

SENIORS IN THE AGE OF ARTIFICIAL INTELLIGENCE: HOW TO BEST USE THEIR KNOWLEDGE, SKILLS, AND ABILITIES

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Abstract

We deal with artificial intelligence (AI) which can be viewed as a main element, and a driving force behind what is often described as the fourth, or even fifth technological (industrial) revolution that takes place in recent years and considerably changes the world of business, industry and organizations. We discuss some serious workforce related difficulties involved in this AI focused industrial revolution, notably the scarcity of skilled workforce and scarcity of new talent. We advocate that older workforce can play a considerable role to alleviate these difficulties. We analyze advantages and disadvantages of older workforce in the context of such high tech, AI based business activities using some elements of the KSA (knowledge, skills, abilities) model, and propose to find posts and tasks at which older workforce will be able to show their advantages.

Keywords: artificial intelligence, technological revolution, 4th/5th technological revolution, KSA (knowledge, skills, abilities), seniors, workforce, AI skill gap, AI talent gap

1. Introduction

The inspiration for this short paper, maybe rather a research note, has been a very timely and up to the point topic of the recent XV Edition of the International

Seminar of Barcelona Economic Network on "Been Senior: Knowledge and experience" organized in November 19-20, 2020 by the Royal Spanish Academy of Economic and Financial Sciences (RACEF) in an online mode due to the Covid-19 pandemic.

The topic chosen for this workshop is very important from many points of view, from the economic through technological to social ones, for the present day world which is plagued by many difficulties. First, in virtually all better developed countries, notably the richest ones which are major economic and technological players, we face a serious and dangerous problem of aging of the society implied by a low birth rate, and even the immigration cannot be a panaceum to prevent societies from a lack of people who would work for older ones who should be supported by pension and social security systems. Second, in most countries around the globe, not only those at the forefront of technological development, there is a firm belief that modern technologies are badly needed to secure a competitive advantage at world markets, and hence to be able to at least maintain the living standard in the conditions of aging of the society and its related growing need for advanced, and hence expensive healthcare, all this in the presence of a lower and lower cohort of a younger population who is in a position to be productive and contribute to the pension and social security systems.

2. Artificial intelligence as a backbone of the recent technological revolution

In the present world a special role is played by one of the recently most talked about technologies, artificial intelligence (or AI, for short), which may be generally described as the use of formal tools and techniques, algorithms, machines, computers, etc. to somehow mimic cognitive functions usually associated with intelligence such as learning and problem solving. Due to the generality of this description, the use of such broadly perceived term of artificial intelligence can occur in all kinds of human activities, and can at least augment human capabilities, support them, or even sometimes replace them in the case of simpler ones.

One can also view AI intelligence as a serious technological change, the next technological (industrial) revolution which will profoundly change the way we live, operate, enter into relations with each other, etc. If we look at the modern history of the mankind, which is important from our point of view, then there are different visions of technological revolutions.

The first technological revolution, which started at the end of the 1770s and lasted until the beginning of the 1990s, triggered a transition from agriculture to production and manufacturing as the foundation of economy and society. Its main characteristic feature was mechanization, in particular via the use of steam engines which also made it possible to develop transportation in the form of very effective and efficient railroads. The extraction of coal was decisive.

The second technological revolution, which started in the second half of the 1980s, brought about many technological developments thanks to the emergence of new sources of energy: electricity, gas and oil. This resulted in the development and advancement of new engines to power all kinds of machines, to be more specific, the electric engine, used everywhere, from small devices to huge industrial plants, and the internal combustion engine used in all kinds of mobile devices like cars, trucks, ships, airplanes, etc. In addition to the new products based on the use of electricity, gas and oil, new communication means were invented exemplified by the telephone and telegraph.

The third technological revolution, which started in the second half of the 1990s and continued until the beginning of the 2000s, was characterized by a wide use of electronics, telecommunications and computers. This made it possible to implement many far reaching ideas related to space travel, biotechnology, automation and control, robotics, etc. which involved some advanced automation of, for instance, many tasks and activities that could make human beings tired and bored.

