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Research Article

COVID-19 Pandemic as Accelerator: Opportunity for Digital Acceleration

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Abstract

The corona-virus pandemic unexpected start and steady pressure continue to influence individual lives and national economies. Definitely a direct threat on people's health and lives, it also indirectly affected global supply chains as well as local businesses. On the other hand, by its uniqueness and relatively long duration, it is becoming a macro-laboratory not only for medical research but also for economic and business studies. Unsurprisingly, like any other global crises, the influence of the corona-virus crisis was not uniform: i.e., healthier individuals with better immunity systems and countries with better healthcare infrastructure and medical assistance systems were less affected than others; so were the companies and economies. Or, in competition terms, the former display a kind of competitive advantage as compared to the latter ones. In addition, on this background, in the particular case of organizations (companies) at advantage and already on the pre-pandemic verge of digitalization, the *corona-virus crisis acts as an opportunity for accelerated digitalization* (i.e., digital accelerator). The authors sustain this thesis by four illustrative examples. The accelerating effect of the corona-crisis is described in two sectors (industry and education) and two industries (book publishing industry and oil & gas industry). The examples were selected based on their representativeness mainly. More specifically, the focus is primarily on the business sector from Romania, specifically on the book publishing industry – chosen for several reasons (large interest among population, subject of dramatic changes as result of the preferences turning to e-books; investments in newer technologies following to strategic changes; its relationship with other social sectors of large interest as education and culture). The research methodology included secondary (literature) research as well as primary (authors') own observations and interviews, over a period of six months, from the onset of corona-crisis in Romania (March – September 2020).The results highlight the role of corona-crisis as opportunity for strategic decisions to invest in new technologies, accelerator of investments in new technologies, and digital [technologies] accelerator. The paper also reveals that corona-crisis accelerated the investments in digital technologies for online education.
This paper also launches the thesis of the education paradigm shift – in that respect of the educator's role in the predictable future, to provoke a discussion, and to open a research path, for higher education strategists, policy makers, scholars and educators.

Keywords: COVID-19 pandemic, Strategic opportunity, Digital acceleration, Oil and gas industry, Romanian book publishing industry, Education paradigm shift, Critical point of education

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Introduction

The Current Coronavirus Crisis Is Increasingly Becoming Not Only A Current Concern For Each Individual, Government, And International Organization, But Also A General Sectorial Problem To Be Solved For Healthcare Sector Firsthand, Then, On Longer Term, Economy; And The Impact On The Whole Society – How We, People, Are Going To Live And Interact – Is Still A Matter Of Mixed Interest, Concern And Uncertainty.

Academia, scholars and researchers are gradually showing a professional interest, besides coronavirus treatment, in its *socio-economic impact*. Within full pandemic, the amount of scientific production itself is going up. As the scope of work is on the latter, it would be interesting to find out how much of the "socio-economic impact" is *social impact* and how much is *economic impact*, although they interact to each other and cannot be separated.

Remember that the first cases of coronavirus were identified in China in December 2019. On 25 January 2020 the first case of Coronavirus was confirmed in France, while the first case reported in Romania was a month later (26 February 2020). If the world powerhouses and major European countries enjoy more attention paid from researchers, *average countries like Romania are less the research object*. Therefore, the focus of this paper will be on *Romania as an EU member state*; nevertheless, in global context.

About a year ago, on the *13th of March 2020*, Europe became "the epicenter of the #COVID19 pandemic, with more reported cases and deaths than the rest of the world combined, apart from #China" and more cases were reported in Europe daily "than were reported in China at the height of its epidemic" as written by Fredericks (2020) on 13 March, quoting a declaration of the World Health Organization (WHO) Director-General. The same day of 13 March, the European Commission (EC) has launched a coordinated answer to mitigate the socio-economic impact of the COVID-19 pandemic.

