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# CAN INNOVATION AND TECHNOLOGY OVERCOME THE CHALLENGES FOR EDUCATION RAISED BY THE COVID-19 PANDEMIC?

Florin Bonciu\*

## Abstract

*The paper stresses the permanent relation between the evolution of innovation and technology and education pointing out to the increasing need for a substantial / fundamental change in education that has been manifested before the Covid-19 crisis. Against this background, the Covid-19 pandemic and its consequences (such as social distancing, lock downs, limitations or banning of international travel) have raised serious challenges to the education process at all levels but also to other related processes such as lifelong learning, up-skilling, and re-skilling. The pandemic also exacerbated the inequality issues, the digital divide, and the lack of proper skills for delivering large scale online course from the part of professors themselves. The paper explores several ways in which innovation and technology may help in overcoming these challenges and draws some lessons from the 2020 experience.*

**Key words:** relation between technology and education, intensive information-based society, impact of pandemic on education, online education.

**JEL classification:** O14, O33, O35, O43

## Overview: the relation between education and technology

Since the beginning of civilization when education was rather a form of apprenticeship and most of the learning was represented by “learning by doing” or “hands on approach” an intrinsic relation has been manifested between technology and learning: on the one hand the young had to learn the use of tools and the skills available at that time and, on the other hand, the existing level of knowledge was used for transmitting the skills and abilities. Much later, we can even say some millennia later, education ceased to be just a passive receptor of knowledge and started to participate in the research that led to new or enhanced knowledge about the near and far away environments.

After the onset of the First Industrial Revolution, as science became more present in all human activities (including education, training, and systematic research), education and technological innovation entered a more complex and biunivocal relationship<sup>1</sup>. The main aspects of this relationship were:

- By means of education students were taught various aspects of human knowledge, including the most up to date discoveries;

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<sup>1</sup> Purdue University, (2021): *The Evolution of Technology in the Classroom*, Purdue University Online, at page <https://online.purdue.edu/blog/education/evolution-technology-classroom>

- Education determined a solid base for further research and innovation in the academic circles and, at the same time, a higher number of people could participate to the development of new technologies, even as lonely inventors, simply because they were educated and could contribute to experimenting and the expansion of knowledge;
- According to the specific circumstances of each historical period, new technologies started to be used in education, from printed books to radio and from overhead projectors using slides and transparencies to movies. Since the second half of the 20<sup>th</sup> century until present times new technologies have been added to the list of tools used for education activities, such as: audio and video cassettes, CDs and DVDs, PCs and laptops, tablets, smartphones, internet, artificial intelligence, and so on.

The perception on the relation between education and technology can be illustrated by an interview with the famous inventor Thomas Alva Edison who made in 1913 a prediction that proved to be at the same time visionary and (for a long period of time) substantially wrong. Asked about his opinion regarding the future educational value of motion pictures Edison's replied: "Books will soon be obsolete in the public schools. Scholars will be instructed through the eye. It is possible to teach every branch of human knowledge with the motion picture. Our school system will be completely changed inside of ten years<sup>2</sup>."

While Edison's prediction was not fulfilled in ten years, one can say that after the first decade of the 21<sup>st</sup> century his vision became reality to a large extent as younger generations (and not only) are using images and movies from their TV sets, tablets, computers, or smartphones to access the news, to learn, to socialize and so on while the number of readers of traditional printed books has declined constantly. Nowadays, for many, as Edison predicted in his interview from 1913, the written text is too abstract and difficult to understand, while an image or a movie are self-explanatory, albeit they do not guarantee the understanding of the mechanisms and the relations existing behind the respective images.

One can say that for almost a hundred years since Edison gave the interview technology has been gradually used by education (as an instrument/tool) and incorporated into education (as a body of knowledge to be transmitted to the students). After the first decade of the 21<sup>st</sup> century it was technology (manifested as internet, search engines, mobile communication, social networks, cable TV) that changed the individual and social behaviors of a large part of the population, requesting a significant if not a fundamental rethinking of education because of 2 reasons:

- The human understanding of the environment at micro and macro levels has become much more complex and the notions, concepts, skills, and abilities that must be transmitted to the younger generations require new curricula and new

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<sup>2</sup> Smith, F.J., (1913): *The Evolution of the Motion Picture: VI – Looking into the Future with Thomas A. Edison*, The New York Dramatic Mirror, July 9, Page 24, Column 3, New York.



teaching methods. At the same time, long life learning became a necessity with its own agenda and curricula, adapted to the needs of more senior people;

- The students themselves (from 6 to 70 years but particularly the young ones) changed themselves due to their exposure to incessant distractions: they may be less patient and with a smaller span of attention, more inclined to find the answer and not to learn how to find the answer themselves, more tempted by electronic means and media than by using printed books. Many of them represent the so-called Impulse Generation, characterized by an attention span of 8 seconds<sup>3</sup>. The marketing experts have become aware of the phenomenon long before the teaching staff.

Nowadays one can say that a significant part of the world population lives in an **intensive information-based society**, a society where information and communication are available on different media and technological infrastructures, and they are used for determining and justifying most of the decisions and actions. In this **intensive information-based society** job-related activities, spending of leisure time, social interactions, and education (including life-long learning) are based on internet and supported by a variety of devices that allow access to internet. Without further comments, one can say that the **intensive information-based society** is a **post-industrial society** that was made possible by the availability of new technologies.

In essence, in today's world innovation and technology are essential for human survival, they are used by economy and society and there is a need for a permanent correlation of the level of knowledge with education, both as regards the content and the instruments to deliver the content.

### **The dynamics of the relation between education and technology**

Understanding reality and harnessing the knowledge obtained from this understanding have been the key for the evolution of human societies. Innovation has been essential for the survival of the human race, for the economic development and for the ascent of capitalism as well as for adapting the education process to the characteristics of different historical periods.

Being essential for the survival of human race, innovation had to be permanent, adding layers upon layers on the wealth of knowledge of humankind. On a daily basis, particularly in market economy-based societies, the need for innovation is determined by competition and globalization increased many times the magnitude of competition and therefore the need of innovation. On the other hand, global challenges, such as climate change, put the need for innovation in a new perspective as this time is not about gaining a larger market share at a company level but about keeping planet Earth in a range of parameters that allow the continuation of human existence.

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<sup>3</sup> Murphy, C., (2019): *The Shrinking Attention Span & What It Means for Marketers*, Boston Digital, August 27, at page <https://www.bostondigital.com/insights/shrinking-attention-span-what-it-means-marketers>

In a similar way, during the long periods of history, education has been a perennial, fundamental and systemic human activity. One can say that each technological period has interacted with education because:

- education prepares the young generation for the use of technologies in economic activities;
- education uses technology and innovation;
- education is closely related to research which, in turn, generates innovation.

In order to illustrate the relation between each technological period and the application of innovations in education one can highlight some key moments for the implementation of innovations in classrooms during the 20<sup>th</sup> century<sup>4</sup>:

- The use of radio and the on-air classes, particularly for remote areas, since the 1920s;
- The use of the overhead projector since the 1930s, of the ballpoint pen since the 1940s and of the headphones (particularly but not only for learning foreign languages) since the 1950;
- The use of videotapes since 1951;
- The use of the photocopying machines since 1959 and of the handheld calculators since 1972;
- The introduction of the first personal computer by IBM in 1981;
- The use of Apple's Macintosh computer in 1984 and of the first mass-market consumer laptop made by Toshiba in 1985;
- The beginning of the World Wide Web in 1990 and of the commercial use of the Internet in 1993;
- The use of the first Personal Digital Assistants (PDAs) that were made by Apple Computer Inc. in 1993;

The above list is not complete but presents some moments that changed not only business activities and business models but also education activities, making easier to teach and to learn and thus helping tremendously both teachers and students.

In connection with the above-mentioned concept of **intensive information-based society**, one can say that these key moments (related to the period 1920-1993) represented in a way **the pre-history** of today, a period of building the knowledge and infrastructures that allow the online and virtual existence of today. The interactions and presence in the virtual space involves much more people today than 30 years ago and, at the same time, the frequency of these interactions increased substantially.

One aspect that differentiate the period since the onset of the First Industrial Revolution until 1993 (when the commercial use of Internet became a reality) is that during that pre-history the hardware part (the radio, the overhead projector, the photocopying machine, etc.) represented tools used for the presentations delivered by teachers. After 1993 and the more so nowadays the hardware part became less and less relevant (because it is largely available), the users focusing more on information, content, and message.

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<sup>4</sup> Purdue University, (2021): *Idem*.

During that pre-history of the intensive information-based society the people learned how to understand and how to explain phenomena from the surrounding world and they used a number of tools (represented by certain technologies) during the learning process.

Nowadays, the people are inclined to search the answer (even if that answer can be an outdated, biased, utterly wrong or buried in a huge number of results from the search that offer conflicting views), being much less interested to understand the explanation and, the more so, to be able to demonstrate themselves the explanation. The widespread use of search engines, such as Google, or of social platforms like Facebook, Instagram, Twitter have made each participant both an emitter and a receiver of information, and as result, “what everybody is saying” or “how vocal some groups are when they are saying” became **more important** than “why everybody is saying” or “what is the logic of what individuals and groups are saying”.

One can note that a characteristic of the period that more or less started after the large scale use of search engines (for which we may consider the year 2000) and social platforms (for which we may consider the period 2004-2006) is that with the exception of researchers, scientists and technicians the majority of people is flooded by a huge quantity of data and information and, as result, people can no longer separate the essential from non-essential, the false from the true and the current news from old or fake ones. Learning how to navigate the universe of data and information became a skill that requires adequate education. As result, a new domain of research and a new profession emerged around 2008, namely data mining or knowledge discovery in databases. A sub-field of this domain of research, related to monitoring and improving the education activity is represented by educational data mining<sup>5</sup>.

As a reflection of these changes, during the period 2010-2020 several new technologies found their way into the classrooms and training facilities, among them being<sup>6</sup>:

- large scale access to internet and the common use of smartphones and tablets;
- the use of cloud services and data storage;
- the partial replacement of former audio-video equipment by media streaming;
- the partial transition from laboratories where real life experiments took place to smart laboratories where computer simulations can be used for a variety of domains;
- the large-scale use of distance learning, both synchronous and asynchronous;
- the emergence of MOOCs (Massive Open Online Courses) as a modern manifestation of distance learning<sup>7</sup>;
- the use of AI (artificial intelligence) for teaching and monitoring the progress of students;

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<sup>5</sup> Peterson, P. Baker, E., McGaw, B., (2010): *International Encyclopedia of Education*, 3<sup>rd</sup> Edition, Elsevier Ltd. All, p. 96, 112.