It is also often mentioned that in recent years there occurs the fourth technological revolution, termed Industry 4.0, which conceptually started in the very beginning of the 2000s and is heavily, maybe totally, based on the use of the Internet, advocates the use of advanced IT solutions like artificial intelligence, big data, data analytics, virtual reality, Internet of Things, sensor networks, etc. Emphasis is on the use of cyberphysical systems, and sensors. These new developments do profoundly change ways in which people and societies operate.

The newest concept that is slowly gaining acceptance is the so called fifth technological revolution which is by some people terms the artificial intelligence (AI) revolution in which a massive automation and use of robotics is changing the way the humans and the entire socio-economic systems operate.

The AI based technological revolution is unprecedented from many points of view, notably with respect to how radically and quickly it changes all kinds of technological and business activities, and – even more so – economic and social environments, with an influence on both the individuals, social groups, even whole nations and the entire world.

What concerns the spendings on artificial intelligence, in a reliable report of the International Data Corporation (IDC) the reported spendings on artificial intelligence (AI) hardware and software were ca. \$40 billions in 2019, and are estimated to be ca. \$100 billions in 2022, that is, with the annual growth of ca. 29%! This is a huge increase not witnessed so far in the case of other technologies. What is also important, 93% of American and British organizations and companies declare that artificial intelligence and machine learning is a top business priority for their prosperity and further development, maybe often for the survival too. Expenditure for research in artificial intelligence in leading countries are in the range of multibillions US dollars, with the USA and China as the clear leaders.

This torrential growth of artificial intelligence has clearly implied that the demand for AI specialists is skyrocketing which has caused an acute shortage of AI specialists, and above all the AI talent, that is, young people who would be able to both use the existing AI systems and solutions in an effective and efficient way, responding to new tendencies and options, as well as to develop new hardware and software solutions, maybe not known yet, but crucial for the companies and organizations to attain and then maintain a competitive edge.

This shortage of AI specialists, which may also be termed as an AI skill gap, is often considered as the main barrier faced by businesses and organizations in this respect. As some recent reports indicate about a half of businesses have no own in-house AI skills to implement their policies related to AI, and some 40% say that a lack of skilled talent is the main barrier.

This AI skill gap has mainly emerged because of a quick pace of the broadly perceived digitalization of the workplace which is a sine qua non condition for the operation of any modern company and organization, notably their ability to develop and implement any new technologies and solutions that are all based on digital technologies. AI is here the best example.

Unfortunately, schools and universities cannot meet the demands for modern digital skills, and the education system is unfortunately not flexible in this respect in the

sense that it is not possible to rapidly increase the number of graduates in crucial fields who will be well trained. For instance, it was estimated that the number of computer science graduates in the UK would have to increase 10 times from 2017 to 2022 to meet the demand of business, industry, governmental and public organizations. This is clearly impossible.

Therefore, the stakeholders involved try to find a way out of these severe difficulties related to their workforce involved in all kinds of AI related activities. This has to involve both young, middle aged and older workers. A natural solution is the reskilling of the workforce, that is, to train these people in different skills. In a study of the World Economic Forum it was estimated that by 2020 54% of workers will require a serious reskilling in particular in view of the fact that, to just give an example, in Europe ca. 37% of workers do not have basic digital skills. A similar estimates were shown by top companies. For instance, in an IBM report it was estimated that ca. 120,000,000 of workers should be retrained. This is clearly an extremely costly and time consuming operation.

The retraining becomes now, in view of a growing complexity of new AI focused technologies, much more time consuming, and hence more expensive. For instance, in an IBM report, it was estimated that retraining for an AI related job would last now some 36 days as opposed to some 3 days in 2014. This is a serious, time consuming and costly, obstacle for all kinds of companies and organizations to be able to introduce and use modern technologies.

As to possible solution with respect to reskilling, there may be different options exemplified by:

- formal courses by universities, vocational schools, external training companies,
- own courses by companies and organizations,
- online platforms (Coursera, Udacity, Udemy, ...),

and, obviously, each of these solution is characterized by a different cost per worker but also a different effectiveness and efficiency in that, for instance, the workers who undergo reskilling can probably learn better and faster from people and not computers but this is more costly.

