FOREWORD

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Being a challenging and a favorable medium for scientific discussions, all the issues of the journal contain articles dealing with current issues from *computer science*, *economics*, *management*, *IT&C*, etc. Furthermore, JISOM encourages the cross-disciplinary research of national and international researchers and welcomes the contributions which give a special "*touch and flavor*" to the mentioned fields. Each article undergoes a double-blind review from an internationally and nationally recognized pool of reviewers.

JISOM thanks all the authors who contributed to this journal by submitting their work to be published, and also thanks to all reviewers who helped and spared their valuable time in reviewing and evaluating the manuscripts.

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We have a history that started back in 2007 and we are permanently striving to bring our community to a higher level of knowledge in the fields we cover. With the constant support of our authors, reviewers, readers and editorial staff I am sure we are and will live up to the mission we have taken on.

Many thanks to our JISOM community and good luck with your research!

Respectfully,

Alexandru TĂBUȘCĂ, PhD

JISOM Editor-in-Chief

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CONTENT

CYBER SECURITY - AWARENESS & ZERO TRUST MODEL IN PUBLIC DOMAIN

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Abstract

Simplifying one's life is realizing, with an exponential growth, by evolution, so as technological evolution makes its presence more and more in each domain of human activities. It is obvious the fact that the development of the Internet and the continuous appearance of new technologies represents a way for social development. Even though, this opportunity brings around a new challenge, the one of assuring the security of the entire virtual space.

The movement towards virtual space, internet network and cloud computing shifts the tension of confidentiality of the public institutions and private also, towards security of the virtual world and equipment security and internal rules and standards. Once the 5G technology will be implemented in real world usage, no matter the provider, the possibilities of turning our life smart will be infinite. unifying and control of all home equipment with your own phone. Regarding all this, all these systems have to be protected of attacks by private or state actors.

So, it is extremely important to be aware of the impact of a cyber-attack and that the virtual space has transformed in the fourth tactic war space. Regarding this we keep in mind Jens Stoltenberg's declaration that even a cyber-attack can trigger article 5 from the NATO book, because an attack of the critical infrastructure can become of absolute importance.

Keywords: cyber security, cyber warfare, cyber-attacks, awareness, zero trust model

1. Introduction

Cyber security domain has become an inseparable part of what collective defense means in NATO way of thinking. The need of clear views of this subject has manifested ever since the Summit in Warsaw in 2016, by the increase in cyber-attacks of important institutions and private companies.

Implementing the virtual space in all the activities of the alliance, clarifies their view on policies of cyber security, and the availability of enforcing cyber operations in wide spectrum is not just a future project for NATO, but a necessity in this dynamic and insecure world of our days.

Cyber security state level or institutional represents a status of normality of digital information, resources and services offered by public and private companies. [1]

Responsibility for cyber security measures is guaranteed and regulated by Romania's Cyber Security Strategy and National Plan of Implementation of the National Security Cyber Security Network.

At national level the subject is transposed by European Directive which gives the idea of current importance of this problem: Directive UE 2016/1148 which reconfigures institutional architecture within the institutional area of control attributes and sanctions of the EU / Regulation 2016. Rigorous regulation on protection of the personal data of the citizens. [2]

According to this information, there is a stable framework, but all technological evolution changes largely the action plan on an incident, as well as transcribed procedures and regulations in laws.

Therefore, all that is the set of laws, regulations, policies, cybersecurity standards is very difficult to regulate and maintained. At the level of a state, consisting of cybersecurity, in a sum of public institutions and private entities, it really is a challenge in comprehensive cybersecurity.

We believe this is a real problem, but also a major necessity, the creation and application of cyber security policies in the scalable and adaptable public domain to the new challenges, generally applicable to a high degree of effectiveness, with niche valences according to the institution Application, also containing various scenarios:

1. Security policies
2. Standards and models
3. Awareness and promoting security culture
4. Risk management
5. Solutions for IT & C Networks and Systems

2. What we need to be aware in Cyber Security?

The concept of Cyber Security is, in a short definition, the security of all IT systems that a state, an institution, a person uses. What is most important is the close link that all these systems have, starting with the smallest unity, namely the individual or the end user.

In order to clearly determine the points we have to follow in this area, they are best highlighted in the Cybernetic Security Strategy of Romania and in the National Action Plan on the implementation of the national cyber security system, 2013. Thus, cyber security is It presents as the state of normality resulting from the application of a set of proactive and reactive measures to ensure the confidentiality, integrity, availability, authenticity and irreversibility of electronic information, public or private resources and services in cybernetic space. Proactive and reactive measures may include policies, concepts, standards and security guides, risk management, training and awareness activities, the implementation of technical solutions for protecting cyber infrastructures, identity management, consequence management. [3]

The cyber space is in fact the fifth battle territory in the 21st century, and the cyber security is a new meaning as the cybernetic component links the other battle, terrestrial, sea, air, space that was predominantly applicable during the war Cold.

The fully affected space in case of cyber conflicts is the global integrated communications and computer networks in which telecommunication infrastructures are also included. In addition, the virtual space includes the Internet and computer networks that cannot access through the Internet, which are separated, for example intranet. Cyber The space has as the main features lack of borders, dynamism and favors actions in anonymity, assigning a cyber-attack being a very complex process.

This concept of cyber security is organized on three layers, according to the unanimous opinion in the field, namely: staff of an entity, the processes that are carried out and technology used at all levels of that entity. [4]

So the first point in ensuring cyber security within an organization is staff and here is also the highest vulnerability. Creating an organizational culture is the best option to protect a computer system.

Cyber Security of staff is represented by behavior in the online but also internally, organizational, person. The uniqueness of a person can be used as a hackers' way of attack today, the fact that the equipment we use are increasingly connected, personally is a help and is at hand, but so a person becomes vulnerable, social media networks are connected, the phone is connected to the browser we use, so access to a single account can give access to all our equipment and possibly to an email account it uses within the organization where they work. Personified data that various accounts have can be used to get the passwords or answers of applications security questions. So it is advisable to hold an IT department capable of Cyber Security in the spectrum of staff training and, of course, respect for internal rules and legislation in force. [5]

Cyber Security at the level of activity refers to a code of conduct for any type of situation that may intervene, namely the steps that any employee must observe in the event of an error in the use of equipment. Documenting these procedures should clearly define roles, responsibilities and chain. Threats evolve, and a fair use can keep the organization safe.

Cyber Security at the technology is of course the widest branch that any entity has to develop. Investments in hardware technology (physical part of the equipment), as well as software (programs, applications) must be directly proportional to the value that the company represents, or the information it holds. Thus, the development of technology that technology has at these times can only come to the package with a level as high as possible vulnerabilities, referring to all uses of equipment for example, the frequency of electricity that enters a socket can become a signal that is repaid by a victim or attacker station, thus can destroy the information of storage units or may provide information to the attacker about the socket pattern if it can support high temperatures if it has sensors for current intensity or not, facilitating an attack of Hardware or a social-engineering type.

From an academic point of view, there is no unanimously accepted security definition, so a permanent revaluation of the methodology for analyzing this concept is relevant. The approach to establish a definition that includes the whole spectrum of threats, risks and vulnerabilities to security and to be accepted by all parties will be continuously as we are witnessing the complex phenomenon of globalization, the transformation of the national and international security environment given by the Technological innovations and not only, but also of the emergence of new asymmetric forms of war such as hybrid war, cyber war or human rights violations. The study of security and investing enormous resources for its insurance is not a novelty, the security being since the beginning of mankind one of the most precious things as it is even from Maslow's pyramid, where only physiological needs occupies a more important place. [6]

At the same time, although there is no current description of the cyber security or a framing of all offenses, as the field evolves, there is legislation at European level that should prevent incidents: The European Union adopted on July 6, 2016, the NIS Directive (Network Information Security) in order to increase the level of security of information and networks whereby this information circulates. The NIS Directive provides a legal framework for increasing the cyber security level by developing incidents response teams (CSIRT-Computer Security Incident Response Team) and a NIS competence authority. This directive encourages the exchange of information between Member States on the risks and threats that can affect a state. [7]

It is promoted security culture for our society in vital sectors such as the economy, critical infrastructure, the cyber espionage issue of the institutions and the exfiltration of data, targeting problems in areas such as energy, health, banking and digital infrastructures. Component undertakings of these sectors, which are identified by the Member States as providers of essential services for the company, will have to align the proposed concrete security measures and to transmit information on serious incidents, competent national authorities. Also, key digital service providers (search engines, cloud computing services and online markets) will have to comply with the new standards in terms of their own security requirements as well as users. [8]

In addition, there is a European Union Agency for this purpose in European territory to ensure compliance with cyber security. "The Commission has also proposed the creation of a stronger E.U. agency. Responsible for cyber security, starting from the existing structures of the European Union Agency for Networks and Information Security (ENISA). The role

of the new agency would be to help Member States, EU institutions, as well as private enterprises to combat cyber-attacks. " [9]

Until now, ENISA has provided ITS security recommendations supporting the development of legislative articles and their implementation and has collaborated with operational teams across Europe. ENISA contributes to ensuring the information society of Europe by increasing awareness and developing and promoting a culture of network security and information in society, thus contributing to the smooth functioning of the internal market and implicitly to ensure national security.

On March 13, 2019, EU Ambassadors granted a mandate for the commencement of negotiations with the European Parliament in terms of the sharing of cyber security expertise. Negotiations will focus on two initiatives: the establishment of a peak knowledge base for cyber security, called the European Cyber Industrial, Technological and Research Center for cyber security and the establishment of a network of national coordination centers. [10]

From an international point of view, NATO declared the cyber space as an operational field as well as conventional spaces for wearing a war. This decision reflects the imminent adaptation to the evolutions of the 21st century and at the same time necessary in the history of 70 years of the Alliance and can be seen as part of a larger development in relation to the correlation of NATO measures with the current security needs that turn out once with the evolution of technology. In this respect, NATO members have decided to defend themselves from cyber-attacks in the identical procedural like against attacks launched in the other areas of war. NATO adapts to the evolution of the cyber line, being able to take pro-active measures against complex Cyber capabilities developed by both state and non-state actors. Cybernetic space is recognized as the integral part of today's wars, conflicts and crises today, but specifically is the basis of the current and future NATO operational security environment. [11]

Cybernetic field becomes an inseparable part in terms of the fundamental principle of NATO's collective defense. The need for concrete decisions at the 2016 Warsaw Summit and beyond it was led by the rapid growth of cyber threats and questions on the resilience of networks that is so much dependent on the society today. The incorporation of the virtual space into all other activities carried out by the Alliance, clarifies the cyber policy on Article 5, and the willingness to carry out cybernetic operations in broad spectrum is not just a future project for NATO but is a necessity in this dynamic, complex world and uncertain of our days. [12]

Declaration of cyber space as a conflict area states that cyber-attacks may be more easily used to justify the invocation of the Collective Defense Clause of Article 5, NATO. The Declaration also highlighted Member States that collective cyber resilience begins with its own countries, the cyber defense to be strengthened. Article 5 Specifies that only an armed attack on a Member State's security may rely on Article 5, and NATO is officially prepared to include complex cyber aggressions in the sphere of armed attacks. [13]

3. Asymmetric threat - Connection between Cyber Intelligence, Cyber Security, Cyber Warfare and Hacker Reinforcement.

Nowadays the damages that a war could cause is the most important reason that discourages the great powers from local conflicts, and excessive armed over-technology and modernization claims the idea that the next war will be the last.

Thus, large powers use other means to make their interests known or to sanction countries that do not respect international or geopolitical rules get too much zonal influence, namely hybrid warfare: destabilization of the population by Fake News and the media flooding False information, the imposition of sanctions from international fora or even cyber-attacks on government institutions. Although most of the time they are disguised in "personal" actions, most attacks are supported by a state actor.

In the cyber environment, the most frequent incidents are caused by crime, as each actor involved wants to take advantage of the vast possibilities offered by the virtual space. The defense of IT systems and networks is based on vulnerable protocols and emphasizes the detection of threats rather than eliminating them. Cyber-attacks are carried out with an unavoidable rapidity, putting a very high pressure on the technological and mental victim, because the part that defends must be successful in the specific actions undertaken, while the attacker needs to succeed once Defense systems or find breaches to achieve their goal. [14]

Cyber offenses being classified according to purpose and attackers: when the attacker is a state, the goal is spying or penetration and maintenance of access to the victim's defense systems called and APT (Advanced Persistent Threat), when the goal is financial resources Most of them are classical cyber criminals, namely hackers who have access to a private network of a company and make commercial espionage or encrypt all internal data asking various amounts for data recovery (Ransomware attack) or even copies all the company's data, not I am doing domestic damage, but they sell their data and customer data victim's data on Dark Web forums.

However, the technology is in full growing, and geopolitical realities are also changing, goals and even attackers can interleave, so a state actor that supports a hacker group can aim to obtain financial resources, etc.

The threat that a cyber-attack possesses is very strong from a functional point of view: the success of a cyber-attack can lead to ruin a whole economic branch of the victim state or to land the communications system or the energy.

Known cases: Stuxnet virus attack on Ukraine's energy network, malicious attack Petya throughout Europe.

Considering all these aspects, we can fit the phenomenon of cyber-attacks on an entity or state among asymmetric threats, considering the definition according to "asymmetry

consists in refusing the rules of the fight imposed by the opponent, thus making any unpredictable operations." [15].

Thus, the most important aspect being the lack of any information on the moment, the target or the method of attack. So cyber-attacks and their use as a hybrid war form are very well motivated:

1. The cyber war is cheaper, because it does not require the involvement of troops or weapons in the classical sense;
2. The cyber war can be worn remotely, so without any movement that could be a logistic, physical or additional cost;
3. The starting costs of a cybernetic war are relatively low. At first, a computer is sufficient with internet connection, but later financial resources can become important depending on the ultimate goal;
4. Most attack instruments are cheap and at the disposal of each person, hackers can find pieces of program in lines on the Internet that they can later change;
5. The proliferation of cyber-type attacks cannot be controlled;
6. Attackers can take advantage of the latest innovations in the technological field;
7. Cybernetic space offers attackers anonymous because it is very difficult to watch the origin of an attack, the attackers operating behind false IP addresses or foreign servers;
8. The cyber war offers the ability to manipulate and disrupt the opponent, and is not necessary to carry out combat operations to achieve interests;
9. The cyber war allows state actors to achieve political and strategic objectives without actually beginning an armed or other conflict;
10. A cyber war takes place at a remarkable speed, the time between the launch of an attack and the experience of its effects is very low. This generates much more risks for decision-makers, especially in times of crisis.
11. The victim of a cyber-attack in the case of an institution must invest considerable resources for neutralizing threats. Teams specialized in software and hardware are needed, and these people are very difficult because they prefer the private environment.
12. The vulnerabilities of countries increasingly dependent on the interconnection of network information systems increase with the implementation of new technologies and can become targets for cyber opponents.

All these reasons transform the cyberspace into the most efficient and effective weapon that any state can have, as the required code lines can be written even on a phone.

4. ZERO TRUST POLICY - The new cyber security model

The increased need for cyber security and recrudescence of cyber-attacks have determined substantiation, especially in private environment, of a new cyber security concept, called "Zero Trust" - "Zero Trust".

This concept is a strategic initiative policy aims at preventing computer security breaches by eliminating the concept of "trust" in the network architecture of an organization. The basic principle of this policy "Never Trust, Always Verify" (never to trust, always check) is representative, being built to protect digital media by segmenting the network, both by preventing the lateral movements of the attacker's potential and by offering a pattern of level 7 threat to the OSI theoretical model, protecting high-level applications from the technologies present in the institution. [16]

The "Zero Trust" model was created by the need to secure network infrastructure, being the successor of traditional internal security models. These traditional models function, and many are still working on the erroneous principle that all infrastructure users are responsible for network, they are reliable, and their identities are not compromised, while maintaining network anonymity.

According to the new concept, any model aims at trust in the human component is from the very beginning an erroneous model, a proven aspect of many successful cyber-attacks through social engineering. This assumption is based on a perfectly natural human trait to overcome the different conditions and limitations imposed by infrastructure security rules, especially on the social component, either in a controlled digital framework.

Thus, the punishment or internal normative conditioning of the behavior of employees / network users denies a fundamental human trait (to challenge and interpret the rules and try to circumvent them), not being long-term viable and / or a larger group of people. [17]

In this respect, on the traditional model, once entered into the network, a malicious user can insert or exfiltrate any type of data, moving sideways in network architecture research. Given that the initial point of the attack is, most often, completely different from the target location, the internal network could be compromised by different ways of access, and the institution's trust policy will foster the presence of foreign or domestic malicious entity, not being prepared for defensive actions.

Therefore, in antithesis, the "Zero Trust" policy is not meant to increase confidence in the institution's internal system, but to completely remove it to build a alert thinking model for an inevitable security breach, regardless of the architectural model of the network.

The initiation of the approach is to identify a protection zone. This area is made up of services, data, assets and critical apps for the network and institution. Once this area identified, organization traffic is analyzed on that area. Identifying users and services using this plan is the pre-tackling of internal cyber security policies by using the Zero Trust. The institution is obliged by this method to keep track of all access points in the critical plan to cover its assets in the case of a security breach. The advantage is both the identification of vulnerabilities as well as the actors that can exploit them by tracking the network of network transit and analyzing disturbing factors.

From the time building "Zero Trust" policy around the protection area, it must be monitored and maintained in real time for possible non-included dependencies as well as for ways to improve policy.

Complementary security policy according to the "Zero Trust" method, it is also noted the advantage of outsourcing responsibility for securing individual applications to the companies that have built them.

A good argument to opt for this outsourcing is the security budget allocated to large firms such as Google, Apple, Slack, and the like. The security component, though impressive at the individual level in each of these, is eclipsed by the whole community. In other words, by managing the different security micro services at the level of each company, a high-level security specialization is achieved, impossible specialization to be achieved at a macro level within a single institution, either with substantial resources.

With regard to the cost of implementing a Zero Trust method, although the initial cost may be substantially, it is amortized within a relatively short term, given the possibility of accessing any network device, including personal devices of users. Also, the cost of the software is low, no longer the renewal of licenses for different operating systems, file management software such as the Microsoft Office package or VPN connectivity server management for remote work.

One of the greatest policy benefits "Zero Trust", apart from the security component, is the dynamics of architecture. The method is not dependent on a location, but involves the constant presence everywhere, so it cannot be imposed in a particular place, but must be proliferated throughout the working environment. In this respect, there will be certain files that can be accessed by certain users based on well-defined conditions that cannot exit the pattern established when drawing the defining lines for the security area mentioned above. A happy consequence of this policy is thus the freedom of movement of responsible staff within the institution, which manages to access the services and tools needed to carry out the activity anywhere in the world at any time. In this case, the above-mentioned traffic analysis will serve as the basis of all possible system vulnerabilities, observing atypical behaviors, influence factors and possible risk spaces to be managed in accordance with the needs of the institution at the initial assessment.

5. Conclusions

In the context of the latest cyber information, certain projections or trends in cyber security are preferable. We believe that technologies related to artificial intelligence and Machine Learning will become the main weapons in the following cyber-attacks, as the full range of information systems used becomes overcome to the power of these technologies.

Also, on the background of the pandemic, remote technological and labor developments, the new industrial system, the economic system will move to the 4.0 model where most

people employed will be replaced by a previously scheduled industrial apparatus, which respected and repeats the chosen parameters. Thus, IOT (Internet of Things) will be increasingly exploited, and the remote work developed and the threats appear. [18]

The problem of the pandemic from a cyber point of view is the lack of a culture of safety and security regarding the general concept applied "work from home". More and more APT formations are appearing, with a clear financial purpose, starting ransomware attacks, which are also the most profitable for attackers. The most affected infrastructures by these attacks are medical institutions, already subjected to a multiplied stress compared to a normal period. This risk is also transposed among employees in most areas, in the context of the current restrictions and laws imposed. Phishing attacks have multiplied 11 times in 2020 compared to 2016, doubled from 2019. In addition, 75% of the companies in the world have been attacked by phishing attacks, 96% started by means of an e-mail, precisely because of this an organizational culture in the private environment, but especially in the environment of state institutions is absolutely necessary. Regarding the costs RISKIQ estimates that minute by minute in the business environment is lost about 17.000$ due to cyberattacks across the broad spectrum. [19]

The development of 5G networks (the fifth generation of Internet transfer speed) will take place worldwide and will increase the Internet speed at least 10 times. Therefore, 5G technology will facilitate interconnection of devices with each other, which will increase the number of cyber-attacks.

Thus, we believe that the cyber-space, the package with all its opportunities and risks, will become the next bathing field for international hegemony, and the actors involved will be in a larger number, attracted by the opportunities generated by the development of cyberspace.

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AN ENHANCED GENETIC ALGORITHM FOR ANNUAL PROFIT MAXIMIZATION OF WIND FARM

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Abstract

Due to the swelling human suffering caused by climate change and the rapidly exhausting reserve of fossil fuels, renewable energy generation processes have gained immense importance throughout the globe. Wind energy is a leading renewable power generation method. To advance the green transition of the electricity generation industry, wind farms should stay commercially sustainable. This paper aims to increase the yearly profit of a wind farm utilizing an enhanced genetic algorithm. A novel method of dynamically allotting the crossover and mutation probabilities has been proposed to increase the effectiveness of the genetic algorithm. The assessment results validate the superior competence of the proposed tactic over the standard invariable method of assigning the crossover and mutation factors.

Keywords: Wind Farm, Profit Maximization, Genetic Algorithm, Dynamic Assignment, Crossover and Mutation Ratios, Annual Profit.

1. Introduction

Renewable power generation techniques recommend a thriving alternate amid the mounting universal disquiet for the constricted hoard of fossil fuels and their hazardous aftermaths on nature. The expenditure of Wind Power Generation (WPG) has fallen dramatically over the previous two decades all over the world. Remarkably, during the Covid-19 associated restrictions in 2020, the utilization of renewable energy underwent an upsurge of 3% whereas the necessity of all fossil fuels plunged across the globe.

The portion of renewable energy in overall energy generation has widened from 19.75% in 1990 to 26.62% in 2019 which is a reasonable indication of the international trend towards low-carbon alternatives of energy resources. Global renewable energy consumption has developed from nearly 941 TWh in 1965 to approximately 7027 TWh in 2019 while the WPG sector has progressed exponentially ever since the preliminary years of the twenty-first century. Global cumulative WPG capacity has expanded from nearly 20 GW in 2000 to 650 GW in 2019 with a forecast of achieving 4042 GW by 2050. Global wind power

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consumption per capita, which was merely 1.89 kWh in 1990, underwent a colossal amplification in the past three decades and reached 458.94 kWh in 2019. Cumulative WPG capacities of nations have been shown in Fig. (1).
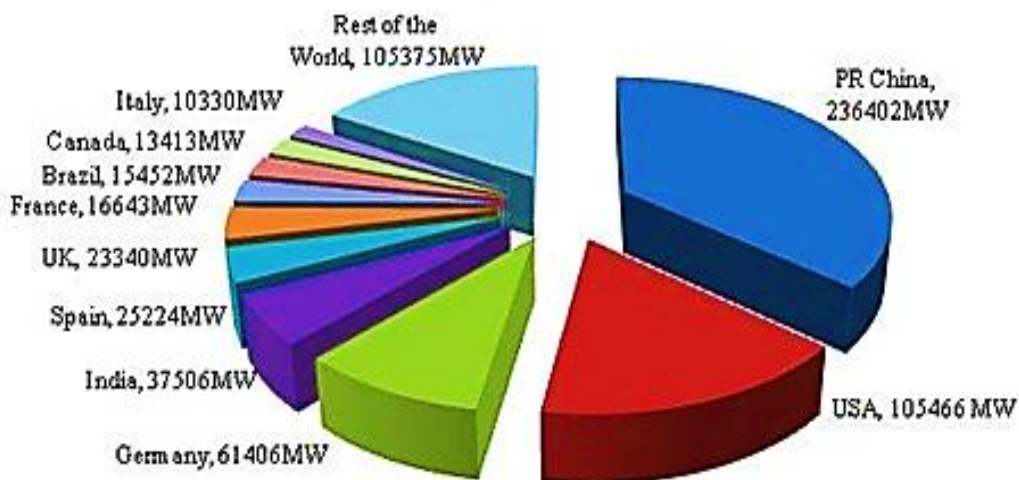
Figure 1: Cumulative Wind Power Generation Capacity as of 2019

Şişbot et al. have engaged Genetic Algorithm (GA) for optimizing the layout of a WPG unit in Gökçeada isle. Saroha and Aggarwal offered a model intended for WPG evaluation with GA and Neural Network (NN). Huang et al. suggested another NN-empowered GA procedure for conjecturing wind power potential. Khosa et al. recommended a profitable dispatch model for probabilistic wind energy generation with GA. Shin and Lee improved the simulation of a generator for WPG through GA. Viet et al. proposed an NN-aided procedure with swarm intelligence and GA for wind power estimating. Roy and Das have utilized GA and swarm intelligence for WPG expenditure minimization. The global trend of WPG project outlay from 1983 to 2017 has been shown in Fig. (2).
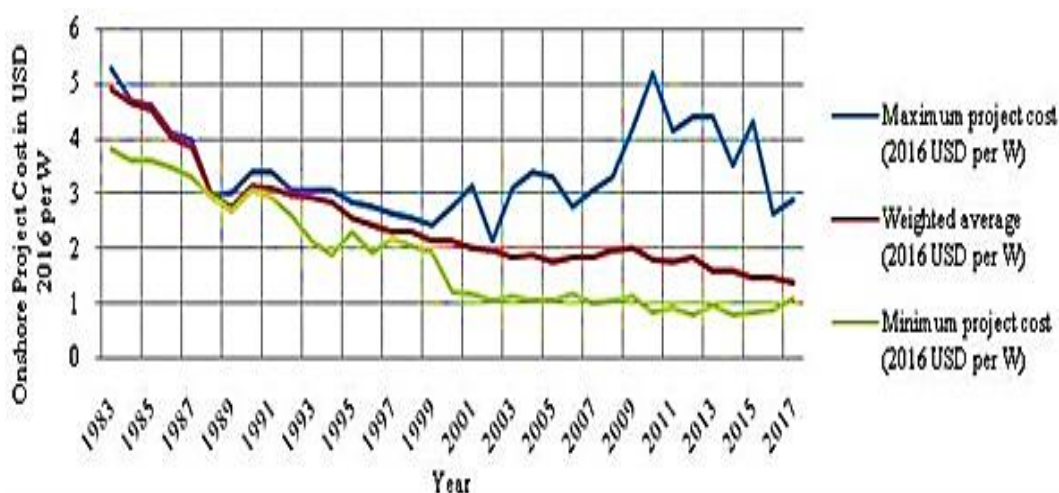
Figure 2: Yearly Statistics of the Global Levelized Cost of Electricity (LCOE) from Onshore WPG System, given in 2016 USD per kilowatt-hour (kWh) from 1983 to 2017

The current study focuses on maximizing the annual profit of a wind farm with an enhanced GA. A novel technique of dynamically allocating the probabilities of crossover and mutation has been proposed and its relative effectivity with respect to the conventional static method of allocating the crossover and mutation ratios has been evaluated.

2. Objective Function

The power captured by a Wind Turbine (WT) is evaluated as per Eq. (1).

$$P = \frac{1}{2}\rho A \vartheta^3 C_p cos\theta \tag{1}$$

where P signifies the extricated power, ρ is the density of the current of air, A is the cross-sectional area, v indicates the speed of air, C_p denotes the Betz threshold and θ symbolizes the angular imperfection of the yaw system. The objective function has been defined in Eq. (2).

$$Q = [M - N] \times P_{annual} \tag{2}$$

Where Q denotes the yearly profit, M signifies the marketing charge per unit power, N represents the generation price per unit WPG and P_{annual} indicates the yearly generated power. The current research work deemed the WPG expense function stated by Bhattacharjee et al. (2021) for calculating the annual profit of a wind farm. The wind flow pattern considered in the present study has been shown in Fig. (3).
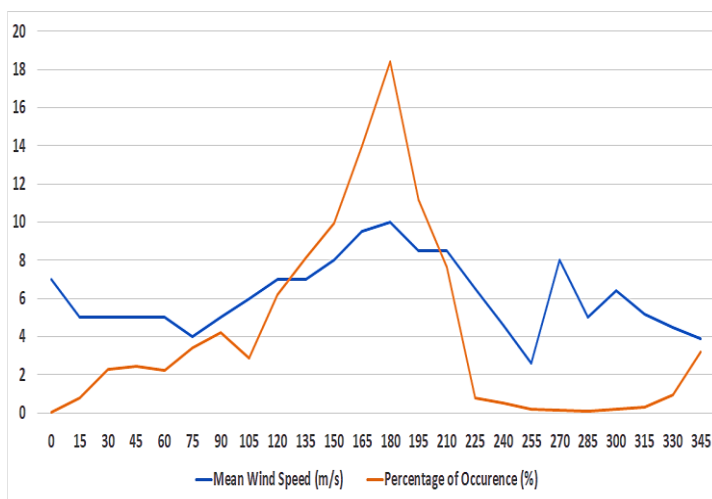
Figure 3. Wind Flow Pattern

3. Proposed Enhanced Genetic Algorithm

GA is an evolutionary exploring method to propose results for optimization study by representing the progression of ecological predilection. It has been implemented in several scientific disciplines for determining choice-building challenges.

The algorithm has succinctly discoursed in the following manner.

1. Establish the essential features like populace extent and recurrence amount.

2. Instigate the population chaotically.

3. Scrutinize the appropriateness of distinctive chromosomes.

4. Assume the crossover process in the subsequent method:

    4.1 Choose a fraction indiscriminately between 0 and 1. If it is not as much of the possibility of the crossover technique, propose the chromosome as the parent unit.

    4.2 Stimulate the crossover activity.

    4.3 Revise the relevance of the descendants.

    4.4 If the inheritor is suitable, adapt it into the fresh population.

5. Accomplish the mutation technique in the succeeding method:

    5.1 Choose a factor unpredictably in the midst of 0 and 1. If it is not as much of the probability of mutation, elect for the unit for the mutation technique.

    5.2 Commence the mutation process.

    5.3 Confirm the recently mutated units for their practicality.

    5.4 Combine the mutated and possible units into the current population.

6. Review the suitability of the fresh units shaped by crossover and mutation approaches.

7. Stipulate the most optimized result concerning the choice-maker's partiality.

For the present study, the dynamic crossover and mutation probabilities have been calculated by Eqs. (3) and (4).

$$c_d = c_1 + \left\{ \left(\frac{c_2 - c_1}{2} \right) \left(\frac{R_c}{R_h} \right)^3 \right\} \qquad (3)$$

$$m_d = m_1 + \left\{ \left(\frac{m_2 - m_1}{2} \right) \left(\frac{R_c}{R_h} \right)^3 \right\} \qquad (4)$$

Where c_d is the escalating crossover factor. c_1 and c_2 are the bounds of the crossover proportion. m_d is the intensifying mutation factor. m_1 and m_2 are the bounds of the mutation ratio. R_c indicates the current recurrence number and R_h represents the maximum recurrence amount.

The static values of crossover (c) and mutation (m) ratios have been computed as per Eqs. (5) and (6).

$$c = \frac{c_1 + c_2}{2} \qquad (5)$$

$$m = \frac{m_1 + m_2}{2} \qquad (6)$$

4. Results and Discussions

For the present study, two layouts of sizes of 3000 m x 3000 m and 4000 m x 4000 m have been deemed. c_1 and c_2 have been considered as 0.6 and 0.4 correspondingly. m_1 and m_2 have been deemed as 0.06 and 0.04 respectively.

The extreme number of recurrences has been considered as 50. Population size has been deemed as 20. A 1.5 MW turbine with a radius of 38.5 m has been engaged. For decreasing the wake shortage, the space between two nearby WTs has been maintained as 308 m.

The cost-related variables and their values required for calculating the WPG cost function as described by Bhattacharjee et al. (2021) have been presented in Table 1.