From that day of March 13 on, according to Scarlat and Stănciulescu (2021), an analysis of a set of press releases issued by the European Commission (EC AV Portal, 2020) and e-mailed by the EC office *in Romania* (European Commission, 2020), *over a period of six months* (March – September 2020), has revealed constant interest of the EC in the topic of coronavirus. Specifically considerably, EU funds were converted in programs and projects to mitigate the impact of the coronavirus pandemic – not only in the EU member states but also in the world most affected countries. Almost half of the topics (44%) were related to the "health" topic (i.e., majority of funds going to health research, services, infrastructure, and pharma products). The study has also shown that:

- social issues (education, culture, labour force and vulnerable social categories mostly) emerge as dominant over economy issues (32% as compared to 24%);
- economic topics (i.e., varied forms of financial support for companies – small businesses and large companies alike) count for even less (14%).

It means that the business sector (companies, actually the business core, producer of all goods and provider of all services) is not a top priority during the first period of corona-crisis, apparently.

Therefore, the authors' scope of work is primarily on the *business sector* from Romania, (as less prominent and fewer studies), specifically on companies from a particular industry – namely the *book publishing industry* – chosen for several reasons: large interest among population, still subject of dramatic changes as result of the preferences turning to e-books; area of investments in newer technologies following to strategic changes; nonetheless, its relationship with other social sectors of large interest as education and culture. The aim is to investigate the *impact of global crisis of coronavirus pandemic* on this industry – from its onset in Romania to-date (March – September 2020).

In addition, the discussion on the impact of the global coronavirus pandemic is necessarily extended to the global environment in both directions: (i) to an industry of global interest as energy (namely *oil and gas industry*); and (ii) to a non-economic sector of global interest as well as *education* (yet related to the book publishing industry). To sustain such an ambitious workload, the provocative theses to be launched are supported by case examples from the above areas (yet each of them supported by literature and authors' own research).

Consequently, the rest of this paper is structured as follows: the dual role played currently by the corona-crisis (threat and opportunity) in the new global environment (business included); coronavirus pandemic as a technology accelerator in both industry (Romanian book publishing) and education system; coronavirus pandemic as a driver of digital acceleration in the oil and gas industry; future research avenues; conclusions and managerial implications.

The Coronavirus Environment: Threat or Opportunity?

The very same day of March 13, 2020, Gambrell (2020) published the results of a study on the US labour force, showing that older workers (particularly vulnerable to the coronavirus) make an increasing part of the American workforce: over 20% increase in a decade (2008-2018). Other than labour market, the financial and capital markets have suffered significant impact as a result of corona-crisis. A gloomy picture of the post-covid finance world is described by Sands (2020). According to Holmes (2020), corona-crisis is impacting "companies, employees and consumers" as well as the global megatrends themselves (Angus and Evans, 2020). To make the things worse, GDP contractions in low-income countries – as India and Mexico – demonstrate that "covid-19 curbs do not worth economic pain" or, in other words, "severe lockdowns [produce] economic damage" (Wheatley, 2020).

Unfortunately, the unexpected corona-crisis has brought unexpected effects. Pandemics on top of "rising political and economic risks in some markets have seen [… investors] flee for the first time in what could be a growing problem for governments struggling to fund budgets bloated by anti-crisis spending" (Aris, 2020a). In addition to these, Chavarria, Walker and Bahamon (2020) reveal the illicit trade in times of corona-crisis.

In Europe, the economies of the EU member states react slightly differently to coronavirus. In Germany, a study conducted by Sita, Dutton and Ha (2020) shows a *rapid evolution amidst the crisis as far as changing the consumer landscape*, how consumers shop and pay. The technology plays a mounting role, changing the balance between leisure and experiences "out of home" versus "in the home". In Central and Eastern Europe, the news is mixed: while "post-lockdown recovery of Poland's industrial production falters in August (Aris, 2020b), there are better news from Romania – where several industries have recovered: IT and constructions sectors (Aris, 2020c), car manufacturing (Ernst, 2020), finance and banking (book publishing industry was not among them). As a result, on September 21, Romania's Bucharest Stock Exchange has been upgraded from a frontier market to an emerging market and "held its first session as an emerging market". The very first two Romanian companies were included in the FTSE GEIS (Global Equity Index Series).