So, to summarize the workforce related situation in the context of high technology, to be specific, AI in our study, we can say that we face:

- the so called AI skill gap, that is, virtually all companies and organizations struggle with an acute shortage of skilled workforce who can operate and further develop AI related activities and devices,
- the so called AI talent gap, that is, there is a common acute scarcity of younger people who would be able to both use the existing AI systems and solutions in an effective and efficient way, responding to new tendencies and options, as well as to develop new hardware and software solutions, maybe not known yet, but crucial for the companies and organizations to attain and then maintain a competitive edge.

The above serious difficulties are amplified by another crucial factor that is related to the fact that in the present world there are generally a few countries, notably richer and better developed, who „import” top specialists, including those in AI, exemplified by the USA, the UK, China, Australia, Canada, the European Union, and some other countries. Most of these countries experience the aging of the society combined with a negative population growth. This all makes it an urgent matter to „import” properly trained people from very many poorer countries who have very often good education systems. These countries spend money for the education of their talents and then loose them to more developed and richer countries. This is a serious matter which may imply some real conflicts and difficulties.

These remarks mentioned above clearly suggest that the use of AI related technologies is crucial for any company or country because, to put it trivially, products and services without „AI inside” will not get an adequately high price so that those companies or countries will not earn enough money for their development, for instance for the financing of science, R&D, social programs, etc.

Due to severe difficulties with attracting younger workforce, the companies and organizations should properly take advantage of their existing workforce. For our purposes, this is related to a proper, maybe even proactive use of older workforce who is often neglected, notably not properly used and appreciated. This is a very important problem because it is estimated that in 2050 over 1/3 of the world's population to be over 50, up from 15.7% in 1950. But, as some other reports quote, only 10 % of adults aged 55–65 are able to complete new multiple step technological tasks, compared with 42 % of adults aged 25–54. This is a problem indeed.

These figures are not very positive for our purpose, that is, an analysis of the role of the so called seniors, that is, older workforce, in the new AI related business

and industrial world. However, there are some positive signs which will be shown in the next section.

3. Seniors as an important part of the workforce in AI related activities in companies and organizations

In the previous section, while analyzing some specific features of the recent technological revolution based on a wide use of the broadly perceived AI based tools and techniques, we have devoted much space to the problem of very special difficulties related to the workforce. Notably, we mentioned the so called „AI gap” which boils down to the scarcity of AI related skills that are badly needed for the workforce to make it possible for the companies and organizations to operate effectively and efficiently in these new AI related economic and technological conditions. Moreover, we also discussed the so called „AI talent gap”, that is an acute difficulty in finding an adequate number of new young, adequately talented people to secure a competitive edge for the company or organization, maybe even a country.

Therefore, all these difficulties call for a proactive approach and notably, from our point of view that is relevant for this paper, for a proactive search for how to best use the older workforce that is often somehow neglected in spite of the fact that it can give much to the company or organization. This claim is supported by many opinion making sources, for instance, the Wall Street Journal which explicitly stated in an 2019 article that in the present situation of a constrained job market, companies and organizations who try to find talents in IT (information technology) could not afford to overlook older workers.. Of course, this statement was on IT workers but the situation with AI is clearly even worse.

That Wall Street Journal article emphasized as one of the many very positive aspects of having older workers in the company or organization, or even hiring them, a possibility to form multi-generational teams comprising of both younger and older workers, both characterized by some positive and negative capabilities, skills, experience, etc. Such teams had already proven to be very effective and efficient, and valuable, in terms of providing an enhanced ability to solve nontrivial problems, and innovate.

In this section we will summarize some finding concerning the role and advantages of older workers, and present some new visions on how to best use their qualities for the benefit of both the company or organization, and – more generally – the society.

The first question we should ask is: what happens with the human being as they age, in terms of which facilities and capabilities diminish, and which stay longer at the same level. The second natural question is: are there some serious scientific studies about this?