<sup>6</sup> Graves, R. (2018): *How Technology Has Changed Education in the Last 15 Years*, May 9, at page <https://info.thespotonagency.com/how-technology-has-changed-education-in-the-last-15-years>

<sup>7</sup> Rollins, A., (2018): *What's A MOOC? History, Principals, And Characteristics*, eLearning Industry, September 3, at page <https://elearningindustry.com/whats-a-mooc-history-principles-characteristics>

- the larger scale use of collaborative learning (based on more frequent interactions among students and between students and professors using online communication);
- learning outside the classroom (decoupling from the classroom);
- the use of social media in education;
- the emergence of interactivity with the teaching support which reflects the transition from printed text (a fixed form teaching support) to augmented reality (teaching support that reacts to the decisions and answers of the students);
- The use of digital games in education (gamification of education).

We stress again the fact that the above list is far from complete. But being long and diverse it reflects the magnitude of changes that took place in the field of education as result of the emergence and wide scale use of different communication technologies. As in many other cases and areas of human existence the dissemination of innovation and technology in the classrooms have been unequal and differentiated by countries or regions of the countries, by social statute and by other social classifications (age, sex, race, etc.).

The transformation of human interactions that include education will continue, without any doubt, during the next years and we can only estimate that 2030 will represent a vantage point from which the new picture of human society and of its education practices will present itself in more vivid colors.

For the rest of this decade, that is from 2021 to 2030, innovations and technologies that may be implemented and influence education in different areas could be<sup>8</sup>:

- the use of biometrics and of artificial intelligence (AI) for adapting education to individual needs and even to physical and emotional disposition of students, thus making reality the so-called adaptive learning<sup>9</sup>. Education may become at the same time collective (taking place in a classroom) and individual (based on AI evaluations and interactions between each student and the AI based software);
- the use of AI for automatic grading and for providing feedback to both students and professors<sup>10</sup>;
- the large-scale use of augmented reality (AR) and virtual reality (VR) in the teaching and evaluating process;
- the use of blockchain technologies for securing education relating data and the personal data of students and professors.

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<sup>8</sup> Dani, V., (2019): *8 Trends in Education Technology That Will Have A Major Impact*, Kitaboo, 2 January, at page <https://kitaboo.com/trends-in-education-technology/>

<sup>9</sup> Vander Ark, T., (2018): *32 Ways AI is Improving Education*, Getting Smart, 10 August, at page <https://www.gettingsmart.com/2018/08/32-ways-ai-is-improving-education/>

<sup>10</sup> Onlineuniversities.com, (2018): *The Future of Learning - 10 Roles for Artificial Intelligence in Education*, at page <https://www.teachthought.com/the-future-of-learning/10-roles-for-artificial-intelligence-in-education/>

If successful, one concept may put all the above in a completely new perspective. By the end of July 2021 Mark Zuckerberg announced its intention to transform Facebook with its 2.9 billion users into a “metaverse”, a virtual reality world in which people can work, play, and live, or, in his own words, “the ultimate social technology”<sup>11</sup>.

Zuckerberg’s idea is not new. What is new in case of Zuckerberg and Facebook are the resources available and the existing number of users. In 2003 Linden Lab started a virtual reality world called Second Life that claims today, 18 years later, about 1 million regular residents that spend time as avatars in a totally fictional existence. Among other activities that can be performed in Second Life (explore, socialize, create, buy, or sell virtual objects), there are education events such as virtual meetings, classes, or conferences<sup>12</sup>. Without any doubt, such approaches will find a place for education in the virtual reality of tomorrow.

After all this long list of technologies and innovations one can ask: “But where is the role of the teacher?” Or “Is there any more a role for the teacher?” The short answer to this question is a firm: „Yes”. While almost infinite quantities of data and information are available today to everybody able to connect to the internet, the understanding and application of these data and information still requires skills and abilities that cannot be achieved without the presence and interaction with a teacher / mentor. We quote here an illustrative statement that goes beyond simply explaining the role of the teacher and stresses the value of human interaction represented by body language and feed-back: “The act of teaching isn’t just imparting what’s in your head to a captive audience. Teaching is a performance; it’s reading the room and working it. This is where technology really falls short.”<sup>13</sup>

### **The impact of Covid-19 pandemics on education**

The onset of the Covid-19 pandemic and the restrictions that were imposed in various ways on a global scale generated numerous effects in all areas of activity, including education. As education deals mainly with the formation of the young generations, any interruption or distortion of this activity has both immediate or short term and long-term effects. The long-term effects are particularly negative as they may manifest for a large part or even for the whole life time of the persons involved.

### **The immediate impact of Covid-19 pandemic on education**

Under these general circumstances created by technologies that build up since early 1990s, the Covid-19 pandemic affected more than supply and demand, it affected human interactions that represent the basic element of personal lives, performance of arts and

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<sup>11</sup> Wagner, K., (2021): *Zuckerberg Says Facebook’s Future Lies in Virtual ‘Metaverse’*, Bloomberg, 29 July, at page <https://www.bloomberg.com/news/articles/2021-07-29/mark-zuckerberg-explains-metaverse-vision-to-facebook-fb-investors-analysts>

<sup>12</sup> Second Life, (2021): Remote Work and Event Solutions, at page <https://www.connect.secondlife.com/about>

<sup>13</sup> Purewal, H., (2016): *Can technology replace teachers? You asked Google – here’s the answer*, The Guardian, 7 December, at page <https://www.theguardian.com/commentisfree/2016/dec/07/can-technology-replace-teachers-google>

education. A clarification is necessary. Although for the vast majority if not for all the people the Covid-19 pandemic came as an unexpected event, some even called it a “black swan”, based on the concept popularized by Nicolas Taleb<sup>14</sup>, the truth is far from that. The threat of a pandemic situation had been announced for at least 30 years and ignored because it was too unpleasant and costly to be taken into account<sup>15</sup>.

The sudden decision to stay at home and avoid social gatherings has a number of immediate consequences on education. Among them one can mention<sup>16</sup>:

- abrupt discontinuity of traditional, face-to-face classes;
- the frantic search for improvised and ad-hoc solutions for most schools;
- the difficult and many times impossible task for the decision makers at central government and local levels of finding a balance between providing continuous education and securing health;
- an increased role for parents and mentors (who, in many cases were not up to the task for a variety of objective reasons);
- the revelation of the digital divide in a dramatic way (separating children and students into those who could access education and the rest);
- the manifestation of numerous constraints related to education (regarding the curricula, time, and technology available, etc.).

As mentioned above, for most schools the initial responses to the close downs determined by the Covid-19 pandemic were based on improvised and ad-hoc solutions. Everybody used what they had available and what they could implement in the shortest of time. In the following we try to identify some challenges and some responses that were present during these initial responses taken during March – April 2020.

Among **the challenges** one can mention<sup>17</sup>:

- the brutal manifestation of physical limits where online solutions could not be applied (areas with no electricity, no internet, lack of equipment, etc.);
- the lack autonomous learning ability at home for students and lack of expertise for teaching online for teachers. To this one can add the lack of skills and abilities of parents or tutors in helping their children with online education;
- the need to identify alternative means of delivery for content (for instance, the delivery of teaching support in a physical format by mail where internet was not available);
- the need to adapt the curricula and exams to the new circumstances (for instance, the so-called Coronavirus syllabus in some US states or in India);

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<sup>14</sup> Taleb, N., (2007): *The Black Swan: The Impact of the Highly Improbable*, Random House.

<sup>15</sup> Henig, R.M., (2020): *Experts warned of a pandemic decades ago. Why weren't we ready?*, National Geographic, April 8, at page <https://www.nationalgeographic.com/science/article/experts-warned-pandemic-decades-ago-why-not-ready-for-coronavirus>

<sup>16</sup> Reimers, F.M., Schleicher, A., (2020): *Schooling disrupted, schooling rethought. How the Covid-19 Pandemic is Changing Education*, OECD – Global Education Innovation Initiative.

<sup>17</sup> Miks, J., McIlwaine, J., (2020): *Keeping the world's children learning through COVID-19*, UNICEF, 20 April, at page <https://www.unicef.org/coronavirus/keeping-worlds-children-learning-through-covid-19>

- the need to develop and implement mechanisms for interaction among teachers, students, parents, authorities, etc.;
- the need to alleviate the aggravation of long-term inequality.

Among **the responses** to the above-mentioned challenges there were<sup>18, 19</sup>:

- the use of whatever technology was available and its adaptation in innovative ways (for instance by sending teaching support by mail in rural areas or transforming school buses into Wi-Fi - hotspots);
- the decision to deliver teaching content according to curricula to the maximum extent possible (that is to do the maximum that could be done and accept the limitations);
- to allow for more initiative at level of schools and teachers in order to face immediate problems.

### **The long-term impact of Covid-19 pandemic on education**

Although as of mid-year 2021 the impact of Covid-19 pandemic is less acute than one year ago, the crisis is still far from being finished and therefore there is a need to assess the long-term impact of it on education.

The first long-term impact can be estimated at a macro-economic level. Because many children in many countries or regions of countries lost some classes or had a lesser understanding of the subjects during the 2020 lock downs, they have a lower level of qualification, are less likely to finish or continue their studies and these facts may affect their entire life because they will have lower salaries. This phenomenon can be called “unfinished education” and it is not specific to the pandemic period. But the pandemic magnified the phenomenon, while at the same time amplifying the inequalities. According to a study for the United States done by McKinsey & Company, these implications may represent a loss of GDP between 128 to 188 billion US dollars<sup>20</sup>.

Beyond the economic implications of the education losses, in our view the assessment of the long-term impact of Covid-19 pandemic on education needs to take a holistic approach, including in the discussion at least 4 stakeholders:

- society at large from political decision-makers to psychologists and sociologists, from business to innovators, including the system of values, the education targets for each education level, etc.).

