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DIGITALISATION AND AI INTEGRATION THE FUTURE OF ARTIFICIAL INTELLIGENCE

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Abstract:
The paper addresses the impact of digitalization in the Romanian economy in the pre-pandemic, pandemic and post-pandemic period. Research questions such as: "Has COVID influenced the share of IT enterprises?", "Have these IT enterprises, established during the pandemic, managed to sustain themselves over time?", "Has the pandemic generated new jobs in the IT sector?", are the basis of this article. The results leading to the conclusion that the pandemic period represented the digitalization boom. Covid has created a new trend, to use technology at another level, technology in this period and after, having a synonym, namely comfort. Step two, represented by AI, could not come to life without step number one, represented by digitization itself. These two stages emerged, after the Covid period, as an awareness of the need for technology, a familiarization with technologies with or without AI valences, the post-Covid period becoming a culture in the use of digital technologies and AI, with their well-defined place in the economy in particular and in society in general. Digitization and the incorporation of AI represent the construction of a "wheel" that does not want and cannot stop. The final part of the paper presents the statements of some world personalities related to AI, the results of specialized studies, as well as our personal opinion, regarding the future of Artificial Intelligence.

Key words: *Digitalization, Artificial Intelligence (AI), Emotional Intelligence, Embedded Technology, Information Technology Services, Technology Ethics*

JEL classification: O11, O14, O31, O33

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INTRODUCTION

The digitalization and integration of artificial intelligence can be compared to a built "wheel" that seems unstoppable. By approaching the notion of technology, we can detach two different but interconnected technologies.

Digitization itself has invaded all social and economic sectors, being the one that transforms information from physical format to electronic format, and on the other hand represents the adoption of technologies by society, for efficiency and performance. There are infinite advantages to list, from online payment systems, which replace physical ones, to digital archives, which replace physical ones. It is also digitalization that has demonstrated a more optimized business environment, with more accessible information and a very successful remote social interaction.

If the specialized literature, for decades, tells us that the economy has invaded all aspects of life and is influential, so has digitization invaded all aspects of life, and the benefits are commensurate. Digitization can also be seen in the automation of certain processes, in an efficiency that involves human decision-making intervention, vital intervention for carrying out the activity in question.

In addition to classical digitization, AI, artificial intelligence, a new technology that wants to come to life, has made its way. *AI is* represented by algorithms, computing systems, for tasks that are performed with human intelligence. In other words, AI is technology that mimics human intelligence. If the technology of digitization is expressed by automating processes, activities, with the urgent assistance of the human factor, AI represents the next stage, through which processes and decisions are automated. The literature talks about AI's goal, to be able to make decisions without human intervention.

I. ARTIFICIAL INTELLIGENCE AND LITERATURE

John McCarthy (1956), creator of the concept of AI, defines it as *"technology that reproduces the intelligent behavior of natural intelligent systems"* (Pasat and Lazariuc, 2016).

From the projection of an idea to create artificial intelligence, conceived in 1956, today, AI begins to be present in all sciences, presenting functions of machine learning (study and find mistakes), deep learning (recognize objects from images, videos – DeepFAce, Facebook) and up to understanding language and having conversations (Pisaniuc, 2022).

Natural intelligence appears defined in DEX as *"Easy and deep understanding of things in the field of culture and science, a faculty of understanding surrounding phenomena"*. In addition to Dex comes the specialized literature that declares, more precisely, that *emotional intelligence* is the most important, it is producing creativity and innovation.

From the definitions of human intelligence, as well as artificial intelligence, we seem to see small differences.

The literature divides AI into two broad categories (Pasat and Lazariuc, 2016):

- *AI – SOFTWARE* – virtual assistants (Google search engines, chat CHAT GPT). Specialists have titled this SOFTWARE as representing the WEAK part of AI.
- *AI - EMBEDDED* - robots, drones, automated machines, thus intervening the HARD component of AI, component that aims to imitate the human brain, creating self-awareness. AI will be a construct that will always learn from input data.