Variable	Considered Value
Turbine Price	USD 750,000
Sub-Station Price	USD 8,000,000 per Sub-Station
Count of Turbines per Sub-Station	30
Percentage of Interest	3%
Yearly Operation and Maintenance Charge	USD 20,000
Probable Operative Lifespan	20 Years

Table 1 Values of WPG Cost Linked Parameters

The minimum and highest operative speeds for WT are 12600 m/hr. and 72000 m/hr. The optimal placements of WTs for 3000 m x 3000 m and 4000 m x 4000 m attained using the conventional static approach of assigning the crossover and mutation ratios have been shown in Figs (4) and (5) respectively.
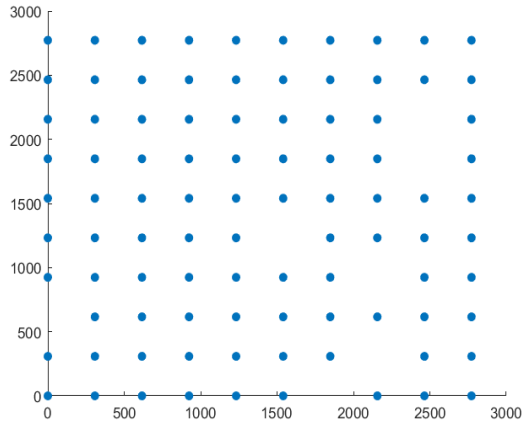
Figure 4. Optimal Placement of Wind Turbines Using Static Approach of Assigning the Crossover and Mutation Ratios for 3000 m x 3000 m Layout
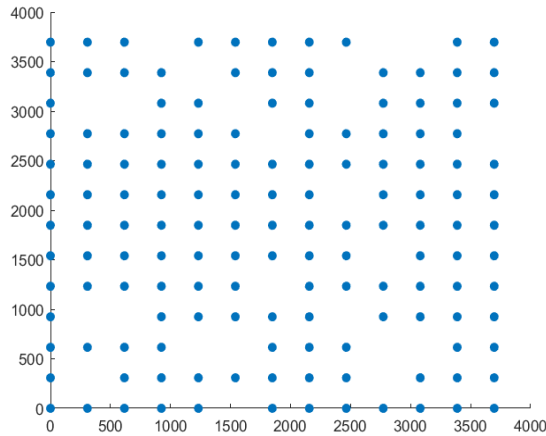
Figure 5. Optimal Placement of Wind Turbines Using Static Approach of Assigning the Crossover and Mutation Ratios for 4000 m x 4000 m Layout

The optimal placements of WTs for 3000 m x 3000 m and 4000 m x 4000 m attained using the proposed approach of dynamically assigning the crossover and mutation ratios have been shown in Figs. (6) and (7) respectively.
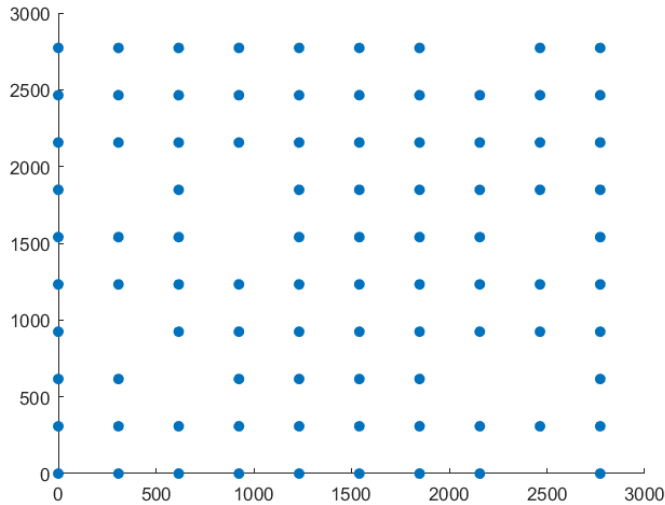
Figure 6. Optimal Placement of Wind Turbines Using Proposed Approach of Dynamic Assignment of the Crossover and Mutation Ratios for 3000 m x 3000 m Layout
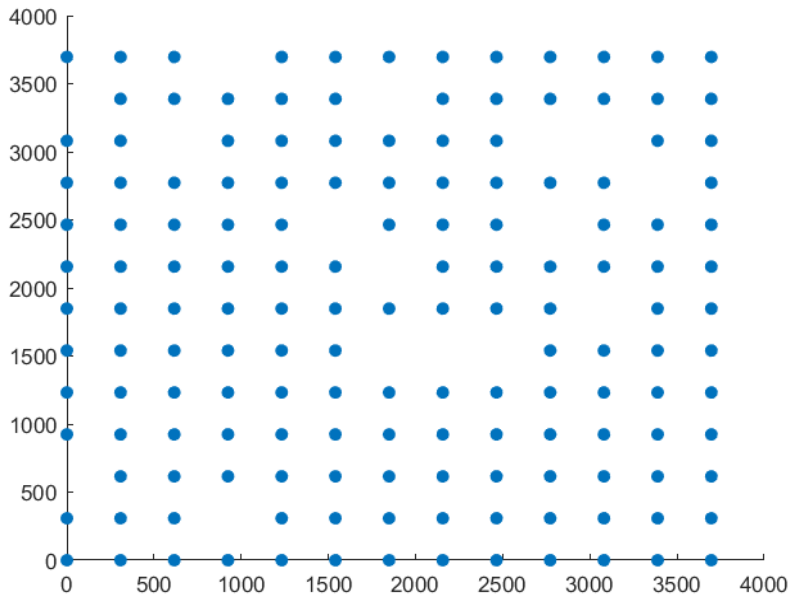
Figure 7. Optimal Placement of Wind Turbines Using Proposed Approach of Dynamic Assignment of the Crossover and Mutation Ratios for 4000 m x 4000 m Layout

The selling price of WPG has been deemed as USD 0.033/kWh. The optimal values of annual profits and corresponding counts of turbine attained by the static and dynamic

approaches of allocating the crossover and mutation ratios for both layouts have been presented in Table 2.

Allocation of Crossover and Mutation Ratios	Optimal Yearly Profit for 3000 m x 3000 m Layout (in USD)	Optimal Amount of Wind Turbines for 3000 m x 3000 m Layout	Optimal Yearly Profit for 4000 m x 4000 m Layout (in USD)	Optimal Amount of Wind Turbines for 4000 m x 4000 m Layout
Static Approach	25146	93	42686	145
Proposed Dynamic Approach	25579	90	43571	153

Table 2 Comparison of Optimal Annual Profit and Turbine Count

The study results validate the predominance of the proposed dynamic approach over the standard static approach for both layouts as it realized the highest annual profit as indicated in Table 2. The outcomes prove that the yearly profit of the proposed WPG location upsurges with the augmentation of the amount of WTs for the 3000 m x 3000 m layout. While the yearly profit declines with the augmentation of the amount of WTs for 4000 m x 4000 m layout for enlarged generation expenditure.

The enlarged productivity of the wind farm allows the enhanced sustainability of the WPG ventures and reinforces the progression of emission manipulation for the power generation businesses. The capable location of WTs by the projected optimization approach can benefit the WPG trades to attain elevated fiscal reimbursements without escalating the layout region and evading added outlay in terrestrial possessions.

5. Conclusion

Global societies are continually endeavoring to decrease the carbon footprints by efficient application of renewable resources. Worldwide societies are constantly endeavoring in the direction of diminution of climate change through efficient application of clean energy generation techniques wind energy as projected by the Paris treaty of 2015 and COP-26 of 2021.

The present study aims to maximize the yearly profit of a wind farm. Comparative study of standard static and the projected dynamic tactics for allotting the possibilities of crossover and mutation ratios for the genetic algorithm-based profit expansion of the wind farm. The optimization results confirm the enhanced suitability of the proposed dynamic technique over the usual static method of allocating the crossover and mutation ratios for improving the layouts with the greatest yearly profit.

The present research can initiate fresh opportunities for wind farm layout optimization and financial sustainability of wind farms.

Acknowledgement

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CURRENT SITUATION AND PERSPECTIVE REGARDING TELEWORK IN THE PERCEPTION OF MANAGERS FROM SMALL AND MEDIUM-SIZED ENTERPRISES

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Abstract:

The interest of specialists and practitioners in telework peaked in recent times, in the context of the pandemic, on the one hand, and also in the context of the extension of the use of information technology, on the other hand.

In this paper, we propose to understand, identify and delineate certain relevant aspects, but also some possible evolutions regarding telework within a predictable time frame of one year, through conducting a circumstantial enquiry among managers and entrepreneurs from some small and medium-sized enterprises in Romania (the municipality of Bucharest and the surrounding areas, namely Ilfov county). The main elements that we took into account are the following: aspects concerning the carrying out of economic activity under the conditions of telework, tele-employees and the perception regarding professional and personal life, the challenges of teleworking.

Managers who participated in the enquiry admit that there are certain causes which limit the activity of the company they represent, and telework, equipment and insufficient demand determine this phenomenon. On the other hand, managers characterize the impact of telework, currently carried out, on the company's turnover as being a positive one. The managers' perception regarding telework in the context of putting an end to the pandemic is that it will decrease, firstly due to the necessity of direct human contact.

Keywords: telework, teleworking employees, challenges regarding telework, circumstantial enquiry.

1. Introduction

In the context of the SARS-COV-19 pandemic, telework has been and continues to be a solution for carrying out economic activities, therefore for the survival, maintenance and/or development of activities, on the one hand, but also for safeguarding and maintaining jobs, on the other hand. It can be asserted that the pandemic imposed telework, in Romania at least, as in other states this type of activity is better developed. In the current context, telework seems to be or truly is the saving solution. The development of technology allows teleworking, even via smartphone, but also creates new jobs, and has negative effects on personal and social life (Lapierre et al., 2016).

Several studies discuss the need for management to manifest a positive attitude towards telework in order for such an activity to manifest positive results (Beham et al., 2015; Silva et al., 2019; Green et al., 2020), and while telework benefits for employees become organizational benefits, implementing a telework program is ultimately a top-management decision (Harker Martin and MacDonnell, 2012). Managerial perception is, therefore, essential for telework adoption and it requires evidence that organizational outcomes of telework could outweigh the costs and consequences of the alternative.

The current study investigates the perceptions of managers in the context of telework. In doing so, we seek to compare positive and negative views on the organizational impact, on life and on the macroeconomic impact of telework. The results contribute to a better understanding of the telework phenomenon and allow an anticipatory approach of the challenges that supervisors face in managing telework. We begin by reviewing the relevant literature in the context of telework, focusing especially on studies and statistics published under recent SARS-COV-19 restrictions, and on the literature focusing on positive and negative results of telework implementation. Secondly, in order to establish the perceptions of managers on the impact of telework conditions, we use a qualitative study under the form of a circumstantial enquiry on their field of activity. We focus on the present and future situation of the unit they lead, the economic climate in which it developed, and the perceived professional impact it exerts. Finally, based on the results of our empirical analysis, we provide implications for future research and practice.

2. Literature review

The concept of telework appeared and was developed during the ′70s, being an alternative way of working. Nilles (1975) uses the concept of "telecommuting network" as a substitute / alternative to ordinary work using modern communications.

A report by Eurofund and The International Labor Office (2021) states: "Working from home, far away or outside the space of an organization, other than in a traditional way, has become a widespread phenomenon." Hoeven and Van Zoonen (2015) support the idea of the proliferation of telework as an effect of employees and organizations' access to new technologies.

In Romania, telework is regulated by Law no. 81/2018 (Labour Inspection, 2018), being defined as "the form of work organization through which the employee, regularly and voluntarily, fulfills the attributions specific to the position, occupation or profession he has, in another place than the work organized by the employer, at least one day a month, using information and communication technology (ICT)".

In the US, for example, President Barack Obama signed the "Telework Enhancement Act" in 2010, which requires all companies to set policies for telework. Thus, work from home is officially recognized. The official definition of "telework" can be found in the "Telework Enhancement Act" of 2010: "the term 'telework' or 'teleworking' refers to a work

arrangement according to which an employee carries out the duties and responsibilities of his or her position, and other authorized activities, from an approved worksite other than the location from which he or she would otherwise work." In practice, "telework" is a work arrangement that allows someone to perform work, during any part of regular, paid hours, at an approved and agreed upon alternative worksite (home, telework center). This definition of telework comprises what is generally known as remote work, but does not include any part of work done while on official travel or mobile work (OPM, 2021).

The adoption of telework as a result of the Covid-19 situation by both public institutions and private companies relies on the citizens'/employees' responsibility and the social initiative to reduce the impact of economic inactivity and ensure the continuity of their employers' performance (Belzunegui-Eraso & Erro-Garcés, 2020). Furthermore, in order for telework conditions to allow the organisation to flourish, an organisational culture based on mutual trust is necessary (Baruch, 2000), as well as the use of multiple ICT tools, to allow efficient communication and supervision (Park& Cho, 2020).

Although telework was practiced in many companies before the pandemic, it was not extended to the current level; the pandemic took businesses and employees by surprise. Some age groups proved more flexible in the new context (35-49 years), while others (50+ years) proved to be either hesitant or slower to adapt. Varlamova and Previtali (2020) state: "The lockdown due to COVID-19 pandemic has accelerated a change in work arrangements and forced many employers to provide the possibility or even obligation to work from home to their employees. The introduction of these modalities has been drastic, and many organizations, managers, as well as employees, were not prepared for this change."

Telework seems to become the new normal, an aspect supported by Eurofund statistics, which highlight the fact that 40% of employees work from home, using modern technology, as an effect of the pandemic. Regarding Romania, in July 2020, approximately 22-24% of employees worked from home, compared to 1% in the same period, in 2019.

The following figure (Fig. no. 1.) shows the situation of working from home by country, as a consequence of the pandemic.
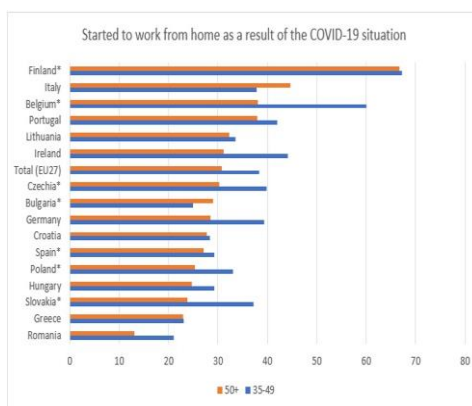
Fig. no. 1: The situation regarding the work from home by country

Source: Based on Eurofound (2020), Living, working and COVID-19 dataset, Dublin, http://eurofound.link/covid19data. Excluded EU countries had insufficient data, data on countries marked with (*) is low reliable.

It is interesting to know who works from home. According to Oprica (Business Magazin, 2021): "In general, people with a high level of education and who perform tasks with a high degree of added value from the point of view of knowledge work from home." The same author supports the idea that telework is closely linked to "the quality of housing, which is also a consequence of education." In other words, in order to carry out the telework activity under favorable conditions, an adequate space is needed, which will ensure the right environment, as it will also make its mark on personal life.

On the other hand, López-Igual and Rodríguez-Modroño (2020) emphasize that the most common determinants of telework are currently still self-employment, namely the high educational levels, the service industry and other non-manual occupations, especially those that require high-skills. In addition, factors such as age, urban residence, high status, better working conditions have less significance with the expansion of telework. The more telework is adopted by companies, factors which were initially required for this type of work evolve or disappear, and we see new teleworkers become available. However, although major focus has been placed on teleworkers' perceptions in general or as subordinates, managers' telework impact perceptions should not be overlooked, as Park & Cho (2020) assess, namely that managers are required to consider multiple organizational consequences of telework when making managerial decisions, because supervising employees and company results from afar may pose new challenges (Golden & Fromen, 2011).

Telework can also imply increased expectations concerning employee work performance, availability, and accessibility (Lott & Abendroth, 2020; Putman et al., 2014), suggesting that the use of telework by managers may be associated with longer working hours, an increase in work intensity, as well as conflicts between professional and personal life (Chung, 2019). Due to reduced physical visibility and spatial separation, managers must overcome the difficulty of behaviour-based control, and must employ the use of ICT to follow-up on employees, as well as a series of control mechanisms to increase the visibility of telework outputs (Bathini & Kandathil, 2020).

Recent research on companies adjusting to the Covid-19 pandemic (Barrero et al., 2020; Buchheim et al., 2020; Papanikolaou and Schmidt, 2020) reveals that companies with high work-from-home quotas registered lower financial declines and less job cuts. Despite the economic effects of the pandemic, opportunities for a greener economy, increased online communication and the adoption of new technologies may create a basis for a breakthrough in telework implementation (Alipour et al., 2020).

Regarding the managers' perceived impact of telework on employees, academic research shows ambivalent results, especially in the case of enforced telework (Mattern et al., 2021).

The main benefits comprise increased productivity and autonomy, reduced times for commuting, a healthier balance between work and private life, lower employer overheads,

new skills acquired by employees and managers (Dingel & Neiman, 2020). The main problems may include technological stress, social isolation, lack of peer support, presenteeism, unclear work and private life boundaries, career disadvantages, role overload and stress (Mattern et al., 2021, Dettmers et al., 2016). This lack of physical boundaries makes it difficult for the entire enterprise to balance the work and private settings, especially in the work from home setting, in which some of the employees have no prior experience and must cope with all of the changes of the new work environment, including with the technological adaptation (Mazmanian & Erickson, 2014). Although the use of collaboration platforms such as Microsoft Teams facilitates collaboration, employees may witness increased communication volumes and be prone to experience lower performance and increased stress levels (Stephens et al., 2017).

3. Research methodology

The present research falls under the category of qualitative research and is realised with a view to allowing a better understanding of the issues tackled in this paper. The obtained results are of a qualitative nature and cannot be extrapolated.

The circumstantial enquiry targets managers/ specialists/ professionals in their respective field of activity, as they have an overview of the current and future situation of the unit they lead and the economic climate in which the activity is carried out. The main characteristic of circumstantial enquiries is that, instead of exact numbers, the usual answer is an appreciation of the indicator in relation to the "normal" level (INSSE, 2021). The received answers are processed and the final result is obtained under the form of a circumstantial percentage point balance, which represents the difference between the percentage of those who indicated the positive variant of the phenomenon and the percentage of those who indicated the negative variant. The answers "normal", "the same", "indifferent", "approximately the same" are ignored.

A positive circumstantial balance shows that favorable answers are more numerous than unfavorable ones and, thus, a favorable evolution (tendency) of the phenomenon.

A negative circumstantial balance shows that unfavorable answers are more numerous than favorable ones and, thus, an unfavorable evolution (tendency) of the phenomenon.

For a better understanding of the importance and relevance of this method, we present below a series of methodological aspects that we took into account.

3.1 The preliminary phase of the research

Understanding the phenomenon of telework is the problem of decision makers. Through this research we propose to delimit certain coordinates which target a time frame of one year regarding the investigated phenomenon.

The goal of the research is to know better, identify and delineate some possible evolutions concerning telework, within a predictable time frame. Regarding the objectives of the research, we intend:

- to identify the tendencies of improvement or worsening of the socio-economic situation;
- to evaluate the increasing or decreasing evolution of the turnover;
- to establish possibilities for the carrying out of telework activities;
- to know the positive or negative impact of telework on professional and personal life;
- to make evaluations concerning the extension or not of telework in the next year;
- to determine the positive or negative impact of telework on the turnover;
- to determine the perception regarding the evolution of the number of employees (increase vs. decrease);
- to establish the causes which impact the evolution of the number of employees;
- to highlight some tendencies concerning the number of employees in the next year;
- to identify the most relevant challenges regarding the limitation of the company's activity.

Taking into account the previously presented analysis of the literature, we consider the following hypotheses:

- H1: The socio-economic situation in Romania will be approximately the same;
- H2. The evolution of the turnover will be decreasing;
- H3: Telework is carried out in a major proportion;
- H4. The impact of telework on professional life is positive;
- H5. In the next year, telework will be approximately the same;
- H6: Telework has a positive impact on the turnover;
- H7. The decrease of the number of teleworkers, as a result of the pandemic;
- H8: In the context of the end of the pandemic, telework within the company will be reduced;
- H9: The most important challenges regarding telework are: getting infected with Covid, the work program, proper equipments.
- H10: Identifying telework as an important cause for the limitation of the company's activity.

We think that the obtained information will contribute to a better understanding of the investigated phenomenon, namely telework, as well as to an anticipatory approach of the related issues; also, it allows the formulation of a certain perspective on telework in a time frame of one year.

3.2 Research design

The primary information that our research is based on (sources of information) are obtained from small and medium-sized organizations, through their representatives (managers or entrepreneurs/business owners), who responded to our enquiry.

Regarding the selection of the modality of gathering and structuring information, the used method is that of self-registration (organization managers fill in the form, which was sent to them by e-mail, according to instructions). The sample includes 58 managers, coordinators, entrepreneurs, professionals with at least 5 years of experience in their field of work, who coordinate activities from the sphere of services of some organizations and carry out economic activities mostly in Bucharest and Ilfov county.

The enquiry took place between February and March 2021, via e-mail.

3.3 Methods

The gathering of information was made through a google form (questionnaire) sent via e-mail. The situation regarding the positions occupied by the investigated managers/ entrepreneurs is presented in the table below.

Table no. 1: Positions occupied by respondents

Current no.	Position	No. of investigated persons
1.	Coordinating teacher/ Training coordinator	8
2.	Administrator/ Entrepreneur	7
3.	IT Coordinator	3
4.	Activity coordinator in public institutions	5
5.	Quality manager	2
6.	Marketing/ market research coordinator	6
7.	Project/ team manager/ coordinator	3
8.	Accountant/ chief economist/ chief financial officer	6
9.	Sales/ commercial/ logistic manager	10
10.	Travel agency coordinator	1
11.	Real estate agency coordinator	1
12.	Pharmacy supervisor	1
13.	Product manager	4
14.	Medical care manager	1
TOTAL		**58**

Processing the information implied preparing the data and information in order to be analyzed and interpreting everything through the use of editing, codification and tabulation.

Table no. 2: Question text and abbreviation

Code	Question	Negative	Neutral	Positive
q1	1. How do you evaluate the evolution of the socio-economic situation in the following year:	it will get worse	it will remain approximately the same	it will improve
q2	2. How do you evaluate your company's demand (turnover) in the following year:	it will decrease	it will remain approximately the same	it will increase
q3	3. Have there been teleworking activities in your company in the past year?	no	hybrid	yes
q4	4. What is your opinion regarding the impact of telework on the professional life of employees?	negative	neutral	positive
q5	5. Do you think that telework in the following year:	will decrease	will remain approximately the same	will increase
q6	6. How do you characterize the impact of telework from your company on the turnover?	negative	indifferent/ satisfactory	positive
q7	7. How do you think that the telework in your company will impact the turnover in the following year?	low/ very low	indifferent	good/ very good
q8	8. Do you estimate that the number of employees from your company in the past year:	decreased	remained approximately the same	increased
q9	9. Do you estimate that the number of teleworking employees from your company in the following year:	will decrease	will remain approximately the same	will increase
q10	10. Do you estimate that, in the context of the end of the pandemic, telework within your company:	will be reduced	will remain approximately the same	will expand

q11	11. How do you evaluate the impact of telework on the personal life of the employees from your company?	negative	indifferent/ satisfactory	positive
q13	13.Are there causes which limit the economic situation of your company?	no	-	yes
q14	14. If the demand/ turnover of your company increases, could you increase the volume of the activity with your current resources?	no	-	yes

Moreover, we employed open questions (q8.1, q 12, q 13.1, q 14.1), thus giving the respondent the possibility to nuance an answer to a closed question. These questions target the finding of answers to problems such as: the identification of the causes which make their mark on the evolution of the number of employees, the main challenges of telework within the respective company, the identification of the causes which limit the company's activity, the extent to which the company's activity could increase, using the current resources, in the context of a higher demand.

The analysis and interpretation of information takes into account the highlighting of some more important aspects drawn from the conducted research.

The presentation of the research results includes the main elements emphasized after the enquiry was conducted.

4. Research results

In the following table we present the percentage of the evaluations for each question, as it resulted from the given questionnaires; these are the analysis elements on the basis of which we determined the circumstantial balance.

Table no. 3: The evaluations' percentage

Question	Negative (%)	Neutral (%)	Positive (%)
q1	25.9	44.8	29.3
q2	12.3	61.4	26.3
q3	6.9	24.1	69.0
q4	24.1	27.6	48.3
q5	19.0	51.7	29.3
q6	19.0	37.9	43.1

q7	13.8	43.1	43.1
q8	28.1	63.2	8.8
q9	29.8	54.4	15.8
q10	44.8	36.2	19.0
q11	26.3	28.1	45.6
q13	43.1	-	56.9
q14	37.9	-	62.1

Regarding the general socio-economic evolution, managers estimate a slight improvement, almost imperceptible, the circumstantial balance being of 3.4%; we can state that the estimates are moderate. We evaluate it as being a moderate opinion of a rather sustained current situation. Thus, hypothesis H1 is confirmed.

According to the estimates, the turnover/ demand will register an increase in the following year, the circumstantial balance being of 14%. We think that the managers' opinion is interesting, to say the least, in the previously mentioned context concerning the general evolution of the socio-economic situation. Therefore, we underline the cautious optimism of professionals who estimate an increase in demand for the company they represent in the context of a relatively constant general climate. Thus, hypothesis H2 is ruled out.

The enquired managers were asked to give an answer regarding the concrete situation of the company they represent in relation to the carried out telework activity and the obtained results show that in 69% of the cases this type of activity is exclusive, in 24.1% of the cases there was a hybrid work program, and in 6.9% of the cases there were no telework activities. As the majority of them are in the service sector, the fact that the telework activities are carried out in a significant proportion is understandable, as the specificity of the work allows this. Thus, hypothesis H3 is confirmed.

It is interesting to see the managers' perception concerning the impact of telework on the professional life of those who carry out remote activities: positive 48.3%, neutral 27.6% and negative 24.1%. Therefore, the circumstantial balance is of 24.2%, which shows a positive perception in relation to the impact of telework on the employees' professional life. Thus, hypothesis H4 is confirmed.

The tendencies of telework in the following year are of major importance for companies and for employees. As a result of our research, we notice a moderate positive tendency for extension, which has a circumstantial balance of 10.3%. Thus, we can state that hypothesis H5 is partially true, telework remaining approximately the same within the time frame of one year, with a slight tendency to extend.

Managers characterize the impact of telework (currently carried out) on the company's turnover as being a positive one and the circumstantial balance is relevant in this sense: 24.1%. Therefore, telework does not have a negative influence on the company's turnover, which is encouraging given the fact that the pandemic is still a hot topic, telework will be

maintained, at least at the current level, and the perception concerning the effects on the profession are positive.

Regarding the impact of telework on the following year's turnover, the managers' perception is positive, the circumstantial balance being of 29.3%. Thus, hypothesis H6 is confirmed.

In relation to the evaluations of the number of employees from the company they represent, as a result of the pandemic in the past year, managers state that it declined, the circumstantial balance being negative, of -19.3%. Their efforts were concentrated on maintaining the jobs, a goal which could not be entirely achieved, as some activities were reduced. The causes which led to this situation are numerous (q 8.1), but the most relevant are: financial aspects, restructuring, low demand (fewer orders), outsourcing, the employees' professional reorientation, new opportunities.

Within a time frame of one year, the managers' perception is that the number of teleworkers from their company will decrease, the circumstantial balance being of -14%; we notice a cautiously optimistic perception in the idea of a reduction of the pandemic's effects and of a return to the previous work form. Thus, hypothesis H7 is confirmed.

The managers' point of view, their perception regarding telework in the context of the end of the pandemic is that it will be reduced and the negative circumstantial balance of -25.8% is relevant in this sense. Thus, hypothesis H8 is confirmed.

Carrying out telework activities also implies a series of challenges for which managers had to find proper solutions. We grouped these challenges into several relevant categories:

- *Getting infected with Covid – 19*: identifying the most adequate prevention measures in the workspace (for those situations in which the physical presence was necessary), finding solutions in order to replace the colleagues who got sick and could not work;
- *Client networking*: the lack of the face-to-face contact, of the direct relation with clients, the impossibility to connect when infections were reported with the provider or the beneficiary;
- *Work program*: adapting to the new reality, the lack of a clear and orderly work program, coordinating the employees' activity with the program of their children who studied online (an issue accentuated also by the lack of sufficient space in the home), combining, sometimes in an unfortunate manner, the work routine with the personal one;
- *The connection with colleagues and subordinates*: the lack of social relations, difficult and slow communication, which brought frustrations, on the one hand, and, on the other hand, difficulties in carrying out work tasks, but also house chores, prolonged business meetings, the migration of the workflow towards the electronic variant in a short amount of time, the difficulty of following up on work results, communication with other departments;
- *Work equipment and employee training:* providing equipment and giving them to employees, internet speed, the fact that there are internal computer programs that

employees cannot access from home, the digitalization of each employee and training them in remote connections.

Thus, hypothesis H9 is confirmed.

Managers admit that there are causes which limit the company's activity, the circumstantial balance being 13.8%. Regarding the causes which determine this phenomenon, we notice the following (presented in the descending order of their mention):

Table no. 4: Recorded frequencies

Current no.	Mentioned cause	The frequency with which it was mentioned (no. of responses)
1.	Insufficient demand	16
2.	Work force/ telework	15
3.	Equipment	6
4.	Problems with suppliers	4
5.	Financial aspects	4
6.	Other problems	13

Thus, hypothesis H10 is confirmed.

The following figure (Figure no.2) sums up the evaluations' results, taking into account the three enquired aspects: positive, neutral and negative.
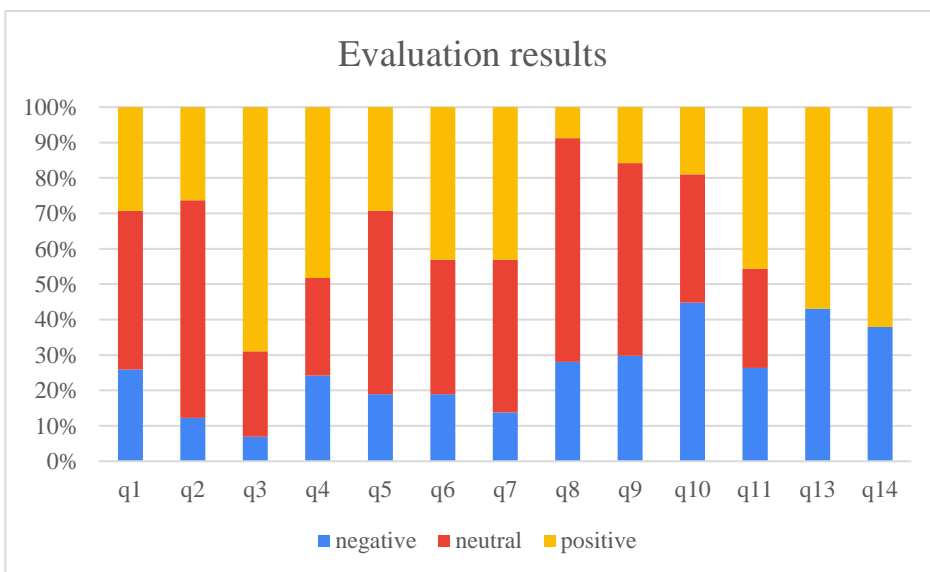
Figure no. 2: Evaluation results

5. Conclusions

The present article contributes to the literature through the obtained qualitative information on the enquired subject, which is currently a hot topic. The telework phenomenon is tackled through the eyes of managers/ entrepreneurs from small and medium-sized companies, who have an experience of at least 5 years, from two perspectives: the concrete one, the perception regarding the activity carried out in the first year of the pandemic, and the future one, within a time frame of one year.

Analyzing the activity carried out in the last year, the managers' perception is that telework has a positive impact on the activity. The pandemic is the premise of a new paradigm regarding economic activity and the enquired managers stated that they had to face new challenges especially in relation to the organization and coordination of work, but also concerning the continuation of the activity. Hygiene in the workplace has new meanings, especially prevention, (re)creating (new) circuits for coming to and leaving work (where office activities were carried out, for example).

Working from home (remote) using equipment and modern technologies meant, in some cases, new costs, purchases of such equipment, training programs or costs with the discounted expenses required by employees in order for them to be able to carry out their activity (electricity, internet etc.).

From the analysis of the answers, an interesting aspect emerges, namely that during the pandemic certain company resources were not used, the main cause being a decrease in demand and, implicitly, of the turnover.

Regarding an increase in demand, managers declared that they can increase the volume of the activity with the resources that they currently have, the circumstantial balance being of 24.2%. The increase of the activity volume can be achieved, according to the managers' estimates, with percentage points which vary between 20 and 50, or even more.

After the pandemic, telework will be reduced, this is the managers' perception (or maybe it is wishful thinking), despite the fact that it currently has a positive impact on the turnover and also on the professional and personal life of employees. This perception could (seems to) come from the necessity to return to the previous way of working or from the desire to control, an attribute of management which was less exercised during the pandemic and which requires the managers' creativity.

From the point of view of managerial implications, the results of this research highlighted the fact that telework is the new reality of economic activity, but it will have a major role in the future, and in this sense, companies will be restructured, internal regulations will have to be rethought, as well as job descriptions, employment contracts, internal marketing, teleworker motivation, bonuses, workspace etc.

The study's main limitation is that the results cannot be extrapolated to the entire population, as previously mentioned, due to the specificity of the carried-out enquiry, which is a qualitative one. In other words, the results of the performed research can serve as a basis for conducting a future quantitative study.

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IS E-LEARNING THE WAY OF THE FUTURE IN EDUCATION?

Vlad Cârstea, PhD [6]

Abstract:

Technology has been a part of our educational systems for more than a decade and has been reshaping it constantly. From computer aided presentations, to online libraries, to online courses, the information technology has been offering the opportunity to access knowledge from virtually any point on Earth. The use of online learning platforms makes learning more attractive for the students and for the younger generations, in particularly, that embrace technology and all its benefits, far easier than anybody else. After the Covid-19 outbreak in March 2020, humanity had to shift from the offline everyday life to the online everyday life. The educational system was no exception and had to adapt from face-to-face teaching to online teaching, a shift which, for the majority, was not an easy task to do, at all the levels: economical, logistical and, of course, technological. The online teaching also revealed a series of shortcomings, that were unheard of in the offline teaching system and they had to be overcome, as fast as possible, in order to reduce the interruption in the students' learning. The conclusion of the article will reveal that the tech-aided learning, although it has its challenges, will prevail even after the pandemic, as all its benefits will widely spread in the educational system throughout the world.