From the macroeconomic standpoint, Euromonitor International Analytics (Euromonitor, 2020a, 2020b) offers short-term or longer term evolution scenarios ("what if"-type), based on its Macro Model. According to Euromonitor (2020a, p.3), "Covid-19 has transformed the economic and consumer landscape. It has changed the way we as consumers live, work and shop. Uncertainty remains high." Among the five consumer markets analyzed, home & technology was highly impacted by corona-crisis – as far as "where and how consumers shop" and mostly how "hometainment and the new experiential consumer markets": "The trend towards digital education and pastimes is further enhanced, including further growth of gaming and online esports" (*Ibid.*, p.13). The companies and industries (*book publishing industry included*) that timely understand this trend *will adapt, survive and succeed in the future business environment* (Scarlat, Stănciulescu, 2021).

From microeconomic standpoint, at the company level, corona-crisis is definitely a threat, and the company's strategies are challenged. However, while facing threats, the companies (their executives) behave differently, from being passive (making no decisions at all) to making excellent to "not-so-good decisions". Scarlat (2015) shows how slightly different results of analyzing the same strategic situation (e.g., by conducting SWOT-type analysis) might lead to different strategic decisions, with huge different results – from failing to *turning a threat into an opportunity*.

Opportunity is one of the four key-elements of the SWOT (Strengths, Weaknesses, Threats and *Opportunities*) matrix/analysis/method (Hill and Westbrook, 1997; Humphrey, 2005) – or its

variant TOWS, championed by Weihrich (1982) – frequently used in the process of strategy analysis, specifically in strategic business planning (Hill and Jones, 1995; Armstrong, 2004) but also in administration and other areas, at macro-, mezzo-, or micro-analyses (Westhues, Lafrance and Schmidt, 2001). In time, SWOT has got both accolades and critics, and the debate is still continuing. Among recent merits, there are extensions of the concepts as: Early Warning & *Opportunities* System – EWOS (Popescu and Scarlat, 2015) or Strengths, Vulnerabilities, *Opportunities* and Risks – SVOR (Mesly, 2017). Thus, the method is so well-known, largely used and, regretfully, many times rather incompletely and/or poorly used (Chermack and Bernadette, 2007). Concluding, making wrong strategic decisions based on wrong SWOT-based strategy design – i.e., poor SWOT analysis (Scarlat, 2015) is of major risk in the business area. Conversely, mastering the methods of strategic analysis, skilled executives demonstrate not only leadership skills (assuming strategic changes by turning threats into opportunities) but also an *entrepreneurial behavior* (Şişu and Scarlat, 2020) – which is pursuing opportunities (Stevenson and Amabile, 1999). To note that "entrepreneurial behavior" formulation (Moore, 1986; Kirkley, 2016; McAdam and Cunningham, 2019) was favoured as compared to "entrepreneurial orientation" (Covin and Lumpkin, 2011; Wales, 2013; 2015) because the former is neatly centered on the concept of opportunity (O'Reilly, 2020; Hisrich and Kearney, 2011), in all its facets: *opportunity identification, opportunity facilitation, and opportunity desire and motivation.*

The concept of *opportunity* plays a crucial role in the Stevenson's *theory of entrepreneurship* as well (Stevenson and Sahlman, 1986; Stevenson and Amabile, 1999): Stevenson believed that entrepreneurship is "the pursuit of opportunity beyond of resources you currently control". Authors of this paper share Stevenson's view at the organization level: an organization is *more entrepreneurial* than other if it is more opportunity-oriented i.e., it (its top management) makes *more opportunity-driven strategic decisions.*

Probably the best and best-known example of *turning the threat of covid-19 pandemic into a business opportunity is the strategic decision* made by a number of companies (not by all of them; only by the most entrepreneurial ones) – even in the early stages of the pandemic – to *go online* (from brick-and-mortar shops to online, virtual shops, as well as online promotion and online payment), forced by the mobility restrictions imposed by governments (lockdown, social distancing measures, *etc.*). The home delivery (of electronics, food and confectionery, clothing and toys, and alike) as well as the delivery service itself (courier service) have proved to be booming businesses.

