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Abstract: First came the digital banks without offices, and then the "fintech" companies that combined technology and finance to achieve greater efficiency and new business models. Later was the turn of transport and logistics, understood as the sector whose economic activities derived from the transport of people and goods, while on the one hand, it has had a new spring thanks to factors such as online sales. Then, perhaps catalyzed by the pandemic scenario, the turn has reached education, where years ago was only a complement of traditional education, now is a central part with multiple modern methodologies. Numerous studies exist about using or implementing these e-learning procedures, but technical analysis is barely found in references. This work aims to analyze the digital transformation of the main sectors of our society, including finances, transport, and education, together with several examples of how technology was helping to fight the pandemic scenario.

Keywords: digital transformation; education; educational sciences; Internet of Things

1. Introduction

Suddenly, everything became digital. Much has been written about "digital transformation", the cloud, and artificial intelligence. These words are repeated presentation after presentation, talk after talking, and entry after entry as if it were a mantra to achieve "survival". This era has also come to be considered the fourth Industrial Revolution (IR) because of the impact of its changes [1]. If we take a fleeting glance backwards, we will see that [2]:

- The First IR began in Great Britain at the end of the 18th century and originated with the steam engine's invention. It was the beginning of large factories, railroads, and modern cities.
- The Second IR was born in the United States between 1870 and 1914. It is associated with the emergence of electricity, mass production and the automobile industry.
- The Third IR is the one that resulted from the use of computers, the Internet and other information technologies. It became widespread around 1980.

Almost four decades have passed since the third one. In all this time, the world is not as it was imagined: people do not go in flying cars, nor can travel in time, nor have conquered other planets, as well long etcetera [3]. Most of these ideas come from the creative minds of science fiction authors. Of course, our society has advanced in many aspects of science, although people can explore more deeply to see that there is still much room for improvement.

At this point, technology, by its nature of automatism and scalability, can significantly facilitate many tasks and processes. This fact is where the fourth revolution begins, through the convergence of digital, physical, and biological technologies. This union creates a metaphor between the environment and us, altering our perception of the world [4]. The individual, per se, tends to spend as few resources as possible and desires material objects and sensations with the most extraordinary

immediacy and least possible effort. Here, many illustrious characters of our time have been able to find the alignment between desire and need with an assumable cost and have managed to create mercantile constructs that make the individual reach his objective by exchanging resources in favor of a third party.

Given all this context and adding to the equation several thousand silent electronic butlers in our pockets, it was only a matter of time before our perception of the world changed. So, modern humans want speed, efficiency, and cost savings and are unwilling to compromise on many other aspects of their way of thinking. Why does it when there is an army of volunteers to satisfy "my needs"?

Here are sectors in which the digital change may have been gradual, such as online sales, where stores began to have their digital version, then the "shopping malls" if it can conceive in this way the large online sales platforms and marketplaces such as Amazon and AliExpress, and finally, have even derived in abstract patterns such as dropshipping [5]. It is not easy to find any retailer without a digital version or catalogue sales in addition to, or instead, only face-to-face. On the other hand, some sectors have been disrupted overnight, such as logistics and passenger transportation, where new players and competitors have entered under the guise of the collaborative economy and resource sharing, completely disrupting the market.

The educational sector, particularly high-education, has gone through a profound digitalization in the hands of e-learning. It is impossible not to mention the 2020 pandemic [6,7], named after a disease that shook the foundations of society and, therefore, the economy. Its effect was such that it would merit several studies on it in the form of analysis or reflections and has worked as a catalyst to include e-learning as a crucial part of traditional education [8–10].

There are a significant number of studies about using or implementing these e-learning methodologies in the traditional educational system [11–14]. However, the number of technical analyses of the digitization impact on high education is rare in references. Thus, this paper aims to analyze the relationship between technology and its disruptive effect on education and other sectors such as finances and transport.

2. Digital transformation and the financial world

The financial sector is made up of a myriad of business models; the most notable representative is probably the banks, but we cannot leave out companies dedicated to portfolio management and investment advice, brokers, companies specializing in credit of all kinds, online payment institutions, currency exchange bureau, and on the other hand, companies for debt collection, appraisal, among others [15].

This group of companies, primarily providing services related to the world of finance, now finds itself at a crossroads, as there are other significant players with the capacity and liquidity to provide these services in less time, investing fewer resources, with greater effectiveness and knowledge of the individual. The current legal framework limits the actions of these new players, but this will only last for a while. On the one hand, it is already common to see instant credit buttons on online shopping portals, but how long will it be before we can take out a mortgage or a business loan from a company with technological roots, or perhaps the latter is already happening in other corners of the world. We are not even aware of it.