Keywords: technology, e-leaning, education, pandemic.

1. Introduction

Education can be defined, in a simple way, as the interaction between two or more persons, one being the teacher/educator/trainer and the other(s) being the pupil(s)/student(s)/trainee(s). The purpose of this interaction is the flow of knowledge from one person to the other.

This process has been done almost the same way since the times of the ancient Greece, where two opposing ideas were presented in order to make people take sides and offer arguments for their ideas. Moreover, even the spaces where the educational process took place were organized in the same manner, to give the professor/trainer/educator the main role.

During recent years, technology slowly emerged into the educational process, into the classrooms, which started the change in this centuries old system. The first influences started during the late 90s, early 2000s when online forums and messaging boards took the educational system by storm as they brought together the demand and the offer for knowledge. The biggest advantage was that the information could be easily accessed

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virtually from any place in the world, with just a monthly subscription to the local internet provider. The downside was the reader had to have some basic knowledge of that particular subject, as the information was scattered everywhere and sometimes did not come from a reliable source, as basically anyone could post on these platforms.

2. Online or offline

At the global level, we are witnessing some fast-growing and irreversible trends at all levels of education: More and more students own and use laptops, tablets and any other mobile devices. For the students that do not own such a device the education institutions may provide the necessary tools. For the higher education levels, the majority of students own such devices.

The academic staff is using the same technology which allows far better results in the educational process as it provides more student-oriented curricula. Long gone are those days when teachers had to spoon-feed the knowledge to their students. This means the majority of time was spent on the theoretical approach instead of the applied knowledge and developing proactive skills, which is more useful in real life. Furthermore, the fact that these instruments allow access to numerous users, simultaneously, users that are not necessarily on the premises, gives students a whole new world of opportunities.

For the higher education system, the change is even more visible and the demand for a new way of learning is even bigger, as students, want to be able to access their information fast, at any given time and from any mobile device they own. Moreover, even in the classrooms the students want to use their devices as a learning tool, and they want the professors to give them this opportunity. According to Melissa Woo[7], Vice Provost for Information Services and CIO at University of Oregon, "University libraries are being converted to learning commons with nary a book insight…" in order to create the environment the students need and want, the place where they can use the new technology to obtain all the information they need. The Vice Provost also believes that knowledge should be created online, on social media like platforms as the new generations of students spend most of their free time, surfing on the internet. As such, it's only natural to offer them the opportunity to learn in the same environment they feel more natural.

This shift in learning spaces, where the educational process moves away from physically classroom to a virtual classroom represented by all the learning platforms is known as flipped classroom[8]. This means the professors use the classroom time to explain or to clarify the delicate aspects of the students' reading. As a result, the learning experience is more oriented to the students' educational needs and less on pushing theoretical knowledge.

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[7] Melissa Woo – "How technology is reshaping education"
[8] Matthew Lynch - "Why digital learning is reshaping education"

The use of technology in education has revealed another benefit: teamwork. During the classes, as students are required to work on projects based on what they read online, they will also be inclined and encouraged even to work together in order to have better and faster results in their research. The benefit, on the long run, is that they are accustomed with teamwork, as well as with individual study, so students will better fit the labor market, after graduation.

The plethora of available information and the easy access to it ensures that education no longer means memorizing all sorts of data, but the understanding and usage of that information. The students are now encouraged to think and come up with solutions to various problems, based on the information they accessed online. This higher-order thinking is also preparing the students for the labor market demands, as it develops critical and analytical thinking skills.

As technology becomes more present in education it's only natural that digital literacy becomes part of the curricula in a continuously growing number of countries. Although during the dawn of technology, the use of a computer was considered a more or less natural skill, today it evolved into a taught discipline in classrooms throughout the globe. As such, the graduates will have the necessary tools to be able to access knowledge and, in the same time, to be more desirable to the labor market.

3. New tech trends in education.

Technology is reshaping education through a few trends[9] that have been identified:

- Digital books;
- Multi-sensory classrooms;
- Remote learning;
- Adaptive learning technologies;
- Virtual reality and augmented reality;
- Artificial intelligence.

The identified trends are considered to be present in most countries where technology has been involved in education. Moreover, these trends considered to be irreversible as the benefits far exceeds the shortcomings.

Digital books. The digital textbooks are taking by storm the classrooms throughout the world as they are far more attractive than the old printed out textbooks. By using digital

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[9] Amol Arora – "7 Technology Trends Reshaping School Education"

books, the need for constant printing (as the textbooks need to be updated periodically) is reduced as well as the costs for printing as well as the need for paper. So, the digital books have only advantages when compared with the printed copies.

Multi-sensory classrooms. The new technology allowed schools and universities to take the classroom learning environment from a dated way of education to the future. The technology used is the interactive whiteboard that fully supports all types of learning: video, audio and kinesthetic. These whiteboards offer a more attractive learning experience for all segments of education.

Another consequence of reshaping education by technology is the fact that the classrooms themselves have to be redesigned in order to allow students to benefit from the mobility that the technology offered them.

Remote learning. As courses become available online through different platforms, the need for physical attendance in the classroom becomes less important. Classes and courses can be accessed virtually from any point on Earth as long as there is a stable internet connection. This allows students everywhere access to the best education possible and tailor it to the students' real needs.

Adaptive learning technologies. This type of technologies help professors / educators / trainers to better focus on every student's learning needs. In every group there some students that are more advanced in the discussed subject than the rest of the group, as well as vice-versa. This technology allows professors to offer students exactly the information they need, at the rate they need or feel comfortable with.

Virtual reality (VR) and augmented reality (AR). Virtual reality technology offers professors and students alike the possibility to experience knowledge in a way not possible up to recent times. This technology, just like the interactive whiteboards, offer students a multi-sensory learning experience, that will ensure better results in terms of comprehension and processing the information. Augmented reality is another useful and innovative technology used in education. Compared with virtual reality which offers a computer-generated reality, the augmented reality uses only few computer-generated elements, placed in a real world, in real time. This technology also helps students to grasp the concepts they study about, faster, easier and in a more pleasant manner.

Artificial intelligence (AI). This technology is present in all the sectors and the education system makes no exception and it is believed that in the near future will be even more present. The benefits of using AI come from two directions: the first one being the accessibility of learning for students and the other offering the professors the most realistic and detailed assessment of their students' performances.

4. Education during pandemic.

The education system had to step into the 21st century with the adoption of technology as a teaching aid but also as a long-term strategy. The classical way of teaching, where professors meet their students and share knowledge, ideas, take part in debates had to intertwine with virtual libraries, online courses, and AI aided testing. Of course, the change has been made gradually in order to try to overcome any possible shocks, but also because of costs. The shift from the traditional education with a pen and paper to the digital one posed numerous problems in terms of infrastructure and consequently in terms of costs. The problem becomes even more delicate if emerging economies come into discussion. However, the biggest problem for the global education system, had sprung in March 2020, when the Covid-19 outbreak put life, as we know it, on hold. It was the debut of an unprecedented crisis in modern times and all the authorities throughout the world had been caught off guard. So the first solution was to stop everything in the attempt to contain the spread of the virus. Schools, universities and any institution involved in education had to shut down their operations. At first, for a limited period of time, then for an unlimited time. The economic crisis that countries were facing could only mean that the national budgets limitations and constraints would impact in a negative way the education system. On the long run this would turn into a human resource crisis even after the covid-19 crisis will have ended[10].

Figure 1. School closure's effects on learners[11]

COVID-19's Staggering Impact On Global Education

Number of learners impacted by national school closures worldwide

1.38 billion

Figures refer to learners enrolled at pre-primary, primary, lower-secondary, and upper-secondary levels of education, as well as at tertiary education levels.
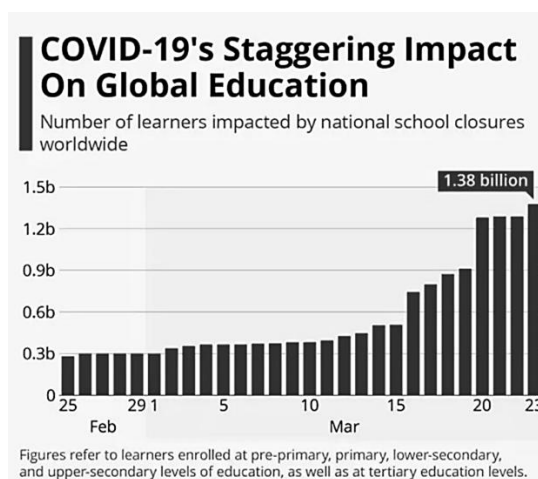
All the national governments had to come up with solutions that would ensure access to education but complying with the ongoing restrictions to limit the Covid-19 spread. Naturally, the solution was to transfer all the activities online since technology was already used for teaching. Unfortunately, this solution led to another problem: the inequalities in digital access for a number of countries, as a result of poor allocations of investments in infrastructure and low-income households.

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[10] World Bank – "Mission: Recovering education in 2021"
[11] Source: UNESCO

Consequently, some of the national authorities, with help from supranational institutions, like the European Union, the World Bank allocated the financial resources needed to update the IT&C infrastructure so that the learning process should be the least affected by the pandemic.

The timeframe for this transition from part offline-part online to full online, was another issue that the national authorities and the heads of al education institutions had to address, because, as mentioned before, the main objective was to reduce as much as possible the timeframe when students did not receive any training.

Universities and all higher education institutions, in general, did have the advantage of being able to transfer their activity online with the least number of challenges, as at this level of education, is far easier to adapt the courses to online teaching, and using all the advantages offered by technology.

The most affected, however, were the institutions that are part of the first educational segments, where the need for physical attendance and real interaction with the professor in a classroom is decisive for the future development of the individuals. Unfortunately, the hybrid system is not the best solution on the long term for these segments, as the children will get even more confused and at best, they can become functional illiterates.
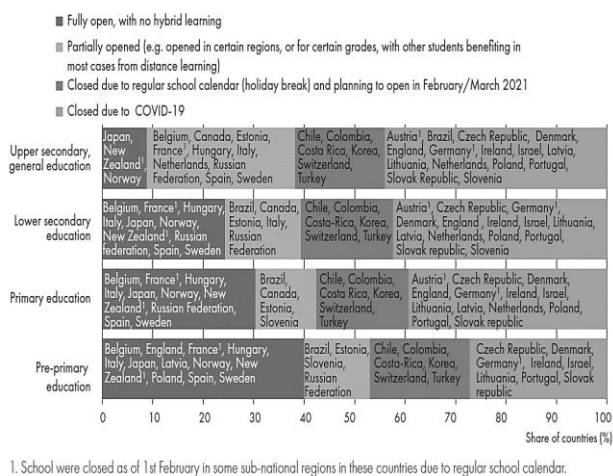
Figure 2. School closure since February 2021[12]

According to different sources the pandemic should end in late 2021, best case scenario, or in 2022, worst case scneario. Of course, the question that everyone's is asking is what will happen with education after Covid: Will the technology greatly influence the way the younger generations get educated? Will schools and universities return to the old way of doing things just like before Covid? Or maybe a hybrid solution is the best answer for the education needs of the future generations? Whatever the answer might be, or which scenario

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[12] Source: OECD/UNESCO-UIS/UNICEF/World Bank Special Survey on Covid.

will be implemented, all the decision factors must examine very thorough what outcome will have each situation.

According to a paper published by McKinsey[13] & Company, on their website, and based on the latest PISA[14] study[15] there are five key components that must be taken into consideration, in order to maximize the students' learning experince and have the best results:

- The type of device matters;
- Geography matters;
- Who is using the technology matters;
- Intensity matters;
- A school's system performance matters.

The type of device matters. According to the study OECD conducted, some devices have a positive impact on the students' outcomes, some have a negative impact and some have little or no influence at all on their performance in school. The conclusion was clear: for the students where a projector and internet connected computers were used in the classroom, the performance was far better, while the use of laptops and tablets showed had a negative impact on the students' results.

Geography matters. Depending on the geographical region, the use of technology in classes can strongly influence the outcome of the education process. For instance, the students from North America, that used laptops in the classrom, scored far better results than students from any other part of the world. This result, although a pretty alarming one, can be explained by the fact that American students start using laptops as a learning tool earlier than the rest of the survey's respondents .

Who is using the technology matters. The results are highly influenced by the person who is using the technology as a learning tool. The best results were recorded in all regions of the world, when the teacher used the computer as a learning tool, while the worst results were recorded if just the students themselves used computers for learning. This showes that although technology is a very important tool, teachers have a decisive role in the students' education.

Intensity matters. The question in the study had two components: how much time is spent on a computer in the classroom and how much was spent at home, respectively. The results showed quite important differences, meaning that during the classroom the best results were obtained either by the students who spent no time at all using the computer and by those who spent more than 60 minutes in front of the computer. The students with moderate time spent had the lowest results. For the second component of the question, the results were differentiated according to the geographical region: students from Asia, Middle East, non-

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[13] Jake Bryant, Felipe Child, Emma Dorn, Stephen Hall – "New global data reveal education technology's impact on learning"
[14] Programme for International Student Assessment – a worldwide study conducted by the OECD
[15] PISA 2018

EU Europe and North-Africa had better results if they spent no time using computers for homework, students from Latin America and EU who spent a modderate amount of time got better results, but the best performance was obtained by the North-American students who spent more than 60 minutes using a computer for homework.

A school's system performance matters. The schooling system's performance will influence how the students will perform with the help of technology. According to the PISA results, apart from the North-American students who spend more than 60 minutes using the technplogy for learning purposes, the students from other regions recorded lower scores, the lowest being recorded by students from Middle East and Northern Africa.

Figure 3.Amount of time on devices associated with highest academic results[16]

The results of the PISA survey, although not very flattering for the education system from different parts of the world and mainly up to this point in time when it was believed that technology influenced education for the good, must be interpreted correctly and the decision making factors should act accordingly.

As the study revealed, the best results were recorded by the students form United States as they use technology as a learning tool from the early stages of education and the American

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[16] Source: Jake Bryant, Felipe Child, Emma Dorn, Stephen Hall – "New global data reveal education technology's impact on learning"; OECD

education system integrated technology as an effective tool for improving children's learning outcomes.

The lowest results were recorded by the regions where the education system suffers from low allocations of capital from national budgets and where there infrastructure is under-developed, so the professors, as well as the students, cannot benefit from technology as well as they could.

Another explanation for the low results is the fact that there is a learning curve for all the implicated factors: students, professors and the system as whole. According to the study, the systems that used the technology as a learning tool, for a longer period of time, got better results, just because the professors and the students, learnt how to use computers, laptops, interactive whiteboards to their advantage and not just occasionally in preparation for some form of evaluation.

5. Conclusion

The tech-aided learning, although it has the benefits of being more accessible both in terms of geography and in terms of costs, (all the students need is a stable internet connection and device that will allow to connect to the virtual classroom) also has its challenges. Schools and universities alike will have lower expenditures, since courses can be provided online, without the logistical nightmare involved by the physical ones.

On the negative side online teaching has not entirely solved all the issues that came up with the advantages, like the evaluation issue as students can be easily distracted by the surrounding environment they access the courses from. The lack of social interaction seen predominantly during the pandemic is another shortcoming of the online education system and unfortunately no matter how advanced the technology will not be able to satisfy the social interactions between people.

After the pandemic the solution for the education system is considered to be a hybrid system (part online, part bricks-and-mortar based)[17], which will mix the benefits from both systems in order to eliminate as many shortcomings as possible at all the levels of the system, whether is the primary education, the secondary one, or higher education institutions.

In this new scenario, the teaching community will have to develop new skills in order to better use this technology, but also to be able to teach the new generations of students digital literacy as it must become a vital component in any curricula.

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BANK RISK MANAGEMENT CASE STUDY: TRANSILVANIA BANK

CIULEI Oana[18]

ABSTRACT

Throughout out this paper, I am trying to cover a meaningful topic in the banking system - the importance of risk management for every banking institution. There is a complex diversity of risk types each bank faces and a prudential approach can assure the sustainability of the banking system and the economy itself. Furthermore, a practical approach will be presented by conducting a study case, focused on the activity of a bank operating in Romania. The results of the research are based on data provided by the bank, taking in consideration as a time frame the period 2008 to 2020 in order to analyze the effects the crises can have. In this way, we will be able to understand that risk management is a vital process, helping banking institutions protect themselves from unexpected events that could strongly affect their activity.

KEY WORDS: banking risk, banking institutions, risk management.

1. GENERAL CONCEPTS OF BANKING RISK

In banking industry, risk is seen as *a phenomenon that arises during the course of banking operations, influencing the way the banking institution operates as it causes a number of negative effects, i.e. affecting the functionality of the institution, reducing profits or recording negative results.* (Dobre E., 2009)

Banks need to place a particular emphasis on the level of the risk they accept in their strategies. They also need to acknowledge the necessity of risk mitigation given that their main objective is the profit maximisation.

Risk exposure is an important concept in banking risk management. *A bank's risk exposure should be addressed from two points of view, that the bank is both a borrower and a lender at the same time* (Anghelache C., Sfetcu M., Bodo G., Avram D , 2017). A bank carries out two main activities: it gathers resources in the form of deposits (passive operations) and distributes the resources to customers in the form of loans (active operations). These activities increase bank's exposure to risk. Even if both operations carry a certain level of risk, passive operations are recognized as being less risky than the active operations.

The solution to controlling and/or mitigating banking risk is the implementation of an effective banking strategy that includes management procedures and programs aiming to minimize the likelihood of risk occurrence and the potential risk exposure. (Nedelescu M.,

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Bunescu P, 2017). Among all of these actions, it is necessary to apply some essential and generally accepted steps such as: identifying the potential risks, assessing, monitoring, controlling and eliminating them.

The bank's strategy must comply with a set of rules imposed by domestic and international legislation that aiming to establish a prudent banking framework. At an international scale, banking risks are regulated throughout **the Basel Agreement**, that lays down a set of provisions aiming to mitigate the risks in the banking system. This agreement strongly emphasis with an appropriate sizing of bank's own funds. In Romania, banking risks are legislatively regulated by **the National Bank of Romania** (NBR). This supreme authority recognizes the significance of an adequate capital and liquidity level for controlling the risks faced in the Romanian banking industry.

The main categories of managerial risks in banking are:

- *Financial risks - are assumed by the bank throughout the balance sheet management and are considered as being the most important ones because their inadequate management causes most of the bank failures.* (Badea L., 2010). This category includes credit risk, liquidity risk, market risk and insolvency risk.
- *Banking services risks* - operational risk, technological risk, product risk, strategic risk.
- *Environmental risks* - are driven by external factors that can have a strong impact on bank performance. These include economic risk, fraud risk, competitive risk, legal risk.

Among all of these, financial risks are the only risks that can be quantified using a system of indicators. The other categories of risks are generated by exogenous factors on which management has limited control. (Badea L., 2010).

2. THE RISK MANAGEMENT PERFORMED BY TRANSILVANIA BANK

Transilvania Bank (TB) is an universal bank providing products and banking services to individuals and companies. Its main income derives from interest and fees, and its cost structure mainly includes technology and digitization, branch modernization and taxes.

Risk management is part of all decision-making and business processes within bank's activity. The main categories of risks to which the BT Group is exposed are **credit risk, reputational risk, market risk, liquidity risk, compliance risk, risk associated with excessive leverage, operational risk and systemic risk.**

The purpose of this research is to analyze the activity of this institution by using a set of banking risk indicators. According to the results reported for 2020, Transilvania Bank is the most profitable banking institution in the Romanian banking system, with a net profit of

RON 1,197,305 million. Given the estimated profit and the share of ~ 70% domestic capital the bank holds, TB is a representative banking institution within the Romanian banking system.

The data processed for this research comes from the annual reports published by Transilvania Bank which mainly include annual financial statements, reports of the Board of Directors, risk management reports, as well as publications related to risk management analysis. Thus, the information processed in this paper is based on data collected from the bank's internal outlook.

This research uses data and information from 2008-2020 in terms of data selection. The main argument for choosing this time frame is the fact that it encompasses two landmark events for the Romanian banking system, namely: The Great Economic Recession and the crisis caused by the COVID-19 pandemic in early 2020. The results may reflect bank's resilience to shocks and the development throughout Romanian banking sector.

The method used to measure the adequacy of bank risk management includes the analysis of the main indicators: *solvency ratio, non-performing loan ratio, provision coverage ratio, liquidity ratio, current liquidity ratio, loan-to-deposit ratio, GAP sensitivity analysis for liquidity and interest rate risk.*

2.1. SOLVENCY RATIO (CAPITAL ADEQUACY RATIO)

It represents the ratio of the bank's own funds to total risk-weighted assets. As a solvency indicator, it reflects a bank's ultimate ability to pay its debts, measuring its resilience and ability to absorb the risk. This indicator is monitored by the NBR through a prudential supervision system and the value of this indicator cannot be less than 8% according to the regulations in force. According to the bank, the capital adequacy ratio is considered one of the most important indicators that can characterize the bank's evolution. The main components of the share capital held by bank are:

- shares,
- bond-to-equity conversion premiums,
- legal reserve,
- reserves for general banking risks,
- reserves from the revaluation of non-current assets.

As seen in **Figure 1**, the evolution of the indicator is fluctuating, but with a positive trend, maintaining an adequate level of capital in line with prudential banking practices. In 2020, the solvency ratio is at a satisfactory level of 22.23%, well above the minimum level recommended by regulators. Thus, the higher the indicator, the greater the ability to bear default risk and BT shows resilience in this regard.

Figure 1: The Solvency Ratio throughout 2008 to 2020
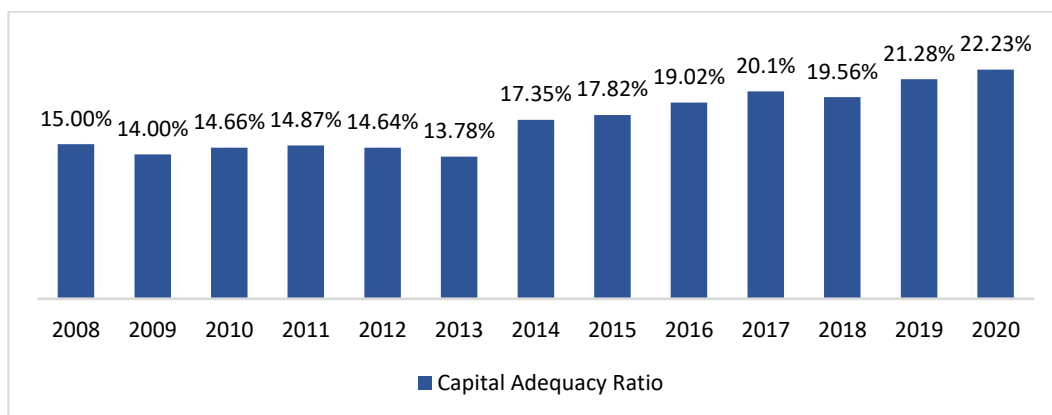
Source: own processing based on data published by www.bancatransilvania.ro

The decrease in the ratio from 2008 to 2009 is explained by a higher increase in risk-weighted assets (mainly loans to customers) than bank's own funds. **The increase from 2013 to 2014** is explained by the increase of the share capital of approximately 20% in 2014 compared to 2013 (from RON 3,082 million to RON 3,702 million).

The high weight of the solvency ratio from 2020 is justified by the increase in equity capital by more than 500,000 thousand lei compared to the previous year, i.e. retained earnings, revaluation reserves or equity attributable to bank shareholders.

Moreover, the solvency ratio remained at a close level in relation to capital requirements, slightly below the average ratio calculated for the Romanian banking system.. The high level of the solvency ratio supports the resilience of the banking sector in the event of adverse events with a negative impact on banking institutions.

Figure 2: Trend of the solvency ratio compared to the Romanian banking system
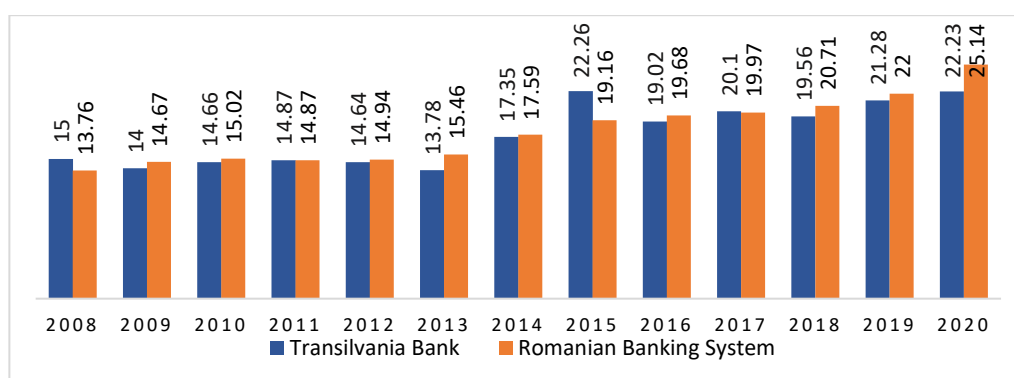
Source: own processing based on data published by the National Bank of Romania [19]

The advantageous evolution of the indicator is mainly due to the evolution of shareholders' capital contributions and the assurance of a considerable level of Tier 1 capital in total equity (subscribed and paid-up share capital, capital premiums, legal and statutory reserves, retained earnings from previous financial years remaining after distribution of profit). All this ensures a high possibility of loss absorption both at bank and system level given the increased capital base compared to 2008.

2.2. NON-PERFORMING LOANS TO TOTAL LOANS RATIO (NPL)

Because one of BT's main activities is lending, the bank is exposed to the risk of default. A loan is considered to be non-performing if the likelihood of repayment by the borrower becomes uncertain or if the period of default has exceeded 90 days.

Figure 3 shows the evolution of the non-performing loan ratio over the period 2008-2020. The NPL showed a fluctuating trend throughout the entire period. In 2008-2013, NPLs showed a steady upward trend, peaking at 12.57% in 2013. Starting with 2014, the overall trend was was declining, with slight fluctuations until 2020. The increase in the NPL ratio reflects a deterioration in the quality of bank's loan portfolio.

Figure 3: The Evolution of Non-Performing Loans to Total Loans Ratio
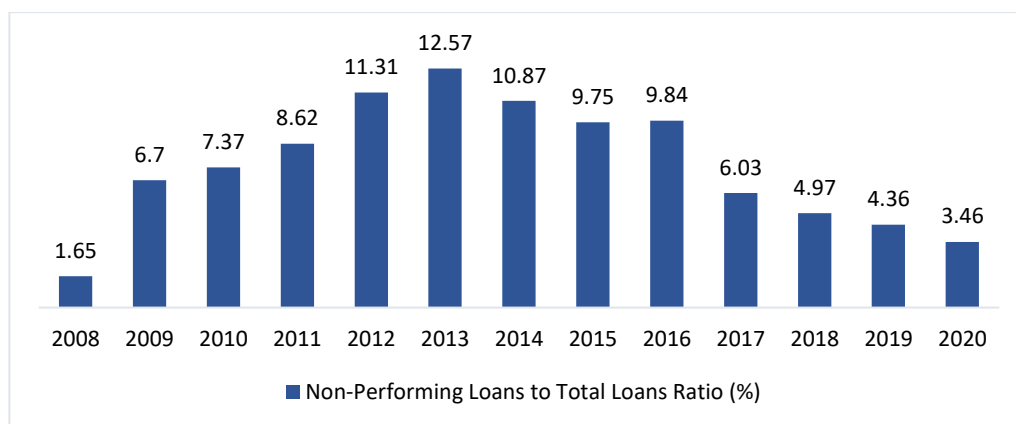
Source: own processing based on data published by www.bancatransilvania.ro

The impact of the 2008 crisis led to an increase in non-performing loans, which remained high up to and including 2016. **The decrease in the share of non-performing loans in 2017** is due to the fact that the bank sold a portfolio of non-performing loans amounting to

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[19] https://www.bnr.ro/StatisticsReportHTML.aspx?icid=800&table=1027&column=

approximately EUR 110 million. The improvement in this ratio in the second half of the period under review is supported by the removal of non-performing loans from the balance sheet.

Figure 4: Trend of the NPL compared to Romanian Banking System
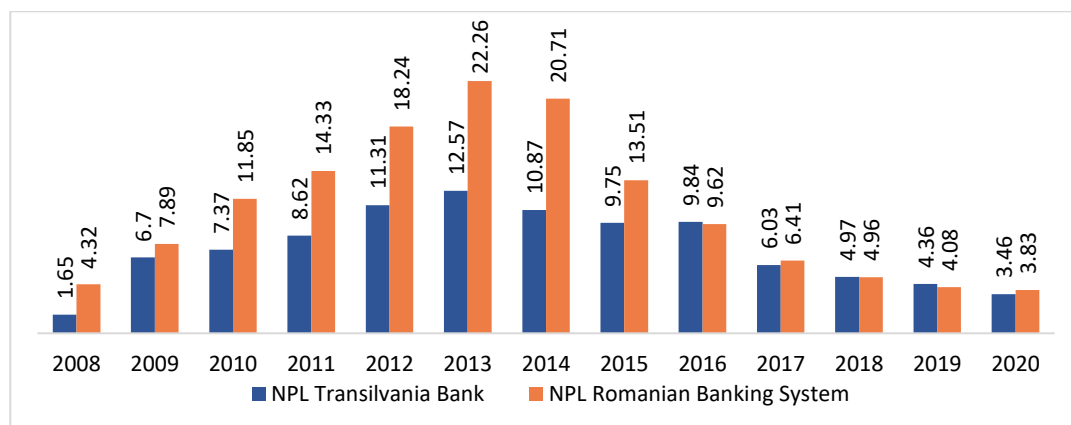
Source: own processing based on data published by the National Bank of Romania

The non-performing loan ratio in the Romanian banking system is determined on the basis of reports made by all banks. Comparing the bank's NPL ratio to the NPL ratio of the banking system, it appears that the NPL ratio is generally below the banking system level and this is a favorable position for Transilvania Bank considering that a lower NPL ratio implies a higher quality of its loan portfolio.

According to data published by the NBR for 2020, the downward trend in the NPL ratio is driven by factors such as the easing of economic policies or a favorable domestic demand environment due to an increase in the creditworthiness of borrowers and thus the quality of the loan portfolio. This indicator stood at 3.83% in December, the lowest level ever.

2.3. PROVISIONING COVERAGE RATIO

Non-performing loans can have a significant impact on the bank as they can negatively affect profitability. These generate losses that can reduce the income obtained from lending. The bank needs to set up provisions to overcome the possible losses arousing from the loans granted in order to combat this credit risk. Provisions are a reserve of funds that remain unavailable for new lending or for absorbing other losses.

Figure 5: The Provisioning Coverage Ratio (2008-2020)
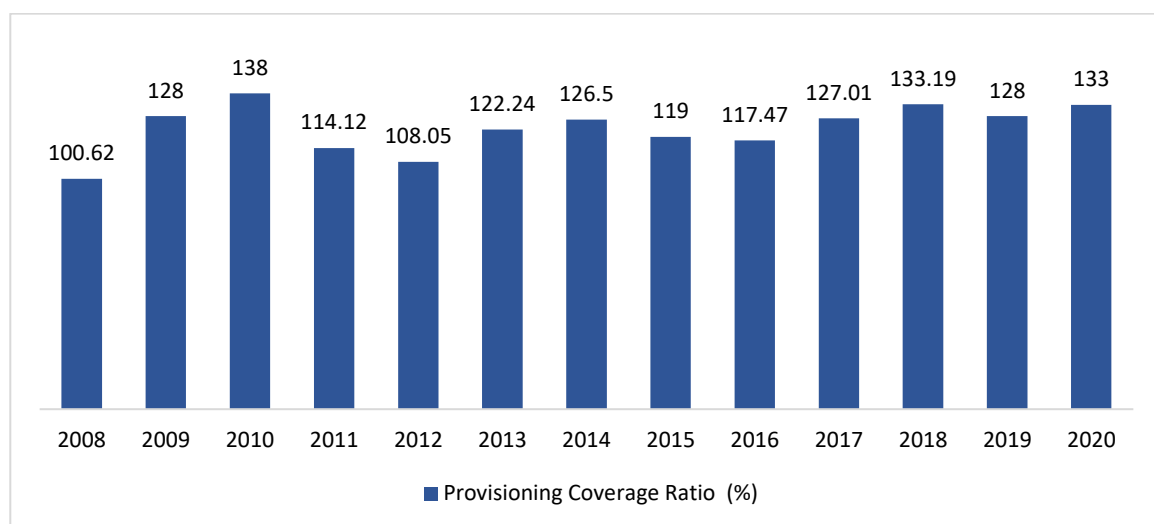
Source: own processing based on data published by www.bancatransilvania.ro

The trend in provisioning from 2008 to 2020 is characterized by minor fluctuations, thus the bank has a consolidated level of provisions to cover loan losses. The maximum provision coverage is 138% in 2010 and the minimum is 108.05% in 2012. The provisions recorded throughout the reporting period are in conformity with bank's prudent approach to credit risk management.

The coverage of non-performing loans with specific provisions and mortgage guarantees remains at a favorable level of over 100%, in line with the bank's risk appetite. According to TB, "provisions for other risks and charges mainly comprise provisions for litigation and other risks taken over through the merger with Volksbank Romania and Bancpost"[20].