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<sup>18</sup> Tugend, A., Jordan, P.W., Stein, M.A., (2020): *How Schools and Colleges Are Innovating During the Pandemic*, Future Ed, 9 December, at page <https://www.future-ed.org/how-schools-and-universities-are-innovating-in-the-pandemic/>

<sup>19</sup> OECD, (2020): *The impact of COVID-19 on student equity and inclusion: Supporting vulnerable students during school closures and school re-openings*, 19 November, at page <https://www.oecd.org/coronavirus/policy-responses/the-impact-of-covid-19-on-student-equity-and-inclusion-supporting-vulnerable-students-during-school-closures-and-school-re-openings-d593b5c8/>

<sup>20</sup> Dorn, E., Hancock, B., Sarakatsannis, J., Viruleg, E., (2021): *COVID-19 and education: The lingering effects of unfinished learning*, McKinsey & Company, 27 July, at page <https://www.mckinsey.com/industries/public-and-social-sector/our-insights/covid-19-and-education-the-lingering-effects-of-unfinished-learning>

- students of all ages, based on dialogue with their representative associations;
- teaching staff at all levels and school administrations;
- parents or tutors.

Such an assessment that can be carried out at a regional, national and international levels should capitalize on the experiences and best practices of 2020, thus identifying solutions that worked and those that didn't work. What we have today is a relatively large number of partial assessments done at a local level or done from an individual point of view. A systematic, national, or even international approach is still to be done and, in our opinion international organizations like OECD or the World Bank can play a positive role in catalyzing dialogue.

Anyway, an overview of the point of view expressed until now reflect some common issues and topics that require further examination. Among them there are the need to:

- develop future abilities for students of all ages such as: self-motivation and self-monitoring, capacity for independent learning, capacity to learn on-line including the use of communication technology and software;
- provide the infrastructure for on-line education from access to internet to the availability of computers, tablets, smartphones, etc. for all children;
- provide training and even full courses for teachers for using online teaching technology as well as for communicating and interacting with students while being online;
- re-design the curricula at all levels both for adaptation to the needs of the 21<sup>st</sup> century and for teaching online. A continuous collaboration with society at large, with the participation of parents and business environment is more than welcome.

### Conclusions

While the immediate risk of a massive pandemic has been known in scientific circles for at least 30 years, the onset of the Covid-19 pandemic came for the general public and the vast majority of administrations as a big and unpleasant surprise. The Covid-19 pandemic has had a major impact on economic and social life, including the area of education. In the following we try to synthesize some results, measures taken and things to be done in the field of education in order to overpass the consequences of the losses and, at the same time, in order to align the curricula and teaching methods to the current level of development of science, economy and society.

In the field of education, the restrictions imposed by authorities due to the Covid-19 pandemic have acted as a catalyst/accelerator for implementation of new technologies and innovations. A rethinking of the curricula and education methods and tools has been anyway necessary due to technological, social, and economic changes that took place in the last 20 years. As the Covid-19 pandemic happened, all this re-thinking has been done due to necessary, rather than due to a plan.

Given the dimension and implications of the losses in education at all levels, due to lower quality of teaching during online courses or during blended courses as well as due to the impossibility to attend classes in either format **the remedial actions have to be designed on the basis of a wholistic and long-term scale** (including at least several years of action).



In our view such remedial actions should take into account, be adapted and be specific for:

- the less favored social categories;
- the types of individual cases because the impact of Covid-19 pandemic on education has been rather differentiated;

At the same time, the existing and emerging technologies and innovations should be implemented in education in order to:

- provide an up to date and larger scope of knowledge, skills and critical awareness;
- prepare students for the new national and international environment, including aspects related to climate change, the new context of globalization, new technologies, changes on the labor market;
- Include new categories of competences like “creating new value” and “reconciling tensions and dilemmas”<sup>21</sup>.

Because education is first and foremost about students (the persons that are educated, irrespective of their age) the new approaches to education should provide adequate measures and techniques for:

- preparing the students, particularly during the early years for 2 aspects: self-motivation and critical thinking. These 2 traits may prove to be the key to their success and adaptation to an ever-changing world;
- preparing the students for remote study in different formats (including in augmented reality and virtual reality);
- providing a clear understanding and balance between what is essential, what is desirable and what is optional in education.

Putting things into a simple perspective, the difference between success and failure in education in the coming years will be made the following option: to reject the change or the embrace the change. How adequate and successful the embracing of change will be is everybody's guess. But one thing is clear: it better to go with the flow of history rather than to oppose it.

A final thought was inspired by a Dr Edward K. Brown, a senior director with African Center for Economic Transformation:” Education must be a crisis priority, not an afterthought”<sup>22</sup>. The real recovery and adaptation of societies and economies to the challenges of the coming years can happen only by prioritizing education, by allocating serious resources not only financial, but also human and political, so that humankind can recover, adapt to climate changes, transition to new technologies and still remain human.

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<sup>21</sup> OECD, (2020): *The OECD Learning Compass 2030*, at page <https://www.oecd.org/education/2030-project/teaching-and-learning/learning/>

<sup>22</sup> Brown, E.K., (2021): *Education must be a crisis priority, not an afterthought*, 2 April, at page <https://acetforafrica.org/media/opinion/education-must-be-a-crisis-priority-not-an-afterthought/>

# ANALYSIS OF THE PRE-UNIVERSITY SYSTEM IN ROMANIA USING THE CLUSTERING TECHNIQUE

*Ioana Gabriela Grigorescu\**

## **Abstract**

*A country is all the more competitive as the pre-university education system is better developed. In this article, a study was made of the pre-university education system in Romania in terms of infrastructure indicators, human resources involved in it and the number of students enrolled in various forms of education. After registering the values of the indicators from the Tempo database of the National Institute of Statistics (INS), with the help of the clustering technique and using the SAS Enterprise Guide program, the counties were divided into three distinct, homogeneous classes. Further on, the results found were analyzed in dynamics, referring to the previous year, 2019, highlighting the differences and finding solutions to improve the existing situation.*

**Keywords:** Romania, education, clustering, strategy, classification, SAS Enterprise Guide

**JEL Classification:** I20, I21, I25

## **1. Introduction**

The present time brings to the fore a rather controversial education system, given the changes that have taken place. Starting from the unanimously valid principle that the formation of a child starts from the embryonic stage, here the role of the mother being an essential one, several stages of this process are identified: the pre-school stage (nursery), the preschool stage (kindergarten), the primary education stage (preparatory class and grades I-IV), gymnasium stage (grades V-VIII) and high school stage (IX-XII). This extensive process of education of an individual has its origins in the family of origin, but is continued by the public environment of the state: nurseries, kindergartens, schools and high schools.

The training course of a child in Romania starts early. In this sense, from the age of one he can attend pre-school education through the regulated institutions of the state. This stage was implemented in the system to help the child to develop emotionally, cognitively and sensorial.

Continuing education with the second stage, preschool, when the child begins to be aware of his abilities, he realizes that he needs to be part of a group that will help him in his own development. Other factors play an essential role in the harmonious development of a child: the size of the group, the ability of the educator to properly manage this relationship between the child and the teacher. That is why the groups should be of

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maximum 25 children, and the teacher must be specialized in this respect. Unfortunately, the system does not always offer what it should and then either the number of children in a group far exceeds the required maximum number, or the educator is overwhelmed by other shortcomings of the system and then acts as he sees fit.

The third stage is that of the primary cycle, when the child walks shyly towards the new world of the challenges that will follow. This stage also comes with a recalculation of the plans, considering that, from the school year 2012-2013, a preparatory class was introduced at the school, appearing a new step and thus giving a new valence to the parents, who due to age fears were later school start due to difficulties that may have existed. At this stage the child enters a new stage of its existence and development where the emphasis is on the connection between the student and the teacher. The teaching-learning methods used by the educator, but also the pedagogical ability represent defining elements of the teaching profession. This stage is a defining one in the mental and educational evolution of the future student. Thus, teachers have an important role to play in this stage because they must combine training in various fields with elucidating behavioral typologies and forming the characters of future adults.

Another defining stage in this educational path is the middle school stage, when students have to make the transition from teacher to more teachers with multiple requirements and different grading methods.

The last stage according to the classification made above is the high school one. Unfortunately, although it should be an important period from the perspective of a child's evolution to adulthood, it seems that some of the students drop out. Either they come from disadvantaged families where education is not a priority and then they have to work to survive, or the lack of cooperation between students, teachers and family pushes students to make certain momentary decisions, which will mark their whole life.

## 2. Defining the problem, data and coding of the indicators

The problem I set out to address in this research paper is the analysis of each county in Romania in terms of infrastructure, staff and students in the pre-university education system. Thus, I propose to make a grouping of counties according to specific indicators.

The indicators chosen further in the analysis are presented in table 1.

**Table 1. Coding of indicators**

<b>Crt. no.</b>	<b>Code of indicator</b>	<b>Description of each indicator chosen in the analysis</b>
1	I1	Number of educational units in each county
2	I2	Number of school laboratories in each county
3	I3	Number of classrooms (school offices / amphitheatres) in each county
4	I4	The teaching staff from each county
5	I5	The number of students enrolled in pre-school education
6	I6	Number of students enrolled in secondary education
7	I7	Number of students enrolled in high school education

I1, the number of educational units in each county, quantifies the totality of the administrative education units in a county with legal personality, in which one or more levels of teaching operate, having a single leadership. In Romania, the following are considered educational units: nurseries, kindergartens, primary and secondary school units, special primary and secondary education units, high schools and others.

Indicator I2, the number of school laboratories in each county, quantifies the total number of rooms in all educational units in a county endowed with facilities, equipment, instruments, substances, teaching materials in which teaching experiences and practical works are carried out.

I3, the number of classrooms (school offices / amphitheatres) in each county, has in its composition the total number of rooms within all the educational units in a county destined for the process of education and school training. In the teaching process the same classroom can be used by two or at most three classes of students in a row, during a day.

I4, the teaching staff from each county, counts all the people in a county who are employed in the education system and teach in the educational and training process, having full or part time. Each teacher registers only once and only at the educational unit where he / she has the basic function or teaches the largest number of teaching hours.

I5, the number of students enrolled in pre-school education, quantifies the number of minor children enrolled in the preschool education system, at the level of each county.

The I6 indicator, the number of students enrolled in secondary education, is represented by the number of minors in the secondary education system, in each county.

I7, the number of students enrolled in high school education, represents the totality of students from each county who attend the form of high school education.