Currently, AI has a narrow capacity, it cannot match human intelligence. A robot can lift heavy parts in a factory, but the same robot cannot lift a paper from a desk (Coombs Crispin, 2020). Industry analysts have, so far, made the findings, regarding AI, of lack in creativity and lack in emotion. And if we talk about emotion, it is the emotion that gives way to human interaction, and further gives way to creativity.

Our personal opinion would refer to the need to double AI with creativity. A performing economy will certainly possess a symbiosis of AI and creativity. Where do we get creativity from? Prelipcean and Bejinaru (2018), provide a pertinent answer: ”The attraction and retention of talents, respectively of the creative class, is mainly represented by graduates of business studies”. Our question would be related to where AI and creativity will be located, within an economic region? Neamțu, Bejinaru, Hapenciuc (2020) present the following point of view ”Both in the academic literature and in policy documents, creativity is essentially considered an urban phenomenon, because human, economic and institutional resources are generally located in large cities”.

We are talking here about human emotion, about the color spot given in the construction of this world, and AI, the technology that wants to come to life, does not possess, at the moment, this attribute. However, the literature also discusses the fact that the robot will have personality, because it will learn daily from humans. Moreover, robots are discussed, independently, with their own habits and beliefs, with their own interactions (Pisaniuc Maia, 2022).

II. THE CULTURALIZATION OF DIGITIZATION DURING THE PANDEMIC PERIOD, REFLECTED IN THE EVOLUTION OF FIGURES, AT NATIONAL LEVEL

Step number two, represented by AI technology (automation of digital processes), could not have been born without step number one, represented by the technologization of everyday life, which came with strong momentum during the famous pandemic year. It was Covid that triggered the digitalization boom, and more than that, governments turned to AI to compensate for employee unavailability. Covid was the period of awareness of the need for digitization, awareness and familiarity with technologies, increasing people's trust in digitization, as well as in digitization with AI valences. The pandemic year was a period of popularity of digitalization, it is the one that

changed preferences from direct to remote interaction, it was the moment of creating a culture in which technology has its place, well defined.

In this chapter we aim to answer three questions related to the influence of the pandemic period in the economy:

1. Has COVID influenced the share of service sector businesses in information technology?
2. Have businesses with IT and IT-related activities *of information technology services and information services*, established during the pandemic, managed to maintain over time?
3. Is the pandemic generating new jobs in the information technology services sector?

These three questions represent the foundation of this article, based on the quantitative approach as a methodology, by collecting and processing data from the website of the National Institute of Statistics, followed by the empirical analysis of the indicators.

1. Has COVID influenced the share of service sector businesses in information technology?

Given the major impact of the Covid pandemic on the population and on the business environment in Romania, we consider it important to assess to what extent the pandemic has managed to accelerate or not the development of economic agents with activities in the IT and IT services sector. With or without will, the population, during the pandemic, had to readapt to a new lifestyle, in which online and digitization are the main pawns. This digitalization trend should be reflected in the activity of economic operators.