2.4. LIQUIDITY RATIO

This indicator is calculated as the ratio of actual liquidity to required liquidity in each maturity band, according to the NBR. Under the NBR regulations, this indicator must exceed the minimum value of 1. The bank recorded satisfactory levels of the liquidity ratio for all maturity bands, being above the minimum level required by NBR regulations throughout the reporting period. As a result, the bank benefits from a solid position and a favorable liquidity thanks to substantial sources of funding.

Table 1: LIQUIDITY RATIO (2008-2020)

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[20]https://beta.bancatransilvania.ro/files/app/media/relatii_investitori/rezultate_financiare/2019/ Rezultate%20financiare/5.situatiile_financiare_individuale_si_consolidate_la_31_decembrie_201 9.pdf

Anul	Indicatorul de lichiditate (%)
2008	3,83
2009	3,13
2010	2,43
2011	2,32
2012	2,11-19,28
2013	2,12-23,59
2014	2,77-22,57
2015	2,26-21,08
2016	1,89-17,54
2017	2,50-25,23
2018	2,00-18,11
2019	1,90-22,35
2020	1,89-29,40

Source: own processing based on data published by www.bancatransilvania.ro

The bank resorts to a series of measures to ensure sound liquidity risk management, such as: raising liquidity through treasury operations (short-term loans, cash on hand, cash on account with other banks, debt securities), capital market operations or external financing from the NBR or institutions on the interbank market. Transilvania Bank is consolidating a liquidity reserve so that it can cover its additional liquidity needs for a limited time and under stress conditions by using alternative scenarios.

2.5. CURRENT LIQUIDITY RATIO

The current liquidity ratio is calculated as the relationship between current assets and current liabilities. Current liquidity mainly comprises cash, cash at central banks and cash at credit institutions. Among all these, the largest share is represented by holdings at the central bank through the Minimum Required Reserve (MRO) held on account with the NBR and it is accounting for about 67% of total current liquidity in 2020.

Figure 6.

Indicatorul lichidității curente (%)
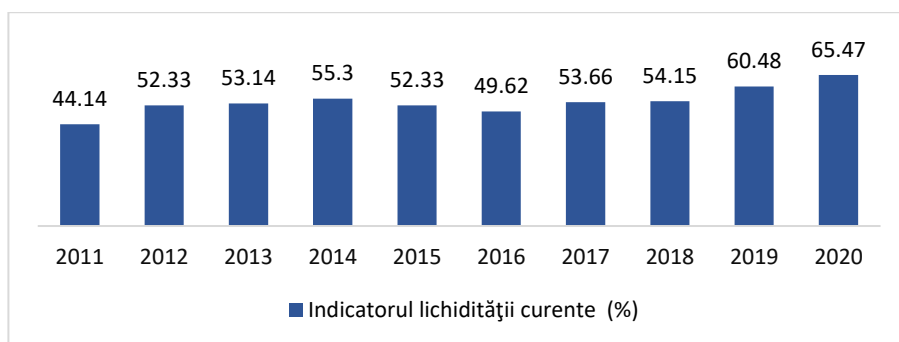
Source: own processing based on data published by www.bancatransilvania.ro

The level of the current liquidity indicator showed a fluctuating but increasing trend. Overall, current liquidity increased each year during the reporting period, the indicator being above the minimum level considered acceptable by the bank in the context of prudent liquidity risk management. However, given the high level of current liquidity, the bank has to be cautious, exposing itself to the risk of mismatching assets with liabilities in the higher maturity bands.

2.6. LOAN-TO-DEPOSIT RATIO

The loan-to-deposit ratio is an indicator used to quantify liquidity risk because it reflects the liquidity of the bank's assets and liabilities. A higher level of the ratio indicates a poor liquidity, and a lower level reflects the bank's ability to use its deposits to fund future loans. The lower the ratio result, the stronger the bank's liquidity and the lower the liquidity risk. Transilvania Bank is aiming to keep this ratio below the 1.

Over the period under review, the loan-to-deposit ratio fluctuated but maintained a downward trend, reaching 0.49 in 2020, almost half of the 0.93 recorded at the beginning of the period in 2008.

The downward trend in the ratio is influenced by the growth of non-government deposits at a faster pace than non-government credits. This phenomenon was particularly pronounced in 2020 due to uncertainty and risk aversion in the context of the pandemic.

Figure 7: LOAN-TO-DEPOSIT RATIO (2008-2020)
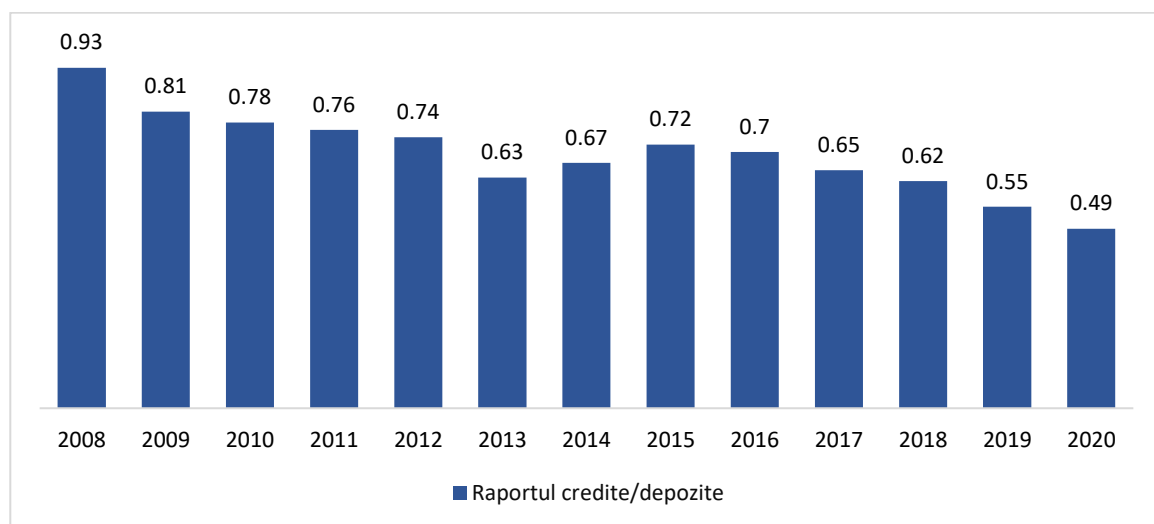
Source: own processing based on data published by www.bancatransilvania.ro

The upward trend for the balance of non-government deposits continued up to and including 2020, driven by the increase in the savings rate and the appreciation of the EUR-LEI. In this respect, the loan-to-deposit ratio maintained a downward trend, with deposits growing at a faster pace than loans. This is a normal trend given the uncertain economic and social conditions caused by the pandemic.

2.7. LIQUIDITY GAP ANALYSIS

The cause of liquidity risk is the mismatch between supply and demand for liquidity. According to the specialists, *a dynamic prediction of potential future supply and demand of funds over a period of time is needed in order to obtain a more realistic quantification of liquidity risk* (Aliu M., Sahiti A, 2019).

The GAP represents the difference between assets and liabilities sensitive to the liquidity risk. If sensitive assets exceed sensitive liabilities, this results in a positive GAP and the bank has an excess of cash flow in the future and it can meet its liquidity needs. Otherwise, there is a negative GAP reflecting a liquidity shortfall and exposing the bank to the risk of not being able to meet its liquidity needs.

Table 3 summarizes the evolution of bank's liquidity surplus over the period 2008-2020. Throughout the period studied, the bank recorded a continuously increasing positive GAP, which means that the volume of sensitive assets is higher than the volume of liquidity risk-sensitive liabilities.

This liquidity surplus reflects the fact that the bank has the capacity to meet future liquidity demands and that it holds a solid reserve of assets that are easily convertible into cash.

Table 2: Evolution of the bank's net liquidity risk position in the period 2008-2020 (thousands of lei)

Year	Gross value (inflows/outflows)	< 3 months	3-6 months	6-12 months	1-3 years	3–5 years	> 5 years	No maturity
2020	30,875,286	9,393,468	-520,559	909,629	-4,543,846	6,194,518	18,928,062	514,014
2019	22,035,181	6,202,407	-1,770,778	-615,694	6,339,897	5,880,828	18,269,748	408,567
2018	22,093,256	2,045,451	-1,873,603	320,015	-2,820,651	5,539,906	18,571,357	310,781
2017	15,759,235	-812,054	-2,028,335	434,537	-912,859	3,818,452	15,018,770	286,975
2016	15,052,940	-1,190,940	-2,100,807	493,943	413,327	4,068,467	13,181,764	187,186
2015	20,947,224	1,876,612	-1,096,941	1,269,855	1,270,579	4,044,344	13,418,867	163,908
2014	12,272,307	-919,513	-1,736,962	1,396,861	4,461,822	2,057,078	6,831,569	211,452
2013	12,457,689	-1,467,418	-1,171,806	4,479,114	3,472,234	1,100,231	1 5.905.942	139,392
2012	2,353,069	-2,597,134	-1,423,813	1,076,667	1,149,943	307,491	3,683,229	156,686
2011	1,995,242	-3,378,568	-1,011,692	1,796,282	598,149	99,926	3,738,491	152,654
2010	1,714,696	-3,258,410	-482,690	1,558,601	755,377	599,784	3,605,549	136,053
2009	1,495,557	-4,452,076	702,074	2,064,171	801,854	-1,423,919	3,684,997	118,456
2008	1,226,868	-3,185,469	92,714	983,648	688,023	-1,169,696	3,757,371	60,277

Source: own processing based on data published by www.bancatransilvania.ro

The main components of liquidity risk-sensitive assets in bank's balance sheet are: investments granted to customers, financial assets at fair value through other comprehensive income and financial assets at fair value through profit and loss. The major part of financial liabilities is represented by: resources drawn from customers, subordinated debt and bonds issued or borrowed from banks on the interbank market or other financial institutions.

2.8. INTEREST RATE RISK GAP ANALYSIS

The acceptable value of GAP should be as close as possible to 0 in order to mitigate interest rate risk. If sensitive assets exceed sensitive liabilities, the bank has a **positive GAP**, in which case the increase in interest rates leads to an increase in net interest income. If sensitive liabilities exceed sensitive assets, this results in a **negative GAP**, in which case the increase in the interest rate decreases net interest income.

Bank's interest rate sensitive assets include credit instruments with variable interest rates, such as: loans and advances to borrowers, cash and cash equivalents, placements with banks. In 2020, the share of loans and advances to customers in total sensitive assets was 58.99%, cash represented 25.62% and placements with banks 13.22%.

Liabilities sensitive to interest rate risk include deposits attracted from banks and customers; loans drawn from other banks and financial institutions, subordinated debt and bonds issued; liabilities arising from leasing contracts; other financial liabilities with variable interest rates.

Deposits from customers are the largest liability sensitive to interest rate fluctuations, their share of total sensitive liabilities in 2020 being 95.60%. They are followed by loans contracted on the interbank market and from the Central Bank, with a share of 3.98%.

Table 3: Evolution of the bank's net position in 2008-2020 for interest rate risk in the banking book (thousands of lei)

Year	TOTAL	< 6 months	6-12 months	1-3 years	3–5 years	> 5 years	Unaffected
2020	**-19,078,986**	-16,275,945	-7,340,289	2,962,119	1,766,906	295,723	-487,500
2019	**-12,780,441**	-10,321,347	-6,174,061	1,694,598	1,854,790	572,668	407,089
2018	**-18,471,350**	-13,688,409	-5,215,727	-178,612	1,204,555	274,529	-867,686
2017	**-12,147,277**	-6,194,161	-5,649,503	-317,885	629,272	372,915	-987,915
2016	**-11,643,524**	-6,796,091	-6,174,160	396,316	718,912	476,376	-264,877
2015	**-4,224,868**	-2,889,095	-3,928,218	868,754	839,356	1,023,985	-139,650
2014	**3,504,679**	3,175,603	-2,376,501	926,358	923,869	261,970	593,380
2013	**2,973,809**	391,786	967,054	768,930	575,195	336,455	717,961
2012	**2,448,778**	4,502,897	-3,158,208	93,897	206,461	40,644	763,087
2011	**2,110,862**	3,706,799	2,320,584	410,997	-61,259	-18,032	392,941
2010	**1,808,309**	2,836,726	-1,966,499	727,401	18,819	-7,299	199,161
2009	**1,442,304**	-913,695	1,508,270	659,846	161,764	22,927	3,192
2008	**1,300,958**	-630,057	1,351,461	488,301	81,138	3,469	6,646

Source: own processing based on data published by www.bancatransilvania.ro

Table 4 shows the fluctuating evolution of the GAP, which recorded a positive value from 2008 to 2014 and then consistently recorded negative values until the end of the period analyzed. This gap is justified by the increase in customer deposits, exceeding by more than 50% the value of loans granted to customers.

The significant gap of -19 billion lei in 2020 reflects the bank's exposure to the risk of interest rate changes on liabilities and its need to reduce the amount of sensitive liabilities so as to ensure the reduction of the gap. It also needs to allocate most care to sensitive assets and liabilities with maturities up to 6 months and between 6 and 12 months, as these are the time bands with a high gap. For example, if the NBR were to increase interest rates during periods of negative GAP, the bank would be exposed to high interest rate risk.

3. CONCLUSIONS

In the light of the above, it follows that banking supervision is an essential part of the proper conduct of banking business in optimal conditions. Through the activities it entails, banking supervision is able to provide reliable information on the soundness of banks and the banking system as a whole, on the basis of which it assesses and plans measures to combat any risks. In this respect, it is essential to respect capitalization and liquidity requirements which, once followed, have the capacity to protect the bank's position in crisis conditions or unforeseen events with a major impact.

Transilvania Bank proves a solid management of the risks underlying its activity, including insolvency risk, credit risk, interest rate risk and liquidity risk. Among these, the risks with a possible major impact on bank's activity are credit and liquidity risk. On the other hand, interest rate risk may have a medium impact on the bank's activity due to the volume of assets and liabilities sensitive to interest rate fluctuations.

The evolution of the risk indicators analysis reflects the prudence of the bank's activity and operations. The high level of the capital adequacy ratio, the satisfactory level of own funds tier 1, the liquidity ratio, the quality of the loan portfolio through the relatively low amount of non-performing loans, the degree of provisioning for losses on non-performing loans, are elements that strengthen the Bank's ability to manage the impact of the risks encountered in its activity.

The study conducted shows that banking risk management is an integrated process in the general management of Transilvania Bank. The bank benefits from a sustainable resilience, that it carries throughout the entire banking system, taking into account its systemic importance.

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ESL TOOLS – GOOGLE TRANSLATE AND VISUALS IN A CULTURALLY DIVERSE CLASSROOM

Mariana COANCĂ[21]

Abstract

This paper outlines the benefits of implementing a strategy for intercultural awareness and language development in the online English class, which consists of twenty international students, enrolled in the Foundation Year Program. Students come from diverse cultural backgrounds and have an intermediate language proficiency. They aim to improve Romanian language skills to apply for a bachelor's degree program at a medical school in Romania. The curriculum includes twenty-five compulsory Romanian classes per week but the students are given the opportunity to attend an English class per week, which is not compulsory. The English instructor collected information systematically to get a complete picture of the students' needs, displaying openness to embrace a multicultural class and sparking conversations to learn about their culture. Then the instructor created an online culturally sensitive strategy to ensure a comfortable and an inclusive teaching and learning environment. The outcomes of this online instructional strategy reveal that students improved their intercultural awareness whereas visuals and Google Translate tasks helped them understand specialized vocabulary and English grammar rules through the lens of their native language. Moreover, students gained confidence to read long texts and wanted to practise more. Therefore, Google Translate is an attractive and efficient tool for building students' vocabulary, grammar and pronunciation if used in tandem with other online teaching methods designed for honing students' reading, writing, speaking and listening skills.

Keywords: international students, online instructional strategy, inclusive teaching, intercultural awareness**,** Google Translate, visuals, benefits

1. Introduction

The internationalization programs of universities around the world, as well as the mobility of students and teachers & staff even at low rate during the Covid-19 pandemic are still the major determinants of diversity and the adaptation of programs and methodologies to manage cultural diversity is imperative. The President of the Association of European Universities, Prof. Michael Murphy, states "The universities that want to retain their high levels of excellence must be able to attract talent at all levels, and in a globalized world, this means being open to diversity. Diverse research environments are obviously more creative and produce better results; various learning environments are also more stimulating than homogeneous ones." [1]

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The Foundation Year is an important linguistic tool of educating & training international people who want to continue their undergraduate studies at the host university or at another university in the host country. Therefore, this program embraces diversity and all the teachers involved in it see diversity as an opportunity to enhance their cultural awareness, to apply teaching methods based on students' needs and to help students understand and accept cultures through the lens of their own culture. During the Foundation Year, international students acquire the necessary reading, writing, listening and speaking skills in Romanian for academic purposes through intensive Romanian classes. English is an optional subject but we always encourage students to attend this class because reading, writing, listening and conversing in English can help them integrate in multicultural environments while studying and working.

Teaching English to a multicultural group is not an easy task even if the teacher has participated in training sessions on multiculturalism and knows how to deal with diversity. It is even more challenging in an online environment. By investigating the students' cultural backgrounds, observing their interaction and learning style, teachers can develop cultural sensitivity and thus become cognizant of students' different needs in order to design appropriate materials and employ instructional strategies accordingly. Instructing a multicultural class online has given me the chance to take the perspective of others, to notice, to comprehend the cultural differences, and to apply new teaching methods that can build confidence and increase student cooperation and engagement. In addition, in the online environment, empathy has played a key role in building rapport with the students. Through mutual attentiveness and positivity, students have involved in the class activities believing in the strength of cooperation and coordination.

The first semester teaching activity is based on General English lessons such as *Nice to meet you, Countries and nationalities, Family, The kitchen, The bathroom, Seasons and months, What is the weather like, Telling the time, Jobs and routines, Asking for directions, At a restaurant, At the weekend, Visiting the doctor, At a hotel, Transport, The body, Clothes and colors and In a clothes shop*. Students learn and practise vocabulary related to these topics, and study the possessive adjectives, the adjectives for describing people, the cardinal numerals, the adverbs of frequency, the present simple, the present continuous and the past tense. The second semester teaching activity is based Business English lessons such as *The workplace, Companies and places, Company history, Work relationships, Making small talk, Describing people at work, First meeting, Business people, Business trips, Marketing words, Location, Achievement, Problems at work and Workplace rules*. In this semester, students learn useful vocabulary and know:

- how to talk about the history of a company using past tense simple, the comparative forms of basic adjectives, the present perfect form of the verb *be* and verbs with irregular forms,
- how to describe the location of people and objects in their offices, the use of *can* and *cannot* for talking about permission and prohibition,
- how to explain the relationships between the members of a company's staff,
- how to use various conversation starters and responses, and
- how to describe people's character traits at work.

In order to develop a teaching and learning strategy we conducted an online survey in which each student expressed his or her preferences. In addition to this teaching material, we created activities to integrate and involve all participants, generating an open and inclusive climate, which influenced students' persistence, curiosity, sense of fulfillment and outcomes. We used Google Translate as a validation practice to help our students build confidence in their ability to learn vocabulary and grammar. This practice gave students a sense of belonging as they started to participate openly in class, to overcome fear and to ask for teacher support.

2. Strategy for Intercultural Awareness and Language Development in the Online Teaching & Learning Environment

In order to help students be acquainted with their cultures contrastively, we considered it is necessary now, in the online environment, on the MS Teams platform, to develop a strategy for intercultural awareness and language development. Although diversity and inclusion are discussed in different contexts, we needed to identify possible barriers that may impede us to boost inclusivity in the online learning environment. To safeguard ourselves, we made a list of the challenges we might face in implementing our online strategy for intercultural awareness and language development: stereotypes, poor attendance because English is an optional subject, reluctance to be part of an online team, refusal to answer questions, fear to answer questions, etc. Therefore, we designed the class activities to overcome the barriers that likely occur in the language classroom and we developed a holistic approach for Microsoft Teams, which led to significant effects on the teacher-student relationship and on the student-student relationship, which we detail in the following paragraphs.

We agree with [2] that the scope of technologies used in language education has emerged rapidly but we do not believe that the "teachers and their beliefs have been the key decision makers in integrating language-teaching methodologies successfully" in the online learning environment. From our perspective, given the pandemic context, teachers and students need to cooperate to implement the teaching methodologies.

Analyzing the characteristics of the 21st century highly effective teachers [3], we have noticed that these qualities are also relevant to a digitally competent language instructor who has adopted a networked approach during the Covid-19 pandemic. Nevertheless, we added three more characteristics (i.e. *being networked, empathizing and envisioning*) that are equally important and required to succeed in managing a multicultural group in the online learning environment (see Fig. 1). The members of multicultural groups have different needs and expectations.

We strongly believe that managing effectively different cultures in the online language classroom is the result of our experience and desire for lifelong learning. This results in a portfolio, which enhances the teacher's capacity to observe the online student behavior, to

reflect on the teaching habits, to improve intercultural awareness, to learn how to use new digital tools & how to boost motivation. In addition, the teacher can establish classroom rules sympathetically and empathetically to build positive relationships, to engage students in group work and pair work and to work on collaborative solutions when problems arise. Microsoft Teams allows us to make an educational partnership with international students, which favors cooperative learning and a natural need of students for interaction.

Microsoft Teams

| Teach | adapting empathizing envisioning collaborating | being networked learning leading | communicating being visionary modelling taking risks | Learn |

Microsoft Teams
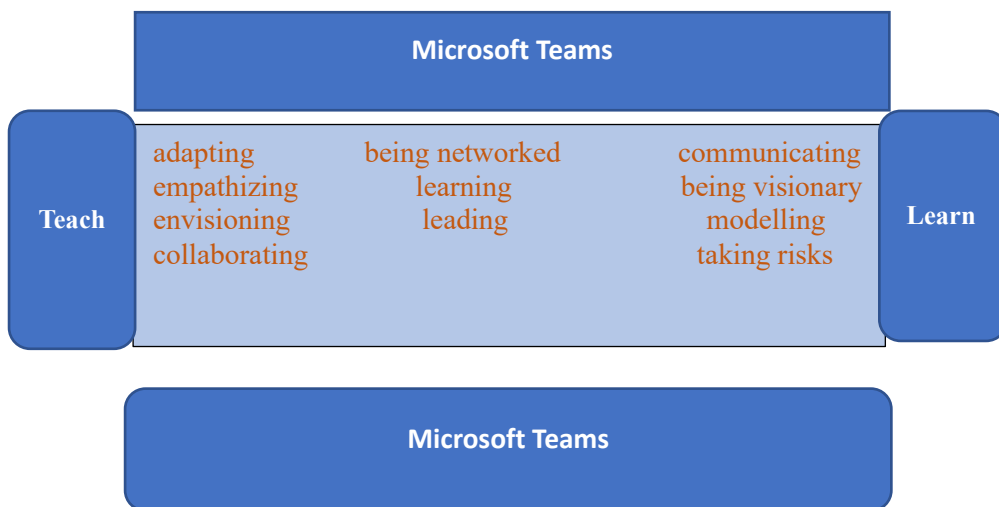
Fig.1: The portfolio of the language teacher

Exploring various approaches to multicultural pedagogy, we found that two researchers designed "an intercultural electronic chat task to see if students from different cultural backgrounds (Taiwanese and Japanese students), who did not have similar English language abilities or similar academic interests, would be willing to communicate using English" [4]. Both groups were open to chat in English and acted accordingly. The Taiwanese group had a lower proficiency but considered the task as an incentive so they "gained confidence to participate fully in discussions", which helped them learn from their peers [5]. After investigating similar studies, the authors found that "online programs develop intercultural awareness and facilitate negotiation of meaning while culture-focused questions enhance intercultural understanding, which reduces prejudice and stereotypes" [6].

In our approach, the teacher becomes a model and presents a traditional Romanian costume, a traditional English costume, then writes greetings in both Romanian and English that all students pronounce assisted by the teacher. This creates an engaging atmosphere and arouses students' interest in comparing and contrasting cultures. Similarly, we ask students to dress in a traditional costume, to describe the costume in one of our classes, and to write some greetings in their native language that all students will utter with the help of the student who has made the presentation and taken on the role of instructor. This activity motivates students as it empowers them to manage a small activity.

Another activity was well received by the students: they created a video individually, in which they show and explain the preparation of a favorite dish from their country, and at the end of the presentation, each student presents once again the ingredients needed to

prepare the dish. Based on these recordings, the teacher involves them in genuine speaking activities because the students enjoy talking about food, the type of cutlery that can be used and about the specific hours of the main meals of the day in their country.

In addition, a teaching activity that establishes an emotional bond between students is the presentation of family members showing family pictures and explaining on what occasion the photo was taken. Even the description of pets that have become members of the family is welcome. This activity encourages students to present important moments in their family life, emphasizing the physical and emotional traits of family members, their age, occupation and hobby.

Finally yet importantly, the teacher may ask students to present a remarkable person from their cultural, artistic, literary, historical, medical, etc. area. This helps students to discover new things about the country of their peers, the achievements these people have had in various fields and how they influence the lives of citizens. This activity helps students develop their listening skills and actively participate in other reading activities about other personalities in the world who fought for human rights, who contributed to technological development, the creation of drugs and vaccines, the implementation of projects for economic development, etc. Moreover, reading comprehension exercises will enrich their vocabulary and hone their ability to make a summary.

Through these teaching and learning techniques, the language teacher aims to broaden his/her cultural horizon, to create an inclusive classroom, to learn things about his/her students' culture, their language needs, their learning style, etc. Moreover, the teacher encourages students to overcome shyness, to ask questions or to ask for clarification from the teacher concerning the topics discussed in the classroom. The teacher accepts the students for what they are, motivates them to achieve tasks more rapidly and focuses on their intercultural knowledge, making them aware that the differences between people eventually bring people closer to build a bridge between diversity and inclusion that offers many opportunities to all those involved. We have constantly adapted to the new reality due to the Covid-19 pandemic, having a student centric approach, in which everyone is part of a whole, is being listened to and is helped to improve his/her abilities for future job roles.

In order to ensure a good transition to the online environment, the teacher needs to empathize with the students' poor Internet access, to help them fix the issues related to the share of their screen, the search for files in the Class Materials or to the use of the meeting chat. Moreover, the teacher needs to check their learning pulse by constantly discussing with each student to find out if they are content with the content of the lesson and class activities. In the online environment, the multicultural class management is very challenging because the teacher cannot be aware of every cultural nuance so he/she needs to find ways to encourage learners to speak up, give feedback, and assess the class activities and the teacher's classroom management. To give learners a more interactive role, to stimulate their emotions and attention, we place emphasis on interface hence on the use of visuals.

Our strategy fosters an online educational environment, which replaces boundaries with new possibilities, leveraging on the skills that everyone brings to class. In this strategy, the

teacher's role is to make the lesson plan and objectives available to everyone and to develop the potential of the learners he/she works with. Furthermore, the teacher commits to enhance the online teaching methods and expand activities regarding the use of tools that can enable them to understand the meaning of new terms and grammar rules.

By meeting learners who come from diverse cultures, we have learned to create a positive and inclusive atmosphere in the language classroom. At the same time, we consider the teacher and students make up a community where people respect each other, converse, collaborate, encourage each other, and help one another to achieve tasks. All students regardless of race, religion, gender, etc. are treated as an integral part of the educational process. The more they accept diversity, the better the teacher can increase inclusivity in classroom thus, students can develop their communicative skills, become more creative, accept to work in a team, etc.

3. Inclusive Teaching in the Online Environment

Inclusive teaching can be tangible if there is a permanent dialogue between teachers and students, where the teacher talks about his/her experience with international students, the structure of the course content and listens actively when students talk about their concerns, preferences and needs for online learning. Thus, the teacher can choose an appropriate approach to help them access course materials and achieve learning goals. Some students did not respond so we conducted an online survey (Microsoft Forms) to get responses from every student about their previous online instruction, collaboration, communication, outcomes, etc. The online survey revealed that students had collaborated well on other online platforms with colleagues and teachers from their home country since the outbreak of the pandemic. Other students responded they did not have reliable internet access and asked to be excused if they did not manage to participate actively. Overall, our interaction with the students in the first class and the results of the online survey allowed us to be mindful of students' concerns and preferences, personal issues and technical barriers.

Nevertheless, how can we ensure that all learners will be motivated to succeed in an optional English course? Firstly, we strongly believe the teacher's extra presence is mandatory to engage with learners online. Therefore, we joined the meeting earlier and sparked fruitful dialogues with the students about the weather, their adjustment to the city vibe, their plans to move to Romania, the previous course content, etc. Secondly, by creating learning opportunities like the ones presented in the previous section will motivate students to attend the online classes and collaborate with colleagues to achieve various class tasks. Thirdly, the teacher can use the Assignments tool to monitor the students' language progress, especially by being flexible on homework deadlines since some students are in different time zones or they do not have enough time to do their homework because they have a job. Finally, the feedback on student work should be offered permanently in a positive and supportive tone in class congratulating them in English, Romanian and in their native language to add a personalized touch.

When we design the online course content, we should always have in mind multiple ways to engage the students through various means of accessibility. We are aware that some students have poor Internet access or do not have access to a microphone or a webcam. Therefore, we offered them alternatives to access materials online, to engage with colleagues and with us, the teachers by:

- sharing lesson content in a PDF format;

- removing barriers to language learning through support materials, additional information, keys to the exercises done in class in a format that learners can adjust easily (e.g. the possibility to increase the text size or to modify the brightness, the possibility to follow the text due to appropriate fonts and colors);

- enhancing online collaboration through discussion groups, which focus on topics proposed by the teacher or self-selected topics relevant to the learners' personal or professional interests;

- providing feedback on progress for each of the language skills (speaking, reading, writing and listening);

- using Google Translate as a tool for reinforcing learners' understanding of English vocabulary and grammar;

- providing opportunities to interact with former graduates, which spark their curiosity and create unforgettable moments (e.g. we invited former graduates who currently study Medicine).

4. Specialized Vocabulary Acquisition

We aim to apply the vocabulary instruction exposing students to many terms and explaining them to the students so that they understand their meaning in various contexts. Since all students want to study Medicine after graduating from the Foundation Year, we included in this teaching strategy a vocabulary comprehension method to increase students' medical vocabulary knowledge. Our model is based on Marzano's six-step process for building academic vocabulary [7], as shown in the table below:

1. Direct Instruction	In this stage, we have focused on learning medical terms in context and learning grammar based on induction. In order to stimulate oral communication, we have given special importance to the description, explanation and pronunciation of the terms

	using the Google Translate speech feature. We have selected online materials relevant to the level of knowledge of students, which deal with various medical topics and contain images and texts that help students repeat the language material and memorize frequent terms and phrases.
2. Linguistic	Another way to engage students is to ask them to reiterate the description and explanation of the terms in their own words. This activity reinforces their knowledge and encourages them to write their own sentences using the described terms.
3. Non-linguistic	Students are asked to create nonlinguistic representations of knowledge in the form of mental images and to construct nonlinguistic definitions of key terms.
4. Journal of terms	Students participate in activities focused on collocations and identification of specialized terms in a text. When the activities are concluded students are asked to list the collocations and the identified terms in a journal.
5. Discussion of terms	The teacher sparks dialogues about the symptoms of the cold or symptoms of the flu, for instance, and asks the students to discuss in pair the afferent terminology.
6. Games	The teachers involves students in role-based collaborative games (e.g. patient-doctor dialogue) to encourage spontaneous use of language.

We believe students need a break from the usual language class routine. For example, we may involve them in another spontaneous and funny game, which requires students to compose half sentences in turn and the other students are required to finish the sentences instantly. |

For several years, I have been teaching English to international learners and I have always implemented my strategies successfully. I have found recently that when the teacher uses Google Translate as part of the vocabulary development stage or as a validation practice, learners feel more confident and are more excited about their tasks when they witness themselves as successful learners. Their vocabulary improvement effort has consisted of selecting words with more intention, developing pronunciation and building communicative competence.

These are the benefits associated with Google Translate, for each student:

- learning English specialized vocabulary and collocations by translating them into the students' native language

Even if students can guess the meaning of words from the context they have read, they still need to contact their native language as it helps them grasp the diverse meanings of a word. Moreover, they will see the synonyms of the respective words and will remember some of them when they read similar texts.

- exercising and learning the pronunciation of the new words

It is necessary for students to practise and learn the pronunciation of new words when they read them first. Otherwise, they risk pronouncing them wrong in subsequent reading and speaking activities.

- writing short sentences using the new vocabulary and word order correctly

The texts that students read show them how to use in writing the encountered expressions and structures. However, the translation of short sentences from their native language into English will help them compare the word order in both versions of language and even reinforce their knowledge of the grammatical structures as shown in the French and English examples below:

TOUT LE MONDE est allé au concert.

(sujet + prédicat + adverbe de lieu)

Maria parle bien le RUSSE.

(sujet + prédicat + adverbe de manière + complément d'objet direct)

Je l'ai vue a L'EXPOSITION la semaine dernière.

(sujet + complément d'objet direct + prédicat + adverbe de lieu + adverbe de temps)

EVERYBODY went to the concert.