Evans (2020) investigated the reasons behind the *surge of e-commerce during coronavirus pandemic period,* providing a sound analysis.

As opposed to the global phenomenon of progressive development of e-commerce and going online in many industries (even sports and entertainment industries), a particular industry from Romania presented a quite similar entrepreneurial behavior: *the book printing industry*.

> *Example 1*: *Turning threats into opportunities in the book printing industry*
>
> In the current period of globalization and accentuated digitalization, *the publishing industry is facing major challenges.* The main challenge comes from the *technology evolution* used in this field, which evolves much faster than the needs, expectations and ability to adapt the editorial output and even often the final beneficiary – the reader. Another challenge is the wide variety of *substitution products, digital books* (eBooks, audio books) – all offered by the evolution of digital technology. This variety can cover a wide range of customized presentation methods of the same product (book) with very low costs (Stănciulescu and Scarlat, 2020).
>
> Exploiting the new capabilities available to the technology offers the publishing industry multiple opportunities to improve and diversify the offer in promotion, distribution and sale, as well as in direct interaction with readers or readers with authors (Greco, Milliot and Wharton, 2013; Michaels, 2015). An immediate opportunity for publishers is to offer readers, especially young people, editions for smartphones, iPads and computers through the use of multimedia, storytelling, gamification, through changes in content (serialization, short forms) and book aesthetics (Cox, 2014; Striphas, 2009; Phillips, 2014).
>
> In Romania, the book publishing industry has its own peculiarities (Stănciulescu, 2020). However, as general characteristic, it

lagged behind from technology standpoint. On top of this, Ceobanu *et al*. (Ceobanu, Dinu and Cristea, 2016; Ceobanu and Despoiu, 2017) have shown significant gap – as far as resources (number of employees), output and productivity (number of titles/year) and financial performance (annual turnover) between the Romanian book publishing industry and EU book publishing industry (actually, the largest cultural industry in the European Union), existing in the coronavirus pandemic's eve. Therefore, in order to bridge this gap, *the most entrepreneurial book publishers have taken the current corona-crisis as an opportunity to make strategic decisions to invest in newer technologies* – as writing software and digital storage; digital technology for text editing and added graphics, and alike. In other words, the publishing book industry is facing the coronavirus-provoked challenges that open a technologized set of opportunities (e-commerce, online education, e-books, pastime, all supported by newer technologies) in business, education, culture – all impacting the society on longer term (Stănciulescu and Scarlat, 2020).

The Romanian publishers hardly adapt to the current trend of electronic book production and only a small part of them make e-books and audio-books. The trend of e-books is increasing, and the same rising trend is also evident in readers' searches for books and e-books on Google. Stănciulescu and Scarlat (2020) have evidenced the probable trend that the two book formats (paper printed and e-books) will continue to coexist for a time – as the future of the book publishing industry is closely related to the technological evolution, as well as the readers' needs and behavior. *Since March 2020, with the onset of the coronavirus pandemic, there has been a sharp increase in book access* – due to population isolation imposed by authorities, discounts and free online titles offered by publishers to maintain their readership communities – a *market opportunity that was clearly taken by the most entrepreneurial book publishers to invest in newer technologies*.

Covid-19 Pandemic: From *Technology Opportunity* to *Technology Accelerator*

The evolution of digital technology in the last decades has brought important transformations in the publishing industry, *significantly accelerating certain stages of the production chain* (Phillips, 2014). If, until the '80s, the publishing activity was cumbersome and relatively slow, most of the stages being incorporated into a functional aggregate model, the emergence of digital technology of editing, storage and printing represented an important qualitative leap (Striphas, 2009; Banou, 2017). Thus, the transition from traditional typographies to offset printers and then to digital printing has greatly increased the profitability of publishers as well as quality and variety of printing, especially as an offer of aesthetic forms.

