategies
3	Critical thinking and analysis	Creativity, originality, and initiative
4	Active learning and learning strategies	Technology design and programming
5	Creativity, originality, and initiative	Critical thinking and analysis
6	Attention to detail, trustworthiness	Complex problem-solving
7	Emotional intelligence	Leadership and social influence
8	Reasoning, problem-solving and ideation	Emotional intelligence
9	Leadership and social influence	Reasoning, problem-solving and ideation
10	Coordination and time management	System analysis and evaluation

Source: Towards the Reskilling Revolution report

Low-skilled workers, older workers and those who do not have the opportunity to develop their skills throughout their careers are at the greatest risk of obsolescence, but even highly skilled (*white collar*) workers are not immune. The qualification levels of the European workforce have increased to 2020 with more than 47% of the workforce with university qualifications or high-level equivalent. The European

challenge for the next 10 years is to prevent high-level skills from being wasted, and thus maintain the competitiveness of its labor market. On the other side of the planet, the picture is very different: in Latin American labor markets, with an estimated average percentage of around 20% of workforce that is *white collar*, the expectations of maintaining global competitiveness will depend on reskilling and upskilling strategies that are jointly implemented between stakeholders in each country. Total workforce indexes are shown in Table 2 [6].

For lower-skilled workers, depreciation is greater: About a third of lower-skilled workers experience a lack of skill development in their current career, compared with about a fifth of highly educated people. In addition, lower-skilled workers suffer more from job losses in the current race for market competitiveness. In the next decade, a considerable number of workers (both with lower-skilled and highly-skilled) will work in technologically intensive jobs, so all workers will need access to continuous training to keep up with new technologies and changing organizational practices. But there is a potential problem that *baby boomer* workers do not have opportunities to catch up with the new demands for skills.

The risk of skills obsolescence is particularly large in industries that use rapidly changing technologies. One of the most feared consequences is that such skill obsolescence will lead to greater job insecurity throughout life, which will make it difficult to maintain an adequate level of participation in the labor market of older workers. It is evident then that not only the skill obsolescence but also the knowledge obsolescence will determine the type of strategies to achieve the reskilling of the workforce: technological change induces skill & knowledge obsolescence, and this will greatly condition lifelong learning initiatives.

Table 2. Comparative Workforce Indexes (2018) for some countries in Latin America and Europe.

LATIN AMERICA	Total Workforce (in millions)	Percentage of Highly Skilled	EUROPE	Total Workforce (in millions)	Percentage of Highly Skilled
Argentina	20.36	24.3%	Austria	4.56	40.8%
Chile	9.08	25.6%	Denmark	3.03	45.9%
Colombia	26.64	18.9%	Ireland	2.41	40.1%
Costa Rica	2.34	22.5%	Netherlands	9.21	47.9%
Guatemala	7.04	9.8%	Norway	2.8	51.5%
Mexico	58.93	18.9%	Serbia	3.23	29.5%
Nicaragua	2.99	18.2%	Sweden	5.44	50.3%
Panama	2.01	25.8%	Switzerland	4.93	52.5%
Uruguay	1.77	21.8%	United Kingdom	33.87	48.2%
Average percentage of Highly Skilled in Latin America		19.91%	Average percentage of Highly Skilled in Europe		47.03%
Total workforce highly skilled in Latin America (in millions)		26.11	Total workforce highly skilled in Europe (in millions)		36.47

Source: ManPowerGroup Total Workforce Index [6].