(subject + predicate + adverbial of place)

Maria speaks RUSSIAN well.

(subject + predicate + object + adverbial of manner)

I saw her AT THE EXHIBITION last week.

(subject + predicate + object + adverbial of place + adverbial of time)

5. Conclusions

The way teachers communicate and behave in the digital environment can have long-term consequences on the learning process. The inclusive online environment is shaped by many factors, including the teacher's perception of diversity, the teacher's experience, the students' awareness of their own culture, the students' willingness to learn about other cultures, the teacher's networked approach, the students' access to the Internet, etc.

Building a portfolio for teaching English online to intercultural students in these unprecedented times, caused by the Covid-19 pandemic, was worth the effort. We reflected on our activity and we kept in mind what went wrong and what went well in the previous online academic year, which made us see Microsoft Teams as a leverage and an opportunity to implement an online strategy for intercultural awareness and language development through inclusive teaching. Thus, the language teacher offered accommodations for different styles of learning, after surveying students and taking into account their responses. Students' sense of belonging activated when they were motivated to enrich the content of lessons and their performance increased when they were encouraged to use Google Translate as they went deeper into the class material and dealt with the specialized vocabulary.

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MASS MEDIA MODULE OF THE ONLINE PLATFORM DEDICATED TO SPIRITUAL INSTITUTIONS

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Abstract

After the pandemic caused by the Covid-19 virus, both religious organizations and other actors involved in religious and spiritual activity, such as training centers, theological schools, migrated to the virtual space. Online platforms have become a safe and easy to use environment. This has led to a very large number of platforms and sources, which has led to an avalanche of news, many of them fake news coming from illegitimate sources that have led to misinformation but also to religious fanaticism. This article presents the main module, a media portal, of a platform that will interconnect religious institutions.

Keywords: mass communication, social media, religious studies, generation Z, database, spiritual organizations, religiosity, cultural communication, online platform.

1. Introduction

The online platform will be a project that will include a number of 12 modules designed to cover the main needs of organizations in the spiritual and religious field. These modules have been created to facilitate and provide a common database and easy-to-access space that will facilitate communication between religious institutions, training centers, media institutions, NGOs and government institutions.

The main module is the media portal. This module will gather the news launched in the public space in a single information system. At European level, the largest number of believers are: Roman Catholics with 41%, Eastern Orthodox 10%, Protestantism with 9% and Islam 2%. The system will take over the news launched by the most important media institutions, religious organizations, spiritual leaders and religious influencers, in a single media portal. The purpose of this portal is to provide the target audience with quality and legitimate religious information. With the outbreak of the pandemic caused by the COVID-19 virus, but also before, fake news and religious fanaticism reached alarming levels. The portal will be available through the use of multilingual translation systems and available on social networks.

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2. Description of the main project

The need for a religious spiritual media portal, started from the need to organize a communication platform structured on several modules. In this article we will present the portal dedicated to religious institutions. This portal will contain several modules. Below we will present the main modules of the portal. Different modules can be added to the specific needs of the users. Religious institutions have begun to carry out pastoral-missionary and socio-cultural activities in the online environment. The modules presented below are a summary of the main activities of these institutions. The media corner module will allow, using specific software, to integrate the news of the main press agencies of religious institutions. Each actor, whether we refer to a local parish or a international institution, can be found using a plug-in, on a specific list or on a digital map. As in the case of sports institutions, religious institutions had encountered problems in accessing funding. The module dedicated to funding will interconnect religious institutions with specialists in the financial field. Both NGOs and government organizations will have access to the platform. They will use the platform as a database but also to post and share specific documentation. In the area of universities, study programs will be available and easily accessible. The modules offered by the platform will be the following:

Modules (many are interconnected modules) such as Private Public Partnerships

1. **Media corner**
   1.1. Social media
   1.2 Live Videos
   1.3 Spiritual and Religious Documentaries
   1.4. News from all religious institutions
2. **Churches and religious monuments**
   2.1 Churches by map
3. **Founding**
   3.1 Documents
   3.2 Public Private Partnerships
   3.3 Online consulting
4. **Dropbox for shared know how and projects**
5. **Administrative zone**
   4.1. Documents
   4.2. Data Base
6. **Government Organizations**
   6.1 Documents and regulations
   6.2 Programs
   6.3 Public Private partnerships
7. **NGOs**
   7.1 Public Private partnerships
   7.2 Civic Engagement
8. **Clergy Zone**
   8.1 Training programs
   8.2 Data Base
9. **Seminars, Conferences, Meetings and Online conferences**

10. **University Zone**
    10.1. Erasmus +
    11.2. Religious High schools, Colleges and Universities offers
11. **Religious Camps**
12. **Social programs and AID**

The first module, presented in this article, which will launch the platform, will be the media portal module that will connect, as a pilot project, all of the mass media portals belonging to the media institutions of the Orthodox organizations, the 15 existing Orthodox Churches worldwide, and as well, as phase 2, with all the media institutions of other European institutions that promotes spiritual values.

This module will include a website - media portal, which will contain information and attitudes resonating with the spiritual and religious space, online courses and conferences, publishing positions from spiritual leaders and specialists, motivational texts from a spiritual and religious point of view, articles of spiritual, religious and general interest, an audio-book with recordings / interviews / music, thus offering the perspective of outlining a brand, which could later be capitalized even commercially by printing thematic almanacs (based on collections of articles published during a year, two years etc.).
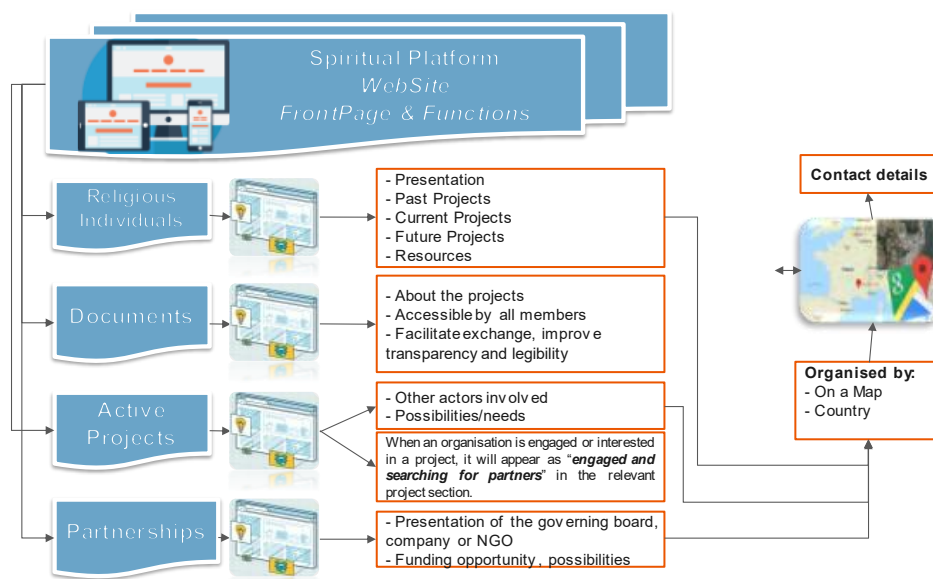
Fig 1 – Front page and functions

1.Religious Organizations	2. Documents	3. Active Projects

Organized by: - Country - On a Map	The platform will provide a space to upload documents - about the projects of the organization for instance -. They will be accessible by all members. This will facilitate exchange and improve transparency and legibility.	Organized by: - Country - On a Map
Presentation of the individual or institution		Members involved
Past Projects		Possibilities/needs
Current Projects		When an organization is engaged or interested in a project, it will appear as "engaged and searching for partners" in the relevant project section
Future Projects		
Resources and Co-Funding		
Contact details		

Fig 2 - Platform sections

3. Media portal

The media module will be the first module. This module was created as during the pandemic caused by the COVID-19 virus, there was an exponential increase in religious news in the online environment. Religious services were broadcast on social networks, often with technical problems. There has been a huge increase in fake news and misinformation, with many illegitimate users taking advantage of this forced migration into the online environment. This module will provide quality news, will collect all news from the Christian world and will ensure an increasing visibility of religious institutions in the virtual space. Below we will present the main functions of this module.

The proposed media portal and adjacent missionary materials aim to:
- collect all news from the Christian world;
- act as a mutual data base for spiritual and religious institutions;
- prevent fake news and religious fanaticism;
- ensuring an increasing visibility of religious institutions in the virtual space;

- creating a young people friendly virtual space with easy access for religious and spiritual news;
- ensuring a pole of attitudes, messages with religious and spiritual themes in the virtual space for the legitimation, credibility and dissemination of official messages transmitted by spiritual training centers and religious institutions;
- providing a space for missionary expression for the Christian laity who wishes to take positions;
- providing a virtual missionary space dedicated to young people (sections dedicated to non-theological students) who do not know enough about the message of the Church and who do not have a direct Christian-Orthodox religious experience;
- ensuring a missionary space and dialogue between the public who want to find out more information about religious and spiritual life and able people to provide publishable answers but also religious, psychological and spiritual support;
- ensuring a space for archiving the missionary material necessary for the competent persons and the directly interested public (thematic posters, missionary leaflets-leaflets, sermon links, etc.).
- from a technical point of view, the module aims to represent a reference communication node for church communication in social networks;

4. Who will join the platform

- Religious organizations;
- Psychologists;
- Training centers;
- Mass-media organizations;
- NGO's;
- Government organizations;
- Companies and individual specialist who offers spiritual support;
- Universities;
- Learning centers;

5. Users and the Target group of the media portal

Within the media portal within the platform is defined the target group consisting of:
- young adolescents (12-17 years old) and young adults (18-35 years old) who are present on the internet and who find poor quality information in the existing spiritual and religious portals;
- young people (25-40 years old) active in multicultural and economic fields (corporations, travel, freelancers, entrepreneurs, activity at European level);
- believers who need good quality catechetical information;
- active users of social networks;
- public looking for information about a healthy lifestyle (ideas, culture, diet, lifestyle, way of thinking);
- public seeking cultural and spiritual information.

- specialized people in the psychological, religious and spiritual field.
- religious institutions.

6. Multi-annual plan

The objectives set out below are part of the three-year plan (Years I-III), corresponding to:

- the initiation of the project;
- project launch (launch conference and mass promotion policies on social networks in the first 6-12 months);
- finalizing the editorial profile of the portal and the magazine,
- organizing and finalizing the editorial team and selecting and retaining collaborators.
- organizing and finalizing the technical team (technical editors, IT specialists, SEO manager),
- creation and dissemination of the online magazine, creation of the magazine brand;
- making, printing and distributing the yearbook, creating a positive reference point for the brand.
- initiating a radio media experience and capitalizing on it for the portal (web space).
- the integration of the media portals of the other partner, spiritual and religious organizations and the installation of software for the translation of news in Romanian and English.
The objectives set out below are part of the six-year plan (Years IV-VI), corresponding to:
- the development of a physical community of readers and followers, able to take over en masse attitudes expressed in the portal;
- the development of a large newsroom, to ensure the fluidity of the information posted on the portal, at national and international level (English, French, new Greek, Russian);

7. The team of the media portal

The project team will consist, in the debut phase: project director, IT specialist, editor-in-chief, column editors, editors, Web & SEO Manager, art director, graphic designer, audio editor and other collaborators.

It is possible to develop a wide collaboration with a team of volunteers, possible students, specialists in communication, advertising and press, who want to dedicate themselves to a missionary online media portal project. This team can be made up of volunteers who can take over the above tasks and an IT specialist, graphic coordinator, editor, technical editor, other collaborators.

8. Portal structure

The portal will be structured in sections, containing articles, teaching and catechetical materials, synthetic texts.

The thematically organized headings are:

People: Editorial (secular and clerical personalities, portal editorialists);

Points of view: Interviews;

Diaspora (editorial, comments, descriptions);

Words:

Book presentation (reviews, presentations);

Conferences;

Facts;

Campaigns;

Events (workshops, conferences, symposiums, workshops)

Social aid (missionary, social, humanitarian campaigns, how can you help?)

Thematic articles (presentations of social centers, missionaries, etc.)

Spirituality:

In the beginning was the Word - fragments from books considered holy. (Fragments from the Old and New Testaments, fragments from the Gospels)

Spiritual practices:

(missionary articles for each topic)

Culture:

Culture and sacred art

Music

Theater

Poetry and Christian literary art

Architecture

Life Style:

Deco: *The altar of the house (*thematic articles, richly illustrated for each field)

Family and children (kindergartens, cartoon file, coloring books, stickers, stickers, teaching materials for working with children)

Calm and rest (free time, holidays, pilgrimages)

Clothing fashions and trends

Gadgets (technology and / or tradition)

Addictions and healing

Biblical and modern cuisine (fasting recipes, sweet recipes, etc.)

Radio and video sections

The headings will be indexed thematically according to the widest possible SEO representation, because [the SEO process is described]

9. Editorial policy

The editorial policy of the portal will be summarized in the following principles:

- accessible vocabulary, non-dogmatical, non-specialized or theological;
- broad synonymous language to help the SEO process;
- short, concentrated articles, maximum 700 signs;
- comprehensive imaging, taken from: Database [name and description];
- photographic database of the project
- new photographic material;
- encouraging volunteering for the team and contributors (by creating a large team with many collaborators, so that the workload is accessible to a lay contributor employed in society on different levels or clergy).

9. Dissemination of social networks

Like any community, the projects need to turn to social media.

The establishment of a group and a Facebook community that would then generate a human capital to address the issues that really matter in the equation of the social moment is one of the objectives of the portal. Linking the topics on the site and adding comments will be the starting points of this approach.

SEO - Search engine optimization involves:

- site traffic optimization
- post management
- optimization of site indexing in search engines
- promoting the portal in Google Ads
- promoting the portal on Facebook and on other social media platforms.

10. Conclusion

Humanity went through the pandemic caused by the COVID-19 virus, that is still present globally today, but after this period, the virtual space is and will remain the main space for communication. Whether we refer to e-commerce, online banking, e-dating, online seminars, social networks, gaming, e-sports, the virtual space has become the *modern agora*, the most public and crowded space. The spiritual life slowly entered this virtual space. The conservatism of some religions, the misconceptions, the lack of the presence of religious leaders but also of some active religious influencers in the virtual environment, made the virtual space to be populated by few subjects from the spiritual life. On the other hand, the lack of spiritual institutions in the virtual space made the possibility for many illegitimate institutions and people to launch fake news and misinformation, without being able to be combated. The leaders of the Catholic world, protestants from USA and oriental spiritual leaders were pioneers in the use of social media. On the other hand, leaders and influencers of the Orthodox religions have found it harder to use these networks. Even though monasteries with severe limitations and rules such as those on Mount Athos are active in the virtual space, the main leaders of the largest Orthodox Churches still do not have social media accounts and are not so visible in the virtual space. At religious institutional level, social media communication is still an incipient field. The pandemic caused by the COVID 19 virus has changed things a little, causing an increase in the use of these networks but also in the presence in the virtual space.

The news portal will allow ease access for religious news, will decrease the flow of fake news and religious fanatism and will allow transparency in projects established by religious institutions. This will allow large public, including younger users to have access to many religions and spirituals teachings.

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ELEMENTS OF AI –
BROADENING THE PERCEPTION ON ARTIFICIAL INTELLIGENCE

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Abstract

Nowadays, artificial intelligence is everywhere around us: in our phone, in our tv set, in our car, in applications that sometimes we don't even know they are related to AI. In order to broaden the perception on the artificial intelligence – what is, when is, when it's not – the University of Helsinki and the Reaktor company joined forces and created a free online course: "Elements of AI". Later, the consortium attracted national organisms and created different language versions of the course, this way making the information more accessible across the Finnish borders.

In this paper we discuss the opportunity of the "Elements of AI" course in the European context related to the artificial intelligence and analyse the impact of several national platforms, including the Romanian language platform.

Keywords: Artificial Intelligence, EU initiatives, "Elements of AI" course

1. Introduction

Within the European Union's strategy entitled "Shaping Europe's digital future", the Commission runs and facilitate the development of a series of actions, a very important segment being dedicated to the Artificial Intelligence domain. It's a common effort of EU, together with Member States and private sector, and not least, individual initiatives to ensure the competitiveness, innovation, and growth of the EU.

We could mention here the "A European approach to Artificial Intelligence" initiative based on three pillars [1]:

- "*Being ahead of technological developments and encouraging uptake by the public and private sectors*", launched in 2018, that allows a significant increase of funding in AI at EU Commission level, under the research and innovation programme Horizon 2020;
- "*Prepare for socio-economic changes brought about by AI*", refers to labour and education policies in the Member States through a set of measures;

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- "Ensure an appropriate ethical and legal framework".

The "Coordinated Plan on Artificial Intelligence 'Made in Europe'", launched in December 2018, was aimed to support the common effort of the European States in boosting AI in Europe.

Also, the General Data Protection Regulation (GDPR) was an important step in the struggle to ensure fair and thrustable digital environment. The following step was the "Communication on Building Trust in Human-Centric Artificial Intelligence", initiative launched by the EU Commission in April 2019.

The AI White Paper, launched by the EU Commission at the beginning of 2020, as a public consultation action meant to assure an appropriate ethical and legal framework for AI in Europe [6].

A group formed with 52 experts on Artificial Intelligence (AI-HLEG) (academic, civil society, and industry representatives) was selected at EU level, in order to assure/mentor/coordinate the progress of the EU "Shaping Europe's digital future" initiative with respect to Artificial Intelligence [3]. As deliverable of the AI-HLEG commission: the "Ethics Guidelines on Artificial Intelligence" (2018) [4] and "Policy and Investment Recommendations" (2019) [5] can be mentioned.

AI Watch is a service created by EU for monitoring the evolution of AI and measure its impact for Europe [8]. The instrument monitors the AI segment through different perspectives: social or public sector perspective, key enablers, education and skills, s.o. Another important achievement of AI Watch is the "AI Landscape 2009-2018", a report on Artificial Intelligence at EU level [7].

2. The Finnish initiative

In the second half of 2019, holding the EU presidency, Finland announced the launch of a campaign by which 1% of Europeans would be taught fundamentals of AI. They targeted over five million people, and the instrument was an online course. They promoted "Elements of AI", created by the University of Helsinki, Finland (UoH) and a private company Reaktor, the course being already of an impressive success in Finland.

The rapid success of the course led to a global roll-out: it continued to be taught in various languages with the collaboration of different national organizations: in February 2019, Sweden became the first country that had a platform in national language. Next, Latvia and the University of Amsterdam in the Netherlands joined the project.

In the beginning of 2020, the Tallinn University of Technology joined the project as well and challenged some 20 Estonian companies to complete the course with their employees within the initiative "Accept the #AIchallenge". [10]

"The elements of AI" course has two parts: "Introduction to AI" and "Building AI". The first part is dedicated to all people, not requiring technical preparation of any kind. It is divided in six chapters [1]:

- What is AI? – introduces the concept with some practical examples of artificial intelligence from the real-world. The most important features of AI are defined. A list of fields where AI proved its utility is presented, also the taxonomy of the domain is described. In the end of the first chapter, some philosophical issues related to the AI are debated.
- AI problem solving – most common methods used in AI are introduced: searching through a space of states and the importance of game theory throughout the history of AI, defining strategies and specific methods.
- Real world AI – introduces uncertainty, presents mathematical concepts used in classification algorithms, such are: odds and probabilities, the Bays rule/formula and naïve classification based on Bayes rule.
- Machine learning – presents the types of automatic learning from data, such are: supervised learning, unsupervised learning, and reinforcement learning used to perform classification of data (predictions, clustering). Regression is another important way of describing relations between data.
- Neural networks are very useful in fields like natural language and image processing. The structure of a neuron is described, how neurons are interconnected, functionalities of artificial neural networks, examples of classifiers based on neural networks. Multilayer networks, the activation functions, and learning rules such as the backpropagation algorithm are debated. Also the Generative adversarial networks (GANs) are introduced.
- Implications. The last chapter of the first part is dedicated to various aspects of using artificial intelligence, such implications are various kinds of predicting the future, or ethic aspects in which the usage of AI played a role.

The second part of the course, "Building AI" is addressed to three levels of readers: beginners, intermediate, and advanced, i.e. from a general user to a user who has programming skills (Phyton programming language). It consists in five chapters:

- Getting started with AI
- Dealing with uncertainty
- Machine learning
- Neural networks
- Conclusions

The second part of the course is also a free course but getting a diploma in this case requires a small fee.

3. Impact of the Finnish initiative

In three years of activity, the course "Elements of AI" reached over 750.000 students. One important measure which led to this result was launching platforms in different languages, with the support of different national organizations. In this section, we study the impact at national level. Data analyzed is extracted from the redash.reaktor.education platform.
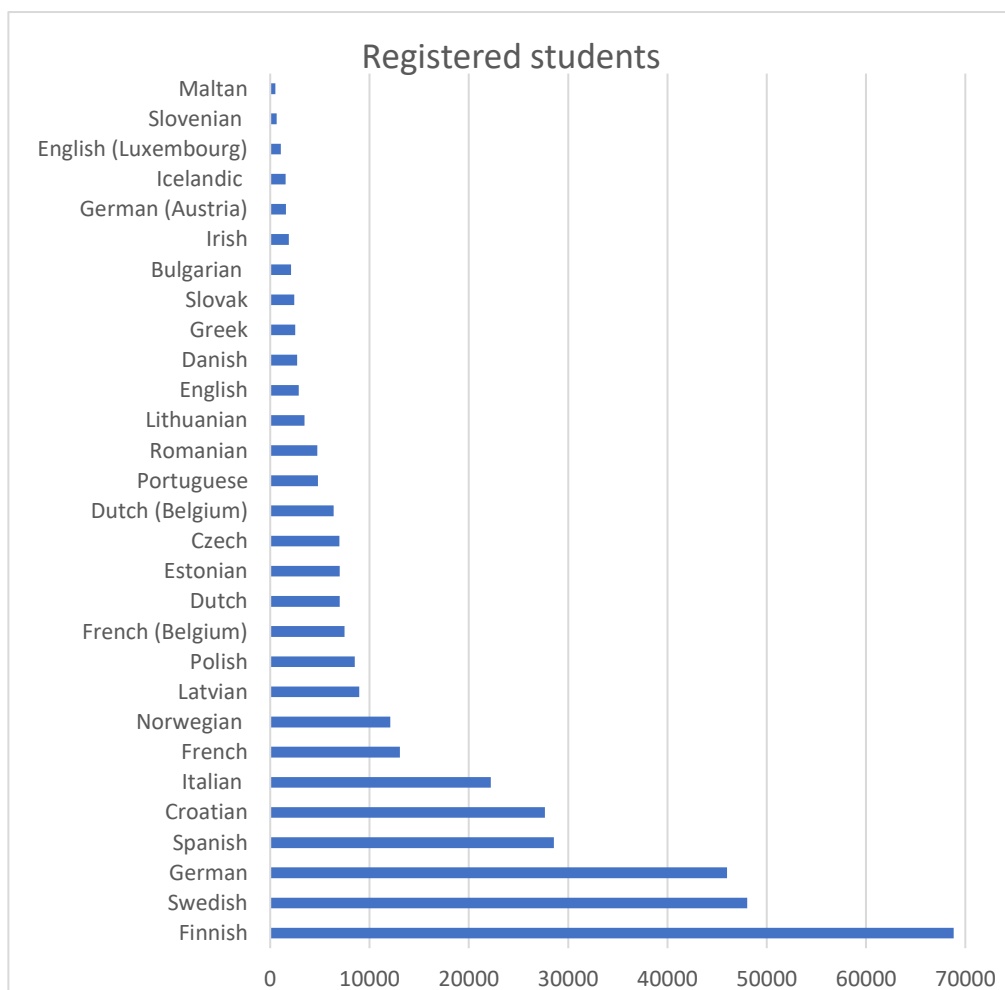
Figure 1. Registered students at the Elements of AI course
(made by the authors with MS Excel, using data from redash.reaktor.education on 23.11.2021)

It can be noticed that almost 70.000 students are enrolled in the Finnish version, while in Slovenia and Malta are less than 1000 enrolled students. Also, it is worth mentioning that,

according to the Finnish statistics, more than 40% of the enrolled students are women, and even more: in the Nordic countries the percentage increases to almost 60%.

In its desire to spread the AI knowledge and awareness, the Finnish consortium attracted national organisms to create local versions/language of the course. An important number of students registered in the national versions. The table above refers to students who have enrolled either in the mother-tongue platform, or the English version, but they are residents of that specific country. The table below refers to students who enrolled in the national platform:
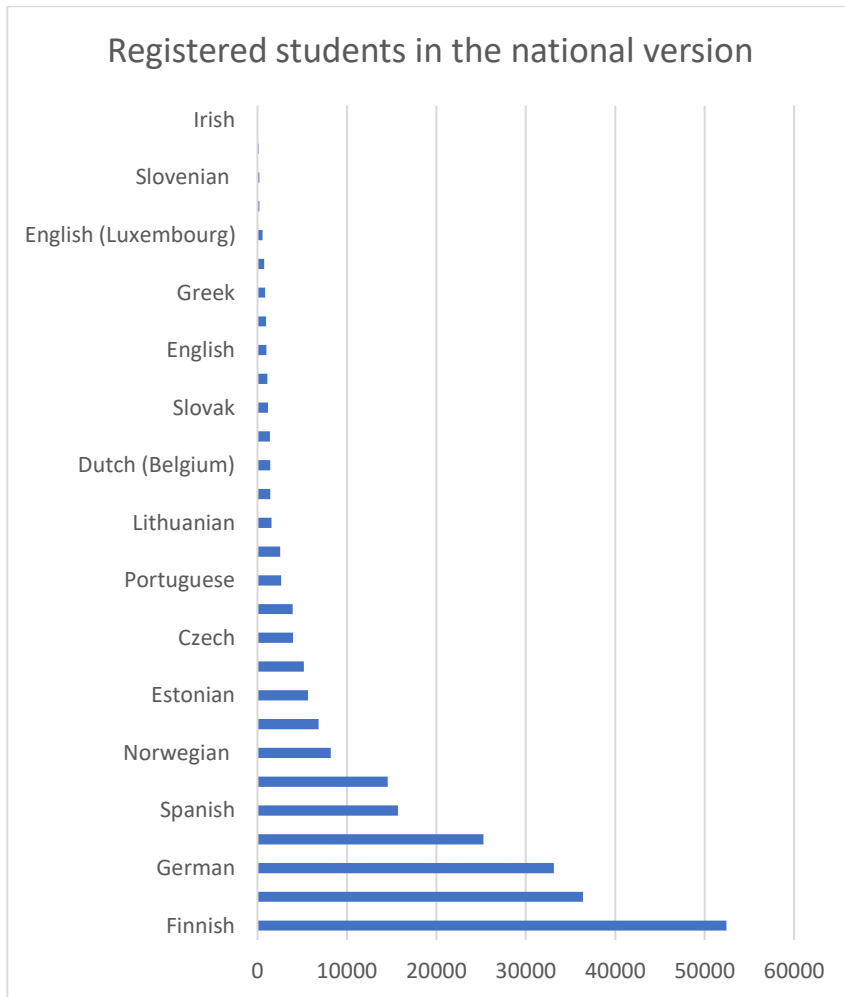
Figure 2. Registered students in the national versions of the course
(made by the authors with Ms. Excel, using data from redash.reaktor.education on
23.11.2021)
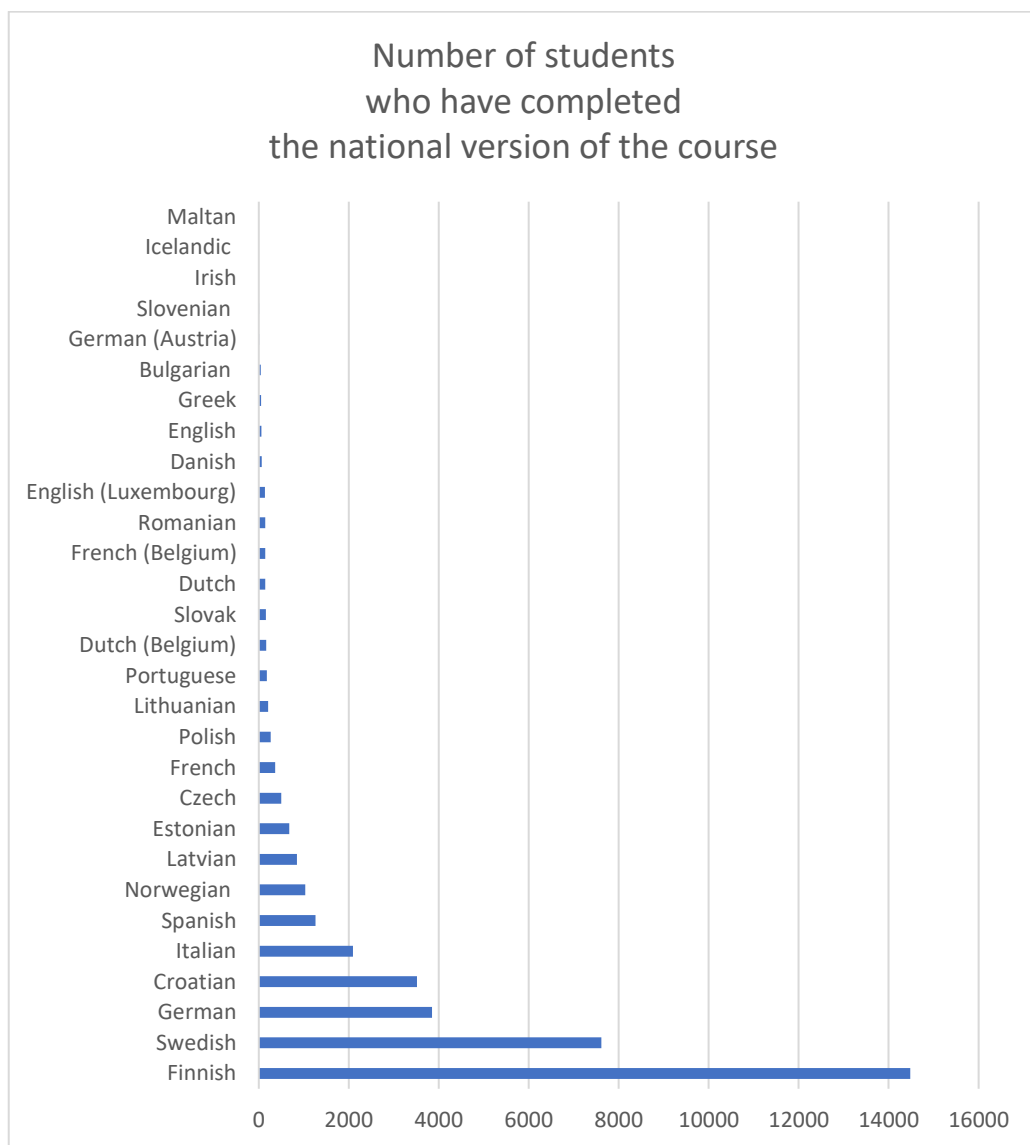
Figure 3. Number of students who have completed the national version of the course
(made by the authors with Ms. Excel, using data from redash.reaktor.education on
23.11.2021)

Finland, the leader of the initiative, is also the leader regarding the number of students who completed the course in the national platform: more than 14.000 students got the Elements of AI certification. Meanwhile, in Austria, Slovenia, Ireland, Iceland and Malta, the number of graduates is still reduced.

The impact of using a national platform can be sustained with the next chart that illustrates the evolution of the number of enrolled students in Romania:
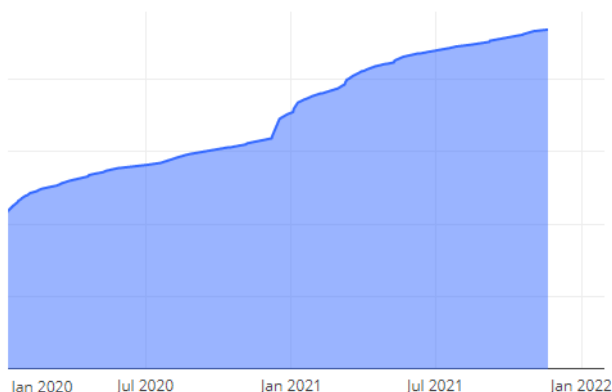
Figure 4. Enrolments in Romania in the last 2 years
(source: extras form redash.reaktor.education, 23.11.2021)

In December 2020, the Romanian project started: the Finnish consortium: the University of Helsinki together with Reaktor joined forces with Romanian partners: Romanian-American University and Bucharest.AI and they launched the Romanian version of the course. The impact of the launching event can be noticed in the above chart: in less than a month, the number of enrolled students increased by more than 10%. Also on the long term, the result is significant: the number of enrolled students significantly increased from around 3200 in December 2020 to almost 4500 in the next 6 months after the launch.