The indicators described above were registered for 2020 from the Tempo database, the National Institute of Statistics (INS), their values being presented in the table 2.

**Table 2. The values of the indicators registered for each county in Romania**

County	I1	I2	I3	I4	I5	I6	I7
Alba	140	338	2733	3914	8332	25574	11195
Arad	154	618	3465	4850	10577	32801	12968
Arges	215	731	4354	6669	15345	46513	20915
Bacau	187	594	4631	6723	15580	50471	18389
Bihor	204	796	5044	7970	16398	48511	17386
Bistrita-Nasaud	116	256	2588	3417	8607	25702	8864
Botosani	132	278	3120	4723	10408	34588	13264
Braila	104	241	2072	2986	6919	22460	8856
Brasov	186	792	3815	6725	16075	48703	14951
Buzau	150	375	2843	4357	9937	33993	12698
Calarasi	96	190	1763	2609	6566	24187	6455
Caras-Severin	120	286	2294	3218	6234	17972	8895
Cluj	271	2286	6263	11667	20338	53830	18973
Constanta	228	871	4201	8030	17945	59571	22831
Covasna	79	183	1863	2715	6083	18804	5105
Dambovita	153	422	3201	4888	11306	37544	13999

Dolj	214	1129	4431	7981	15464	46668	20465
Galati	188	853	3091	5884	11783	40211	17719
Giurgiu	87	170	1434	2353	5385	21255	5568
Gorj	116	406	2460	3809	7619	24092	12642
Harghita	130	255	3028	4259	10176	27840	8741
Hunedoara	111	459	2983	3804	8039	26540	12595
Ialomita	91	208	1629	2309	5860	20587	7299
Iasi	260	2158	6396	11630	21357	72607	24554
Ilfov	132	212	2011	3243	11904	33979	7096
Maramures	182	398	3747	5357	12818	35480	17083
Mehedinti	106	229	1822	2732	5460	16995	9476
Bucuresti	597	3974	12482	26675	44103	151097	72820
Mures	187	586	4686	7355	15984	46932	15300
Neamt	140	457	3530	4640	11026	37493	15094
Olt	161	277	2610	4043	9348	28359	13878
Prahova	236	713	4236	6960	15751	56638	23114
Salaj	111	308	2086	2607	7346	19443	6922
Satu Mare	131	276	2776	3806	9959	28052	9301
Sibiu	176	677	3510	5407	12547	35523	11294
Suceava	224	721	5357	8019	20315	61670	23925
Teleorman	140	224	1987	3253	6945	22118	9339
Timis	238	1644	5715	9871	18036	52213	20519
Tulcea	80	256	1293	2063	4745	16180	5779
Valcea	129	329	2556	4016	7954	25336	11308
Vaslui	148	278	2981	4494	10181	33879	12412

## 2. The research methodology

The research methodology has the following stages:

- identifying the indicators and registering their values for each county in Romania from the Tempo, INS database;
- classification of counties according to all registered indicators using specific data mining algorithms (clustering);
- grouping the counties by homogeneous classes and their characterization according to the aggregate indicators calculated at the level of each class: minimum, maximum and average;
- dynamic analysis of aggregate indicators according to 2019;
- identification of the main differences existing at the level of the classes determined at the previous step, in 2020, compared to 2019;
- establishing the measures that are required at the level of the entire Romanian economy in order to improve the situation in the pre-university system.

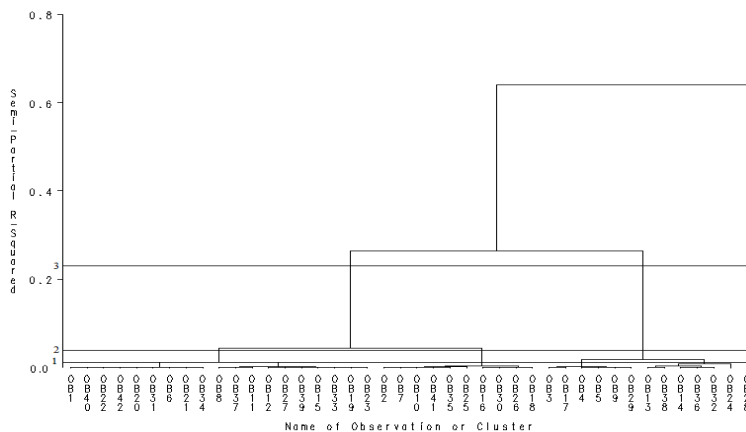
## 3. Results and discussions

The next step in the proposed research methodology is to conduct cluster analysis. This involves first of all obtaining information about the distribution of data series: whether or not the series are close to the normal distribution, whether they have larger or smaller queues in a certain directive, etc. (Table 3).

**Table 3. Descriptive statistics for the indicators according to which the companies will be classified**

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Bimodality
<b>I1</b>	166.0	84.7939	3.3394	15.9369	0.6339
<b>I2</b>	637.3	713.1	3.1841	11.8640	0.7378
<b>I3</b>	3459.4	1925.3	2.7018	10.9713	0.5843
<b>I4</b>	5608.6	4111.5	3.5375	16.6307	0.6803
<b>I5</b>	12028.1	6800.7	2.7047	11.2112	0.5757
<b>I6</b>	37843.6	22649.3	3.2283	14.8056	0.6332
<b>I7</b>	14776.8	10651.6	4.0946	21.8304	0.7089

The purpose of the cluster analysis is to group the sample of counties according to the choice of the classification algorithm and well-established criteria. Thus, Ward's classification algorithm was chosen, which involves calculating the distance between an object and the centroid of each of the classes. The object will be assigned to the class where this distance will be minimal. The same will be done with the other objects in the county sample. In the end, there will be an aggregation graph (figure 1) and, depending on the assumed error, the classes will be delimited.



**Figure 1. Dendrogram resulting from the analysis**

In order to classify the counties, the classes must be chosen according to an assumed error. Thus, if the dendrogram is sectioned at the level of line 1 (figure 1) then the error will tend to zero, there will be five classes and one outlier (Bucharest). The classes, in this case, will be very close to each other, the objects can be easily classified into several classes. If the cut is made at the level of line 1 in the graph, then there will be two large classes and an outlier (Bucharest), the objects in each class will be quite different, and the error will be well above the allowed limit of 5%. If, instead, the cut will be made at the level of line 2, the error will be within the allowed limit and there will be 3 homogeneous classes and an outlier (Bucharest). Furthermore, the county of Bucharest will be eliminated from the analysis, it can be analyzed separately.

The classification of the counties according to all the indicators is the following:

- class 1: Alba, Bistrita-Nasaud, Braila, Calarasi, Caras-Severin, Covasna, Giurgiu, Gorj, Harghita, Hunedoara, Ialomita, Mehedinti, Olt, Salaj, Satu Mare, Teleorman, Tulcea, Valcea, Vrancea;
- class 2: Arad, Botosani, Buzau, Dambovita, Galati, Ilfov, Maramures, Neamt, Sibiu, Vaslui;
- class 3: Arges, Bacau, Bihor, Brasov, Cluj, Constanta, Dolj, Iasi, Mures, Prahova, Suceava, Timis.

Class 1 is represented by counties with rather low values of the indicators chosen for the study. Thus, at the class level, on average, each county has 114 educational units equipped with 274 school laboratories and 2220 classrooms. The teaching staff is also reduced compared to the other classes of counties, so on average, at the level of each county in this group its number rises to 3234. In general, in the pre-university education system, the infrastructure is built according to the number of potential students. For this group of counties, the indicators that quantify the number of students have low values compared to the other groups. Thus, on average, I5 is 7368, I6 has the value 23080 and I7 is 9098 (table 4).

Class 2 is composed of counties with a higher number of children who are enrolled in the pre-university education system (on average, I5 = 11249, I6 = 35549 and I7 = 13363). Consequently, the number of teachers is higher, I4 = 4784, but the infrastructure indicators are not with double average values compared to class 1, as it was expected to be, I1 = 156, I2 = 457, I3 = 3150. In this group, an almost double number of children compared to class 1 is enrolled with about 40 additional educational units and with only half of the necessary teachers (I4 in this class is higher than I4 in class 1 with 1550, on average) (Table 4).

Class 3 contains, on average, counties with a large school age population, so the indicators regarding infrastructure and the number of teachers will follow this trend (table 4).

**Table 4. Aggregate indicators calculated at the class level  
in the years 2019 and 2020**

		2019						
		I1	I2	I3	I4	I5	I6	I7
<b>Class 1</b>	minim	80	168	1297	2037	5012	16730	4991
	maxim	161	457	2988	4223	10485	29542	14412
	average	114.05	280.74	2223	3229.11	7648.42	23749.26	9180.32
<b>Class 2</b>	minim	132	199	1888	3111	10457	33433	6881
	maxim	187	864	3755	5940	13102	41655	17571
	average	156.5	463.9	3151.9	4767.9	11629.1	36440.7	13340.5
<b>Class 3</b>	minim	186	598	3777	6658	16163	47598	14727
	maxim	272	2201	6480	11573	22546	73626	24283
	average	221.08	1085	4930.17	8268.17	18082.25	54508.92	20027.33

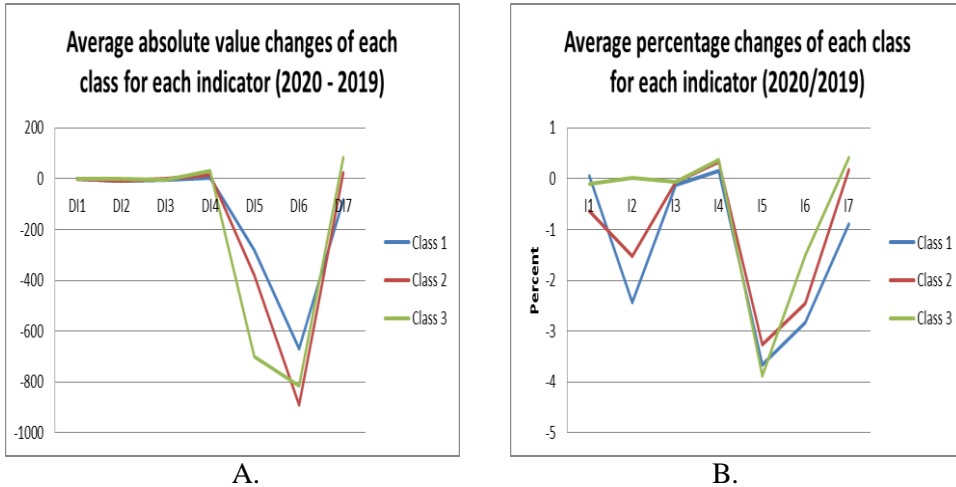
		2020						
		I1	I2	I3	I4	I5	I6	I7
Class 1	minim	79	170	1293	2063	4745	16180	5105
	maxim	161	459	3028	4259	10176	28359	13878
	average	114.11	273.89	2220.16	3233.95	7368.47	23079.84	9097.68
Class 2	minim	132	212	2011	3243	9937	32801	7096
	maxim	188	853	3747	5884	12818	40211	17719
	average	155.5	456.8	3149.9	4784.3	11248.7	35549.1	13362.7
Class 3	minim	186	586	3815	6669	15345	46513	14951
	maxim	271	2286	6396	11667	21357	72607	24554
	average	220.83	1085.08	4927.42	8300	17382.33	53693.92	20110.17

In order to highlight the impact of the Covid-19 pandemic on the pre-university system in Romania, the classification algorithm for the data registered in 2019 must be applied, having the same sample of counties and the values for the same indicators. Following its application, the structure of the groups has not changed, the only changes are on the aggregate indicators calculated at the level of the classes. Thus, some indicators increased compared to the previous year, but most of them have lower values (table 5).