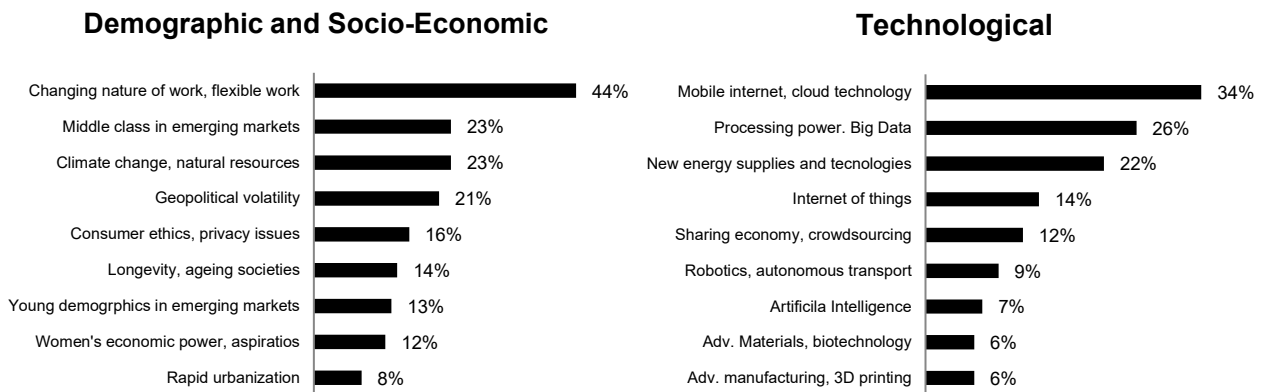
4 CONTINUOUS EDUCATION IN TECHNOLOGY AND ADAPTATION OF DIFFERENT INDUSTRIES

Thomas Friedman in his book "Thank you for being late" [7] showed that 2007 was a year of a great disruption in technology. It was the year when the iPhone hit shelves, when Twitter reached a global scale and when Airbnb was created in a San Francisco apartment. Technology changed the business environment, but the changes are similar in all industries? The World Economic Forum [8] introduces their survey results of the expected impact of the drivers of change. They also show how the senior executives estimated that those drivers of change will influence in the different industries.

They found two kinds of drivers, the demographics & socio-economic and the technological. The first ones are led by "changing nature of work, flexible work" in a 44%. It is a sociological change but it is a consequence of the technological change. Business model has expectations of change principally by the growth in cheap computing power and the ubiquity of the mobile internet. What is remarkable in this report is the perception about the different impact that those drivers have in the diverse industries. For example, in healthcare the significance of the driver: "changing nature of work, flexible work" is 20%, while in the overall is 44%. Mobile internet & cloud technology is 0% in healthcare while in the overall is

34%. What does it mean? The obsolescence of some skills is not universal for all the industries. In observance of the average of the different technological drivers, obviously the industry that will change the most is Information and Communication Technology (mean=20.7). The second place is not so evident, it is for Professional Services (mean = 16.2) and the third position is occupied by Media, Entertainment and Information. The industry where technology is expected to change less is Consumer (mean = 8.8).

Graphic 1: Drivers of change, industries overall



Source: Future of jobs survey, World Economic Forum

In Latin America, different stages of technology coexist in industries. There are big sectors with high tech equipment and advanced level of digital transformation and others that continue with old technologies. For that reason, what WEF shows about the different needs of reskilling in Latin America is more evident.

As mentioned, the second industry that is changing with the new technologies is Professional Services. These workers are highly skilled and they work globally. This is the reason why a lot of professionals with undergraduate degrees, masters or even PhD, not only in engineering or computing, are requiring education in new technologies. Some schools offer online and offline courses in their executive education. Platforms as Coursera or Edx seek to join the offer. The questions at that point are:

Which is the role of the governments in certify the diplomas with a national or international recognition?

It is necessary to reskill all the diplomas for all knowledge areas?

How the academic education will face this challenge?

5 SUSTAINABILITY AND CIRCULAR ECONOMY IN EDUCATION

In the field of environmental and consumer policy there is another type of planned obsolescence known as "built-in obsolescence". It refers to those malicious practices of those manufacturers who deliberately design products with built-in defects [9]. In 2015 the European Commission integrated Built-in Obsolescence into its circular economy package and announced "an independent testing programme on issues related to possible planned obsolescence practices".

Although the concept of circular economy is a solution for a "use and throwaway society" based on the short product lifespans, there is a risk that practices that accelerate obsolescence are not avoided, but rather integrated and justified within of the circular economy framework itself. By not taking into account the socio-economic context, regulatory measures such as the prohibitions of built-in obsolescence are not effective because they direct attention only to the possible misuse of the idea of circular economy. The arguments used for this misunderstanding of the relationship between planned obsolescence and circular economy is that a longer product life cannot be achieved with a circular economy model based on improvements in product efficiency. Probably the most common argument presented by technology

providers is that they are simply reacting to consumer demand. Some European studies on manufacturers of technology products found that they use a distorted image of the consumer as a constant innovation claimant to justify the rapid introduction of new products [10].