If we take as a reference the three main groups of trends on the emerging technologies radar of the strategic consultancy Gartner [16,17], we will have:

- **Interfaces and Experiences:** This includes the areas of the Internet of Things and virtual agents, such as chatbots and other practical applications of natural language recognition. Given the shift in most of the members of this sector towards a model with minimal presence, it is worth nothing that all technologies that allow the interface with customers to be extended will be welcome and will find their place in this sector. The world of the Internet of Things is also exciting in this context. These technologies allow us, among other things, to optimize speed and ease of use. Here, the ability to adapt payment methods becomes an indispensable requirement of the business fabric, transferring these same flexibility and speed requirements from consumers to the partners and third parties involved.

- **Business Enablers:** Among the most current technological trends, one has gained much popularity and has an immediate financial application: blockchain and smart contracts. It is the elephant in the room, dividing people into advocates and detractors, and has undoubtedly generated a massive community around it. Here we will focus on its potential and its broader scope. The discourse that this technology goes beyond cryptocurrencies tends to prevail among the defenders. Moreover, this is indeed a discourse as accurate as it is powerful; blockchain technologies are the gateway to the third generation of the web, the era of trust. We are used to trusting prestigious entities because of social and cultural conventions, but unanimity as a criterion is also a source of trust. In a very simplified way, it is as if through a collaborative economy construct, we could all be notaries simply by putting resources at the service of others. At the center of this whole universe is the identity and privacy of the individual. These technological advances can act as catalysts for procedures requiring compliance between multiple parties, leading to cost reductions, and facilitating B2B and B2C communications and relationships by establishing an environment and context with sufficient guarantees of identity and persistence. There is also a direct translation between crypto-assets and traditional products and services.

- **Productivity Revolution:** This section includes low-code solutions and artificial intelligence. On the one hand, robots and technologies that allow repetitive tasks with a certain degree of complexity to be easily automated, such as RPAs (Robotic Process Automation) and other LCAP (Low-Code Application Platform) solutions, make much sense in this sector due to the breadth and variety of administrative procedures that make up the day-to-day running of its business. Moreover, on the other side, cognitive technologies can solve diverse problems through models that emerge from reality materialized in the form of data sets. Coupled with the cheapening of cloud computing, storage systems (Data Warehouse, Data Lake and Data Hub) and procedures for processing large volumes of data (Big Data), they provide access to the necessary and sufficient means to solve challenges in a reproducible, automatic and reliable way, but also with a certain level of transparency (or explainability). What is interesting is the diversity of these challenges and the possibility of composing integral solutions by composition, managing to cover business processes completely and improving human interaction through feedback and active learning processes.

3. Digital transformation in transport and logistics

In this sector, we can find many business models, from multinational courier companies with their planes and ships fleet to local delivery through non-contracted personnel, with the legal complexities that this brings [18–20]. On the other hand, there would also be renting these means of transport and even the airlines. In general, they all share the same objective: to move resources or people from one point to another in the shortest possible time, in the most economical way, or both.

Mostly, these are sectors that are heavily intervened from a governmental point of view. This last characteristic establishes specific barriers to entry for new actors to guarantee a minimum of security in terms of what is being transported, but also by introducing additional costs, formalities and efforts required to carry out a simple task.

One of the first examples of digital transformation in this sector came from ridesharing. In 2006, a small French company designed, implemented, and completed a system to connect travelers with a common interest. The key was that there was an opportunity: travelers who wanted to travel and drivers who were making the same journey and had accessible seats in their vehicles. At this point, technology comes in as a medium, providing a secure context and facilitating communication between all parties. An example of a collaborative economy is, "you help me pay for the petrol, and in exchange, we travel together". Even pollution reduction can be mentioned as a secondary objective as a side effect, as we ultimately reduce the number of cars on the road. The other side of the coin is the companies that use this type of transport, whose target group has been eroded by a new competitor.