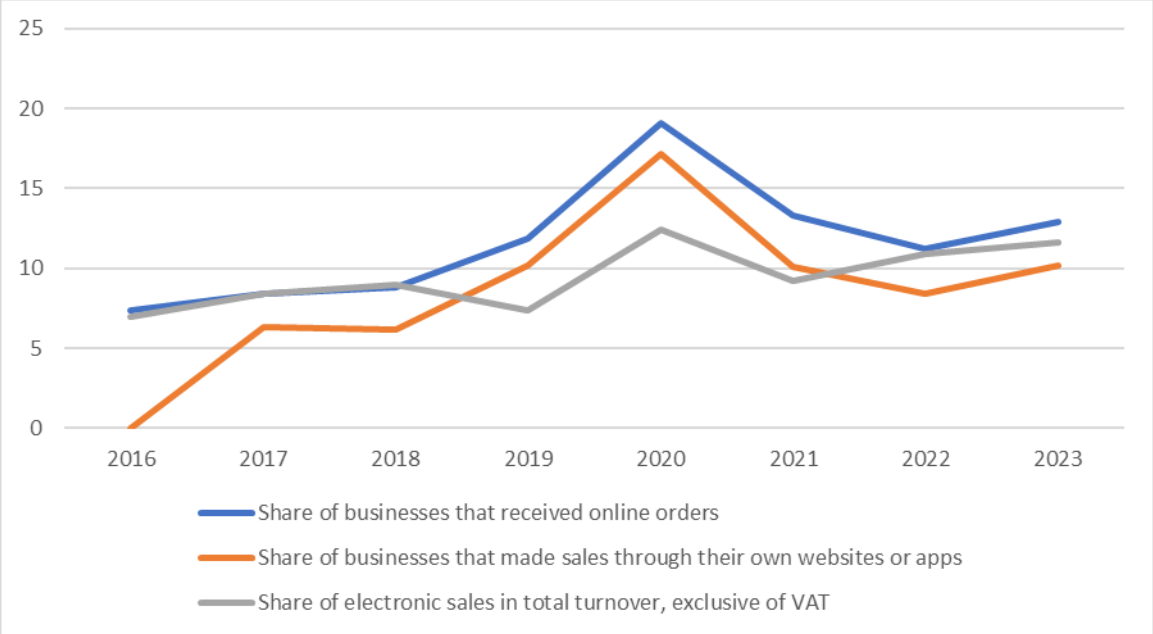

Figure 1 - Indicators of enterprises in Romania, 2016-2023

Source: Adaptation of the author according to the data of the National Institute of Statistics

According to data collected from the website of the National Institute of Statistics, in the period before the pandemic, 2016-2019, the share of businesses receiving online orders in total business was, on average, 9.12 percent, with an annual increase, approximately, of 1.16 percent.

The peak pandemic year, 2020, showed an increase of 7.2 percent, which *represents a 60.5 percent increase compared to 2019*, in the share of businesses that received online orders, an increase driven by restrictions imposed during the pandemic.

After the pandemic period, the shares returned slightly to the previous ones, showing the same linear increase, prior to 2020. Although in 2020, the share of enterprises that received online orders from Romania reached 19.1% in total enterprises, in 2023 it returned to 12.9%, keeping the

upward trend compared to previous years, except for the pandemic year. These indicators show us that the pandemic has created a forced growth, *growth that has not remained at the same level, after the pandemic.* Analyzing the period 2016 – 2023, the trend is upward, but not at the level of 2020. The year 2020 becomes the Gauss bell of digitization in Romania.

Also on the analysis of the share of online sales, the share of enterprises that made sales from their own websites was analyzed, the increases being linear from year to year, except for the pandemic period.

In Figure 1, we can see the increase in the share of businesses that made sales from their own websites, reaching 17.2% share, *increasing by 68.63% in 2020, compared to 2019*. In 2023, the share of enterprises that made sales from their own websites returned to 10.2% as it was in 2019, thus maintaining linearity, the pandemic year being only a forced growth, which could not be sustained over time.

Although digitization and the use of technology is on the rise, online orders, according to the analyzed indicators, maintain over time a linear growth, not explosive as it was in 2020.

Figure 1 also highlights the share of electronic sales in total turnover, thus trying to identify how the pandemic has or has not helped the sale of electronics. Before the pandemic year, 2016-2019, the share of electronic sales in total turnover was, on average, 7.95%, thus increasing in *2020 by 67.57%*. The growth recorded in 2020 subsequently showed a slight decrease, but not of high significance, a decrease of 6.45% in 2023, compared to 2020.

Concluding the analysis carried out on the 3 indicators, we can say that 2020 was a year in which both the population and businesses had to readapt, being directed towards online orders and the use of technology, the maximum point of use being even the pandemic period, but subsequently, the trend is still towards technology, but at a more linear pace.

2. *Economic agents with IT and IT-related activities of information technology services and information services, established on the occasion of the pandemic, managed to maintain themselves over time?*

The entire pandemic period has affected businesses and population in various ways, the ability to adapt and reorganize weighing on the evolution of economic agents.