**Table 5. Absolute and relative changes of the aggregate indicators at the level of each class**

		2020 - 2019						
		I1	I2	I3	I4	I5	I6	I7
Class 1	minim	-1	2	-4	26	-267	-550	114
	maxim	0	2	40	36	-309	-1183	-534
	average	0.06	-6.85	-2.84	4.84	-279.95	-669.42	-82.64
Class 2	minim	0	13	123	132	-520	-632	215
	maxim	1	-11	-8	-56	-284	-1444	148
	average	-1	-7.1	-2	16.4	-380.4	-891.6	22.2
Class 3	minim	0	-12	38	11	-818	-1085	224
	maxim	-1	85	-84	94	-1189	-1019	271
	average	-0.25	0.08	-2.75	31.83	-699.92	-815	82.84
		2020 / 2019						
		i1	i2	i3	i4	i5	i6	i7
Class 1	minim	-1.25	1.19	-0.31	1.28	-5.33	-3.29	2.28
	maxim	0	0.44	1.34	0.85	-2.95	-4	-3.71
	average	0.05	-2.44	-0.13	0.15	-3.66	-2.82	-0.9
Class 2	minim	0	6.53	6.51	4.24	-4.97	-1.89	3.12
	maxim	0.53	-1.27	-0.21	-0.94	-2.17	-3.47	0.84
	average	-0.64	-1.53	-0.06	0.34	-3.27	-2.45	0.17
Class 3	minim	0	-2.01	1.01	0.17	-5.06	-2.28	1.52
	maxim	-0.37	3.86	-1.3	0.81	-5.27	-1.38	1.12
	average	-0.11	0.01	-0.06	0.38	-3.87	-1.5	0.41





**Figure 2. Average absolute value changes (A) and average percentage changes (B) for each indicator from each class, in the period 2020 - 2019.**

According to table 5, respectively to graphs A and B from figure 2, it is observed that in 2020, compared to 2019, at the level of each class found, the indicators in absolute value tend to remain constant or to register slight decreases. And from a percentage point of view, the trend is maintained, proving once again that the infrastructure (educational units, classrooms, laboratories, etc.) and human resources (teachers) are developing or contracting depending on demand (number of children enrolled in the pre-university education system).

Some solutions can be highlighted to improve the activity of the pre-university education system as follows:

- ✓ Organizing specialized monthly trainings attended by all teachers from the entire pre-university system, regardless of background;
- ✓ Development of new learning methods based on innovation and personal development of the student;
- ✓ The use of different new teaching means, which combine traditional methods with elements of originality and thus highlight the abilities of each student;
- ✓ Increasing teachers' salaries, settlement of transportation and housing provided to those who choose to go to disadvantaged environments to practice;
- ✓ Finding methods to stimulate the increase of nature: vouchers, facilities offered to parents, increase of allowances for raising children and other allowances;
- ✓ Encouraging teachers with good results by offering certain merit scholarships for a certain limited period of time;

#### 4. Conclusion

A country is more developed the more functional and competitive the education system is. For an individual to go through the whole pre-university educational process, from kindergarten to high school, it requires quite a lot of resources. Human, financial and infrastructure resources must be adapted to the number of children, and a possible

imbalance caused by more or less predictable causes can be overcome without greatly disrupting the educational process. Looking at the two years analyzed as a whole, it can be concluded that although the pandemic had a major impact on all economic and social activities around the globe, in the end people have adapted their actions so that they can lead a life as close as possible to normalcy. From the point of view of future research, it is recommended to minimize the error assumed. This can be done by applying other classification methods, such as discriminated analysis. Attempts can also be made to improve the results by using special artificial intelligence algorithms, such as training neural networks for classification or genetic algorithms.

Looking at the two years as a whole, it can be concluded that although the pandemic had a major impact on all economic and social activities around the world, in the end people have adapted their actions so that they can lead a life as close as possible to normality.

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# A CASE AGAINST THE MINIMUM WAGE

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## Abstract:

*The minimum wage law is a snare and a delusion. All too many people think it is the be all and end all of economic welfare. At no particular cost, except that for a legislative enactment, peoples' wages can magically increase, with no negative repercussions, such as unemployment. Not so, not so. We demonstrate that this law does not serve as a rising floor, increasing wages on its upward path. Rather, it constitutes a barrier in terms of productivity that workers must overcome if they are to have a job, and the higher it is the harder it is to leap over.*

**Key words:** Wages; productivity; unemployment; ethics

**JEL Category:** E24

## Introduction

Virtually every city, county, and state in the U.S. has been gradually raising its respective minimum wage since it was first introduced in 1938<sup>1</sup>. It was implemented during the great depression, in an attempt to lift the poor out of an economic collapse. It was not at the forefront of political campaigns until fairly recently though, specifically during the presidential run in 2016, where left-wing democrats such as Bernie Sanders were advocating the implementation of a \$15/hour national minimum wage<sup>2</sup>. On the other end of the spectrum, Donald Trump opposed a minimum wage hike, but has no objections to our current \$7.25 wage<sup>3</sup>. Republican senators Tom Cotton and Mitt Romney favor a boost to \$10 per hour.<sup>4</sup> So there is more than a “dime’s worth” of difference between the two major parties, but no philosophical divergence. Both accept the claim that this law raises compensation for the poor and unskilled.

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<sup>1</sup> “History of Changes to the Minimum Wage Law” U.S. Department of Labor Seal, [www.dol.gov/agencies/whd/minimum-wage/history](http://www.dol.gov/agencies/whd/minimum-wage/history)

<sup>2</sup> FeelTheBern.org. “Bernie Sanders on Minimum Wage.” FeelTheBern.org, [feelthebern.org/bernie-sanders-on-minimum-wage/](http://feelthebern.org/bernie-sanders-on-minimum-wage/)

<sup>3</sup> Saltzman, Michael, *Trump's Minimum Wage Alternative*” Employment Policies Institute, [epionline.org/oped/trumps-minimum-wage-alternative/](http://epionline.org/oped/trumps-minimum-wage-alternative/)

<sup>4</sup> [https://www.google.com/search?q=republicans+favor+%2410+minimum+wage&rlz=1C1CHBF\\_enUS724US724&oq=republicans+favor+%2410+minimum+wage&aqs=chrome..69i57j33i22i29i30.14294j0j15&sourceid=chrome&ie=UTF-8](https://www.google.com/search?q=republicans+favor+%2410+minimum+wage&rlz=1C1CHBF_enUS724US724&oq=republicans+favor+%2410+minimum+wage&aqs=chrome..69i57j33i22i29i30.14294j0j15&sourceid=chrome&ie=UTF-8)

Support for an increase in minimum wage (or the minimum wage in general) is based in a vision of equity and fairness for the less fortunate people in our society. The idea here is that it will even out the playing field, and give unskilled workers an opportunity to make ends meet more easily. While these ideas are well intentioned, one aspect should be questioned; does a minimum wage actually do what it is intended to?

We answer in the negative and thus argue that the law should not even exist in the first place. The answer to both questions is very simple: No! Governments should not implement a minimum wage for two major reasons. The first is because it is unnecessary; as people are paid based on their productivity and the mere passage of this enactment will have no effect upon that variable whatsoever. Thus there is no need for the government to step in and arbitrarily choose a wage that this person “deserves” to be paid. Second, it actually does the exact opposite of what it is intended<sup>5</sup> to do, ultimately hurting those supposedly uplifted. In fact, the minimum wage leads to unemployment for unskilled workers<sup>6</sup> (often fast-food workers, cashiers, janitors, etc.). The idea of having no floor on wages may seem unethical, like a recipe for exploitation, or a green light for poverty, but in reality, the effects are just about the opposite of what is widely believed.<sup>7</sup>

### Logical Reasoning

The minimum wage law, on its face, is not an employment law. Rather, it is an unemployment law. It does not require that any employer hire any employee at any wage at all. Rather, it mandates that *if* an employment agreement is made, the pay must be at least at the level stipulated by this law. Anyone whose productivity lies below that level will therefore become unemployed by this law. Bradford<sup>8</sup> has put it as follows, “The minimum wage law can be described as saying to the potential worker: ‘Unless you can find a job paying at least the minimum wage, you may not accept employment.’” (Gorman). Peter Schiff similarly wrote that “It makes it illegal for you to work unless you have a certain amount of productivity”<sup>9</sup> (Rogan, 2020). For example, let’s say we have a 16-year boy who is interested in mechanics and wants to work at his local automotive repair shop. He is willing to work for a low wage because he has the leverage to do so, having little financial responsibility in his life. He can only bring \$5 in productivity to the shop by completing small tasks and whatnot. In this case, the repair shop will most likely hire him if he is willing to work for anything less than that \$5/hour. This agreement would be mutually beneficial as the young man is gaining skills and work experience, and the shop is making a small profit from his labor. Now posit the government decides that there needs to be a \$7 minimum wage. Then, the shop would lose \$2 every hour that the young man works. They are now disincentivized to employ him, because he would now

<sup>5</sup> Below we relax our assumption that all advocates of this law do so for benevolent purposes.