If we consider the overall figures, we can notice that only 23% of the registered Romanian students chose to have the course in Romanian, compared to the average of 65% for the other countries where the course has been launched.
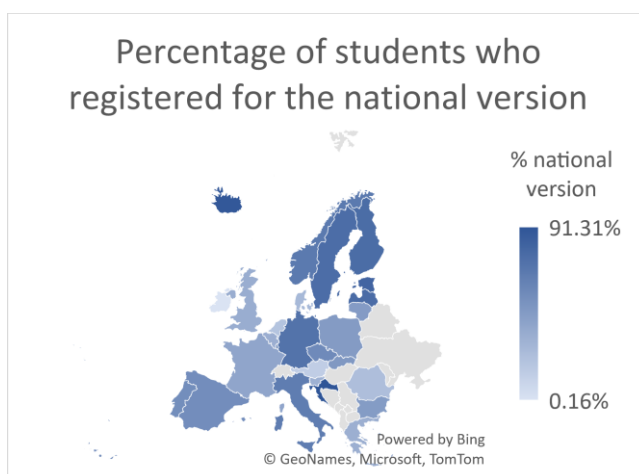
Figure 5. Percentage of students who had chosen the national version
(made by the authors with Ms. Excel, using data from redash.reaktor.education on 23.11.2021)

On the other hand, if we consider that out of the 1700 new enrolments after December 2020, more than 1100 students preferred to have the course in Romanian, we can conclude that the overall impact of the launching event for Romania was much higher and the preference for the Romanian version is dominant.
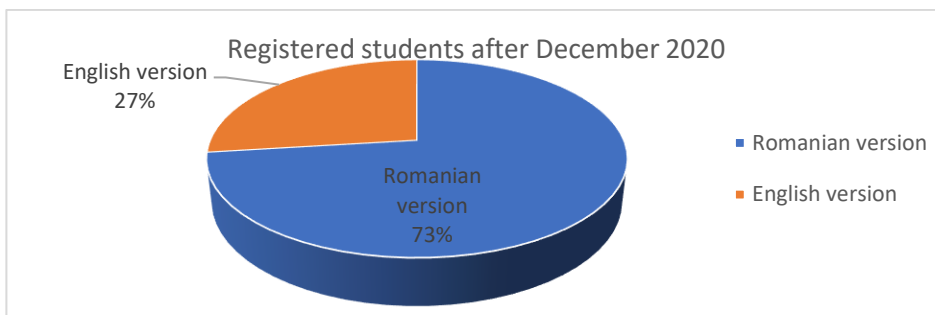
Figure 6. Percentage of students who had chosen the Romanian version vs. the English one
(made by the authors with MS Excel, using data from redash.reaktor.education on 23.11.2021)

If we analyze the completion rate of the course for Romania, the percentage of Romanian students who have finished the course is only 9.2% (in either the Romanian or English version), which is much lower than the overall average of 16.6%
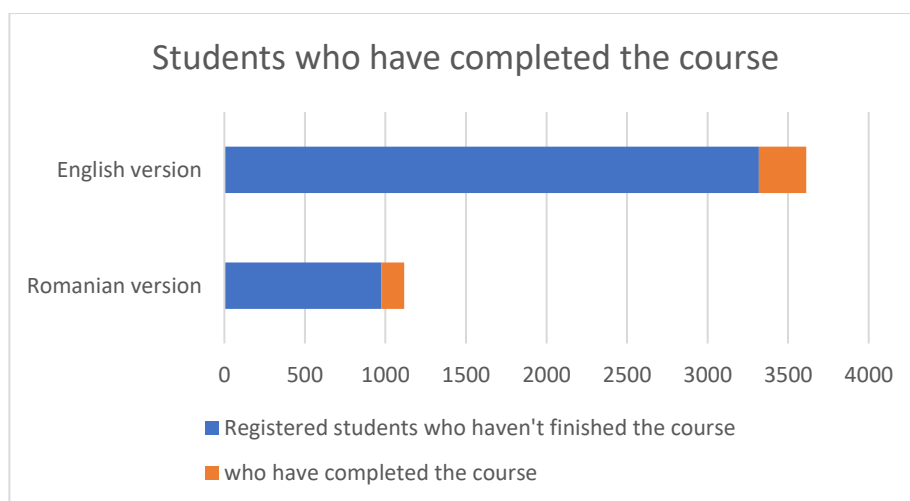
Figure 7. Romanian students who have completed the course
(made by the authors with Ms. Excel, using data from redash.reaktor.education on 23.11.2021)

However, we can notice that the rate of completion of the Romanian version (12.6%) is higher than the one of the English version (8.1%) that the Romanian students took. This comes to emphasize the positive impact of launching the platform in Romanian.

4. Conclusion

In the context of Finland's Presidency of the European Council between July and December 2019, and in line with its priorities to invest in citizens skills and knowledge, Finland has set the ambitious goal of teaching 1% of Europeans the basic concepts of Artificial Intelligence, through the free online course "Elements of AI".

The course, designed and developed by the University of Helsinki and the technology company Reaktor as a MOOC (massive open online course), was initially launched in May 2018, with the goal of reaching 1% of the Finish population. The course proved to be a real success and the goal of training 1% of the Finns (about 55.000 people) in the basics of AI was achieved in just a few months.

The initial success of the course in Finland led to the idea of spreading the AI know-how outside the Finish boarder; this, combined with the opportunity of Finland's Presidency to the European Council, created the context of launching the course in other languages, to make it available to all Europeans.

The course is available in English for people worldwide, so far reaching over 750.000 people from 170 countries [13]. But in order to reach the European objective of educating 1% of the population in the AI basics, the course had already been translated to almost all official EU languages (except Hungarian), as well as Norwegian and Icelandic. The translation has been provided by the European Commission. The efforts of Finland did not stop here. For a higher impact, the University of Helsinki and Reaktor collaborated with local partners to prepare launching events in different countries and increase the visibility of the course at local level.

For Romania, the launching event took place in December 2020, with the involvement of the local partners the Romanian-American University and Bucharest.AI. The launching event was a success, in less than a month the enrolled Romanian students increased by more than 10%. We also need to mention that the Romanian version was preferred to the English one, almost three quarters of the students chose to take the course in Romanian, once this version was available.

Even if the objective of reaching 1% of the Europeans (about 5 million people) by the end of 2021 is far from being reached, the Elements of AI is undoubtfully a success, managing to broaden the perception on Artificial Intelligence by "demystifying AI".

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(All online resources were retrieved in November 2021)

Population migration in the year of the Covid-19 pandemic: a case study on Romania

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Abstract

Population migration, whether it is an internal or an international approach, has always been an issue intensively studied and debated at any decision-making level. In the article we have developed an analysis of the population movement both on the Romanian territory, between counties, and of its relations with the international environment. Thus, by using data mining techniques, clustering and discriminant analysis, we classified the counties in Romania according to the indicators of population migration registered in the databases of the National Institute of Statistics. The results found were quantified in the determination of three classes of counties: the class with intense population migration, the class with moderate migration and the class with low population migration.

Keywords: population, migration, cluster, discriminant analysis, SAS Enterprise Guide, data mining

1. Introduction

Labor migration is treated as a more or less organized movement of a group of people moving to a certain territory of a country. The push and pull model was developed by the World Organization for Migration (IOM), the purpose of creating this model being to highlight the factors of attraction and rejection that underlie the decision of migration behavior between countries around the world. The migration phenomenon that takes place between economically developed countries is a selective process, less intense in duration and importance, as opposed to the migratory axis. This axis comes from poor or developing countries to developed countries. The push-pull model is based on the most important determining factors that underlie the migration phenomenon: economic, social, political, ethical, cultural, religious factors. The Pull model focuses on the existence of five factors of attraction, existing in a destination country that push them and are also the basis of the main economic and social causes of the migration phenomenon, the decision to move to another area or economic region.

The Push model consists of a series of internal factors existing in the country of origin of an emigrant, which determines and influences him to leave for a country of destination. The

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Push - Pull model is considered a more subjective model, which can be applied only on a certain emigrant profile or on a certain type of country. The factors that influence the Push & Pull model have certain peculiarities.

Pull factors that are often considered factors of attraction for migrants in the destination country are: better living conditions, better paid salaries or financial opportunities, increased income of emigrants, positive experience of other people who have emigrated, the pursuit of a beaten path, the advantages of obtaining a better job and possible professional achievements and also a series of economic, political, religious and social facilities.

Push factors are considered in the literature as those internal factors in the country of origin that cause the emigrant to leave: problems of ethnic, social, religious nature in the country of origin of the emigrant, xenophobic or political persecution of some communities. of migrants. Other factors are: natural disasters or natural cataclysms that can be decisive in making a short-term decision, economic factors in the emigrants country of origin, social factors in the emigrants country of origin, declining labor productivity and wages in various fields economic activity, rising unemployment in different areas of activity, areas, regions or localities, lack of investment and infrastructure in different regions or localities, poverty of the population or total lack of income for certain families.

The international migration process is supported by different levels of economic development between different countries of the world. It promotes the creation of new jobs in countries of origin, due to the liberalization of trade and foreign investment, which takes place mainly at national level.

The reason behind the migration act is the main tool that gives the individual or subject involved in the process the opportunity to move to a place. The place or country of destination offers him more opportunities in terms of work, education, training, political and social rights, health. All these elements give people the ability to motivate themselves to emigrate, by increasing their own social, economic and political freedom.[28]

In the literature, there are a number of similarities between external and internal migrations[29]:
   a. the temporary migrations (whether external or internal), which leave in the area of origin: family, relatives, property, friends, they still maintain communication relationships.
   b. emigrations (which take place from an area or a country) and which are based on a series of determinants of a socio-economic and psychological nature of persons, of re-migrants (of those who return to the area, society or country of origin).

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2. Migration in Romania

For Romania, the most important factors that determine Romanians to emigrate are: better living conditions, better paid salaries, the experience of other people (family or strangers) who migrated to other countries, the prerequisites for getting a better job and, better paid, as well as a number of real professional opportunities.

If we refer strictly at Romania, the following Pull type factors can be applied, namely: better living conditions, better salaries, the experience of other people who migrated, the premises for obtaining a better job and real professional opportunities. In the case of Push type factors, social and economic conditions are the main reason for the emigration of many Romanians to countries with a real economic potential.

The main tendency of the Romanian citizen who intends to emigrate to other lands in the last decades is mainly accompanied by a series of social reasons (family reunification, close relatives working abroad). There is a predisposition to emigrate of the inhabitants of Romania from almost any generation of age, regardless of the studies carried out in the country (gymnasium, high school, higher) or of ethnic, religious or cultural ancestry. The answers would be that most Romanians emigrate abroad for money or higher incomes, due to the lack of a stable job, to ensure a decent living for his family, due to poverty in the country or in certain areas, the austere measures taken by to governors or for investments in human capital (of children or close relatives).

Migration leads to the imbalance of the labor market, by creating a surplus of labor supply in certain regions of the host country and also leads to the creation of a labor shortage in certain sectors and areas of the emigrants' country of origin.

Migrants, regardless of the destination country chosen, are trying to improve their quality of life and opportunities, especially the income level of their families. Many of the emigrants in the destination country are forced to bear various psychological costs or various discriminatory treatments related to pay that are below the level of training and professional capacity.

In order to reduce production costs and to have the effect of increasing labor productivity at regional or national level, it is ideal for an investor or producer to use labor as cheaply as possible. To achieve this goal in the medium and long term, the most effective means is the use of foreign emigrants from poor countries.

In the long run, Romania has to gain if the arrived immigrants have a clearly higher level of education and training or at least similar in different fields of activity to that of the local active employed population.

The labor market is influenced by the discrepancy in different sectors on the level of wages in different fields of activity, and these generate over time a series of social tensions (for example in the form of strikes) between the local labor force and immigrants.

3. The methodology used in the application

In this research article we want to make an analysis of population movement, in terms of domestic and international migration, for 2020, the year that coincided with the onset of the Covid-19 pandemic. Thus, we will analyze the population movement in each county in Romania.

The methodology for conducting this study is as follows:

Step 1. Choosing and defining indicators

Step 2. Classification of Romanian counties according to the indicators under analysis using SAS Enterprise Guide

Step 3. Improve the classification made in the previous step using discriminant analysis

Step 4. Identify and briefly characterize the identified classes.

4. Choosing and defining indicators

The values of the indicators regarding the migration of the Romanian population were taken from the website of the National Institute of Statistics (NIS), Tempo database, for 2020. Thus, eight indicators were chosen which, in our opinion, most accurately describe the migration to domestic and international level of the population in each county of Romania (table 1).

Table 1. The indicators used in the application

No.	Index code	Description of the indicator
1	I1	Number of foreign immigrants from Romania with temporary status
2	I2	Number of temporary emigrants by counties
3	I3	Number of permanent immigrants by destination counties
4	I4	Number of permanent emigrants by counties
5	I5	Number of people left with domicile (international migration) by counties
6	I6	Number of persons established with domicile (international migration) by counties
7	I7	Number of people who moved their residence, by counties
8	I8	Number of persons established by residence by counties

Temporary immigrants (I1) are persons who settle in Romania for a maximum period of 12 months. The data provided are obtained from two administrative sources: the General Inspectorate for Immigration and the Directorate for the Registration of Persons and the Administration of Databases, the General Directorate for Passports.

Temporary migrants (I2) are people who emigrate to another country for a period of at least 12 months. The residence of an emigrant person is the place or space where that person spends most of their rest time, without taking into account temporary absences for holidays or visits to friends or family.

Official statistics for labor migration records are obtained in accordance with the provisions of Regulation (EC) No 862/2007 of the European Parliament. Some of the data provided also comes from the national statistical offices in Italy, Spain, the United Kingdom or from the Inspectorate General for Immigration.

The I3 indicator is represented by people who immigrate permanently, not temporarily to Romania, this implying the change of domicile or citizenship, the acquisition of Romanian citizenship.

I4 refers to persons of Romanian citizenship who emigrate abroad and change or establish their domicile on the territory of another state.

Indicator I5 represents the total number of departures of persons with domicile, respectively those who leave a locality and prove that they have provided housing or residence in another locality.

Indicator I6 refers to the total number of persons established with domicile who have arrived in a locality and can prove that their home is insured in that locality.

I7 is composed of persons who have resided in a locality other than their domicile, who, starting with January 1 or July 1, have entered in the identity document and in the population records the mention of establishing the residence.

I8 is represented by persons arriving in a locality other than the one of domicile, who from January 1 or July 1 is in the record of the population with the mention of the establishment of the residence.

5. Classification of counties using cluster analysis

Further in our scientific approach we will continue with the classification of counties using cluster analysis. Each indicator is expressed in number of persons, and their initial data are presented in table 2.

Table 2. Initial data of the indicators

County	I1	I2	I3	I4	I5	I6	I7	I8
Alba	2893	5485	5298	4662	5523	267	77	3292
Arad	3511	6114	5381	7738	7467	557	124	4172
Arges	4832	5240	8169	9333	11059	348	105	5726
Bacau	4876	4721	6251	10320	11978	782	654	5895
Bihor	4694	14222	12891	10149	9761	282	119	5512
Bistrita-Nasaud	2310	2796	3375	3920	4527	281	92	2779
Botosani	3045	3474	4935	8130	7827	366	2397	3913
Braila	2419	1291	2146	3239	4832	344	57	2996
Brasov	4626	7492	6316	11761	9742	722	398	5155
Buzau	3512	5031	5137	6843	8379	274	83	4388
Calarasi	2453	3918	3732	4561	5911	215	52	3065
Caras-Severin	2592	6681	6019	4429	5702	485	99	2953
Cluj	5890	15146	11345	16964	12444	536	353	6559
Constanta	6400	5603	5772	13020	13625	727	211	6771
Covasna	1782	2279	2323	2204	2551	60	34	2081
Dambovita	4027	4456	4091	8077	9030	381	263	5027
Dolj	5798	10534	11366	10973	11737	410	102	6503
Galati	4335	2801	4753	11705	9809	860	4396	5107
Giurgiu	2167	6112	4173	4040	4727	144	75	2818
Gorj	2946	5418	7083	5897	7544	140	44	3276
Harghita	2726	3156	3234	2903	3365	81	47	3119
Hunedoara	3253	6935	7947	5862	7743	497	128	3835
Ialomita	2361	3212	2566	3903	5105	160	59	2786
Iasi	6210	12118	8396	25182	19615	1831	5683	7307
Ilfov	3353	12620	7282	23588	9546	278	379	3836
Maramures	4176	5492	6822	5812	6631	393	171	4665
Mehedinti	2208	10736	9734	4505	5441	144	47	2585
Bucuresti	13641	27499	33396	59033	47982	3260	8687	16162
Mures	4699	6076	5443	8450	9054	355	142	5441
Neamt	3967	3405	4993	7540	8735	559	632	4694
Olt	3622	9338	8221	6484	8292	235	89	4287
Prahova	6202	8395	8165	10738	12398	499	150	7341
Salaj	1725	4533	4344	3037	3618	130	33	2133
Satu Mare	2949	3524	3438	5144	5571	284	118	3403
Sibiu	3271	5669	5089	8394	7378	602	183	3744
Suceava	4994	3739	5711	10847	10887	569	1351	6078

Teleorman	2980	6750	5233	5373	7502	333	120	3777
Timis	5872	11987	11057	19336	16596	1078	400	6608
Tulcea	1844	2329	2397	3524	4604	246	52	2115
Valcea	2894	6515	6168	6323	7614	185	62	3526
Vaslui	3035	3133	5000	10014	9969	869	3841	3817
Vrancea	2716	2986	3769	5862	6779	262	141	3384

A first step in cluster analysis is to determine for the data series certain specific indicators such as mean, standard deviation, skewness, kurtosis and bimodality. By analyzing these indicators, it is possible to identify whether or not the distribution of each indicator is close to the normal distribution, how large the vault is and whether their distributions have longer or shorter tails (table 3).

Table 3. Descriptive statistics for indicators

Index	Mean	Std. Dev.	Skewness	Kurtosis	Bimodality
I1	3900.1	2030.1	2.8367	12.1595	0.5877
I2	6641.9	4732.4	2.4214	8.276	0.5963
I3	6641.9	4956.9	4.0338	20.964	0.7138
I4	9519.5	9386.4	3.9194	19.097	0.7327
I5	9252.4	7044.1	4.2753	22.8283	0.7397
I6	500	541.3	3.7323	16.9757	0.7388
I7	767.9	1756.3	3.2499	10.9904	0.8129
I8	4586.5	2347.5	3.0417	13.8207	0.6012

The eigenvalues of the covariance matrix provide information about the amount of information brought by each of them and, implicitly, how many indicators will be retained further in the analysis (table 4). In this case, all the indicators in the analysis will be retained, even if the informational contribution brought by each of them has relatively low values.

Table 4. Eigenvalues of the covariance matrix

	Eigenvalue	Difference	Proportion	Cumulative
1	183101740	174513477	0.9262	0.9262
2	8588263	4770760	0.0434	0.9696
3	3817503	2577056	0.0193	0.9889
4	1240447	663940	0.0063	0.9952
5	576507	229868	0.0029	0.9981
6	346639	326784	0.0018	0.9999
7	19855	11039	0.0001	1

8	8816			0	1

The chosen classification method is Wards method which aims to minimize the sum of squares of errors, by calculating the Wards distance. Thus, depending on the minimum distance from the centroids of the future clusters, the future groups can be built, resulting in the dendrogram (figure 1). Furthermore, depending on the place of its sectioning, the classes will result. Thus, if the dendrogram is cut above the value 0.2 of the Oy axis, then there will be two inhomogeneous classes: one consisting of a single element and another composed of all the other elements. If, on the other hand, the cut will be around 0.1 of the Oy axes, then three rather inhomogeneous classes will result. If, instead, it is sectioned at a level closer to 0.05, then there will be four classes, three of them will be very well defined, homogeneous, with similar elements and another formed from a single element called outlier. Further in the analysis, the outlier (Bucharest) will be brought to the nearest class.
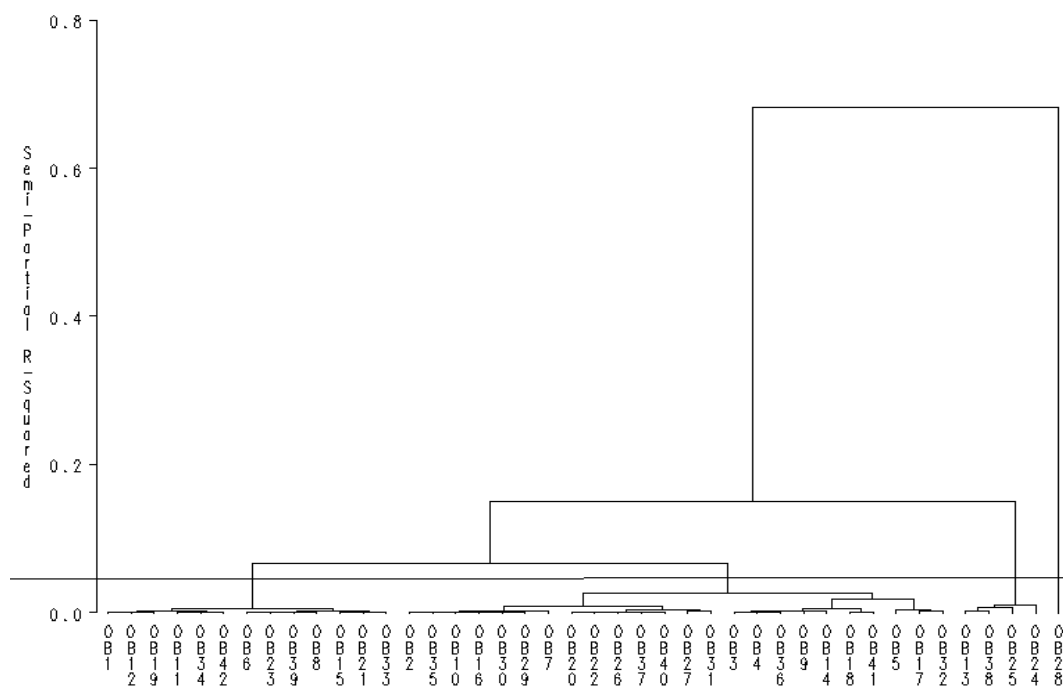
Figure 1. The dendrogram results from the cluster method

From the dendrogram (figure 1) results three classes and an outlier (Bucharest):

 - class 1: Alba, Bistrita-Nasaud, Braila, Calarasi, Caras-Severin, Covasna, Giurgiu, Harghita, Ialomita, Salaj, Satu Mare, Tulcea, Vrancea

   - class 2: Arad, Arges, Bacau, Bihor, Botosani, Brasov, Buzau, Constanta, Dambovita, Dolj, Galati, Gorj, Hunedoara, Maramures, Mehedinti, Mures, Neamt, Olt, Prahova, Sibiu, Suceava, Teleorman, Valcea, Vaslui

   - class 3: Cluj, Iasi, Ilfov, Bucuresti, Timis.

6. Classification of counties using discriminant analysis

Discrimination analysis involves finding a determining space and the equations of discrimination rights. The discrimination equations are of linear type, having general forms such as equations (1) and (2):

$$Sk1_i = \sum_{j=1}^{8} Ij_i * Ck1_j + ak1, \forall i = \overline{1,42}, k = 1,2,3 \qquad (1)$$

$$Sk0_i = \sum_{j=1}^{8} Ij_i * Ck0_j + ak0, \forall i = \overline{1,42}, k = 1,2,3 \qquad (2)$$

where:

- $Sk1_i$ represents the probability of the county and (the score) to be in the class k;

- $Sk0_i$ represents the probability of the county and (the score) of not being in the class k;

- Ij_i represents the value of the indicator Ij for the county i, j=1...8;

- $Ck1_j$ represents the function coefficients that calculate the probability of belonging to a county to class k (k = 1,2,3) results from SAS Enterprise Guide Software;

- $Ck0_j$ represents the function coefficients that calculate the probability that a county does not belong to class k (k = 1,2,3) results from SAS Enterprise Guide Software;

- ak1 and ak0 are constants related to linear functions that calculate probabilities;

- i represents the county order number.

Based on the application of general equations (1) and (2) of the discrimination model for class 1, the relations (3) and (4) resulted. These relationships will further help calculate the probabilities of a county belonging to class 1.

$$S10_i = -5.89 * 10^{-3} * I1 + 1.2 * 10^{-3} * I2 - 0.85 * e^{-6} * I3 - 0.45 * 10^{-3} * I4 - 0.98 * 10^{-3} * I5 - 1.51 * 10^{-3} * I6 + 0.6 * 10^{-3} * I7 + 10.75 * 10^{-3} * I8 - 8.33, \forall i = \overline{1,42}$$

$$\tag{3}$$

$$S11_i = -6.27 * 10^{-3} * I + 0.83 * 10^{-3} * I2 - 0.6 * 10^{-3} * I3 - 0.4 * 10^{-3} * I4 - 0.8 * 10^{-3} * I5 + 0.9 * 10^{-3} * I6 + 0.05 * 10^{-3} * I7 + 9.4 * 10^{-3} * I8 - 3.85, \forall i = \overline{1,42}$$

$$\tag{4}$$

The application of the discriminant analysis for the affiliation of each county to class 2 was performed with equations (5) and (6).

$$S20_i = -6.28 * 10^{-3} * I1 + 0.82 * 10^{-3} * I2 - 0.6 * 10^{-3} * I3 - 0.4 * 10^{-3} * I4 - 0.8 * 10^{-3} * I5 + 1.04 * 10^{-3} * I6 + 0.04 * 10^{-3} * I7 + 9.37 * 10^{-3} * I8 - 4.28, \forall i = \overline{1,42}$$

$$\tag{5}$$

$$S21_i = -6.58 * 10^{-3} * I1 + 0.75 * 10^{-3} * I2 - 0.03 * 10^{-3} * I3 - 0.68 * 10^{-3} * I4 - 0.95 * 10^{-3} * I5 - 1.54 * 10^{-3} * I6 + 0.63 * 10^{-3} * I7 + 11.35 * 10^{-3} * I8 - 7.47, \forall i = \overline{1,42}$$

$$\tag{6}$$

For the last class the same algorithm was applied, the functions after which the probability of belonging to a county to class 3 was calculated are represented by equations (7) and (8).

$$S30_i = -6.11 * 10^{-3} * I1 + 0.92 * 10^{-3} * I2 - 0.67 * 10^{-3} * I3 - 0.2 * 10^{-3} * I4 - 0.8 * 10^{-3} * I5 + 1.19 * 10^{-3} * I6 - 6.52 * e^{-6} * I7 + 9.12 * 10^{-3} * I8 - 4.87, \forall i = \overline{1,42}$$

$$\tag{7}$$

$$S31_i = -0.38 * 10^{-3} * I1 + 4.43 * 10^{-3} * I2 - 4.44 * 10^{-3} * I3 + 1.95 * 10^{-3} * I4 - 0.82 * 10^{-3} * I5 + 5.56 * 10^{-3} * I6 - 1.16 * 10^{-3} * I7 + 1.41 * 10^{-3} * I8 - 29.38, \forall i = \overline{1,42}$$

$$\tag{8}$$

Table 4. Resubstituting and cross validation results for every county

No	County	Resubstituting Results			Cross Validation Results		
		Class 1 (%)	Class 2 (%)	Class 3 (%)	Class 1 (%)	Class 2 (%)	Class 3 (%)
1	Alba	60.74	50.64	0	57.84	53.74	0

2	Arad	53.38	39.04	0	61.92	29.48	0
3	Arges	24.93	90.58	0	29.88	89.89	0
4	Bacau	33.85	74.11	0	41.28	68.76	0
5	Bihor	4.61	89.64	0	3.92	87.72	0
6	Bistrita-Nasaud	82.85	35.48	0	81.10	39.20	0
7	Botosani	46.47	72.38	0	59.53	64.68	0
8	Braila	83.31	42.30	0	80.12	49.59	0
9	Brasov	30.72	33.91	0.19	36.42	23.20	0.95
10	Buzau	39.15	70.71	0	44.55	66.81	0
11	Calarasi	72.78	41.27	0	69.75	45.21	0
12	Caras-Severin	78.72	26.59	0	69.84	34.20	0
13	Cluj	1.74	60.55	99.99	1	86.59	68.61
14	Constanta	9.76	72.07	0	14.07	21.76	99.98
15	Covasna	83.07	35.72	0	81.37	39.43	0
16	Dambovita	23.46	76.71	0	28.34	71.79	0
17	Dolj	4.23	94.76	0	3.86	94.95	0
18	Galati	22.37	80.73	0	42.28	64.35	0
19	Giurgiu	57.61	42.62	0	45.92	50.91	0
20	Gorj	75.57	47.53	0	92.66	25.26	0
21	Harghita	50.53	70.86	0	41.16	79.01	0
22	Hunedoara	69.33	51.76	0	78.34	43.33	0
23	Ialomita	72.81	36.56	0	67.87	41.64	0
24	Iasi	6.82	8.88	100	5.88	30.37	100
25	Ilfov	47.14	0.31	100	100	0	100
26	Maramures	28.59	86.02	0	37.38	83.40	0
27	Mehedinti	65.81	39.66	0	85.99	17.77	0
28	Bucuresti	0.25	30.69	100	0	100	100
29	Mures	10.31	85.78	0	10.92	84.71	0
30	Neamt	51.41	68.03	0	55.65	65.37	0
31	Olt	23.06	75.13	0	26.86	70.84	0
32	Prahova	1.43	97.85	0	0.79	98.56	0
33	Salaj	84.84	29.18	0	83.42	32.03	0
34	Satu Mare	63.09	46.66	0	61.37	48.69	0
35	Sibiu	73.34	17.92	0	82.41	9.52	0
36	Suceava	14.14	90.95	0	16.36	90.26	0
37	Teleorman	45.42	55.01	0	55.79	44.32	0
38	Timis	31.71	11.54	99.76	43.84	15.20	3.75
39	Tulcea	92.09	15.14	0	90.61	17.65	0

40	Valcea	57.73	48.16	0	65.95	40	0
41	Vaslui	75.52	36.75	0	90.41	18.41	0
42	Vrancea	75.88	41.47	0	72.13	46.85	0

After an overall analysis of the results obtained from the discriminant analysis and taking into account both the maximum probability of belonging a county to a class and the probability of validating the results (table 4), the final classification of counties is as follows:

- class 1: Alba, Arad, Bistrita-Nasaud, Braila, Calarasi, Caras-Severin, Covasna, Giurgiu, Gorj, Hunedoara, Ialomita, Mehedinti, Salaj, Satu Mare, Sibiu, Tulcea, Valcea, Vaslui, Vrancea;

- class 2: Arges, Bacau, Bihor, Botosani, Brasov, Buzau, Constanta, Dambovita, Dolj, Galati, Harghita, Maramures, Mures, Neamt, Olt, Prahova, Suceava, Teleorman;

- class 3: Timis, Bucuresti, Iasi, Ilfov, Cluj.

Class 1 is characterized by intense migration of the population, both domestically and internationally. The second class contains counties in which the population movement is at a moderate level, and in the third class the population movement is at a minimum level.

The causes of migration can be various: from economic to social and political. People leave an area, either because they are looking for development opportunities and a better socio-economic level, or because they take refuge in another area due to calamities or disasters: wars, religious or even political persecution. Migration can be explained from a macroeconomic point of view, as a way of balancing some deficiencies resulting from the labor market, as a result of a gap between labor demand and supply.[30]

7. Conclusion

The changes produced by domestic and international migratory movements are presented at the level of economic, political, social, cultural and religious life for each country involved in the process. They manifest themselves both in the place of origin, from where the potential emigrants must leave, and in the place of destination, where, in the end, they settle. The migration exodus knows and presents important repercussions (especially negative) on the labor market, but also on unemployment and social protection policies in the countries of destination of emigrants. For many countries, external migration is an important factor in reducing the supply of domestic labor, both quantitatively and qualitatively. The short-term consequences of this are not long in coming; this is observed by a decrease in the unemployment rate or a lack of labor force in a certain area or region.

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To improve the study conducted in this research paper, the authors recommend refining the classification using advanced techniques of pattern recognition or artificial intelligence, such as genetic algorithms or neural networks. If we follow the approach of artificial intelligence, we can train a neural network with three layers: the first layer (input) will contain indicators, the second layer will contain a number of neurons determined experimentally, and the output layer will contain three neurons, one for each class.

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STATE BUDGET. EVIDENCE FROM ROMANIA

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Abstract

The purpose of this article is to analyze the state sources of budget revenues of Romania during 2019-2021 and trough this research we will see the influencing factors on the increase or decrease of the state budget income. Budget incomes are the necessary means for the formation of funds from which budget expenditures are made. In the second part of this article, we will analyze the budget revenues and expenditures in the same period to better understand how state institutions work and how our country's resources are distributed. Based on the information extracted from the website of the Ministry of Public Finance, we identified the evolution of public expenditures and the reasons that determined the allocation of amounts for each functional category. The paper is a brief assessment of the situation in which our country is during the 2017-2021 period.

Key-words*: State Budget, revenues, expenditures, budget deficit, funds, public resources.

1. Introduction

The budget is a central, planning and policy document of the government that outlines the expected public incomes and expenditures and is usually adopted by the legislature.

We chose to look at this issue because the budget reflects the choices the government has to make and is the tool it uses to achieve its economic and development goals. In the budget, the government determines what it is going to spend — but also the revenues it collects — that it needs to fund spending. The government must balance a wide range of legitimate demands with the limited resources at its disposal. It is also important to measure the efficiency of public spending and how public resources are spent.