We intend to pay special attention to the increase in the number of enterprises during the pandemic, with IT activities, as well as the evolution of this increase over time, especially after the end of the pandemic, thus being able to conclude whether this growth managed to be maintained over time and whether the behavior adopted by economic agents led to continuity and why not, to development.

Table 1 - Number of active enterprises by activities of the national economy, in the period 2018 – 2022, sourse: INS

NACE Rev.2 - (activities of the national economy - groups) Number of enterprises	**Number of enterprises**				
	Year 2018	**Year 2019**	**Year 2020**	**Year 2021**	**Year 2022**
262 Manufacture of computers and peripheral equipment	217	195	196	175	164
263 Manufacture of communication equipment	58	61	57	56	48
582 Software publishing activities	1060	1049	1079	1104	1162
620 Information technology service activities	13279	14359	16347	19160	23510
631 Web portal activities, data processing, website administration and related activities	3821	3916	4204	4463	4791
639 Other information service activities	285	293	300	303	330

Regarding the economic activity group of manufacturing computers and communication equipment, we would tend to think that, during the Covid period, it experienced a major growth and development, but the figures show something else. We expected an increase in the number of enterprises manufacturing IT equipment, as the population was forced to use electronic and online due to restrictions imposed during the pandemic, thus requiring a larger number of electronic equipment.

INS data show that in 2018, there were a number of active enterprises of 217, in the economic activity group of manufacturing computers and communication equipment, a number that decreased from year to year, including in 2020, when it reached a number of 196, continuing to decrease until now, the last data published by INS was in 2022, when the number of enterprises reached 164.

An alleged cause of this decrease, despite the fact that the need for IT equipment production has increased, would be the import of such equipment, as well as the granting by the European Union of devices in the form of subsidies.

Information technology services and information services activities showed annual growth, according to the data in Figure 2, with percentages ranging on average between 4.48% and 12.99%.

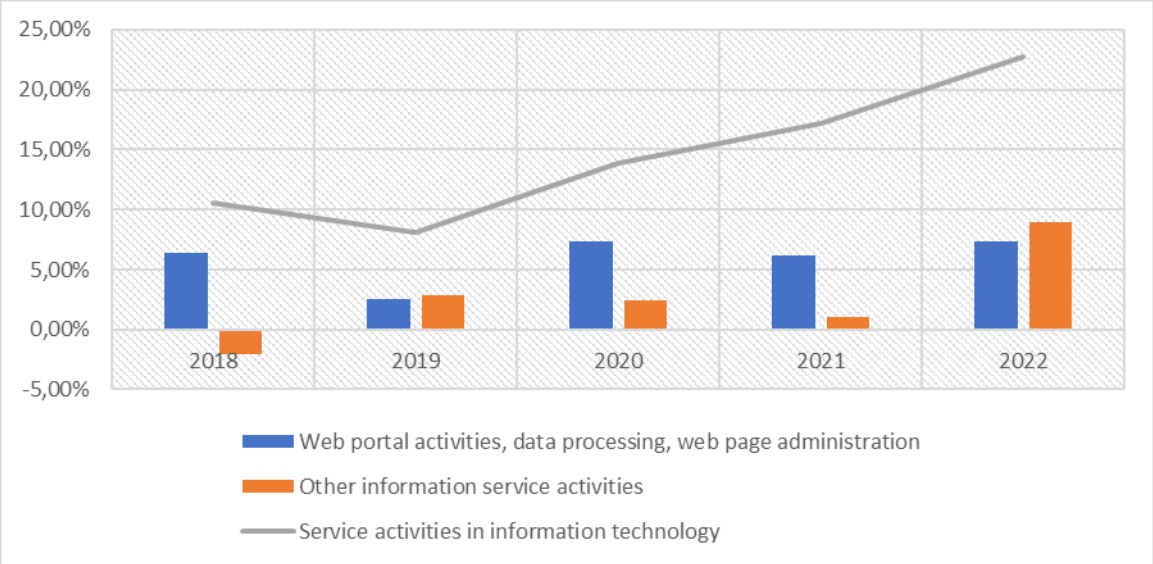

Figure 2 - Percentage increase in no. enterprises with economic activities in the sphere of IT services

