

Technology, Socioeconomics and Education

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Abstract— One of the characteristics of the late 20th century and early 21st century is the constant technological, economic, and social transformations that are clearly interrelated where any technological innovation directly influences the socio-labor sphere. This fact can be seen, for example, in the growth of business models based on the economy of platforms, such as the gig economy, and in the robotization of productive systems that are accelerating a new labor scenario by creating, replacing and transforming many occupations as we know them. Some of the most representative facts that characterize these transformations are articulated below.

Keywords— socioeconomic, employability, creativity, technology

“By one popular estimate, 65% of children entering primary schools today will ultimately work in new job types and functions that currently don’t yet exist.”
-- *The Future of Jobs Report, World Economic Forum, 2016*

1 The Technology Field

The development and innovation in the technological universe, which is general, is characterized by the ease, speed and creation of new products and services, combined with the massive use of information technologies, in particular, are breaking into all areas of human life.

The convergence between the physical, digital and biological world (Klaus Schwab) of the new NBIC technologies: nanotechnologies, biotechnologies, computing (Internet of Things, big data) and cognitive science (Robotics and AI) lead to the digitalization of daily life with a strong impact on the models of commerce, work and home.

On the other hand, the development of biotechnology both in the health sector, through different genetic and cellular therapies opens a wide range of possibilities for the diagnosis, treatment and prevention of diseases. Additionally, the agro-food, industrial and environmental sectors will have a strong impact on the creation of products and solutions to current problems such as: the recycling waste, the

modification of cereals to overcome resistance to pests, and the development of new fuels and materials.

According to the EU, "By the year 2030, biotechnology could account for 2.7% of the Gross Domestic Product (GDP) in industrialized countries and even more in developing countries, according to a recent report by the Organization for Cooperation and Economic Development (OECD). At present, biotechnology accounts for less than 1% of GDP in OECD countries."

2 The Socioeconomic Field

To the classic productive factors of land, labor and capital a fourth factor, information, is added. This new techno-economic paradigm has information and knowledge as its raw material.

For this reason, currently, the centre of the economy is no longer occupied exclusively by companies that produce and distribute products as they did thirty years ago, but by companies that produce and distribute knowledge and information. Think of the value and dominant position in the market that companies like Facebook, Alphabet and Microsoft have.

And if, according to Rolf Jensen of the Dream Society, the tendency is that products and services have a more emotional value rather than a purely intrinsic value, for which they were originally designed, that is, they evoke certain sensations and lifestyles, it is quite likely that the next change will be to move from a market based on information and knowledge to one that gives priority to covering emotional needs. Two clear examples of this are the tourism and video game sector.

2.1 Globalization and Digitization of the Economy and Productive Systems

The development, thanks to the Internet, of the sharing economy has facilitated the relationship directly and without the need for intermediaries in the sale of services and products, which has led to the transformation of the business model into different sectors: mobility of goods and people, tourism, services (micro areas - Gig economy), education (MOOCs, collaborative e-learning), and collaborative finance (crowdfunding). These companies based on the economy of platforms (the "gig economy") and the economy of ratings seek fidelity to the brand and its commercial success through achieving a favourable opinion on the part

The many faces of the robot revolution



Source: Future of Jobs Report 2018, World Economic Forum

of the final consumer and the so-called influencers.

It is important to highlight that the commercialization of the collaborative economy causes, on the one hand, changes in the competitive guidelines of companies due to the progressive elimination of barriers between the design, development and commercialization of their products and services. On the other hand, it causes the users to become the product due to the free use of different platforms such as: Facebook, Google, etc. Our browsing profiles and personal data are the new oil for companies that market with our "Big Data."

The digitalization of products such as music (e.g., iTunes) and books (e.g., Amazon) allows you to store and distribute your stocks at a marginal cost that tends to zero that, together with the reduction of barriers to enter into the market, thanks to technology, we see new consumption habits regarding the preference to use a good (rent it) instead of owning it (buying it) which was the norm until now.

These changes have generated great debates between the most extreme positions on the possible consequences of the globalization and digitalization of the economy and the productive systems such as, the opinions that affirm a decline of capitalism (Jeremy Rifkin) or an ultraliberal deregulation (Charles A. Schwere).

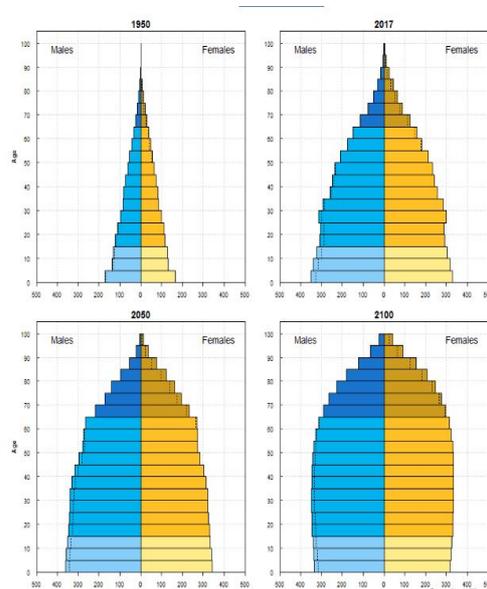
2.2 The Financing of the Economy

For the last few decades there has been an exponential growth of the speculative economy with clear repercussions on the efficiency of the productive economy and employment, but with great influence on the creation of start-ups through venture capital funds.