The direction of publishing industry evolution has always been that of democratizing information, knowledge and taste, of fast access to friendly books with aesthetic value and accessible as a price. Digital technology has given a strong impetus in this regard, starting with the creative segment of the publishing industry (Hartley *et al*., 2013; Clark and Phillips, 2014; Cope and Phillips, 2014; Banou, 2017) and continuing with the entire book production and marketing chain. This trend has led to the modification of the value chain (Thompson, 2012), reaching in many cases the highest wish of readers: immediate and free access to a wide range of books offered by various publishers and online bookstores (Clark and Phillips, 2014; Ramrattan and Szenberg, 2016).

In Romania, during the current coronavirus pandemic, the acceleration of book production pace is associated to the *acceleration of investments in newer book publishing technologies*. Actually, there were *two quite independent phenomena that just happened to overlap*:

(i) this unexpected and brusque move to go online in the book publishing industry, forced by the coronavirus pandemic;
(ii) the quasi-natural trend of growing e-commerce, supported by the technology progress that has made an increasing number of businesses to go online – e.g., music industry in which the intangible

music product – traditionally sold on hard support (vinyl, CD) – that went to be downloaded, and then provided as online service by streaming technology.

Phillips (2014) draws a parallel between the publishing industry and the music industry and, at the same time, emphasizes the impact of the Internet and technology on them. The opportunities offered by digital technology to the publishing industry have to be offset by new legislative measures to protect intellectual property, measures similar to those in the music industry.

Example 2: *Coronavirus pandemic as an opportunity for accelerating the new technology investment, in the Romanian book publishing industry*

In Romania, the combined effect of the two phenomena [(i) + (ii)] has as result an *accelerated effect of investments in new technologies*, in the book publishing industry – as compared to the instance in which coronavirus pandemic did not happen [(ii) only]. In other words, investments in newer publishing technologies (ii) would have been happened anyway; strategic technology investments in the book publishing industry, which are the result of coronavirus crisis, (i) just added-up.

Therefore, the *coronavirus crisis may be considered an accelerator of investments in newer publishing technologies* (Scarlat and Stănciulescu, 2021).

A similar phenomenon, on a larger scale, that has happened not only in Romania, and not in a single industry – even not in industry at all – is *online technology acceleration produced in educational system*, as a result of the current coronavirus crisis (Scarlat, 2021).

The education system is part of the society as a whole, evolving and transforming together, in principle addressing the needs of the society. Nevertheless, the higher education immediate environment is currently under the pressure of several forces that induce challenging transformations as well as rapid changes. All these forces and influences are interlinked, and all of them influence or are influenced by the education systems and processes – on all their dimensions: students, educators, teaching infrastructure and methods. Our focus is on the *educator's role*, amid mostly desirable changes and undesirable turbulence.

The technology progress (namely quasi-instant Internet communication) offers some solutions in terms of making the distance irrelevant – in that respect of blitz-access to information. However, in spite of faster and faster transportation means, distance is still an obstacle for people and material resources. If the blended learning seems to be a balanced solution applicable in several instances (education infrastructure, teaching materials and methods), a particular question stands still: If the source of information (source of knowledge, ultimately) can be almost instantly accessed, then how to cope with this tremendous amount of data?

Computers and artificial intelligence (AI) algorithms may help (and will be of more and more help). In addition to this, to make things more difficult, this amount of data develops exponentially in time. Nowadays hundreds of thousands new books are published yearly, which corresponds to an amount of information (new data) of more than 1 million bits/sec (Hawking, 2001). On the other hand, the amount of information that human brains are able to process is related to the human DNA. According to Hawking (2001), the complexity of DNA improved over time, as measured in bits of information: from 1 bit/100 years (during the first two billion years since the emergence of life on Earth) to 1bit/year (during the last few million years) – as a result of random mutations and natural selection. The relatively low pace of improving the DNA complexity suggests a relatively linear increase in brains capacity to process the information. In this matter, following earlier studies (Hick, 1952), Moscoso del Prado (2011) estimates the human reaction time at maximum 60 bit/s. Obviously:

60 bit/s (Moscoso del Prado, 2011) << 1 million bit/sec (Hawking, 2001)!

It means that humans in general (and educators especially) are not able to cope anymore with exponentially increased volumes of available data.