Source: Adaptation of the author according to the data of the National Institute of Statistics

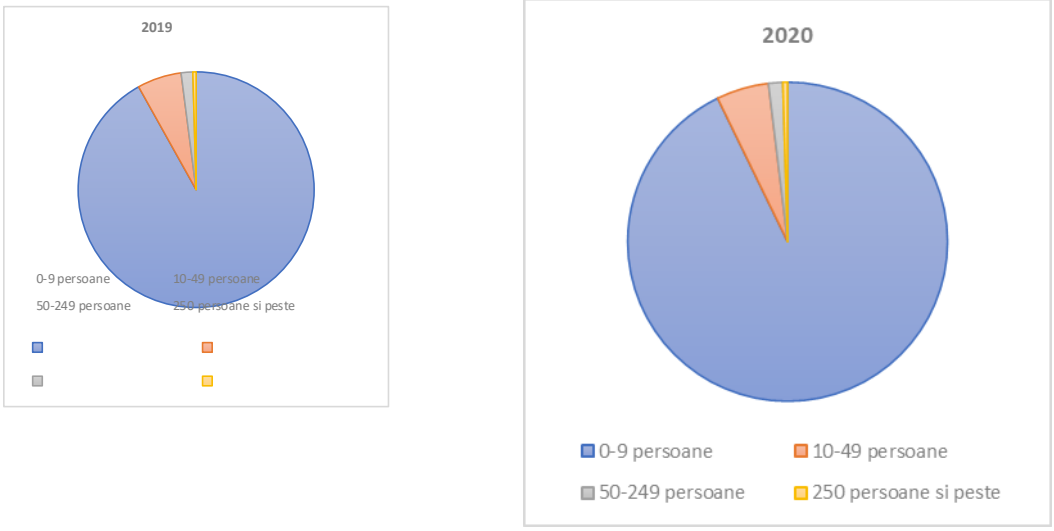

Figure 3 – Share no. enterprises with IT service activity, 2019-2020

Source: Adaptation of the author according to the data of the National Institute of Statistics

The number of active enterprises with information technology services activity has seen the most progressive path, starting from increases of 8.13% and 10.55%, respectively, per year, before 2020 (pandemic year), reaching increases of 22.7% in 2022. The year 2020 was a starting point for a large number of economic agents with information technology services activity, their number increasing by 1988 enterprises, at national level, growth that not only maintained after the pandemic but also grew at an accelerated pace, showing annual increases between 17.21% and 22.70%.

The upward trend of activity in information technology is strengthened not only by the increase in the number of enterprises, but also by the increase in the number of large companies with a large number of employees in this field of activity, the number of companies with over 250 employees increasing from 64 in 2019 to 78 in 2020, at national level. Figure 3 shows a similarity in proportionality for the years 2019 - 2020, which indicates a balanced growth on all four types of economic agents, growth that can be considered sustainable.

3. *Can the pandemic be considered generating new jobs, in the information technology services sector?*

In 2018, according to data published by the National Institute of Statistics, the average number of employees in the information technology services sector at national level was 99562 people, a number that increased from year to year, reaching a number of 128925 people in 2021.