<sup>6</sup> Burkhauser, Couch, Wittenburg, (2000), *A Reassessment of the New Economics of the Minimum Wage Literature with Monthly Data from the Current Population Survey*.

<sup>7</sup> According to Vox: “Minimum wage increases are a politically popular means of helping low-income families...” <https://www.vox.com/2014/5/21/18079894/minimum-wage-explained>

<sup>8</sup> Bradford quote found in: Gorman, Linda, et al. “Minimum Wages” Econlib, [www.econlib.org/library/Enc/MinimumWages.html](http://www.econlib.org/library/Enc/MinimumWages.html)

<sup>9</sup> Peter Schiff in Rogan, Joe, *The Joe Rogan Experience Podcast*, Episode #1508, 15 July 2020.

be a net loss for them. He will be denied this opportunity to work and gain skills because of a law that is supposed to help him. Meanwhile, the already skilled workers at the shop will maintain their employment because they can produce at a level above this minimum wage. Why should an individual who is willing to work at a certain wage be denied the opportunity? The employee is not being exploited, at least not in the *ex ante* sense, since he chooses to work for them. He decided that the opportunity cost of doing anything else with his time, is less beneficial to him than working for this \$5 wage. Of all the opportunities he sees as open to him, this is the best alternative. The consequence of the minimum wage in this case is that this young man is now prevented from obtaining the skills that would have led him to higher wages in the future, organically; he also loses out on the salary he might otherwise have been paid. There was no need for the government to step in and “uplift” this young man. With “friends” like this he scarcely needs enemies.

A similar analysis applies to internships. Only here there is no salary at all. Yet, these programs are very popular, since the interns benefit from on the job training. Surprisingly, there are people in positions of power who favor internships, and also the minimum wage law, and see no contradiction between the two.<sup>10</sup> They attempt to distinguish between low paid work and internships on the basis of irrelevant considerations. For example, that in the one case financial profit is earned from the employer – employee relationship, whereas this does not occur with internships. Why this should matter is difficult to discern. For in both cases, people, usually youngsters, are both working and learning; why should zero compensation be legal, while pay below that mandated by the minimum wage be illicit? Logical consistency requires that both be treated in the same manner. If we take the minimum wage law seriously, then unpaid internships should also be banned.

The ultimate result of a minimum wage is long run unemployment. This conclusion follows ineluctably from simple logic. To illustrate this from the perspective of an employer, consider another hypothetical example. Suppose a McDonald’s restaurant has a labor budget of \$60/hr; it has 6 employees working at any given time, each paid at \$10/hr. Now, the local government implements a \$15 minimum wage. If this McDonald’s keeps their 6 employees working, their hourly payroll will be \$90, putting them \$30 in the red every hour they work. In order to stay open, the business must lay off 2 employees to remain profitable.

The minimum wage is not akin to a floor which rises and pulls up everyone’s wages previously below that level. Rather, it is like a high-jump bar; the higher it is, the more difficult it is to overcome it, and land into employment. If it were like a floor, it should be raised to a zillion dollars per hour, and then we would all become rich at the stroke of a legislative pen. We could end all foreign aid, contenting ourselves with recommending that poor countries raise wages to astronomical levels.

### **Real World Manifestations**

A dramatic real-world example of the detriment of a minimum wage occurred in American Samoa. This is a small island; its economy relies heavily on exporting tuna.

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<sup>10</sup> Congressman Pelosi in one such: <https://www.youtube.com/watch?v=8pFC3LKMIQo&t=62s>

At one point, they were one of the largest exporters of this fish in the world because they had a comparative advantage in its production. Their largest company, Starkist, paid workers roughly \$3.26/hour prior to 2007<sup>11</sup>. Peter Schiff described their wages as “enough to offer the average worker a standard of living that was superior to the denizens of other islands in that area of the Pacific” (Schiff, 2011). In 2007, Congress decided that the “exploitation” of these workers needed to stop, and passed a bill implementing a \$7.25 minimum wage which covered this island.

Businesses are always going to chase profit, it is in the nature of the marketplace. In order to compete these companies had to make decisions based on these new government orders. The government effectively squeezed these companies into laying their workforce off and closing down operations. This example perfectly demonstrates how minimum wage does the opposite of what it is presumably intended to. When Rep. Mark Kirk (R-IL) introduced this bill, his intention was to bring a fair wage to Samoan workers<sup>12</sup>. The ultimate result was far more devastating than predicted. Chicken of the Sea laid off 2,041 employees (nearly 50% of cannery workers)<sup>13</sup>, while Starkist moved their plant out of Samoa completely. Part of the reason raising the minimum wage is so appealing is because you only see the initial effect of a pay raise, and you do not account for those who become jobless. Politicians can show how much progress their new law has made, and how fast food workers are being uplifted out of poverty through a “living wage”<sup>14</sup>. This is why it is difficult to convince unskilled workers that a minimum wage is not only unnecessary but counter-productive. It is not easy to look past the initial effect in the short term without considering the long-term detriment.

### **Counter Arguments**

Arguments for a minimum wage, and an increase thereof are based on the claim that low wages are a product of exploitation, or that employers arbitrarily set wages. In a free market however, the worker and an employer agree on a wage. If the worker feels the wage is too low, he will look for work elsewhere, incentivizing the employer to pay him more, if his productivity is higher than his present wage. Posit that Bob’s production is \$8/hour, but his employer only pays him \$3/hour. In the view of some, the employer is exploiting him in this case because they are extracting more value from him (\$5) than

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<sup>11</sup> “*Upcoming Minimum Wage Hike May Doom Tuna-Canning Operations in American Samoa.*” SeafoodSource Official Media, [www.seafoodsource.com/news/business-finance/upcoming-minimum-wage-hike-may-doom-tuna-canning-operations-in-american-samoa](http://www.seafoodsource.com/news/business-finance/upcoming-minimum-wage-hike-may-doom-tuna-canning-operations-in-american-samoa)

<sup>12</sup> News, RNZ. “*American Samoa Added to US Federal Minimum Wage Bill.*”, RNZ, 16 Mar. 2007, [www.rnz.co.nz/international/pacific-news/168520/american-samoa-added-to-us-federal-minimum-wage-bill](http://www.rnz.co.nz/international/pacific-news/168520/american-samoa-added-to-us-federal-minimum-wage-bill)

<sup>13</sup> Furchtgott-Roth, Diana. “*Thousands Lose Jobs Due to Higher Federal Minimum Wage*”, Reuters, Thomson Reuters, 14 May 2009, [blogs.reuters.com/great-debate/2009/05/14/thousands-lose-jobs-due-to-higher-federal-minimum-wage/](http://blogs.reuters.com/great-debate/2009/05/14/thousands-lose-jobs-due-to-higher-federal-minimum-wage/)

<sup>14</sup> “*Why Do Politicians Endorse Raising the Minimum Wage, but Economists Remain Skeptical?*” MinimumWage.com, 8 Oct. 2020, [www.minimumwage.com/2020/10/why-do-politicians-endorse-raising-the-minimum-wage-but-economists-remain-skeptical/](http://www.minimumwage.com/2020/10/why-do-politicians-endorse-raising-the-minimum-wage-but-economists-remain-skeptical/)

they are paying him (\$3).<sup>15</sup> We are assuming a free market though, where Bob can quit at any time and another firm in need of Bob's skills can come along and hire him at a level higher than his present wage. This incentivizes Bob's initial employer to give him a raise. This is how the free market self regulates. It follows the same principles as the goods and services market. A seller in a free market does not determine the price at which to sell his product, rather the price is determined by both buyers and sellers<sup>16</sup>. No one is compelled to buy this product at a high price because eventually there is sure to be a competitor<sup>17</sup> who will offer a substitute at the equilibrium price. In effect, no one will buy the more expensive product, leaving that business to fail.

### **Livable Wage Argument**

Another common argument for this legislation is we need a "living wage"; this gives the poor more spending power. Economist and UC Berkeley professor Robert Reich has been a significant proponent of this idea. In fact, he advocates a national minimum wage increase to \$15/hour for this reason. He states "a higher minimum puts more money into the pockets of people who will spend it, mostly in the local economy. That spending encourages businesses to hire more workers." (Reich, 2015)

The problem with his perspective is that it is short sighted. He is only considering the workers who will see a temporary pay increase, not those who will be unemployed immediately and in the long run. Yes, he is correct that some employees will now be earning more money, therefore have more spending power, but what about those who lose their jobs and will have zero income to spend in the market? There is an evident logical fallacy in his argument, which he demonstrates in the conclusion of his article; he says "Even if a \$15 an hour minimum wage risks job losses, it is still the right thing to do." (Reich, 2015). He admits that unskilled workers will be consigned to a life of joblessness yet defends it anyway. What makes it "the right thing to do" if it will cause unemployment for the people it intends to uplift? Why does he only care about those who will benefit and not those who will be left with nothing?

### **Morality Argument**

Then there is the argument for a minimum wage increase on the ground that poverty is unjust! During his 2013 State of the Union address, then President Barack Obama averred „A family with two kids that earns the minimum wage still lives below the poverty line. That's wrong... Tonight, let's declare that, in the wealthiest nation on Earth, no one who works full time should have to live in poverty, and raise the federal minimum wage to \$9 an hour." (Obama, 2014). The argument that someone should be

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<sup>15</sup> This is an idiosyncratic and erroneous way of looking at the matter, however. Since the employee has agreed to the wage, he, too, makes a profit: he values the \$3 he receives more than whatever else he could be doing with his time. A sells B a rowboat for \$1000. A values it at \$900, B at \$2100. Did B then "exploit" A because he earned more profit from the deal? No. Neither exploited the other. Rather, both gained ex ante, A to the tune of \$100 and B at \$1100.

<sup>16</sup> In technical terms, the marginal one of each.

<sup>17</sup> We abstract from the case of monopoly and monopsony, which do not exist in the labor market at the ranges of minimum wages.



able to live reasonably well while working full-time makes a lot of sense, as does wanting wages to increase. The problem is that this is a circular argument; it assumes as true the very point in contention: does this law really reduce poverty?