To a certain extent, computers do help – by their growing processing and memorizing capacity – to amplify the human capacity. However, new sciences and deeper areas of knowledge in each sector of science, associated with unprecedented volumes of information, make it almost impossible that any contemporary scientist / professor to master more than a single subject, a very few or narrow knowledge areas. Actually, our society already experienced reaching a *critical point in time* – not necessarily

as technology management but as *information management in education*. This happens when the *amount* [*pace*] *of available information generated exponentially is larger than the limited amount* [*pace*] *of information the human brains are able to process* [brains' processing rate]; call it the *critical point of education* (Scarlat, 2021).

Hence, the author's (*Ibid.*) opinion is that education system is currently at a critical point in time when the educator's role must change from knowledge repository to skilled, expert knowledge explorer and identifier. *The educator will continue to exist in the near future at least, but with a different role.* First and foremost, s/he has to be familiar with new teaching technologies (not only e-learning platforms but also diverse algorithms and devices for AI – artificial intelligence, VR – virtual reality, AR – augmented reality) and teach students how and when to use them. Then, the educator has to switch from teaching the subject to teaching and guiding students how to pick the right information related to the subject from the ocean of data, literally; to distinguish the better from poor quality, the true from false information, and eliminate the fake data.

In the near foreseeable future, the role of the educator is not going to be diminished; exactly the opposite is the case: the educator's role becomes more complex, to teach how and when to wisely manage the technology tools in general; how and when to use the newer technologies as online and mobile teaching, AI, AR and VR devices; to promote experiential teaching together with students in order to effectively guide them to achieve the educational objectives. Pacansky-Brock (2017) explains how educators need to understand the applicability of the new educational technology-based tools (as social media and web 2.0 technologies) that are currently transforming the learning trends and preferences of students as well. The public web and open educational resources are going to replace the traditional learning management systems and technologies that no longer exist; and their mastering should be on the educator's list of competencies – in order to enhance "communications with and between students, and cultivating participatory, student-centered learning activities". It seems that our society is at crossroads, not necessarily as technology management but as management of the technology-generated information, mainly in education. *We are witnessing a paradigm shift in education, related to the educator's newer role* in a more technologized society (Scarlat, 2020; 2021).

The COVID-19 pandemic generated "the largest disruption of education systems in history, affecting nearly 1.6 billion learners in more than 190 countries and all continents" – according to a United Nations report (UNO, 2020, p.2). In response to numerous school closures (universities in many countries included), UNESCO (2020) recommended the use of distance learning programs, educational e-platforms and open educational applications – in order to limit the effects of social distance administrative measures (i.e., disruption of the education process). Diverse negative influences on the education system are also reported by Schleicher (2020) in his OECD report. However, this paper aims at identifying a positive outcome.

> *Example 3: Coronavirus pandemic as an opportunity for accelerating the process of online education, by new technology investments in education*
>
> During the current coronavirus pandemic, the process of introducing new educational technologies is associated to the process of dramatically developing the online education. Actually, there were two quite independent phenomena that just happened to overlap:
>
> (i) this unexpected decision of educational institutions to urgently move online, forced by the harsh circumstances of the coronavirus pandemic;
>
> (ii) the quasi-natural trend of gradual implementation of newer educational technologies (in general compatible with distance and online teaching and learning), supported by the technology progress linked mostly to AI, VR and AR algorithms.
>
> The combined effect of the two phenomena [(i) + (ii)] has as result an *accelerated effect of investments in new educational technologies for online teaching and learning* – as compared to the instance in which coronavirus pandemic did not happen [(ii) only]. In other words, investments in newer educational technologies (ii) would have been

happened anyway; technology investments linked to online and distance teaching and learning, which are the result of coronavirus crisis, (i) just added-up.

In Romania, this combined effect was more visible, because of the previously existent gap in the area of online education (as compared to the Western European countries).

Therefore, the *crisis provoked by the coronavirus pandemic may be considered an accelerator of investments in newer online educational technologies* or, as direct effect, *an opportunity for accelerating the process of online education,* by new technology investments in online education (Scarlat and Stănciulescu, 2021).