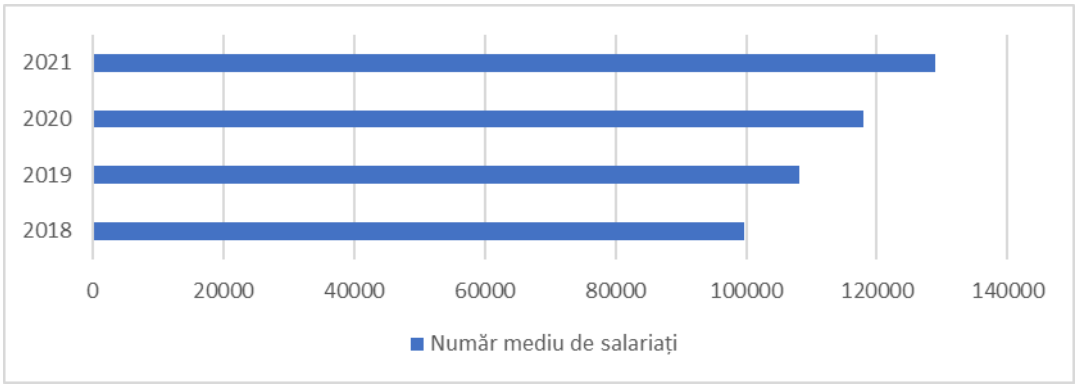

Figure 4 – Evolution no. average number of employees, 2018 - 2021, in the IT services sector
Source: Adaptation of the author according to the data of the National Institute of Statistics

The annual increase in the average number of employees, in the period before 2020, was 8.71%, in 2020 it was 8.95%, and after the pandemic it reached an increase of 9.34%. The trend, in the case of the average number of employees, in the information technology services sector, is one of growth, but it does not show excessive growth in the pandemic year, which shows us a natural and sustainable growth evolution over time.

The current increases in IT, as well as the upward trend that persists, make us implicitly think about AI, which is part of the information technology services activity, AI being increasingly present and used among the population and economic agents.

III. THE FUTURE OF DIGITALIZATION DESIGNED BY INCORPORATING AI TECHNOLOGY

The Covid 19 pandemic has familiarized humanity with technology, and things don *'t seem to want and can't stop*. The scenarios in which AI will evolve are multiple, with opinions that seem to have split into two camps. The camp of the optimists and the camp of the pessimists. So controversial is the topic of AI that many question marks appear on the horizon. Some of the statements of some world personalities, compacted by Roman Chirilă (2018), in his article, on artificial intelligence, we present below:

- Lord Martin Rees – "*Within 100 years, humanity will be wiped out."*
- E. Musk – "*AI is more dangerous than the atomic bomb. Humans will be outclassed by having biological weaknesses. One implant and they can become specialists in various fields."*
- Gheorghe Adam (Romanian physicist) – "*AI technology will replace man just as the Neardeshard Man of 430,000 years ago was replaced by the early Man of 28,000 years ago."*
- Bill Gates – "*Robots will become electronic people and it is appropriate for them to start paying tax."*
- Roy Kursweil – "*Scientific progress will grow exponentially, and machines will become smarter than humans."*

According to a research conducted in higher education institutions (Academy of Economic Studies, Polytechnic University of Bucharest, *"Alexandru Ioan Cuza*" University of Iasi, "*Stefan cel Mare*" University of Suceava, "*Constantin Brâncuși*" University of Targu Jiu, University of Craiova, "*Babes-Bolyai"* University), in 2023, representing an opinion survey, applied to learners, bachelor and master level, with online answers, it was synthesized, in a significant proportion, that the use of artificial intelligence in education improves the learning experience, will have a positive, medium impact on employment prospects, but still lead to the loss of many jobs.

Another research, conducted internationally by Microsoft, also in 2023, balances the disadvantages of using AI, surveying people from 17 countries. As a result, 71% of respondents in 17 countries were very concerned about AI-assisted scams about impersonating a person in the public eye, a government official, or a close acquaintance of respondents.