Henry Hazlitt, in his book *Economics in One Lesson*, demonstrates that it will not:

“All this is not to argue that there is no way of raising wages. It is merely to point out that the apparently easy method of raising them by government fiat is the wrong way and the worst way.”

(Hazlitt, ch. 18)

He reasons:

“The best way to raise wages, therefore, is to raise labor productivity. This can be done by many methods: by an increase in capital accumulation—i.e., by an increase in the machines with which the workers are aided; by new inventions and improvements; by more efficient management on the part of employers; by more industriousness and efficiency on the part of workers; by better education and training. The more the individual worker produces, the more he increases the wealth of the whole community. The more he produces, the more his services are worth to consumers, and hence to employers. And the more he is worth to employers, the more he will be paid. Real wages come out of production, not out of government decrees.”

(Hazlitt, ch. 18)

Hazlitt perfectly illustrates how an increase in wages must be a product of an increase in productivity. Labor is not charity, you earn what you produce, at least at equilibrium.<sup>18</sup> No company is going to lose money to make their employees happier, that’s nonsensical. If they did, they would go broke, and their workers would suffer. The way to earn a greater salary is to produce more; and that is accomplished through gaining skills<sup>19</sup>.

Suppose the authors of the present paper were to make the following offer: “Come work for us; we’ll pay you \$5.00 per hour.” Have we thereby violated rights? Have we worsened the condition of anyone on the planet? Of course not. We are not forcing anyone into taking a job at this relatively low pay scale. Yet, if we were serious about this offer we would be subject to imprisonment. You, too, if you accept this position would also be at risk for a jail sentence, since both sides of this transaction would be breaking the law. In all likelihood, the employer in such a situation would be seen as a criminal, and the employee as a victim, and therefore innocent, even though both would be acting illegally. But for this contract to be immoral, at least someone should be hurt by it.

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<sup>18</sup> True, we never quite arrive there, but we are always tending in that direction.

<sup>19</sup> Phelan, Written by John, and John Phelan. “*Increasing Productivity, Not the Minimum Wage, Is the Way to Increase Worker's Pay.*” *American Experiment*, 19 Aug. 2020, [www.americanexperiment.org/2017/06/increasing-productivity-not-the-minimum-wage-is-the-way-to-increase-workers-pay/](http://www.americanexperiment.org/2017/06/increasing-productivity-not-the-minimum-wage-is-the-way-to-increase-workers-pay/)

However, no one is. Insofar as the potential worker is concerned, all we have done is widen his options. He is certainly free to avoid our “offer.”

### **The Card and Krueger Argument**

Card and Krueger (1998) makes the most compelling arguments for a minimum wage. They ran a 1992 study on the fast food industries in New Jersey and Pennsylvania in which they took statistics from 410 fast food restaurants in these states before, during, and after a minimum wage hike in New Jersey. Both states had a \$4.25 minimum wage at the time, while New Jersey was in the process of raising theirs to \$5.25 on April 1, 1992, while Pennsylvania stood pat in this regard. Card and Krueger described their study as: “Comparisons of employment, wages, and prices at stores in New Jersey and Pennsylvania before and after the rise in the minimum offer a simple method for evaluating the effects of the minimum wage.” (Card and Krueger, 1998, page 1). They called all the fast food restaurants in the region to conduct their telephone surveys and register employment statistics. After conducting their study, they found no evidence showing that a raise in minimum wage caused any unemployment. They state: “Contrary to the central prediction of a textbook model of the minimum wage, but consistent with a growing number of studies based on cross-sectional-time series comparisons of affected and unaffected markets or employers, we find no evidence that the rise in New Jersey's minimum wage reduced employment at fast food restaurants in the state. Regardless of whether we compare stores in New Jersey that were affected by the \$5.05 minimum to stores in eastern Pennsylvania (where the minimum wage was 35 constant at \$4.25 per hour) or to stores in New Jersey that were initially paying \$5.00 per hour or more (and were essentially unaffected by the new law), we find that the increase in the minimum wage slightly increased employment.”

### **Flaws**

The study did not prove what Krueger and Card claim it did, because of a major flaw. The study was conducted in late February and in early March, roughly a month before the scheduled increase. The problem with this is that the restaurants in New Jersey by this time, surely, had prepared for this increase. They had plenty of time to anticipate the new law by laying off and reducing work weeks for employees. They had 2 whole years to adjust! It is not as if the businesses would wait until the day of the increase to suddenly adjust, that would be foolish. This is the main reason why the statistics did not show a shift in employment at the precise time the law was enacted.

Worstell (2011) counters Card and Krueger (1998, 2000), but for a different reason. He finds that “Card and Krueger were looking for their evidence in the wrong place”. This is because large food chains are not “labor intensive” like independent businesses. Worstell writes “The chains are better equipped, differently supplied (things as seemingly trivial as buns for hamburgers arriving pre-cut instead of having to be sliced open in store) and labour as a portion of turnover is much lower (and capital correspondingly higher) than in that independent sector”. This explains a lack of direct unemployment statistics after the wage hike. Another difficulty with this finding is that

other economists were unable to replicate the empirical findings of Card and Krueger, and replicability is the sine qua non of statistical work.<sup>20</sup>

### Conclusion

The minimum wage argument will continue to be a large scale political topic in the years to come, especially as the cost of living continues to rise in most cities. The hike to \$15/hour will be controversial but there will be no talk of the removal of the law in the first place. Based on logic and statistical evidence, it is clear that the minimum wage is detrimental. It hurts the unskilled workers in society.<sup>21</sup>

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<sup>20</sup> For additional critiques of Card and Krueger, see Block, 2001; Burkhauser, Couch and Wittenburg, David, 1996; Burkhauser and Finnegan, 1989; Gallaway and Adie, 1995; Hamermesh and Welch, 1995; Neumark and Wascher, 1992, 1995, 2000.

<sup>21</sup> For further criticisms of the minimum wage law along the lines laid out in the present paper see Batemarco, Seltzer and Block, 2014; Becker, 1995; Block, 2001; Cappelli, and Block, 2012; Deere, Murphy and Welch, 1995; Friedman, Undated; Hovenga, Naik and Block, 2013; Klein and Dompe, 2007; Lingenfelter, et al., 2017; McCormick, and Block, 2000; Rothbard, 1988; Rustici, 1985; Sowell, 1995; Williams, 1982.

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# RESILIENCE AND STRATEGIES OF REGIONAL DEVELOPMENT IN CRISIS TIMES

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## **Abstract:**

*Some regions in the European Union, especially those in the south, today face the impact of an economic crisis, which is global and systemic in its size, but has different effects on a regional and local scale, which reinforces inherited spatial inequalities. In this paper is applied the emerging concept of territorial resilience that tries to explain why some areas are capable of renewal and revitalization, while others remain blocked and begin a process of decline. Beyond the structural keys of the capitalist crisis, the text raises the value of accumulated theory and practice in promoting local development and creating innovative environments to better understand the unequal vulnerability of territories to the current recession. This involvement implies on the part of the states the development of economic development policies and the proposal of strategies in terms of increasing resilience.*

**Key words:** Economic crises, vulnerability, resilience, regional development, economic policies.

**JEL Classification:** O10.

## **Introduction**

In an insecure society, in a global environment in constant motion, the ways of survival, resilience, adaptation and reconfiguration are of increasing practical interest, especially in the conditions of rapid and diverse changes, conditioned by the challenges imposed. Of the paradigm of development, still excessively linked to the idea of growth, of accumulation without a qualitative, essential dynamic support [4].

In a context where the pace of change is growing faster and the pressures on states, societies, communities and individuals are becoming increasingly disruptive, recovery and resilience plans are drawn up in line with the relevant challenges and priorities specific to each issue identified. Thus, the need to move from keeping a crisis under control to a more structural, long-term and non-linear approach to vulnerabilities, with an emphasis on anticipation, prevention and preparedness [1].

In this context, the Concept of Resilience refers to two aspects: the opportunities that disturbances induce, respectively the recombination of evolved structures and

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processes and, consequently, the renewal of the system as well as the emergence of new trajectories. In this sense, it means not only the resistance to change and the preservation of existing structures, but also that adaptive capacity that allows the capitalization of previous experience, self-organization and continuous development, integrating change into systemic functionality. In this context, resilience becomes more than a concept - a framework for thinking, which opens an integrative, dynamic perspective and creates a favorable basis for systemic analysis [6].

### **Literature review**

The origin of the term is found in the respective technical sciences in the strength of materials as a field that initially used it. In English the word was introduced in the seventeenth century from Latin (*resilio*, -ire - to jump back, to retreat, to recover, to return). Today, the technical definition of resilience, which we find in: Materials mechanics is “the ability of a material to absorb and release energy in a certain range of elasticity.”

In the social and economic sciences, resilience has been defined as the ability of human communities to withstand and readjust to external shocks that are the result of social, political, or natural changes [7].

The assessment of social resilience is made in relation to human indicators, respectively to vulnerable groups of people and to the factors that contribute to their vulnerability. Economic resilience is influenced by the forms of administration of the affected region, insufficient or poorly prepared human resources, lacking in public systems, an aspect that predisposes to the vulnerability of human indicators [8].

The general resilience index is composed of indicators from three areas: the economic capacity of the region, the socio-demographic capacity and the cohesion capacity of the communities. Economic capacity is expressed by summing up the following indicators: income equality (calculated as the inverse of the Gini coefficient for income inequality), economic diversification (distribution of income and employment by sectors of the economy), percentage of households spending less than 35% of income on housing, the state of the business environment [2].

Economic resilience has two areas of applicability: the probability of transition from one state to another depending on the decisions of political, socio-administrative actors in terms of consumption and production, but also the ability of the system to withstand market or environmental shocks, without -and loses the ability to allocate resources efficiently [9]. Thus two forms of economic resilience can be identified:

- static economic resilience - the ability of an economic system to maintain its functions when it goes through a shock, to make maximum use of existing capital. It starts from the need to mitigate the crisis by using, in the most efficient way possible, the resources left during the recovery;
- dynamic economic resilience - able to increase the speed of recovery after a shock, through an efficient use of resources for repair and reconstruction, thus by increasing its own capacity.