The unexpected coronavirus pandemic and its subsequent corona-crisis made the problem of the educator's role more acute. And, willing or not, the education dilemmas remained, although with a positive note: the process of online and distance teaching learning, using newer educational technologies, is gaining momentum and speed.

Rightfully, the corona-crisis could also be qualified as an *accelerator of the process of higher education reform*, re-thinking its elements at a crisis pace.

Scarlat (2020; 2021) argues that the education system is currently at a crossroads – calls it *critical point of education* – and launches the *thesis of education paradigm shift* – in that respect of the educator's role in the predictable future. The educator's role must change from knowledge repository to skilled, expert knowledge explorer and identifier. S/he has to switch from teaching the subject to teaching and guiding students how to pick the right information from the ocean of data, literally; to distinguish the true from false information, and eliminate the fake data; and to master the newer online teaching technologies. In the future, as part of the human society as a whole, the education system will continue to play its role and answer the newer and newer needs of the higher and higher technologized society. The humans – both educators and students – will change themselves.

Covid-19 Pandemic: A Driver of Digital Acceleration

The permanently increasing interest in technology and digitalization shown by business environment led to a new concept known as *Industry 4.0*, which represents the fourth industrial revolution. Montanus (2016, p.2) defines Industry 4.0 as a "new wave of technological development" which leads organizations to redesign their business model. According to Fraser, Anastaselos and Ravikumar (2018), Industry 4.0 creates smart networks by connecting machines, systems, individuals and products. Schlaepfer, Koch and Merkofer (2015) have identified four defining characteristics of Industry 4.0:

(i) The "vertical networking of smart production systems" refers to production and maintenance management through cyber-physical production systems (CCPSs);
(ii) The "horizontal integration via a new generation of global value chain networks" means a flexible and transparent system for real-time networks and processes optimization;
(iii) "Through-engineering across the entire value chain" underlines the importance of focusing on the entire product life cycle, from production process to end product;
(iv) "*Acceleration through exponential technologies*" is focused on the impact of the new developed solutions as autonomous solutions based on artificial intelligence (AI), drones for maintenance, 3D printers or nano-materials and nano-sensors.

Example 4 illustrates exactly the fourth defining characteristic of Industry 4.0 in the case of oil and gas industry: how current coronavirus pandemic has accelerated the process of digitalization by decisions to invest in newer technologies specific to Industry 4.0 (Panduru, Scarlat, Gherman, 2021).

Example 4: Coronavirus pandemic as digital accelerator in oil & gas industry

The new information and communication technologies create value for each company by optimizing costs and streamlining the business processes. Specifically in the *oil and gas industry*, there is a big uncertainty regarding its future – as oil and gas organizations are in a difficult position to strategically plan the future, based on the multiple challenges they are facing. *Coronavirus pandemic*, political measures taken regarding climate change, electrical vehicles market increase are factors that are forcing *the leaders of oil and gas industry to*

respond quickly (make rapid decisions – which is somehow in contradiction with longer term strategic decisions) as noticed by Panduru, Scarlat and Gherman (2021).

The World Economic Forum (WEF, 2017) was focused on the impact of innovation and new technologies in oil and gas industry and it recommended for *oil and gas industry* – somehow declarative but very to-dated – to push for automation, remote operations via end-to-end processes connected through *Industrial Internet of Things* (IIoT), advance analytics and modeling tools, connected worker technologies, and development of innovation culture inside the organizations.

A defining particularity of the oil and gas organizations is emphasized by McCarthy (2018): their strategic thinking is challenged by crucial decisions that have to solve the problem of improving their operational efficiency, and, in the same time, facing the challenge of reducing the environment carbon footprint. This challenge requires *huge investments to be made in digitalization of operations* (estimated at 1 billion USD by the end of 2023).

According to a study conducted by Pandey and Branson (2020), most executives from oil and gas industry are familiar with the benefits of digitalization, which will generate increased revenue and decrease in costs due to higher operational efficiency and larger production. According to the same study, the *top five drivers of the digital transformation* are the following: manufacturing execution system, cloud computing, energy analytics, Internet of Things (IoT), and machine learning technologies designed for operations efficiency and sustainability.