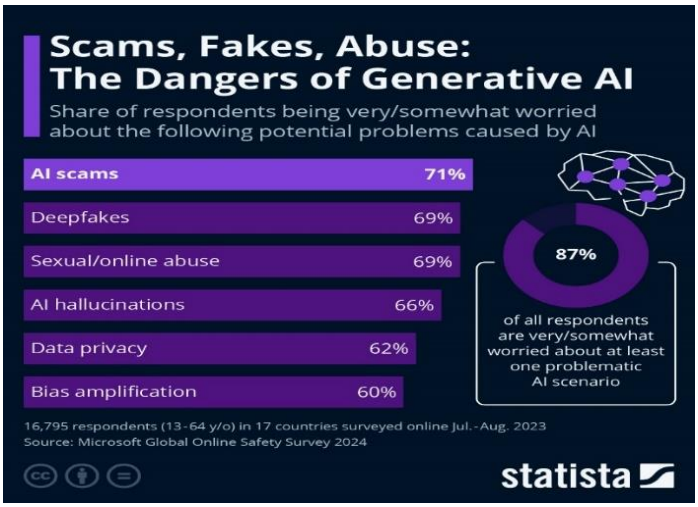

Image 1 - What are the biggest perceived dangers of AI?
Source: www.statistica.com

Overall, 87% of respondents were worried at least to some extent about a problematic AI scenario.

In analyzing the listed aspects, as well as the forecasts of specialists, personal opinion related to AI, concerns the following aspects:

AI will gradually integrate through digitalization in all socio-economic sectors. With major benefits, both in the public sector (fraud detection - in the police, fraud detection - in education, complicated operations - in medicine, working in environments unsuitable for humans, eliminating standard statistical models and issuing their own forecasts, customizing learning content, analyzing student performance data, identifying possible cases of plagiarism - in universities and in the private sector, where AI will present the major benefits for corporate interests, for cost efficiency (e.g. banks, algorithmic trading, customer solvency. AI will manage to operate huge data sheets, it will

manage databases at a speed inaccessible to humans, it will draw decisions that, sporadically, will be proven by the human component. AI will excel both in the public environment, but especially, due to the return on investment, it will excel in the private sector. In order to popularize humanity with AI and emphasize the use of AI by humans, decision-makers will have to regulate, quite rigorously, cyber security, as well as the monitoring of created algorithms, respect for human rights. AI will not be able to move forward without the help of appropriate ethical conduct.

In the future, the winners will be the world's economies that incorporate AI technology, even today, and the gaps between European regions will remain, with economies incorporating AI technology being stronger and more competitive. The developed regions will be those where humans and machines combine their individual capabilities for progress in sectors of the economy, and the strongest interactions will be *human-robot rather than robot-robot.*

No one can predict the future exactly because no one has returned from there, and it is harmony that must dominate us in meeting the things that will come (Nedelea and Nedelea, 2015). However, Neamțu, Hapenciuc, Bejinaru (2019) present two fundamental questions: ”What will be the next step?” and ”When and what will the next revolution be?”

They also specify the answers, namely that ”the next industrial revolution will take place when machines (tools) reproduce themselves: they will think, design and make themselves the means (or tools) they need to perform the tasks given by the human subject. How far away is this moment? Hard to say.”

With excellence in business, AI still presents questions about integrating this technology even where emotion, human virtues had a say, thousands of years ago. People's good decisions are backed by a combination of factors, affection, satisfaction, emotion, empathy and, last but not least, loyalty. It's hard to admit that AI will meet such human virtues! In good decisions, we tend to believe in human success versus AI. As Burciu and Hapenciuc (2010) point out, top managers make effective decisions using experience, intuition, imagination and emotion management, an unbeatable aspect in front of AI.

IV. CONCLUSIONS

The peak pandemic year, 2020, managed to create a new trend, that of using technology at another level, both among the population and among economic agents, 2020 being dominated by digitization, with a 60.5% increase compared to the previous year, in the number of enterprises that received online orders, and new companies turned their attention in business to the information technology services activity, increasing annually, by up to 22.7%.

In other words, the new trend of using technology has a synonym, namely comfort. Comfort is the subject of both business and consumers. Businesses that have gone through the fire of digitalization are businesses that show economic balance and profitability (Jasman et. al., 2022).

The present digitalization and its decision-making automation, through AI, represents the new culture and the new contemporary comfort.

Because forecasts estimate an exponential capacity for this technology, which is always learning from input data, a construction similar to the human brain, we wonder how far humanity is willing to accept this technology, and time will show that there is a boundary that will delineate, very precisely, between where we need AI, as an aid for socio-economic prosperity and the place where AI is not needed.

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