The following "victim" in this sector would be taxi drivers. We will start with an example: we have all taken a relative, friend or acquaintance to the airport at some time. It is something sporadic that, in some way, takes away "potential profit" from the taxi drivers/transporters. However, it is not

something remarkable since we do not dedicate our "full working time", and we do not do it for economic considerations. Once again, we find ourselves in a marginal situation, with no capacity for scalability, which through an application, becomes an opportunity for a business model and has introduced a new competitor into this sector. A competitor that on paper provides the same service, and even, in some respects such as appearance and value-added services, allows itself to innovate in an apparently stagnant and highly regulated sector. In this case, the situation is much more complex, as there are legal requirements to become a taxi driver, with high restrictions and licenses that are not cheap or easy to obtain.

Another advance in this direction is the car-sharing services, which allow access to the basic machinery to be able to make the journey at a meagre cost, an opportunity which, although it arose in a garage in the hands of a few entrepreneurs, did not take long to gain the backing of the large groups of car manufacturers, who saw how they could generate constant profit from providing vehicles and a layer of services (maintenance, rentals) to take advantage of the opportunity that lies in need for economical transport. This other model competes with rental cars and taxi drivers/drivers, or is it even capable of absorbing it completely? In this respect, the Daimler group's involvement in MyTaxi/FreeNow and Car2go/ShareNow illustrates this scenario.

Courier and delivery companies are characterized by a myriad of value-added services: insurance, tracking and guaranteed timetables or by their specialization: range, cost, and speed. These categorizations allow us to group and classify the companies. However, some niches resist them, especially at the local level. Here we cannot avoid taking as a reference the cities I know, but as far as we understand, there was no company in charge of food delivery; this type of service was provided by hired personnel; it took the democratization and scaling up of technology for there to be an entity capable of offering white-label home delivery for any restaurant so much so that many establishments have "parked" their delivery motorbikes and fully embraced this system. Curiously, some delivery companies are so aggressively competitive that they even "sell" below the restaurant's price. Customer attraction is taken to its extremes. On the hospitality side, with the high level of competition in the sector, how can we say no to an intermediary who can solve the delivery problem (and potentially increase sales), even if it is in exchange for a small commission? Again, a start-up, an untapped niche, a partially solved need, and technology allow this model to scale without virtual limitations. Physical constraints are a thing of the past.

The proliferation of retail services, drop shipping, and digital catalogue sales have pushed home delivery of products forward. The need is such that some suppliers rely on "sharing economy" delivery services to obtain efficient delivery drivers at low prices or even deploy their team of delivery drivers on the same premise. In this sense, the multinational Amazon has its delivery services, as well as those of specialized companies and the Amazon Flex programme, covering the entire spectrum.

Pulling the rope even tighter, local delivery companies are hyper-specializing and seeking higher profit margins by creating the product or service themselves. These are macro kitchens and supermarkets do not open to the public that take advantage of warehouses and forgotten spaces in the middle of big cities to have their small factories and warehouses to free us from the constraints of preparing our food and going by ourselves to get that last ingredient that is always missing in every recipe. Who has not needed a tomato to make a pasta dish at two in the morning? On the other side, we have the neighbors of those macro kitchens that overnight had a silent, abandoned carpentry workshop and today an army of motorbikes and smoking chimneys.

If we follow the structure of the previous section, we can structure the emerging technologies into these three trends and relate them to the transport and logistics sector we are dealing with:

- **Interfaces and Experience**: Companies in this sector provide B2B and B2C services. The most significant advantages are obtained in the latter by reducing friction and providing better service in the contracting, monitoring and service assessment processes with NLP technologies, reducing the costs of 24x7 direct customer services. We believe that, at this point, balancing speed through automation and quality through human touch is essential.
- **Business enablers**: one of the sectors that can benefit the most from IoT, along with industry, is present as it is a way to substantially improve the collection of up-to-date information with

proportionally low latency and cost. In addition, the scalability of the technology has been demonstrated in the four case studies mentioned above.

- **Productivity revolution**: automation made with behaviors that emerge from data directly obtained in the field is undoubtedly the next turning point for this sector.

4. Digital transformation and education

The education sector comprises activities aimed at improving people's knowledge and skills. The education sector is forced to embrace new technologies to keep pace with an ever-changing world. New technologies such as cloud computing, artificial intelligence, big data, and the Internet of Things (IoT), among others, can create interactive learning environments. Students can learn through online games, simulations and videos and collaborate with classmates online [21,22].

The Internet of Things is a term that describes the interconnection of physical objects and devices with the Internet. This interconnection allows objects and devices to communicate and interact with each other. The potential benefits of IoT for the education sector are enormous [23]. Some of the benefits already being realized include the following:

1. The digital transformation of the education sector can also improve teaching. Teachers can use new technologies to create dynamic learning environments. They can also use new technologies to assess student learning. This point can help teachers identify students who need extra help.