Currently, *digitalization represents a critical point for oil and gas industry* because of its important role in the process of "energy transition"; therefore, digitalization should be among "the strategic priorities for the organization in the future" (Dickson, 2021, p.5).

This example illustrates, besides the definite negative impact of the coronavirus pandemic on the population health and global economy, that it is acting as a driver of accelerated digitalization of the oil and gas industry – in other words, as a driver of *digital acceleration*.

To note that the term "digital accelerator/acceleration" [completely: "digital technology accelerator/acceleration"] should apply in case of digital technologies; otherwise, the more general term "technology accelerator/acceleration" is recommended.

It also should be observed that corona-crisis acted, more generally, as a new technologies accelerator (not only in oil and gas industry, and not only in industry); however, in some industries (as book printing or oil and gas industries) or sectors (as education), the accelerator role is more pregnant.

Covid-19 Pandemic: ... And A Future Research Avenue

As this exploratory study is limited to four illustrative examples, an immediate future research avenue is, obviously, to continue exploring more industries (other than book publishing or oil and gas industries) as well as other than education non-industrial sectors.

As the coronavirus pandemic is at its apex (i.e., it continues to be a challenge for world economies), it would be appealing for researchers to continue, deepen and extend this study both longitudinally and transversally. In other words, it will stand still the question if this coronavirus pandemic will continue to act as *opportunity for technology investments, technology accelerator* or *digital accelerator* (Scarlat, 2021; Scarlat and Stănciulescu, 2021; Stănciulescu and Scarlat, 2021) – especially for *digital technologies* – and, essentially, as a driver for strategic changes – focused on Romanian economy mainly, in oil and gas industry in particular.

Conclusions And Managerial Implications

The examples that illustrated the instances and concepts in discussion (coronavirus pandemic as *business opportunity* for *strategic changes* and *investments in new technologies*; coronavirus as *technology accelerator* and *digital accelerator*) refer to authors' previous and/or current studies. Other concepts or ideas presented in

relation to business sector (*entrepreneurial behavior* of the organization) or education sector (*paradigm shift*, *critical point in education*) are discussed previously as well (Scarlat, 2015; 2020; 2021; Scarlat and Şişu, 2019; 2021; Şişu and Scarlat, 2019; 2020).

The coronavirus pandemic could also be qualified as an *accelerator of the process of higher education reform*, re-thinking its elements at a crisis pace.

Nevertheless, nobody should conclude that the current pandemic or other future pandemics could be a solution for future development! This paper has the role to reveal the other side of the phenomena, in order to mitigate the crisis negative effects and possibly accelerate the positives.

The four examples associated with two sectors (industry and education) and two industries (book publishing, oil and gas industries) presented in this exploratory study were selected as representative as well as for several reasons already presented in the introductory part. Nevertheless, the phenomena and concepts related to them might be applicable in other sectors and industries as well.

On longer run, a multitude of questions arise, depending on future technologies and their impact on the human society, but mostly depending on future decisions made by humans. The education system and educator's role will significantly depend on how the future humans (both educators and students) will evolve. The human race suffocation or extinction as result of wrong technology decisions is an extreme possibility (Wiener, 1989; Martenson, 2011; Harari, 2016). In other words, is the humankind going to cope with sustainable technology development as *homo sapiens*? Is it going to be a different community of *homo networkingus* or *homo cyberneticus*?

To answer all these questions is beyond the goal of this paper. The main objective remains to launch a discussion on the subject announced in the title, and, eventually, to open a research path, for academia and business community; strategists and policy makers; scholars, managers and educators.

As far as education system, the [higher] education is at a crossroads – as its future is intimately inter-linked with the future of human society as humankind. The humans are actually in front of largely spread options: within the conceptual angle bordered by *wise-man* and *cyborg*, the common sense must prevail. *It is up to contemporary educators; it is their educative mission and mentoring role to steer younger generations to make the right decisions for the future.*

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