**Table 1 Examples in Hazard classification for which resilience can develop**

<b>Natural</b>	<b>Technological</b>	<b>Socio-economic</b>
Drought	Building collapses	Business discontinuity
Earthquake	Chemical leaks	Corruption
Epidemics	Cyber threats	Demographic changes
Extreme temperatures	Fires	Economic crises
Floods	Gas leaks	Unemployment
Infestations	Industrial accidents	Strikes
Storms	Pollutant leaks	Political conflicts
Tsunami	Radiation	Social Conflicts
Volcanic eruption	Poisoning	Crisis of goods
Natural fires	Transport accident	Terrorism
	Systems failure	War

Economic influencing factors refer in particular to the ability of systems to implement resilience and sustainability programs [3]. The general level of income, the initial economic structure or the consumption patterns associated with a large part of the population are all fundamental elements. The most common areas of applicability of resilience and sustainability that are influenced by economic factors are related to sustainable promotion and growth and jobs.

### Methodology

Knowing the cyclical phases of resilience that any system goes through is extremely useful in sustainable management and in the spirit of resilience, because it gives us a reference on the appropriateness of interventions, respectively the allocation of resources, which may be effective at times but unnecessary. In this regard, the composition and normality of some cycles were observed [13, 14].

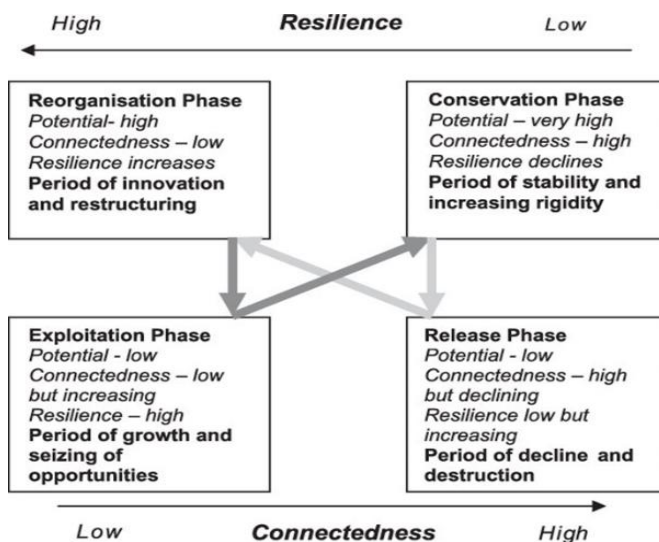


Figure 2. A four-phase adaptive cycle model of regional economic resilience. Source: Adapted from Holling and Gunderson (2002) and Pendall et al. (2008).



- a) The exploitation phase. It is a phase of maximum and rapid growth, in which the elements of the system exploit new resources and opportunities that are made available to them, making the most of each niche. There is a relatively rapid accumulation of structures and an increase in complexity. The exploitation phase is a period of capturing resources and transforming them into systemic structures with specific functions.
- b) Conservation phase. The transition to the conservation phase is gradual. During this phase there is an accumulation and storage of energy and materials, at the same time the system approaching certain limits of exploitability. The connections become more numerous as the growth rate within the system decreases. The system is becoming better defined, but also more rigid, as its internal state is more strictly regulated.
- c) Release phase „creative destruction” The term „creative destruction” was coined by economist Joseph Schumpeter in the 1950s to describe the perturbations that mark the phases of the adaptive cycle, inducing a relatively chaotic operation. When external forces cause disturbances that exceed the system's ability to cope or quickly return to a state of functional equilibrium, the system enters a phase of creative destruction, characterized by the release / loss of accumulated capital and partial or total destruction of system elements. of the systemic organization as a whole
- d) The reorganization or renewal phase. It is the phase in which a new system appears and develops, which will lead to a new period of growth. Reorganization means the transition to an alternative regime, to a period of domination of uncertainty, of randomness, a phase in which all opportunities are open, in which invention, experimentation, resettlement, risk are the order of the day. Novelty can easily triumph, sometimes in the form of seemingly uncoordinated or insignificant events, but which represent original inventions, creative ideas and changing mentalities at the individual and collective level.

Within economic systems, in the case of opportunities that disturbances induce, there are certain active innovative elements and if the company / entrepreneurs exploit the opportunities well, they can develop. They contribute to the emergence and rapid development / progress of large companies. Other examples are the emergence, rapid growth and expansion of new, reorganized societies [10].

But there is also the risk that the longer the preservation period persists, the more insignificant shock can lead to negative, destructive, sometimes extremely fast elements, by exceeding resilience, by destroying vital connections and weakening control capacity. It is manifested by destruction, upheaval, disintegration of previously accumulated forms of capital, as a result of breaking ties, which leads to the leakage of natural, social, economic capital outside the structures of the system [5].

## **Examples of Resilience**

### ***Resilience in case of natural disasters***

A very current example of resilience is the current situation following the Covid Pandemic 19.

The outbreak of the COVID-19 epidemic in early 2020 changed the economic, social and budgetary outlook in the Union and in the world, requiring an urgent and coordinated response at both Union and national level to deal with the enormous economic and social consequences, as well as asymmetric effects on Member States.

The European Commission has so far received the official recovery and resilience plans of 13 EU Member States. The latest arrivals in Brussels come from Belgium, Italy, Austria and Slovenia. They set out the reforms and public investment projects that each Member State intends to implement with the support of the Recovery and Resilience Facility (RRF). The economic crisis caused by the pandemic was not long in coming, and in July 2020 the EU was forced to approve a recovery fund called Next Generation EU - a plan for future generations [15]. This recovery fund does not yet have a legal basis as it contains a component, that of „EU own resources”, which not all national parliaments have ratified so far. Thus, the RRF is the key tool at the heart of this Next Generation EU - the EU's plan to get out of the pandemic. It will provide funds to support investments and reforms, the basis of which is the 2018 prices. It is divided into grants totaling EUR 312.5 billion and loans of EUR 360 billion. The fund has another role, namely to ensure the ecological and digital transition - the new European ambitions.

The money is then obtained gradually, project by project, it is borrowed from the financial markets with moderate interest based on the triple A held by the European Commission. Some countries such as Romania and Finland have requested additional time for the analysis compared to the deadline set by Brussels, which was 30 April 2021. Romania has submitted a provisional version of the plan, a version that needs to be improved, as recommended by Brussels.

Romania's National Recovery and Resilience Plan, to be used in the next five years, focuses heavily on building irrigation systems, afforestation and waste management, but also on social and structural reforms (pension reform, private sector investments, etc.) [16].

### ***Resilience and state security***

Within the framework of the EU's overall strategy, peace and security are inextricably linked to sustainable and inclusive development, as well as to compliance with global and international rules-based systems. The promotion of this program continues to be at the heart of the EU's external action. But the overall strategy also recognizes that the EU and its Member States are subject to many of the structural pressures that test resilience and expose the vulnerabilities of our partner countries. This is why the strategy identifies EU protection as a key task for the future. Greater resilience of neighboring countries is part of the response. EU foreign policy, including through the CSDP, also has a role to play in directly contributing to the development of resilience within our borders, at a time when the Union has a greater responsibility than ever to contribute to the security of its citizens. This requires better detection of external

pressures and threats, as well as appropriate mechanisms to ensure an appropriate policy response [12].

The EU's work on the security union also places resilience at the heart of its action, while addressing the issue of external non-state actors. In the April 2015 European Security Agenda, the Commission focused on two main pillars: the fight against terrorism and organized crime and the strengthening of the Union's defenses and resilience.

The challenge now is to integrate the internal and external security dimensions of EU policies in a way that strengthens each other, effectively increases the costs of external coercive action and enables the Union to anticipate and adopt early political and operational measures in response. at other types of pressures [11].

The EU will continue to pursue six main areas of concrete action in this regard:

- Resilience against hybrid threats. Building on the Common Framework on Combating Hybrid Threats, a central goal of the EU's efforts will be to strengthen the protection of critical infrastructure, while diversifying energy sources and suppliers and strengthening defense capabilities. Priority will be given to ensuring effective operational cooperation and secure communication between Member States, as well as collaboration with actors from different sectors, using common tools. Cooperation with third countries, especially those in the EU's neighborhood, will be stepped up;

### **Results and discussions**

Resilience involves certain skills / abilities of the system, respectively, of its decision centers, to respond to what is happening, to monitor critical elements, to anticipate potential disruptions and to learn from what has happened in the past.

Understanding resilience factors in a given context can help us better plan our response to unforeseen pressures and situations. This requires a good understanding of the links between the different parts of the complex systems that regulate and support states, societies and communities, and how they react when faced with unexpected shocks or recurrent or long-term pressures.

The ability to respond to moments of rupture and disruption is essential for resilient systems and can be enhanced either by implementing a precise set of responses or by adjusting the operation in relation to what is practically happening in reality.

Ability to control and monitor factors that could become a threat in the near future. Monitoring must cover both what happens in the environment and what happens in the system itself, respectively its own performance. This feature is closely linked to the control over the critical elements of the system. However, knowing the evolution of an indicator cannot give us a complete picture of the phenomena that take place, given that the constituent factors of the system are always in different combinations and configurations.

### **Conclusion**

According to the concept of resilience, a resilient region recovers quickly after moments of crisis (economic, social shocks or natural disasters) and adapts effectively to the changing conditions of the external environment. Although the concept of resilience has become almost as widely used in the scientific literature and documents of

international organizations as that of sustainable development, the mechanisms by which a region becomes resilient still need the attention of researchers. However, following the case studies and bibliographic summaries, several common issues with an important role for regional planning in order to increase resilience emerge:

- assuming the change and uncertainty inherent in complex systems;
- awareness of the dependence of human communities on goods and services;
- maintaining diversity and relativizing competitiveness and optimization;
- receiving disturbances as opportunities to create new development directions;
- creating opportunities for self-organization, experimentation and innovation; streamlining learning processes by combining several sources of knowledge;
- adopting perspectives on the regional system for different time periods and at different spatial scales;
- assuming a flexible way to manage the region.

Planning should be a continuous process of adapting and responding to the feedback of the managed system.

It will not always be possible to address the pressures at the point of origin or to avoid the consequences of an unexpected crisis. But addressing issues when they reach the critical point is important so as not to incur disproportionate costs. Therefore, flexibility and the ability to adapt to change need to be integrated into the design of the resilience program.

In conclusion, we can define resilience as the ability of individuals, societies or states to adapt to major shocks and crises, to maintain their vital functions, to limit their impact on their own functioning, and to improve as a result. Resilience requires flexibility, strength and durability alike.

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