2. The digital transformation of the education sector can also help students acquire new skills. Students can learn to use new technological tools, such as computers, tablets, and smartphones. They can also learn to use new software applications. This point can help them to be more productive in the future. Artificial intelligence has introduced many changes in the education system. It has made the learning process easier and faster.

3. Digital transformation is changing the way education and learning are delivered. With the advent of new technologies and platforms, educators can offer students more personalized and engaging learning experiences. These technologies also allow students to learn anytime and anywhere, giving them greater flexibility and control over their learning.

Thus, online learning platforms and tools are crucial to digital transformation in education. These platforms enable educators to create and deliver engaging digital content to students, such as videos, interactive activities, and simulations [24]. This point allows for a more interactive and engaging learning experience, as students can learn at their own pace and on their terms.

Finally, another essential effect of digital transformation in education is data and analytics. With the proliferation of digital tools and platforms, educators now have access to vast amounts of data about student learning and performance. This data can be used to gain insights into student learning and identify areas where students may struggle. This aspect can help educators tailor their teaching methods and strategies to better meet individual students' needs [25]. The potential benefits and caveats are listed at follow:

1. **Increased efficiency and productivity**: the IoT can help educators become more efficient and productive in their work. For example, IoT can be used to monitor and track the location of students and staff, which can help improve safety. It can also automate tasks, such as taking attendance and marking.

2. **Improving learning outcomes**: IoT can help improve learning outcomes by providing students with real-time data and information access. For example, students can use IoT devices to collect data on weather patterns, plant growth and animal behavior. This data can be used to support learning in a variety of subject areas.

3. **Improving student engagement**: IoT can help improve student engagement by providing opportunities for students to interact with technology and use creativity. For example, students can design and create their apps, games and websites to use IoT devices.

5. Helping to fight the Covid-19 with technology

In this section, we are going to compile initiatives that have emerged throughout society to collaborate in reducing the effects of the devastating pandemic that is affecting us and of which we

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finally see the light at the end of the road. It is a ray of hope that has enlightened and inspired many to share these lines with which to pay them a sincere and humble tribute.

1. **Juan donates his CPU time**: Commercial by day, rally driver by night, this fellow computer enthusiast does not hesitate to leave his noisy and gigantic gaming computer at the service of Boinc. This distributed computer network is doing the calculations to find a vaccine for the virus. He only needed a little time and his personal computer (although it could have been a pi raspberry). You can find all the info at https://boinc.bakerlab.org/rosetta and https://foldforcovid.io.

2. **Daniel is a maker who manufactures and distributes masks**: Responsible for an area of innovation, Dani, as everyone calls him, did not hesitate to ask his company for support and put all the 3D printers he could get his hands on and put them to print masks and protective equipment (PPE) for health personnel and agents serving the public (police, civil protection, among others), in addition to collaborating on the design of respirators and other actions of the maker movement. You can see it and collaborate here: https://www.coronavirusmakers.org.

3. **Josefa has generated some models of the evolution of the pandemic**: A data scientist, she put her ingenuity and experience to work for the community, directing her efforts to locate a model that would allow organizations to estimate valuable and scarce resources during the worst times of the pandemic. Josefa and her team took data samples and applied a predictive model that analyzed the progress of the pandemic throughout the country. You can see the result of his work in this dashboard: https://keepler.io/covid19.

4. **Javier helps people with reduced mobility**: Remembering old times as "Ryder", Javier took his bike. He shared time and effort, helping people who had no facilities to move around during confinement but still needed access to resources and necessities, but the sometimes such simple company. Initiatives such as the one in which Javier participates are https://minutosencompañía.org, https://www.adoptaunabuelo.org and https://grandesamigos.org.

6. Conclusions

This work analyzes from a technical point of view the digital transformation of some of the most critical sectors of our society, including finances, transport, and education. According to our analysis and the situations mentioned above, digital transformation has brought significant changes to these sectors. In the case of finances, the sector is in an environment of high uncertainty, whether to opt for crypto-assets or wait for legislation, devote resources to optimization or research, forge alliances or explore new areas. In the transport and logistics sector, we begin to glimpse an army of silent machines eager to make the repetitive effort of moving objects and people from one place to another. Finally, overall, digital transformation is transforming the way education and learning are delivered, providing students with more engaging and personalized learning experiences. It also enables educators to gain more significant insights into student learning and support student success.

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