The main objectives of the budgetary work applied are to ensure that the government's budget priorities are in line with the stated policy objectives and that the financial resources allocated to the priority areas are fully and properly spent. However, budgetary work also has a broader aim, which is to contribute to democracy by ensuring openness, transparency and accountability for public resources. Governments face certain constraints in terms of

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the overall size of the budget. These are constrained by the ability or willingness of taxpayers to contribute, to some extent. Other constraints include political decisions to quickly reduce budget deficits or increase spending, such as military or health funding.

Understanding budgetary constraints is important in assessing the extent to which budgetary analysis will be carried out in the context of a budget that can only reallocate its resources, as opposed to increasing overall levels of revenue and expenditure.

In order to have a clearer and correct picture, we have chosen for the analysis the budgetary situation for the years 2017-2021, in the forecasted form. Further, based on the information extracted from the website of the Ministry of Public Finance, we have identified the evolution of public revenues and expenditures, but also the reasons that determined the forecast of these revenues, respectively the allocation of amounts for each category of functional expenditures. According to European Commission Report (2020) there are some progress implementing the national public procurement strategy, but also some limited progress in the efforts to strengthen collection of revenues.

2. Analysis of the (forecast) revenues of the Romanian state budget in the period 2017-2021

The budget is an economic category in the field of financial science whose existence is closely linked to the existence of the state. The state budget represents all revenues, expenditures and sources of funding intended for the performance of the functions of central public authorities, except for the functions of the public social security system and the compulsory health insurance system, as well as for the stability of relations with other budgets.

According to the Table no.1, the total revenues increase by 32,61% from 2017 to 2021. And even if „a new Centre for Financial Information allows electronic interaction with taxpayers (European Commission Report (2020)) and from 2018 was redesigned and simplified so that the taxpayers can submitted online the tax declarations and where the payment obligations are established, the module does not include a payment module. So, the bureaucracy still prevents taxpayers for the facility to pay in an easier way their taxes.

Table 1. Table of total revenues and main categorize of revenues according with State Budget classification (thousand lei)

Indicators	2017	2018	2019	2020	2021
Total Revenues	117.046.581	141.395.499	164.494.130	167.702.382	173.700.780
Current revenues	96.372.894	117.262.176	137.565.829	145.842.361	135.624.924
Capital revenues	372.679	1.331.806	317.302	326.104	300.501

Financial operations	5.448	3.535	5.687	5.835	5.981
Amounts received from the EU/other donors on account of payments made and pre-financings	68.660	38.662	36.757	21.532.517	35.095.955

Source: own calculation based on data from https://mfinante.gov.ro

The current revenues in 2017 were of 87.674.336 thousand lei, and in 2018 they reached 117.262.176 thousand lei. Current revenues increased in 2020 compared to 2019 by 8.276.532 thousand lei, following that in 2021 it can be noted a decrease of 10.257.437 thousand lei compared to the previous year.

Capital revenues in 2018 increased by 959.127 thousand lei compared to 2017 because revenues from selling homes built from state funds increased by 4.1%, and revenues from guarantees granted and paid to credit institutions under the program ,,The first house" increased by 2.8% according to the Ministry of Public Finance. The following year there is a decrease of 1.014.504 thousand lei. Capital revenues register an increase in 2020 compared to 2019 of 8.802 thousand lei due to the transfer to the state budget of revenues obtained in the process of settling budget receivables, and in 2021 according to the Ministry of Public Finance there is a decrease of 25.603 thousand lei because the incomes from selling some goods belonging to the private domain of the state or of the administrative-territorial units decreased by 16% compared to last year. Capital revenues register an increase in 2020 compared to 2019 of 8.802 thousand lei due to the transfer to the state budget of revenues obtained in the process of settling budget receivables, and in 2021 according to table 1, there is a decrease of 25.603 thousand lei for that the revenues from the sale of some goods belonging to the private domain of the state or of the administrative-territorial units decreased by 16%.

Financial operations consist of operations involving the movement of capital, banking, foreign exchange or credit operations, investment operations, stock exchanges, insurance, mutual investment or bank accounts and those assimilated to them, domestic and international commercial transactions. According to table 1, the financial operations register an increase in 2020 of 148 thousand lei because the receipts from the repayment of other loans granted increase in 2020 compared to 2019 by 7%. In 2021 there is a continuous increase because the receipts from the repayment of loans from the financial recovery fund increases by 5.21% this year and the receipts from the repayment of other loans granted increase by 7.56%.

Since Romania's accession to the European Union, on January 1, 2007 until July 31, 2021, the amounts received by Romania from the EU budget were approximately three times higher than the amounts paid by Romania to the EU budget, according to the data provided by the Ministry of Public Finance: "According to the net financial balance, the evolution of financial flows between Romania and the European Union shows that our country received 66.2 billion euros, while it contributed to the European Union budget by 22.8 billion euros. However, Romania could benefit from more funds given that the absorption rate from European funds related to the cohesion policy allocated for the period 2014 - 2020 is about 50%, money that Romania can access until the end of 2023."[34]

In 2018 there is a decrease of 29.998 thousand lei compared to 2017. In 2019, the amounts granted from the EU decreased by 1.905 thousand lei compared to the previous year. These amounts consist mainly of amounts received from the European Agricultural Guarantee Fund (EAGF) in the amount of 8.687,5 million lei (53.1%), the Cohesion Fund (CF) in the amount of 1.679,4 million lei (10,3%), European Regional Development Fund (ERDF) in the amount of RON 1.266,8 million (7.7%), European Agricultural Fund for Rural Development (EAFRD) in the amount of RON 4.191,5 million (25.6%) according to the Ministry of Public Finance.

According to the Report on the macroeconomic situation for 2021 and its protection for 2021-2023, the amounts received from the EU /other donors on account of payments made and pre-financings had an increase in 2020 compared to 2019 of 21.495.760 thousand lei and in 2021 continues to register an increase of 34.966.377 thousand lei. In 2020, the Ministry of European Funds signed the largest funding received so far by the General Inspectorate for Emergency Situations, which was approved by the European Commission, due to the onset of the coronavirus pandemic. The EU has mobilized resources to support the population during the pandemic, by ensuring the delivery of protective equipment and stimulating research.

The EU has provided larger amounts in 2020 and 2021 for SME development and increased business competitiveness, infrastructure investment (transport, drinking water and sanitation, waste management, health, education, tourism, cultural heritage, energy efficiency and renewable energy), investments in research, development and innovation in priority areas for Romania, as well as in the field of information and communication technology. The amounts reimbursed by the European Union on account of payments made in 2021 are up 18.4% from the same period last year.

Table 2. Table of main sources of current revenues (thousand lei)

Indicators	2017	2018	2019	2020	2021
Current revenues	96.372.894	117.262.176	137.565.829	145.842.361	135.624.924
Fiscal revenue	87.674.336	104.003.171	114.546.832	122.898.328	111.799.566

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[34] https://european-union.europa.eu/principles-countries-history/country-profiles/romania_ro

Contributions	1.278.050	5.249.918	9.355.865	10.438.604	10.182.020
Non-tax revenues	7.420.508	8.009.087	13.663.132	12.505.429	13.643.338

Source: own calculation based on data from https://mfinante.gov.ro

In 2017, the fiscal revenues were of 87.674.336 thousand lei, and in 2018 the amount increase to 104.003.171 thousand lei. Fiscal revenues according to the Report on the final budget execution for 2020, registered an increase in 2020 of 8.351.496 thousand lei, then these revenues are decreasing by 11.098.762 thousand lei.

According to table 2, in 2018, contributions had a significant increase of 3.971.868 thousand lei because they were influenced by the increase in the number of employees in the economy, the average gross earnings, the minimum wage in the economy, the reduction and transfer social security contributions from the employer to the employee, the introduction of the employer's insurance contribution for work representing 2.25%, as well as the increase of payments from legal persons for disabled people not included in the level of a guaranteed minimum gross basic salary in the country in payment. In 2019, they continued to increase reaching 9.355.865 thousand lei because social contributions were influenced by the increase of the minimum guaranteed gross salary in differentiated payment depending on studies and in the field of constructions. In 2019, revenues from social security contributions stood at 11.3% of GDP, slightly below the level of 2018 (11.4% of GDP), their evolution being influenced by the slowdown in wage dynamics in the fourth quarter of 2019 and the fiscal facilities adopted in the sector constructions. Social security contributions show an increase according to the Report on the final budget execution for 2020, in 2020, compared to 2019 of 1.082.739 thousand lei because the calculation basis of CAS and CASS was changed due to employees with individual employment contracts with time partially, and in 2021 there is a decrease of 256.584 thousand lei because the delay calculated for non-payment of compulsory state social insurance contributions in the amount of 36.070 thousand lei is increased, resulting from the accumulations during the current year.

Non-tax revenues represent money resources that come from sources other than taxation, such as: royalties, transfers from the profit of state-owned companies, fines, tariffs. According to table 2, non-fiscal revenues presents an increase in 2018 compared to 2017 of 588.579 thousand lei, and will increase to 13.663.132 in 2019. There was a decrease in 2020 compared to 2019 of 1.157.703 thousand lei, and in 2021 there is an increase of 1.147.909 thousand lei.

Table 3 Table of fiscal revenue components (thousand lei)

Indicators	2017	2018	2019	2020	2021
Fiscal revenue	87.674.336	104.003.171	114.546.832	122.898.328	111.799.566

Income tax, profit and capital gains	27.794.362	22.484.942	21.885.294	23.523.782	20.792.464
Taxes and property taxes	124.862	117.526	542.212	563.401	587.064
Taxes and duties on goods and services	58.747.906	80.155.182	91.377.009	97.427.627	89.830.454
Tax on foreign trade and international transactions	951.250	1.042.032	1.144.697	1.253.940	1.131.856
Other taxes and fees	55.956	203.489	139.832	129.578	44.792

Source: own calculation based on data from https://mfinante.gov.ro

Revenues from taxes and fees vary from year to year. The main reasons are the changes in economic activity (employment levels, sales of goods and services, etc.) and changes in tax legislation (tax rates, tax base, thresholds, exemptions, etc.). Income tax, profit and capital gains in 2017 where 27.794.362 thousand lei, and in 2018 decreased by 5.309.420 thousand lei. This decrease was due to the reduction of the tax rate from 16% to 10% in the conditions of transferring contributions from employer to employee, starting with January 1, 2018. In 2019 there is a decrease of 599.648 thousand lei due to the legislative measure applied to employees in the field construction (income tax exemption). Income tax, profit and capital gains had an increase in 2020 compared to 2019 of 1.638.488 thousand lei, because the revenues from the income tax from pensions increased by 40.9% compared to the previous year and the income from the tax on dividends by 7.9%. In terms of structure, income tax revenues increased by 8.5% compared to the first quarter of 2019. This growth was supported by the increase in the number of employees by 0.7% and the average gross earnings in the economy by 9.2%, in the period December - February 2020 compared to the similar period of the previous year in the conditions of increasing the minimum gross salary from 2,080 lei to 2,230 lei. In 2021, according to the Ministry of Public Finance, the income, profit and the capital gains tax had a decrease compared to the previous year of 2.731.318 thousand lei because in 2020 most companies postponed the payment of taxes and duties.

In the category of income tax, profit and capital gains from legal entities according to the Ministry of Public Finance, there is a decrease of 889.929 thousand lei in 2018 compared to 2017 in terms of reducing revenues from income tax on micro-enterprises by 4.7%. In 2019, compared to 2018, there is a decrease of 2.763.912 thousand lei because the profit tax rate was very low, this led to a decrease in revenues to the state budget. In the category of income tax, profit and capital gains from legal entities according to the Ministry of Public Finance there is an increase in 2020 of 2.663.303 thousand lei, in 2021 according to the

Ministry of Public Finance there is a decrease of 2.416.010 thousand lei due to the establishment of new deadlines for the payment of tax obligations declared by taxpayers paying income tax on micro-enterprises, as well as 10% exemptions granted to them for the payment of maturity tax.[35]

In the category of income tax, profit and capital gains from individuals, there is a decrease in 2018 compared to 2017 of 4.379.267 thousand lei. In 2019, compared to 2018, there is a decrease of 3.404.156 thousand lei generated by the exemption from the payment of income tax of employees in the field of construction and of some industrial sectors (according to the Government Emergency Ordinance no. 114/2018 on the establishment some measures in the field of public investments and some fiscal-budgetary measures, the modification and completion of some normative acts and the extension of some terms, with the subsequent modifications and completions).

According to table 3, revenues from income tax, profit and capital gains from individuals decreased in 2020 by 32.0% compared to the corresponding period last year, this negative evolution being explained by the postponement of the payment of tax obligations by taxpayers profit tax payers. The structure of income tax revenues shows reductions in revenues from economic agents by 26.9% and commercial banks by 76.2% in 2020, also the decrease of 66.209 thousand lei in revenues and in 2021 is due to the continuous postponement of payment of tax obligations.

In the category of other taxes on income, profit and capital gains in 2018 compared to 2017, a decrease of 40.224 thousand lei can be observed because the income tax from other sources decreased by 4.5% compared to the previous year. In 2019, compared to 2018, an increase of 40.596 thousand lei can be observed because the tax obtained by non-residents regarding the distributed dividends increased by 5.6%. The tax due by non-residents for the taxable income obtained from Romania is calculated, withheld, declared and paid to the state budget by the income payers. According to the Ministry of Public Finance, in the category of other taxes on income, profit and capital gains, an increase of 316,028 thousand lei can be observed in 2020 compared to 2019 because the exemption from paying income tax on income obtained from Romania by non-residents distributed dividends, and in 2021 there is a decrease of 315.308 thousand lei because a new exemption is introduced regarding the income tax obtained in Romania by non-residents for the dividends paid.

In 2017, property taxes and fees were 124.862 thousand lei, in 2018 decreasing to 117.526 thousand lei. This decrease is due to the decrease of the building tax and the building tax by 3.2% compared to 2017. In 2019 there is an increase of 424.686 thousand lei because the land tax has an increase of 2.0% compared to in 2018. In the category of property taxes and fees in 2020 there is an increase of 21.189 thousand lei compared to 2019, these incomes increased by 1.1 thousand lei due to the postponement of the payment term for the building tax and the tax on land, and in 2021 according to the Ministry of Public Finance there is a continuous increase, compared to 2020 they increased by 96.8% because they paid the postponement of the payment term from 2020 for the building tax and the land tax.

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[35] https://mfinante.gov.ro/documents/35673/148567/legeabugetuluidestat2020.pdf

According to the Report on the final budget execution for 2020, in the category of revenues from taxes and fees on goods and services in 2018 there is an increase of 21.407.276 thousand lei compared to 2017 because VAT revenues were influenced by the evolution of the volume of retail trade (excluding trade in motor vehicles and motorcycles), gross series, which increased by 5.7% in the first eight months of 2018. Also, revenues from excise duties on energy products for 2018 recorded 16.3 billion lei representing 60.4% of the total state budget revenues for 2018, increasing by 14.4% compared to the same period of the previous year. From a legislative point of view, the increase was influenced by the increase in the level of excise duties on energy products, the increase in excise duty on fuels being carried out in two stages, on September 15, 2017 and October 1, 2017, the increase of 0.15 lei per liter for each of the two stages. In 2019 there was an increase of 11.221.827 thousand lei because there is an increase of 10.8% of gross VAT revenues (excluding refunds) and 14.5% of VAT refunds given that the relevant macroeconomic basis (turnover in trade, services and industry) increased by 10.4% on average in 2019. Revenues from the state budget from excise duties on tobacco for 2018 amounted to 9.8 billion lei, representing 36.3% of total annual revenues, being 0.1% higher than the same period of the previous year. Revenues from the state budget from excise duties on alcohol for 2018 compared to the same period of the previous year increased by 9.5%.

According to the Report on the final budget execution for 2020, in the category of revenues from taxes and fees on goods and services there is an increase in 2020 of 6.050.618 thousand lei compared to 2019 because this category includes excise revenues that have increased by 8.7%, registering increases both in revenues from excise duties on fuels (by 2.2%) and on excise duties on tobacco (15.3%). In 2021 there is a decrease of 7.597.173 thousand lei compared to 2020 because excise revenues amounted to 16.53 thousand lei in the first half of 2021, down 21.2%, and in the first quarter of 2021 revenues of excise duties for energy products decreased by 3.3%. According to the Report on the execution of the budget for the third quarter of 2021, the evolution of net VAT revenues in the third quarter of 2021 was negatively affected by: postponement of the deadline for payment of declared tax obligations, unfavorable economic developments in economic sectors market services provided to the population, industry and trade.

Revenues from the tax on foreign trade and international transactions in 2017 were 951.250 thousand lei, increased in 2018 by 21.407.276 thousand lei because the value of non-EU trade in goods increased by 23.5% on imports and 8.4% for exports according to the report on the final budget execution for 2018. In 2019, these revenues increased by 102.665 thousand lei compared to the previous year because the imports of goods increased by 9.0% (+ 0.2 billion). lei) compared to the third quarter of 2018.

According to the Report on the final budget execution for 2020, foreign trade tax revenues and international transactions increased by 10.5% in 2020 compared to 2019, amid an increase in the value of non-EU trade in goods by 6.2% on imports. Foreign trade tax revenues and international transactions decreased in 2021 according to the Ministry of Public Finance, by 3.5%, compared to the previous year, amid the decline in the exchange value of non-EU trade in goods by 7.8% on imports.

In the category of other taxes and fiscal duties in 2018, there is an increase compared to 2017 of 147.533 thousand lei because the incomes from "Tax on additional revenues obtained as a result of deregulation of prices in the natural gas sector" increased, registered in 2018 compared to 2017 by 24.6%. In 2019, these revenues decreased by 63.657 thousand lei because the revenues from the specific tax decreased by 4.2% compared to 2018.

In the category of other taxes and fiscal duties in 2020 there is a decrease of 10.254 thousand lei due to the fact that the taxpayers were obliged to pay the specific tax, and in 2021 a decrease of 84.786 thousand lei because the government again extended the exemption from the payment of the specific tax for the Horeca sector until the end of 2021, more precisely until 25.12.2021. In 2020, respectively 2021 according to ANAF GEO no. 99/2020 - new fiscal measures and extensions of deadlines for the application of the facilities already granted, the payment of the specific tax has been postponed, that is why we have a continuous decrease of the revenues from other taxes and fiscal fees.[36]

Table 4. Non-tax revenue components (thousand lei)

Indicators	2017	2018	2019	2020	2021
Non-tax revenues	7.420.508	8.009.087	13.663.132	12.505.429	13.643.338
Property revenues	6.062.245	6.703.564	11.831.647	10.718.100	11.768.331
Income from goods and services	1.358.263	1.305.523	1.831.485	1.787.329	1.875.007

Source: own calculation based on data from https://mfinante.gov.ro

According to table 4, in 2018 the property revenues increased by 641.319 thousand lei compared to 2017 because the revenues from concessions and rents increased, as a result of the 26% increase in oil royalties generated by the change in the methodology for setting the reference price for natural gas extracted in Romania. Revenues and amounts from the sale of greenhouse gas emission allowances also increased by 0.6% as a consequence of the increase in the price/bidding certificate and the exchange rate. In 2019, continuing to increase, reaching 11.831.647 thousand lei as a result of non-transfer of payments from the net profit of the autonomous utilities and income from term dividends and their non-distribution under the provisions of art. 43 of the Government Emergency Ordinance no. 114/2018. According to the Ministry of Public Finance in the category of property income there is a decrease in 2020, because it was collected less by 6.23% compared to the previous year revenues from concessions and rents, and in 2021 there is an increase of 1.050.231 thousand lei compared to 2020 because interest income increases by 1.2% compared to the previous year.

Sales of goods and services in 2018 recorded a decrease of 52.740 thousand lei because the revenues from compensations are down by 3.2% compared to 2017 according to the

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[36] https://mfinante.gov.ro/documents/35673/331915/oug_99_mo551_2020.pdf

Ministry of Public Finance. In 2019, there is an increase of 525.962 thousand lei compared to 2018 because the revenues from the recovery of advanced state legal expenses increased by 10.9%, and the revenues from consular fees increased by 9.0%.

In the category of sales of goods and services according to the Ministry of Foreign Affairs, there is a decrease in 2020 of 44.156 thousand lei, because this year is marked by the crisis generated by the COVID-19 pandemic, which affected both domestic and foreign demand. There is a marked decrease in industry (-14.1%) against the background of the manifestation of the pandemic, as well as in agriculture (-6.7%) against the background of the drought. The services registered a balanced decrease of -1.7% compared to the corresponding period of 2019 because the branch of entertainment, cultural and recreational activities registered a decrease of 29.1%, respectively a negative contribution of 1.1 percentage points, and in 2021, according to the Report on the budget execution for the third quarter of 2021, it registers an increase of 86.678 thousand lei because the revenues from the organization of professional qualification and conversion courses, specialization and improvement increased by 5.6%.[37]

3. Analysis of the State Budget Expenditures (forecasted) in Romania for the years 2017-2021

Public spending is important because it best reflects how the state can help each individual or entity at different stages of his life through the prism of public institutions. According to the way they are managed, the state makes efforts to modernize and offer citizens a civilized country, with European standards, which gives everyone equal chances to the health, education, defense, and development system. According to this criterion of grouping the public expenditures, the objectives of the financial policy of the Romanian state are implicitly reflected.[38]

Rouf, Islam, Miah, Raham (2021) like a lot of other researchers reveal that: "A budget deficit occurs when expenses exceed revenue and indicate the financial health of a country" and also that "A nation wishing to correct its budget deficit may need to cut back on certain expenditure, increase revenue- generating activities, or employ a combination of the two". So, due this the importance of studying the state budget is revealed.

Table 5: Total State Budget expenditures and main components through functional classification (thousand lei)

Indicators	2017	2018	2019	2020	2021

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[37] https://www.mae.ro/
[38] Liliana Donath – Finance public and elements of tax administration, Publishing House Marineasa, Timisoara, 2004, page. 69

Total expenditure	150.1 59.50 5	177.17 1.941	202.7 81.47 3	215.2 24.16 1	261.0 50.48 9
Part I General public services	43.14 8.476	41.607. 541	39.80 9.771	52.85 9.042	75.82 0.245
Part II Defence, public order and national security	26.21 0.939	31.211. 365	35.26 8.282	40.34 1.313	39.96 3.278
Part III Social and cultural expenditure	42.63 3.134	63.912. 810,00	81.90 0.477	83.32 0.267	90.62 3.151
Part IV Public services and development, housing, environment and water	4.626. 717	4.734.6 11	5.526. 538	5.169. 305	6.989. 374
Part V Economic actions	33.54 0.239	35.705. 614	40.27 6.405	33.53 4.234	47.65 4.441

Source: own calculation based on data from https://mfinante.gov.ro

According to the data extracted from the State Budget Law for the years 2017-2021, we can see that the total expenditures of the state budget in 2017 was 150.159.505 thousand lei and starting with 2018 there was a continuous increase, reaching in 2021 an increase of approximately 42.48% compared to 2017.

In Part I, General Public Services had a slight decrease in 2018 and 2019, of approximately 3.7% and 8.39% respectively compared to 2017, followed by a continuous and significant increase of approximately 18.37% in 2020 and 43.09% in 2021, respectively, compared to the same year. These fluctuations occurred due to the expenditure on transfers of a general nature between the different levels of administration, due to the rate of the shrew, which in 2019 reached a historic low of 2.97%, but as the pandemic gradually hit more and more sectors of activity that had to restructure and order employees unemployed, the rate would climb to 3.38% in 2020.

Table 6: General Public Services Expenditure Components (thousand lei)

Indicators	2017	2018	2019	2020	2021
Part I General public services	43.148.47 6	41.607.5 41	39.809.7 71	52.859.0 42	75.820.2 45
Public authorities and external actions	13.206.91 6	14.507.4 13	19.168.1 37	19.574.4 18	28.952.5 02
Fundamental research and research and development	2.010.006	1.956.43 1	2.138.04 0	1.828.48 5	2.010.00 6
Other public services	1.413.157	2.406.56 2	2.744.03 8	3.075.05 4	1.413.15 7
Transactions on government debt and loans	11.821.07 2	13.523.0 64	14.486.5 56	14.816.6 39	11.821.0 72

Transfers between different levels of administration	14.697.325	9.214.071	1.273.00 0	13.564.4 46	14.697.3 25

Source: own calculation based on data from https://mfinante.gov.ro

Expenditure with public authorities and external actions increased by 54.38% in 2021 due to the import of SARS-CoV-2 vaccines from other countries. Out of the total personnel expenses, the payments representing the risk incentive granted for COVID-19 amounted to 71.71 million lei, as well as other personnel expenses, including increases granted to the medical and auxiliary staff involved in the activities with patients diagnosed with COVID-19, of approximately 1.877 billion lei. The Ministry of Internal Affairs paid 187.12 million lei for the purchase of emergency medical products-stocks, including thermal scanners to combat the spread of SARS-CoV-2 coronavirus infection.[39]

According to Table 7, Defense, public order, and national security expenditures register consecutive increases of up to 3,41% in 2021, compared to 2017, necessary for the quarantine period, protests, and electoral elections, although compared to the previous year there was a slight decrease, being a priority other area, such as health. The Ministry of National Defense has pledged to allocate 2% of GDP to Defense, according to the North Atlantic Alliance. Over 28 million lei are used for the rehabilitation and modernization of the specific infrastructure at the National Institute for Medical-Military Research and Development "Cantacuzino" as follows: funds for investment actions such as the procurement of essential equipment, worth a total of 3.5 million lei, funds for the activity of combating the spread of COVID19 through specific RT-PCR testing activities, mainly consumption of reagents and sanitary materials - 12.5 million lei, as well as for the scientific research activity in the medical-medical field, mainly for the development of the projects included in the sectoral research plan of the Ministry of National Defense: "Imuno 1 - Orostim" - 1.4 million lei, "Imuno 2 - Polidin" 1.6 million lei, Good Laboratory Practice 500 thousand lei and Tetanus Anatoxin 320 thousand lei.[40]

Table 7: **Defense, public order, and national security expenditure components (thousand lei)**

Indicators	2017	2018	2019	2020	2021
Part II Defence, public order and national security	26.210. 939	31.211. 365	35.268. 282	40.341. 313	39.963. 278
Defense	11.805. 429	12.687. 443	12.809. 564	15.373. 185	11.805. 429
Public order and national security	14.405. 510	18.523. 922	22.458. 718	24.968. 128	14.405. 510

Source: own calculation based on data from https://mfinante.gov.ro

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[39] https://mfinante.gov.ro/documents/35673/1504261/nota_bgc30092021.pdf

[40] https://www.mae.ro/node/46982#null

Also, over one billion lei are allocated for the purchase of specific equipment and materials, such as armored personnel carrier, aircraft modernization and others. Thanks to the missions to extract the seconded Romanians and Afghans who collaborated with the Romanian authorities, fewer resources were allocated to personnel expenses in Afghanistan's capital, Kabul, conquered by the Taliban, fewer resources were allocated for personnel expenses in 2021.

Table 8 Components of expenditures on Social and cultural expenditure (thousand lei)

Components Part III Social-cultural expenditure	2017	2018	2019	2020	2021
Part III Social and cultural expenditure	42.633.134	63.912.810,00	81.900.477	83.320.267	90.623.151
Education	5.712.703	22.082.774	31.898.874	30.208.203	29.705.287
Health	4.116.827	5.672.572	10.272.664	9.678.664	11.895.437
Culture, recreation, and religion	3.058.438	3.175.811	3.614.558	3.476.718	3.390.850
Insurance and social assistance	29.745.166	32.981.653	36.114.381	39.956.682	45.631.577

Source: own calculation based on data from https://mfinante.gov.ro

Social and cultural expenditures show consecutive, gradual increases, reaching an increase of about 53% compared to 2017, being favored in the health sector, by implementing measures to stimulate anti-covid vaccination, the purchase of medicines, the development of national health programs and special arrangements for vaccination centers. In the state budget, in 2021, an increase is reflected, respectively 19.7% compared to the same period of the previous year, as well as in the budget of the Single National Health Insurance Fund of 8.9%, mainly, according to the data communicated by the principal authorizing officers, 5.27 billion lei out of the total goods and services represent payments for medicines, sanitary materials, reagents and other products necessary for the diagnosis and treatment of patients infected with the SARS-CoV-2 coronavirus, as well as the payment for vaccines against Covid -19. The evolution of social assistance expenditures was mainly influenced by the increase of the pension point from 1 September 2020 by 177 lei, respectively from 1,265 lei to 1,442 lei. Also, it is reflected the increase from 1 September 2020 of the level of the social allowance for pensioners guaranteed from 704 lei to 800 lei, as well as the increases regarding the state allowances for children starting with January 1, 2020, with August 1, 2020, which represents an increase of the allowance by approximately 20% more than the one paid in July 2020, as well as 1 January 2021 which represents an increase in the allowance of approximately 16% more than that paid in December 2020. Also, the

settlements of the social health insurance indemnities for medical leave are continued to reduce the stock of outstanding payments related to them.[41]

As it can be seen in Table 8, in 2018, there is an increase in education spending of 74.13% compared to 2017, due to the implementation of policies and programs, through which to achieve the strategic objectives and targets in its field of activity, such as combating school dropout.[42] Strategic priorities being, for example: ensuring equal opportunities for access and participation in relevant and inclusive education, quality at all levels of education and training, and modernization of the infrastructure of pre-university education; the use of new technologies and the improvement of school management and career development in education.

Health expenditures recorded continuous increases, of up to 65.39% in 2021 compared to 2017, due to the implementation of actions such as: the acquisition of new ambulances, the development of the Balti Central Hospital, the renovation and modernization of regional hospitals, the Transplant Program, the National Cancer Control Program, in the amount of 478.2 million lei and that of tuberculosis – 333.5 million lei.[43]

As we can see, if we refer to 2020, in 2021, the pandemic but also the need to modernize the infrastructure of several areas has led to the allocation of more consistent amounts. Education, culture, recreation, and religion recorded decreases by approximately 589.000 thousand lei due to social distancing and measures to prevent SARS-COV 2, a period during which education was carried out in the online environment, respectively the other fields had their activity suspended, which led to a decrease in maintenance costs. The education sector is seeing a decrease in spending in 2021, in an absolute amount of 2.193.587 thousand lei, because a series of expenses are no longer included, such as holiday vouchers, payment of salary differences according to Law 85/2016 or allocations from the reserve fund. But there are also increases, the most relevant ones are to ensure, for the first time from the state budget, through local budgets, the funding for students' scholarships. In 2020, the total budget at national level of students' scholarships was 270 million lei, in 2021, the total budget of students' scholarships was 540 million lei. Also, a substantial increase is registered by the basic financing of the state pre-university education units, the component dedicated to material expenses and professional training, an increase of 26%, from 1.259 billion lei to 1.585 billion lei.[44]

Table 9: Public Services and Development, Housing, Environment and Water Expenditure Component (thousands of lei)

Indicators	2017	2018	2019	2020	2021
Part IV Public services and development, housing, environment and water	4.626 .717	4.734 .611	5.526 .538	5.169 .305	6.989 .374

[41] https://mfinante.gov.ro/documents/35673/1504261/nota_bgc30092021.pdf

[42] http://legislatie.just.ro/Public/DetaliiDocument/185778

[43] http://legislatie.just.ro/Public/DetaliiDocumentAfis/192824

[44] http://legislatie.just.ro/Public/DetaliiDocument/178164

| Housing, services, and public development | 3.481 .176 | 3.674 .333 | 4.230 .293 | 3.976 .260 | 5.787 .413 |
| Environmental protection | 1.145 .541 | 1.060 .278 | 1.296 .245 | 1.193 .045 | 1.201 .961 |

Source: own calculation based on data from https://mfinante.gov.ro

For Part IV, Services and public development, housing, environment, and water in 2021, hydro-technical developments were made that determined an increase in expenses by 2.362.657 thousand lei compared to 2017. The Ministry of Development, Public Works and Administration has allocated the total amount of 50.000.000 thousand lei to a new program, namely the program called "The National Investment Program "Anghel Saligny", which involves the development of the basic infrastructure: water-sewerage, roads and connection to natural gas systems, at the level of all localities.[45]

Table 10: Economic Actions Expenditure Component (thousand lei)

Indicators	2017	2018	2019	2020	2021
Part V Economic actions	33.540.239	35.705.614	40.276.405	33.534.234	47.654.441
General economic, commercial, and labor actions	1.332.984	2.225.491	3.035.218	2.173.449	5.241.551
Fuels and energy	100.728	139.641	135.062	148.175	701.072
Extractive, manufacturing, and construction industry	140.745	157.691	448.364	322.893	148.601
Agriculture, forestry, fish farming and hunting	17.750.538	23.989.119	23.509.031	19.053.855	26.912.090
Transport	13.522.262	8.621.307	12.580.856	11.346.387	13.716.839
Communications	508.891	288.724	260.472	195.079	578.857
Economic research and development	128.416	253.643	268.698	282.698	298.441
Other economic actions	55.675	29.998	38.704	11.698	56.990

Source: own calculation based on data from https://mfinante.gov.ro

According to Table 10, expenditures on Economic Actions, recorded increases in 2018 and 2019, compared to 2017 of 6.06% and 16.72%, respectively, due in large part to the Agriculture, Forestry, Fisheries and Hunting sector, where the general objective of

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[45] https://www.mdlpa.ro/uploads/articole/attachments/6151bbc554214183914086.pdf

governance was to harness Romania's agricultural potential and to ensure food security at national level, as well as to create availability for export.