In the case of the obsolescence of workers' skills and their need to overcome reskilling and upskilling we could find disturbing similarities:

Is there any significant risk that educational institutions are designing products (courses, workshops, conferences, trainings or even degrees) that suffer from built-in obsolescence?

The official argument: it is the responsibility of each worker to reskilling periodically, does it not imply a fallacy?

Although the decision to reskill is often taken by the worker him/herself, such "voluntary" training is often the result of a decrease in productivity rather than a simple expression of one's own willing. Many workers, even those highly-skilled, are currently facing a decrease in productivity due to rapid changes in the world of work. One of the main drivers of such change is the increasingly complex technology that is being used in many industries. It is more or less inevitable that this will lead to changes in the nature of the jobs and the anticipated skill obsolescence to perform in these jobs. Workers whose skills development has stagnated or deteriorated are more likely to worry about losing their job, have a temporary contract and are less likely to progress in their career. Different surveys show similar results that confirm the pressure workers feel: [2]:

- An average of 16% of workers believe that their skills have become obsolete in the last two years due to technological developments or structural reorganization.
- Around 18 to 20% of workers indicated an inability to handle cognitive aspects related to the knowledge of their work, as they did two years ago.
- 34% of workers who did not receive training in the previous year are affected by the obsolescence of the skills, but even 22% of those who had participated in the training feel affected by it.

The validity of educational products should not be determined solely by employers and accrediting agencies as the skill obsolescence narrative suggests, but is constantly negotiated in the interaction between all stakeholders in the educational market.

We believe it is of utmost importance to understand how to calculate a reasonable lifespan for educational products -such as courses and workshops- and why and how workers accept that the trainings have an increasingly ephemeral validity in their lifelong learning; and in parallel, to obtain a better understanding of the underlying causes and drivers of change of the increase in the rates of generation of continuing education products. It should be noted that such a perspective also implies a change in the policy of the predominant focus on obsolescence incorporated into other strategies of marketing, as there are clearly commercial interests in promoting a particular understanding of normalcy.

6 DIRECTIONS IN FUTURE RESEARCH

In our research study we want to analyze the processes of obsolescence, determine the variables involved, and how continuing education can help develop the skills that make workers less likely to become obsolete in the workforce.

There are various mathematical models on the effects of technological change, training and learning at work and its effects on the competitiveness and job stability. The model we plan to investigate during the present study is a dynamic model in which the obsolescence of skills and lifelong learning reinforce each other, driven by the technological change that takes place in the workplace [10]. This model could predict what happens when workers experience skills obsolescence more or less continuously in their work and its healthy dynamic effect, in which technological change has the following advantages: (i) the worker get actively involved with his/her own learning process; (ii) the worker feels a genuine stimulus and a commitment to adequate training; and finally (iii) the worker him/herself is aware of the increase in productivity in job.

We also propose that a discussion on the official validity of educational products and the current reskilling offer be established so that even educational institutions with less flexible administrations and less innovative curricula can evolve into a strong circular economy and avoid significant negative effects of a likely "built-in" skill obsolescence.

7 CONCLUSIONS

The circular economy proposes to recycle products that become useless mainly due to aesthetic, economic, social or technological obsolescence. Now, the concept of obsolescence also includes the skills and competencies of human capital. The Fourth Industrial Revolution challenges blue-collar and white-collar workers to reskill themselves. Although expectations of technological change generate transformation in all industries, not everyone is affected in the same way. For that reason, not all skills will be obsolete for all activities. In the data analysis of the WEF survey, it was found that professional services are the second industry most affected by the technological obsolescence of skills. This is a big market for reskilling. At present, there are different educational institutions that offer training, courses, webinars, etc. This work proposes a review of the situation and opens a discussion on the role of governments in the official validity of educational products and how the diplomas will consider renewing the future obsolete skills.

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