According to the United Nations Conference on Trade and Development (UNCTAD Report 2017), the current capital stock of the speculative economy exceeds the needs derived from international trade in goods and services. This is in part due to: the sophistication of the instruments in short-term financing, the globalization of the capital market, and the development of a market where the actors of the same financial sector negotiate with higher returns than the productive system where the majority of large companies prefer to be financed via shares or bonds exclusively through bank loans.

2.3 Demographic Changes

According to the latest report on the population by the UN, global population growth will be located in Central Asia, Bangladesh and some countries in sub-Saharan Africa. This leads to a clear imbalance between ageing and low birth rates in developed countries and the demographic growth in developing countries, with



consequent geopolitical tensions due to the amount of labor available and their geographical distribution.

This demographic scenario generates a series of adaptation measures through the creation of new products and services related to dependency, such as: financial products aimed at financing a longer life with less income, oriented socio-cultural animation programs and services specifically for the elderly, and the development of technological home automation projects that facilitate greater independence for ageing populations.

2.4 The Green Economy

The growth of the green economy: green jobs and renewable energies, such as, photovoltaic, wind, geothermal, hydrogen fuel, etc., and greater environmental regulation means an increase in investment and demand for ecological products and services as well as industrial modernization. Therefore, the creation of new sources of sustainable employment.

3 Changes in Job Positions

Directly or indirectly, technological and socioeconomic transformations have generated and are generating profound changes in the contents, methods and means of a labor organization. As an example, we could highlight that we are moving from an incremental innovation to a disruptive one where the workers, who until now, operated with machines, in the future may simply supervise them if we approach a new production paradigm.

3.1 New Contents, Media and Methods

We can observe in a general way two important occupational challenges. On the one hand, an increase in demand for professionals related to education, health and social services in many OECD countries due to the upcoming massive retirement of the baby boomer generation. On the other, most professions have a high potential to be at least partially automated and their speed of implementation will depend on the combination of technical feasibility/cost - benefit ratio. From the technical point of view, those occupations would be:

- a) Professions that experience a greater technological disruption and with a greater degree of physical activity that develops in environments and predictable scenarios.
- b) Professions that need a high volume of collection, processing and data analysis to achieve their objectives.

The fact that occupations are being automated by technological advances does not necessarily imply that they disappear, but that they incorporate new tasks or change some of the current ones. For example, Robotics, when combined with Big Data and the Internet of Things, reach new sectors and new occupations beyond the industrial assembly lines where their implantation is currently the majority.

4 New Forms of Labor Organization (employer-employee relationship)

With the digitalization of the economy, new business models and business dynamics are being developed with a clear rethinking of the classic foundations of labor relations and the emergence of new forms of work organization that relativize the need, in many cases, for the workers to be located in the traditional physical centres owned by the company to carry out their daily tasks.

There is also a clear tendency towards increasing flexible work with the reduction of classical salaried work, fixed hours, full-time, etc., and an increase in self-employment and freelancers. There is also an increase in the number of people who choose the option of entrepreneurship as a strategy of labor insertion, sometimes as the only option other than unemployment.

Finally, I would like to highlight in this section that if the new forms of labor organization are not properly regulated, economic digitalization can have a negative impact on labor rights (precariousness) and compliance with tax obligations (transparency) on everyone in these groups with more vulnerable profiles, such as workers on online platforms, due to the ease of subcontracting their services.

5 Strategic Planning of the Labor Force

The educational systems of Europe and the United States were designed from the beginning to meet the labor needs of an industrial economy based on manufacturing, engineering and related businesses, including construction, mining and metallurgy. This demand profoundly influenced the structure of public education systems. (Robinson, 2012)

Currently, as CEDEFOP affirms, "the speed with which technology evolves makes it difficult for educational and training systems to maintain the rhythm of response (adaptation) that technological advances require," which leads us to reflect on which educational model will be the most suitable to face the new labor scenario with the predominance of robotization and the development of artificial intelligence, where algorithmic procedures will be the basis of operation.

Possibly, the employability will depend more on the abilities for the permanent formation and the capacity of adaptation to put into practice what was learned (competence) from previous knowledge accumulated in previous stages. It will be necessary to foment a proactive attitude towards the permanent learning ("Learn to learn") as a guarantee of employability against the disruptive innovation that will characterize the 21st century.

Therefore, in order to favour the employability of future workers, it will be necessary to anticipate as far as possible, the competencies and qualifications that best adapt to the new demands of the market. According to different studies and a personal reflection it seems very likely that to achieve this goal it will be important to develop the basic STEAM competences (science, technology, engineering, art and mathematics), critical

and systemic thinking, teamwork and above all an enhancement of the creative capacity in students because in the short term said capacity is hardly imitable by the algorithms.