Among many papers on this topic which appeared in the literature, we can use as an example a very serious and deep study by Horton, Baker and Schorer (2008) which is concerned with the preservations of skills and abilities as people get older. To briefly summarize the findings of the authors, one should mention, just as examples, the following which are to a large extent natural.

Basically, the aging of the human beings brings about some decline of many aspects of cognitive, perceptual, psychomotoric, etc. functioning. The authors exemplify this by a decrease by 16 points of the intelligent quotiens (IQ) scores or a decrease by ca. 50-60% of the reaction time while making choices or decisions. These decreases in the functioning are clearly a negative aspect of aging and can have a negative effect on the functioning of an older human being in companies and organizations.

However, this is not totally true. Namely, on the one hand, it can be observed that companies and organization do function properly, and effectively and efficiently, even if a considerable percentage of their workforce is older. On the other hand, in many areas of human activity, notably those in which experience, creativity, original solutions, changing environments, etc. dominate, older people show their superiority. Numerous examples can be given from business, politics, science, arts, music, etc. where the leadership and responsibility are crucial, and then the top and most successful people are usually over 60 (or more) years of age.

A natural question can therefore be asked. It is a fact that there is an age related deterioration of memory, and perceptual and psychomotoric performance of the humans. However, how in spite of these growing disabilities, do old(er) people preserve such a good performance in so many areas of human activities, from personal to social ones, from purely economic to creativity related like in the arts, music, science, etc.?

To try to find some explanation and justification, maybe a good idea would be to consider a general model used by human resources (HR) departments, the well known KSA (knowledge, skills, and abilities) model. These three terms are used for setting up a personal profile of a worker in relations to his or her professional possibilities.

Knowledge is mainly meant as a person's „theoretical” understanding of some concepts, relationships, procedures, etc. in a particular field of science, technology

or – more generally – in any kind of human activity. Knowledge is usually acquired from some information sources exemplified by books, journals, TV and the Internet, textbooks, courses, lectures, etc. Knowledge need not be learned from experience. As important as knowledge is, it is not yet everything that determines what people can do.

Skills are the second aspect in our context and are mainly meant to be more practical than knowledge, that is, they are acquired by a person by performing some tasks, not theoretically at some courses but and via a practical experience. As to the relations between knowledge and skills, skills involve the application of knowledge in a particular situation and context, and using some previously acquired knowledge and information. Clearly, some practice is required to master a skill. Proficiencies belonging to skills are developed through training or hands on experience, and they constitute the practical application of theoretical knowledge.

Abilities can be, from the outside perspective, viewed to be equivalent to skills but they are not. Namely, they are a (synergistic) combination of knowledge, skills, attitudes, personal cognitive and intellectual abilities, etc. which can make it possible to achieve some goals or objectives in a proper way in (usually) distinct situations and contexts. Abilities are therefore innate capabilities or talents of a person which are used in a particular situation, and cannot be learned.

The very essence of the KSA (knowledge, skills, abilities) model is that it somehow „produces” a sum of knowledge, skills and abilities of a particular worker and this can be employed for the determination if he or she is a proper candidate for a particular job or not, and if so, then to what extent.

This is a convenient vehicle for our analysis and our proposal for the role of seniors, in the sense of older workers, in the context of AI focused employers, or – even more generally – a high tech type employers.

The KSA model has been originally developed by the US government, for their agencies, institutions, etc, as the basis for recruitment of their employees and has served for this purpose for many years, maybe decades. It seems to be useful for our purposes too.

In recent times, the KSA model has been often used for the analysis of particular training programs, and their necessity or just a need, as it can help identify potential skills gaps and work out possible solutions. To be more specific, the KSA model provides a tool for a clear cut determination of the knowledge, skills, and abilities that are particularly needed and important for a specific job. It can also help separate essential skills and core competences from secondary

requirements. The model also provides insight into a candidate or employee's special talents, abilities and relevant experience that can be invisible while looking at his or her diplomas, certificates, etc. For instance, the KSA model can help clarify which skills and abilities are still not adequately represented among the company's workers so that it can be easier to decide which training courses and workshops are most relevant to current workplace requirements, or which workers should be hired or maybe even fired. Needless to say that the KSA model is usually implemented as some software system.

This knowledge, skills and abilities perspective seems to be useful for our analysis of the role and strength of seniors in AI focused companies and organizations. Namely, first, it should be noted the following:

- for knowledge, it takes a long time to master a field but this is faster if one knows some related fields, i.e. older people can be better in this respect.
- for skills, it takes again a long time to learn a skill because much practice and hands on experience are needed, and again the older people can clearly be better and, moreover, they can already have related skills so that it can be easier to master the skills needed,
- for abilities, both the old and young workers are equal in this respect as these are individual characteristic features, not to be learned.

It can therefore be said that if we follow the essence of the KSA (knowledge, skills, abilities) model, then the old(er) workers are certainly not worse, maybe even better in some cases.

For completeness, the KSA (knowledge, skills, abilities) model has some drawbacks, notably it can lead to: long and sometimes redundant job descriptions, complex and frustrating application processes, and confusion over the differences between the terms, in particular between skills and abilities. However, from our perspective, it can properly play its role.

In general, our main message is that a proper assignment of the seniors to posts and tasks at which they may fully use their proficiencies is crucial for success. One can briefly say that:

- the seniors have to be included in all kinds of broadly perceived AI-related industries, institutions and undertakings because of a general aging of societies, and an acute shortage of workforce and talent in these areas,

- in general, the positions and tasks the seniors should be assigned to can be summarized as those for which more emphasis is on:
 - experience and difficult to master skills,
 - conscientiousness, agreeableness, and emotional stability.

The companies and organizations should:

- form mixed age working teams to synergistically combine qualities of younger and older workers,
- assign people, notably older workers, to age specific tasks and workplaces,
- develop own retraining systems taking into account the specifics of older workforce, and not only hire new workers as the seniors are really important and much needed!

This is in line with what is often advocated by business executives as the most important skills in the workforce today like:

- To be flexible, agile and adaptable to change,
- To have time management skills and ability to set adequate priorities,
- To be able and willing to work effectively and efficiently in team environments,
- To be able to effectively and efficiently communicate with all stakeholders in business processes,
- To have business analytics skills,
- To have skills which are specific for not only the job but for the industry in question.
- To have an ability for innovation and creativity,
- To have at least basic computer and software skills, etc.

Moreover, as operations of companies and organizations involve more and more foreign countries, the proficiency in a foreign language is also considered to be an additional advantage.

Luckily enough, these skills are in line with what we have claimed as being crucial for the involving of seniors in business, industry and organizations.

4. Concluding remarks

The main conclusions that can be drawn from our brief analysis of the problems related to the employment of seniors, or old(er) workers, in high tech companies and organizations, to be more specific AI focused ones, can be summarized as follows.

First, the seniors are and will be in the foreseeable future an important part of the workforce in practically any company and organization in the field of broadly perceived artificial intelligence (AI) but maybe, more generally, high technology (high tech). The reasons are clear, that is, the scarcity of properly qualified employees, notably the scarcity of the AI talent, people who can develop new AI related systems and processes to maintain and even gain a technological edge.

Second, in spite of a clear decrease of some cognitive and psychomotoric abilities, which is a natural consequence of aging, the seniors can exhibit many positive characteristic features in the sense, for instance, of an advantage in terms of knowledge and skills, which can be shown using elements of the KSA (knowledge, skills, abilities) model, but also reliability, emotional stability, etc.

Third, the full potential of the seniors can be achieved by a proper assignment of them to tasks and function, in general by forming multi-generational teams, and properly assigning them so that they should fully use their potential due to many characteristic features that can be developed only through a longer life like experience, agreeableness, emotional stability, to just name a few.

References

Horton, S., J. Baker and J. Schorer (2008) *Expertise and aging: maintaining skills through the lifespan*. Eur Rev Aging Phys Act 5, 89–96 (2008)