Focusing specifically on the development of creative capacity, it was in the late 50s when the American Psychologist, Joy Paul Guilford, known academically for his model of the structure of the intellect that allows a factorial analysis of intelligence in three dimensions, published one of the first scientific articles on creativity. This author affirms that divergent thinking is the most important for the creative resolution of problems characterized by flexibility, fluidity and the ability to elaborate.

We can define creativity, artistic or scientific, as the capacity that potentially possesses any person at any age for the creative resolution of a problem or difficulty, but that together with genetic factors requires environmental and social conditions to be able to develop (Dewey, 1910; Gardner, 1973).

Traditionally, two types of procedure for solving problems have been defined, the so-called algorithmic procedure in which a previously established method is applied (eg, solving second-degree equations) and the heuristic, which is a mental process characteristic of the creative capacity for creative problem-solving.

On the other hand, we can use a series of indicators that can be measured and evaluated to know their evolution, such as: originality, fluency, flexibility, ability to open, elaboration, communication skills, sharpness or penetration (Guilford, 1950 and Torrance; 1962.).

We now know that skills and creative habits can be developed in the classroom and that these depend on multiple factors such as the school curriculum, the pedagogical and didactic competence of the teacher, the pedagogical model of the institution, the type of evaluation, and the contents of the programs, etc.

If we focus specifically on the role that the teacher must adapt to stimulate students' creativity, we could say that it would be a sociocultural mediator and a facilitator that creates the right conditions to mobilize divergent thinking as opposed to convergent thinking. That is, the teacher would go from being an exclusive transmitter of content to a designer of learning spaces where the main axis of the teaching plan is no longer exclusively in the content to be learned and developed, but in proportionally integrating content, activities, resources and communication that stimulate creativity in the classroom.

As an example, we can mention some popular techniques and actions to favour the development of creativity, such as learning strategies based on reflection and participatory dialogue, everything related to proposing hypotheses based on a set of facts and data, original solutions to problems known by students, association exercises (look for relationships, similarities and differences, etc.) and others of a similar nature.

- 1.) Osborn, Brainstorming: <https://en.wikipedia.org/wiki/Brainstorming>
- 2.) Solución Creativa de Problemas (CPS):
https://en.wikipedia.org/wiki/Creative_problem-solving#Creative_Problem_Solving
- 3.) Role-playing: <https://en.wikipedia.org/wiki/Role-playing>
- 4.) Mind map: https://en.wikipedia.org/wiki/Mind_map

- 5.) The lateral thinking of Edward de Bono and his associated techniques:
https://en.wikipedia.org/wiki/Six_Thinking_Hats

To summarize, the economic, technological and social transformations described above are causing profound changes in the labor market causing a clear imbalance between the supply and demand of professionals in the so-called information society. Given this situation and with the objective of promoting employability, the education system must respond to this challenge by developing the competencies and qualifications that best adapt to the new labor market scenario and enhance the creative capacity and proactive attitude to lifelong learning.

Finally, we must not lose sight of the current demographic crisis for many OECD countries that, in the short to medium term, also represent an employment opportunity for skilled workers in the fields of education, health and social services.

6 Bibliography

- [1] Disruptive technologies: Advances that will transform life, business, and the global economy <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/disruptive-technologies>
- [2] Global Economic Prospects <http://www.worldbank.org/en/publication/global-economic-prospects>
- [3] The Global Talent Competitiveness Index 2018 <https://gtcistudy.com/wp-content/uploads/2018/01/GTCI-2018-web.r1-1.pdf>
- [4] Manuel Castells (2006) La sociedad roja: una visión global. Alianza Ensayo
- [5] Delivering TVET through Quality Apprenticeships https://unevoc.unesco.org/up/2015eForum_Quality_Apprenticeships_Report.pdf
- [6] Parlamento europeo “las competencias clave para el aprendizaje permanente” http://infofpe.cea.es/fpe/norm/Rec%2018_2006.pdf
- [7] New Skills Agenda for Europe <http://ec.europa.eu/social/main.jsp?catId=1223&langId=en#upskilling>
- [8] J. P et al. Guilford (1968) Intelligence, Creativity and Their Educational Implications
- [9] Ferreiro, R. (2008). Informe final de investigación: "Nuevo entorno de aprendizaje" (2003-2008). Miami: NSU.
- [10] De Bono Edward. 2006. Lateral Thinking: A Textbook of Creativity
- [11] Goleman, Kaufman, Ray (1992): Creative Spirit
- [12] Montessori <https://www.montessori-ami.org/>
- [13] Ken Robinson <https://www.youtube.com/watch?v=nPB-41q97zg>
- [14] World economic forum The Future of Jobs Report 2018 <https://es.weforum.org/reports/the-future-of-jobs-report-2018>

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