As in 2017 not all the money allocated to the Transport sector was spent, for 2018 it was allocated 56.85% less and, as a result, needing the money to cover the rising salary expenses. The only increase appears in the maintenance of the road infrastructure, from 304.000.000 lei to 331.000.000 lei.

In the year 2020, there is a decrease of 20.1% in the expenditures with Economic Actions, compared to the previous year, allocating fewer resources to the sectors, except for Fuels and Energy, but also research and development in the economic field.

Expenditures on goods and services in 2021 increased by 7.2% compared to the same period of the previous year. For agriculture, the expenditures increased by approximately 1.300.000 thousand lei for granting financial support for diesel used in agriculture, and 2.000.000 thousand lei for land improvement, irrigation, dewatering and combating soil erosion through regional and local development programs such as the National Anti-hail Program. The state contributed with 40.000 thousand lei to the share capital of the Commercial Company "Romanian National Air Transport Company – TAROM" S.A. to cover the damages suffered, in the period 01.07 - 31.12.2020, because of the COVID-19 pandemic and caused directly by this pandemic.[46]

As for the communications sector, the expenses increased by 383.778 thousand lei in 2021 compared to 2020, due to the process of modernization and expansion of the information technology, communication technology infrastructures and systems under administration, these steps taking place following the development of school and professional activities in the virtual environment.

Expenditures on other economic actions increased by approximately 45 million lei in 2021 compared to the previous year, largely for the development of economic activities, such as the High-Performance Green Port project – "Green Port And High Performance". This is one of the 14 infrastructure projects submitted by Romania for contracting European funds under the Connecting Europe Facility" (CEF), through which in Giurgiu, in the vicinity of the Free Zone, a hall with trimodal access (river, road and rail) will be built. The project aims to build a quarter hall (river, road, rail) and aims at restoring and modernizing the unloading quay, investments in high-performance equipment, extending the railway for the realization of a trimodal transport infrastructure, rehabilitating the road infrastructure inside the port area, upgrading the existing information technology systems, and integrating into the River Information System.

The implementation of this project will increase the traffic and the volume of goods through the port infrastructure in Giurgiu and will animate the economic activity in the area. The

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[46] https://mfinante.gov.ro/static/10/Mfp/buget2021/og97_mo858.pdf

trimodal center built in Giurgiu will be the only one in South-Eastern Europe. The hall will have 8,000 sqm and a working capacity of 300,000 tons/year.

4. Conclusion

The state budget is a document that reflects the expenses and incomes of the country. The budget should reflect the general elections of citizens in relation to the services that the state must provide to them as members of society, payers of taxes and fees. Following the analysis, it can be seen that Romania's state budget revenues are increasing in the period 2017-2021 but are lower than the expenditures recorded in this period. The essential issues of the market economy and the developing economy are consisting on finding the optimal ways of financing budget deficits, under the conditions in which the public debt represents a problem in Romania, and deficit financing has a number of implications on the interest rate and the economic growth.

The perspective of a large budget deficit outlines the perspective of both reduction of the government expenses and tax increase which would certainly determine a reduction of the economic growth. In 2021 Romanian State Budget has a deficit of approximately 62.1% higher than in 2017, because expenditures increased more than could be covered by revenues, encountering several events that require additional expenditures compared to previous years, among which we can mention the pandemic and inflation, which is currently about 8%. This deficit results from the accumulation over time of significant budget deficits and the formation of a substantial public debt. A strong impact on the overall economic balance is debt financing and the interest burden that generates inflation and limits the possibilities for stimulating economic growth.

Following this analysis, we can conclude that the state is trying to distribute the country's resources for the benefit of the citizens, but it seems that the management was done in a wrong way. The health crisis is one of the examples, because the purchase of a very large number of vaccines and the expenses of almost half a billion lei for the vaccination campaign did not have the expected success, the number of people who were vaccinated during that period being very low.

To sum this up, we propose some ideas on the future of Romania's state budget, more exactly the gradual achievement of fiscal consolidation through measures to achieve the deficit target provided by regulations. This can be achieved by creating a fiscal policy designed to support and adapt the business environment to the challenges posed by the health crisis, the rapid adoption of fiscal measures, made to cover the financial needs in the fields most affected by the COVID-19 pandemic crisis. In particular to support employees or ensure a minimum income for the unemployed, as well as to avoid bankruptcy of a very large number of companies, especially SMEs, are essential to avoid a more severe decline in economic activity.

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THE IMPACT OF DIGITALIZATION IN THE FIGHT AGAINST FRAUD - EUROPEAN FUNDS SECTOR

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Abstract

For the European Institutions and all the Member States, the last three decades were a continuously challenge to find the best methods to fight against fraud and to protect the financial interest of the European Union. The digitalization process and programs like Helcules supported this fight and assist in these protection process. So, in-depth investigations into European Funds have increased significantly in recent years, generating more and more data to be processed.

The article presents to what extent, this digitalization process, has managed to make improvements at EU level over the last decades, in the sector of European Funds. So, the Member States through the digitalization process implement a series of actions to stop irregularities, fraud and corruption that have a negative effect on the EU budget.

Keywords: funds, fraud, digitalization, European Union.

1. Introduction

The world as we know it is constantly changing and one of the fundamental driving factors is the digital transformation. For most of us, digital transformation refers to the transformation of services or businesses. This can be done by replacing manual processes with digital processes or updating the existing one.

People regularly work from different offices, from home or from a local cafe - now, even more so, with the pandemic situation. Given that the workplace is changing, we all expect the same level of connectivity in the office, which happens or not. Instead, what the pandemic has certainly managed to change is the need for organizations to take a more open approach to digital employee activity.

Traditionally, economic transactions were governed by the interaction between producers and households. Now things are different.

When we talk about the digital economy, we mean a wide range of economic activities and the huge volumes of data generated. There are now many new sources of information, but mainly unstructured for statistical purposes. This requires statistical agencies to play a new

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role in data management, which involves some efficient and secure practices for data storage, manipulation, and dissemination.

2. The three decades

In the early 1990s, the number of reported irregularities or frauds was very low at EU level, but since 1994 there has been a significant increase. There have been many fluctuations over the last three decades, but mainly in the direction of increasing irregularities, and so the EU has tried to identify several remedial measures.

As table no. 1 shows, till 1993, only few countries reported irregularities. After 1994, the number of cases of fraud or irregularity reported increase in almost all the countries, especially in Greece, Denmark, Spain, Italy, Portugal and UK. Beside these 6 countries, in the last 3 years of these decade, another 3 countries (Germany, Ireland and Sweden) registered an increase in the number of cases. At the level of member states the total number of cases of fraud and irregularity reported increased from 41 in 1991 to 698 in 1999.

Table no.1 - UE - no. of cases of fraud or irregularity reported (first decade)

Country/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Belgium		0					6	12	2	6
Germany		1	6	1	9		1	0	14	11
Denmark		0	1	4	10	21	52	47	66	82
Greece		9	0	0	34	58	23	53	17	21
Spain		6			17	46	34	33	159	141
France		3			3		30	8	3	169
Ireland		5			5		9	16	25	18
Italy		0	1			5	42	33	23	59
Luxembourg		0	0	0	0		0	0	0	0
Netherlands		12	0	0	12	13	0	0	3	22
Portugal		0			6	44	87	69	52	76
UK		5	0	0	8	7	6	20	30	67
Austria								0	1	6
Finland								1	4	5
Sweden								17	8	15
Total		41	8	5	104	194	297	309	407	698

Source: *own calculation based on data from ec.europa.eu*
Note: no data reported for 1990

The amount involved in the cases of fraud or irregularity keep the trend of the number of cases through the period 1990-1995, because some Member States are still having difficulties in meeting their reporting obligations. After this period we can notice an increase due to four countries: Denmark, Spain, Italy and Portugal.

In the case of the Cohesion Fund, the low number of notifications of irregularities by the Member States may be explained by the fact that only four of them are involved. Regarding the Structural Funds, the small amount involved in 1998 (ECU 42,47 million) compared with 1997 (ECU 57,07 million) can be related to the small number of cases dealt with by UCLAF (table no. 2). The overall budget impact declined from 0.45% in 1997 to 0.18% in 1998.

Table no. 2 - UE - the amount (ECU millions) – first decade

Country/Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Belgium		0				0	0,26	0,5	0,15	0
Germany		0,01	0,2	0,02	0,12	0	0,1	0	0,53	0,1
Denmark		0	0,18	0,04	0,38	12,69	14,93	11,6	5,47	15,2
Greece		0,12	0	0	0,83	2,59	1,7	3,8	3	1,2
Spain		0,08			2,16	20,15	3,18	4,3	8,5	9,7
France		0,87			0,92	0	1,27	0,3	1,79	2,8
Ireland		0,04			0,04	0	0,97	2,3	0,24	5,1
Italy		0	0			4,44	24,4	4,8	0,6	42,8
Luxembourg		0	0	0	0	0	0	0	0	0
Netherlands		0,11	0	0	0,12	0	0	0	0,06	1,9
Portugal		0			0,53	2,5	10,77	18,17	6,3	4,6
UK		0,22	0	0	0,42	1,96	7,11	9,8	15,1	36,1
Austria								0	0	0,1
Finland								0,009	0,0061	0,1
Sweden								0,5	0,16	0,5
Total		1,4	0,2	0,06	5,37	44,4	63,87	57,07	42,47	120,6

Source: *own calculation based on data from ec.europa.eu*
Note: no data reported for 1990

According to Protecting the Community's Financial Interests and the Fight against fraud – Report (2010) – „Member States are required to report irregularities which they have identified and to indicate where these may constitute suspected fraud. The systems for reporting have been modernized and improved, which has led to an overall improvement in the quality of reporting. This in turn has led to an increase in the coverage and reliability of the analysis."

Regarding the second decade (table no. 3), number of cases recorded a significant increase from 1217 cases in the beginning of 2000 to 4632 cases in the last part of the period. A reason that explains this is the closure of the 2000-2006 programming period is aspect that conduct to an increase in checks and audits.

Germany, Spain, Italy, Portugal and UK were the group of countries which totalize more than 60% of the total of cases. Even the last two countries entered in EU, Romania and Bulgaria, have both reported irregularities.

If at the beginning, in the 1990s the total the number of reported irregularities or frauds was almost insignificant, by the end of the 1990s these data had changed, and the EU was not prepared with specific mechanisms to combat this situation.

Table no. 3 - UE - no. of cases of fraud or irregularity reported (second decade)

Country/Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Belgium	0	0	14	8	45		31	28	35	77
Denmark	12	13	22	18	47		19	11	7	22
Germany	107	164	1958	766	985		321	412	372	10
Greece	14	80	176	172	150		70	66	96	449
Spain	185	80	183	443	263		346	613	488	15
France	266	205	463	178	110		98	140	98	90
Ireland	88	55	126	74	43		0	32	2	884
Italy	117	91	107	173	638		744	658	802	28
Luxembourg	0	0	0	39	3		3	8		
Netherlands	223	323	932	52	58		182	146	262	128
Austria	44	20	87	38	38		59	28	37	79
Portugal	50	55	58	104	256		440	540	403	612
Finland	13	38	82	33	37		48	43	28	173
Sweden	19	15	54	73	119		71	79	146	12
UK	79	55	394	316	244		223	502	483	857
Estonia					7		11	32	28	75
Latvia					2		3	8	22	38
Hungary					1		91	35	39	16
Poland					3		282	147	329	330
Cyprus							0	1	4	79
Czech							40	35	80	546
Lithuania							25	8	26	12
Malta							2	2	1	4

Slovenia							7	4	13	13
Slovakia							7	27	62	82
Bulgaria									4	1
Total	1217	1194	4656	2487	3049		2988	3740	3867	4632

Source: *own calculation based on data from ec.europa.eu*
Note: no data reported for 2005

The estimated financial impact of the irregularities is higher for the area of structural funds. The average financial impact of the irregularities is around 2% for structural funds (including cohesion funds), in 2004. In the same year, „financial impact (€695.6 K) increased with respect to the previous year owing to an increase in cases of irregularities in the area of ERDF", according to Protecting the Community's Financial Interests and the Fight against fraud – Report (2004).

Table no. 4 - Last year of the decade show a significant increase from previous year: EURO 1111,5 million (2009) over EURO 528,9 million (2008).

Table no. 4 - UE - the amount (EURO millions) – second decade

Country/Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Belgium	0	0	1,2	1,7	14,9		3,6	1,5	1,5	5,1
Denmark	0,02	0,4	4,4	1,3	2,4		0,8	0,3	0,3	1,3
Germany	17,2	12,5	290,3	89,2	127,4		27,2	49,5	20,9	0,6
Greece	2,8	6,1	23,9	163,7	112,3		13,2	25,5	19,8	146,9
Spain	11,3	6,2	43,7	42,9	25,8		85,6	181,3	140,8	0,3
France	9,9	12,1	22,8	16,6	3,1		4,3	6,1	4,9	4
Irland	8,7	48,6	16	7,2	3,4		0	2,1	5,3	328,4
Italy	22,9	58,7	30,4	56,6	194,9		228,2	158,4	74,9	4,4
Luxembourg	0	0	0	3,2	0,1		0,1	0,2		
Netherlands	23,7	14,2	120,5	9,5	6,8		15,3	27,2	28,7	19,3
Austria	1,3	0,6	3,1	3,2	3,4		7,8	4,7	2,8	9,9
Portugal	3,4	9,3	13,5	37,3	11		37,1	49,9	29,5	110,2
Finland	0,03	1,05	2,2	1,5	1,4		2,9	2,4	1,8	11,4
Sweden	1,2	0,2	0,5	1,2	2,7		2,5	3,6	3,7	0,7

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
UK	10,6	31,1	40,9	46,6	22		60	161,2	123,3	279,6
Estonia					0,1		1,3	1,2	2	46,9
Latvia					0,3		0,04	1,9	0,8	3,1
Hungary					0,006		6,1	2,7	3,3	0,9
Poland					0,001		12,2	30,2	35,3	48,3
Cyprus							0	0,003	0,1	12,9
Czech							3	4,9	13,9	44,4
Lithuania							1,2	0,1	3,2	3,3
Malta							0,3	0,03	0,4	0,5
Slovenia							2,5	0,1	0,4	5,1
Slovakia							0,5	1,9	9,5	23,5
Bulgaria									0,8	0,06
Total	114,2	201,5	614,09	482,2	532,8		516,7	717,4	528,9	1111,5

Source: *own calculation based on data from ec.europa.eu*
Note: no data reported for 2005

As table no. 5 shows, in 2011, the number of irregularities reported as fraudulent in the area of cohesion policy decreased significantly in comparison with the previous year, by 46%. In these decade we have a gap in 2015, with over 10.000 cases, followed by a negative trend till the end of 2019.

Given the scale of the situation and the visible increases of irregularities, the EU set up the Hercules I program in 2004. The program has managed to bring visible improvements in the coming years, in some countries, but not enough.

In 2007, the EU launched the second Hercules program, with a budget of 98.5 million euros.

The Hercules II program helped strengthen transnational cooperation. Formal and informal networks have been set up between the European Commission, Member State authorities and OLAF, for a faster exchange of information and a better anti-fraud response.

Although the Hercules II Program was mainly effective in accessing data for some states, for others the contribution was small.

Table no. 5 - UE - no. of cases of fraud or irregularity reported (third decade)

Country/Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019

Belgium	123	60	32	70	85	42	58	51	9	13
Bulgaria	66	51	65	58	177	103	147	77	50	57
Czech	213	270	549	998	982	623	414	282	184	132
Denmark	4	6	1	5	7	3	14	3	1	3
Germany	354	293	187	220	282	381	260	83	43	71
Estonia	50	46	93	75	53	38	30	24	50	56
Ireland	621	34	14	167	131	545	66	44	0	0
Greece	680	381	119	194	226	114	554	504	30	13
Spain	738	18	491	277	167	5105	2687	1115	52	18
France	166	313	70	13	170	19	80	26	16	22
Croatia						1	7	10	43	55
Italy	1014	389	447	331	272	191	158	555	240	103
Cyprus	5	1	3	5	4	3	7	30	2	3
Latvia	35	41	38	79	92	51	179	31	8	25
Lithuania	52	138	92	142	121	53	31	72	39	42
Luxembourg	3	4	1						0	0
Hungary	119	42	76	156	190	304	522	149	256	206
Malta	3	3	3	10	14	14	13	23	1	1
Netherlands	75	50	28	62	40	63	55	63	4	5
Austria	64	43	12	9	56	90	33	8	8	14
Poland	399	725	800	685	681	826	1077	499	425	526
Portugal	925	388	117	171	98	215	171	392	35	40
Romania	20	59	245	242	330	374	557	368	98	109
Slovenia	19	34	13	46	37	38	24	41	4	5
Slovakia	160	125	190	152	267	373	428	248	84	118
Finland	37	50	10	6	12	12	15	7	12	12
Sweden	13	7	27	29	29	30	5	11	4	16
UK	1104	309	355	472	454	711	498	413	141	147
Total	7062	3880	4078	4674	4977	10322	8090	5129	1839	1812

Source: *own calculation based on data from ec.europa.eu*

According to table no. 6, in 2011, the amount related to number of irregularities reported as fraudulent in the area of cohesion policy decreased significantly in comparison with the

previous year, by 63%. The amount increase from 2012 to 2016. From 2016 till the end of the decade we have a descending trend.

Table no. 6 - UE - the amount (EURO millions) – third decade

Country/ Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Belgium	12,3	3,9	2,7	2,5	11,6	1,1	3,2	6	0,4	1,6
Bulgaria	21,3	4,9	6,8	13,1	28,7	31,8	33,9	29,6	8,8	4,8
Czech	338	164,3	1033,5	356,5	290,8	234,8	112,3	60,9	73,4	16
Denmark	0,2	0,1	0,001	0,07	0,3	0,1	0,6	0,6	0,02	0,1
Germany	58,8	42,8	25,3	22,4	19,5	37,5	24,9	10,5	3,5	7,1
Estonia	3,6	3,3	27,4	9,9	8,2	1,4	1,5	2,8	6,3	5,3
Ireland	105,9	2,3	4	52,5	53,6	74	8,1	3,2	0	0
Greece	179,9	93,2	65,1	152,7	107,2	37,6	183,5	272,4	11,2	3,3
Spain	131	0,4	516,6	86,8	381,2	434,3	313	366,9	29,9	15
France	9,1	309,8	12,4	0,1	39,3	2,5	8,9	4	1,6	2,2
Croatia						0,2	2,2	0,5	6	6,7
Italy	192,4	193,4	66,9	37,1	71,1	45,8	50,1	86,1	74,5	16,1
Cyprus	0,3	0,02	0,06	0,1	0,1	0,4	0,3	3,2	0,05	0,3
Latvia	3,3	13	3,1	31,5	12,7	9,8	40,5	3,7	0,9	5,1
Lithuania	12,4	54,3	5,3	29,9	36,8	6,9	3,9	23,6	2,7	6,1
Luxembourg	0,1	0,06	0,005						0	0
Hungary	35	3,5	8	18	15,9	37,5	105,6	27,2	33	34,4
Malta	0,04	0,09	0,5	0,8	0,9	0,5	10,9	2,3	0,01	0,02
Netherlands	7	2	2,4	8,8	5,1	5,3	3,7	4,8	0,03	0,1
Austria	8	16,1	0,2	0,5	2	8,1	2,1	2,4	0,5	1,1
Poland	71,4	165	358,9	107,5	121,5	190,5	305,8	195,7	58,6	71
Portugal	65,3	61,4	19,6	19,6	21,2	27,7	11,5	63,8	3,4	4,2
Romania	2,4	7	61,4	44,6	40,6	123,8	109,4	102,9	12,9	40,8
Slovenia	3,1	7,4	0,6	7,5	8,9	4,7	4,3	1,4	1,9	0,1

Slovakia	106,5	24,3	57,1	121,1	240	416,5	445,6	108,2	267,5	256,4
Finland	1,5	13	0,2	0,3	0,3	0,8	0,4	0,6	0,8	0,3
Sweden	1	1,3	0,8	1,2	1,1	1,9	0,2	0,8	0,1	1,5
UK	178,5	32	16,9	52,1	41,7	33,8	38,8	10,5	0,9	1,8
Total	1550,1	1219,6	2296,5	1178,02	1561,3	1770,2	1826,2	1395,8	599,9	502,4

Source*: own calculation based on data from ec.europa.eu*

Tax fraud have always existed, as official data show, and that is why the EU has tried to find ways to combat these situations.

The Hercules program is one of the measures, and now it is in the third stage, Hercules III, under the multiannual financial framework 2014-2020.

The program provides grants for various tools and equipment for information technology, for databases and tools through which they can be accessed. At the same time, it supports conferences in the field, but also other actions that help to achieve the objectives.

Thus, EU Member States have requested funding for this purpose, insofar as they deemed it necessary - The program provides 104,9 million euros.

Table no. 7 – UE – Grants requested, awarded and finalized (EURO), 2014-2019

Country /Grands	Grants requested	Grants awarded	Grants finalized
Austria	0	0	47447
Belgium	1540098	1263529	819989
Bulgaria	4225582	3871384	1567043
Croatia	7619661	3720124	124092
Cyprus	463010	60909	29420
Czech	969493	704738	141922
Denmark	1069716	823088	639252
Estonia	580224	292238	296313

Finland	1213127	2274160	850126
France	1722507	2526655	728254
Germany	197096	197053	0
Greece	4845796	2744201	82561
Hungary	7412540	1732531	1916305
Ireland	2249778	3249660	230156
Italy	5407770	3094398	2089120
Latvia	5703592	3850867	678864
Lithuania	5287348	6420756	422206
Luxembourg	133471	127679	58800
Malta	3608869	2156430	1690667
Netherlands	658807	1459373	151932
Poland	19139030	6080345	1886448
Portugal	2765911	2999718	1825382
Romania	16560453	6365592	1295583
Slovakia	4263213	3095338	482938
Slovenia	3131820	2116700	0
Spain	6293554	3671587	1602794
Sweden	247056	398178	199316
UK	685378	159628	0

Source: *own calculation based on data from ec.europa.eu*

In the last decade, countries such as Spain, Poland, the Czech Republic, the United Kingdom and Italy have had the highest number of irregularities at EU level (Table no. 5) and the amount involved in the cases of fraud or irregularity keep the trend of the number of cases, with the exception of the United Kingdom (Table no. 6).

Given that they have identified and reported these irregularities, not all of them are at the top when it comes to asking for help through the Hercules III program. Poland is first, with over 19 billion euros requested from the EU, Romania is in second place, Spain in fifth place, Italy in seventh place.

On the other hand, if we talk about the countries with the lowest number of irregularities, the leader is Luxembourg, followed by Denmark, Cyprus, Malta and Croatia, keeping the related amounts at a low level.

In-depth investigations into EU funds have increased significantly in recent years, generating more and more data to be processed and moreover a greater need for training for analysts. In order to cope with these situations, since 2018, courses for analysts have been added.

They aim to improve investigations, the quality and accuracy of EU funds, and progress can already be seen in the official data published, both in terms of reducing irregularities and reported cases of fraud and the amounts involved.

3. Conclusion

Digital technologies have already proven to be transformative forces in terms of development, thus generating economic and social benefits for people, but also for businesses and governments.

The digital economy is fueled by - and generates - huge amounts of data. Traditionally, in a store, we paid using cash, no one took into account our personal consumption or financial transactions. Now, online ordering and electronic payment means that many of consumer transactions generate electronic data that is recorded and stored by someone.

Clearly, we need professionals with good skills to exploit large volumes of information together with a technological infrastructure that allows their efficient storage and processing.

The digital economy is in each of us. However, the boundaries between digital and traditional are blurring as technological changes penetrate every facet of modern life. We all need to understand the nature of this change in order to meet the challenges and adapt to the new requirements.

The EU has become increasingly aware of the problems of the number of irregularities and the amounts involved, and over the last three decades has been constantly working to remedy these situations.

Countries with a high number of irregularities need to be more careful and follow EU guidelines, and at the same time turn to EU help.

Thus, the Hercules program continues to be an important tool for protecting financial interests, providing more security for Member States, but any other extra tool is welcome for even greater safety.

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EFFECTS OF THE EUROPE 2020 STRATEGY ON THE CURRENT EUROPEAN CONTEXT

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Abstract

The European Union has faced a number of structural deficiencies in recent decades, as global challenges have intensified. The European Union must face some challenges that are exacerbated by the current global crisis, but also the global economic interconnection, the adaptation of the global financial system, climate challenges and resource depletion. The challenges are major and have a number of short-term implications - exiting the health crisis, as well as long-term ones. On the other hand, EU member states have to deal with globalization, resource pressures and an aging population. In this article, we set out, based on the objectives proposed in the EU's 2020 Strategy, to analyze the binomial of eco industries - reducing harmful emissions. The binomial eco industries - reduction of harmful emissions was used in a mathematical model, the main source of statistical information being Eurostat, the data being subsequently processed in the Eviews program. All this research in the article aims to quantify the relationship of influence between the evolution of investments in eco-industries and that of greenhouse gas emissions at European level, starting from the arrangements made by the European Union in recent decades, in the context of amplifying the phenomenon of climate change.

Key words: Gross Domestic Product; growth favorable to economic inclusion; sustainable development; greenhouse gas emissions; European eco-industry.

1. Introduction:

The European Union has launched a new strategy in the light of current realities as a result of the world economic challenge that it has faced in the last decades of the 20th century. Across the Union, it is promoted as a strategy "for a smart, eco-friendly growth, favorable to social inclusion".

The current health crisis has revealed a series of structural deficiencies within the Union, given that the global challenges become fiercer, and it is truly necessary to approach a strategy on the harmonious sustainable economic development of the European Union members states.

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The Europe 2020 Strategy relies on two pillars: a thematic approach structured on objectives and priorities, and the draw up of regular Country reports through which the Commission could constantly assess the situation in each member state. At the same time, each member state will receive specific recommendations; in case of an incompliant reply to these recommendations, political warnings may be issued at country level.

The Europe 2020 Strategy focuses on three priorities:

- smart growth – the development of an economy based on knowledge and innovation;

- sustainable growth – the promotion of an economy which is more efficient in respect of resource use, eco-friendlier and more competitive (economic growth under the conditions of low carbon dioxide emission, the limited use of non-sustainable resources and the loss of biodiversity);

- growth favorable to inclusion – the promotion of an economy with a high rate of labor force occupancy, capable of ensuring economic, social and territorial cohesion.

The *five objectives* of the Europe 2020 Strategy are as follows:

- the rate of labor force occupancy within the population in the 20- and 64-year range should grow from the level set in 2010, namely 69%, to at least 75%, including through more involvement of women, aged workers and better integration of migrants on the labor market;

- the European Union is currently following the target of investing 3% of the GDP in research and development (RD). The Commission proposed to maintain the 3% target together with the development of an indicator which would reflect R&D intensity and innovation;

- the reduction of greenhouse effect emissions by at least 20% as compared to the 1990 levels, or by 30 %, if there are favorable conditions to this end; the increase to 20 % of the importance of renewable energy sources in the end power consumption and a 20% increase of power efficiency;

- an objective related to studies which approach the issue of early school drop-out, with the aim of diminishing the drop-out rate from the current 15% to 10% and increasing the percentage of persons aged 30-34 attending higher education forms from 31% to at least 40% in 2020;

- the number of European citizens with a living standard lower than the domestic poverty threshold must be diminished by 25%, which would mean that over 20 million persons should rise over the poverty status.

All these objectives are interconnected. For instance, investments in more eco-friendly technologies, with low carbon emissions, will protect the environment, will contribute to

fighting climate changes and will generate new business opportunities and new jobs by reducing unemployment rate across various sectors of activity.

2. European Union Eco-Industry

During the last decades of the 20th century, environmental issues have continued to grow worldwide. This was due to the excessive use of natural resources, air and water pollution, industrial waste; all these have contributed to the increase of the global demand for eco-industries and the services they entail.

Eco-industries are "those productive economic sectors which generate products or services meant to allow the measurement, prevention, limitation or correction of changes occurring in the environmental climate and which are detrimental to it. They include technologies, products and services which diminish the environmental risk and minimize pollution" (OECD and EUROSTAT 1999).

This definition comprises the production of those equipment, activities and services provided in connection with pollution and resource management. The focus is on fields such as wastewater treatment, air pollution control, waste management, monitoring instruments, water utilities, reusable resources. They must not be mistaken for those eco labels, "green" products or productive processes which are more visibly nonpolluting.

In the last decades, eco-industry has proven to be one of the most dynamic sectors of European economy. In fact, starting with 1993, the envisaged industrial subsectors have been deemed main sources of competitive edge. The most competitive companies in the eco-industry field are to be found in countries such as France, Germany, Great Britain and the Netherlands.

A well-thought environmental policy could provide opportunities for innovation, creates new markets and increases competitivity through a more efficient use of resources, but also generates new investment opportunities. One such example of competitive edge at global level can be noted especially in the field of wind power.

For society as a whole, these are highly beneficial, as they result in the reduction of financial and personal expenses; such actions can also diminish healthcare costs, particularly since 1/6 of all diseases affecting European children can be attributed to environmental factors.

The efficiency of eco-innovations is a first example of how environment protection and competitivity development can go hand in hand.

3. Methodology of the Eco-Industry Research – Harmful Emission Reduction Binomial

The results of the research relying on the scenario of the *eco-industries – harmful emission reduction binomial* are mainly targeted at emphasizing the role played by the increasing volume of investments in eco-industries across the European Union on the evolution of greenhouse gas emissions in the European Union and implicitly on the phenomenon of climate changes, thus estimating the fulfillment of commitments made within the Europe 2020 Strategy (the 20% reduction of greenhouse gas emissions).

The general objective of the research is the analysis of the eco-industries - harmful emission reduction binomial starting from the need to increase investments in eco-industries in the context of new challenges triggered by climate changes.

An essential role in this context is played by the evolution of greenhouse gas emissions in the European Union, as a main element of the climate change phenomenon.

In order to reach this goal, in this paper we envisage several objectives:

- the analysis of the European GDP evolution as current prices;

- the analysis of the evolution of greenhouse gas emissions in the European Union;

- the analysis of the future evolution of the volume of investments in European eco-industries – we believe this to be a key factor in approaching environmental issues;

- drafting an analysis scenario on eco-industry efficiency – harmful emission reduction binomial from the perspective of the Europe 2020 Strategy;

- proposing and analyzing an indicator for the reduction of greenhouse gas emissions following the investment effort;

- proposing an indicator able to measure the degree of efficiency of eco-industry investments in terms of environmental issues – this being a pillar of the objective related to harmful emission reduction.

The research methodology contains an analysis of data from published studies, mainly the EUROSTAT web page of the European Commission, with individual investigation of all analyzed indicators at the level of European Union member states.

In order to analyze the eco-industries – harmful emission reduction binomial in our research, we have considered four scenarios (GDP in current prices, greenhouse gas emissions, volume of investments in European eco-industry and emission reduction following the investment effort), each scenario relying on a series of hypotheses.

First, we used an indicator which measures the eco-industry efficiency in terms of greenhouse gas emission reduction.

In our opinion, the most representative factors which must be and have been analyzed are as follows:

- *Gross Domestic Product (GDP) in current prices* - which reflects the value of all produced goods and services, minus the value of goods and services used as interim consumption within the production process.

- *greenhouse gas emissions* – with the paramount objective of decarbonization of the European economy.

- *volume of investments in European eco-industry* – which quantifies the evolution of investments made at European level in various control or pollution curbing equipment.

- *emission reduction following the performed investment effort* - which measures the efficiency of investments in eco-technologies at European level and the extent to which they trigger a reduction of harmful emissions, simultaneously generating an increase in the quality of citizens' living standard. This indicator is expressed in tCO2 / mil. euro.

All four indicators will be analyzed at the level of UE27 and based on these factors we will create another one starting from the vectors.

$Ieei = a1 * X1 + a2 * X2 + a3 * X3 + a4 * X4$, where:

X1 – GDP per capita expressed as current prices

X2 – greenhouse gas emissions

X3 – volume of investments in European eco-industry

X4 – emission reduction following the investment effort

a1, a2, a3, a4 = weight of factors x1, x2, x3, x4 in the efficiency eco-industry indicator

The Ieei indicator may take values in the [-1, 1] range, where:

-1 represents the economy with the lowest eco-efficiency degree

1 represents the highest eco-efficiency degree

In order to determine the weight of the four factors in the indicator for the measurement of eco-industry efficiency, we will consider the four coefficients (a1, a2, a3, a4) as the product of two components: $b_i * c_i$, where i takes values between 1 and 4.

- b_i represents the importance coefficient assigned to factor x_i within Iee and will be positive/negative depending on the influence of x_i on Iee.

- c_i represents the weight coefficient of factor x_i on Iee

$c_i = 1 / (X_i \max - X_i \min)$, where:

$X_i \max$ – maximum value that X_i may take in the analyzed range;

$X_i \min$ – minimum values that x_i may take in the analyzed range.

First, we will consider the values of coefficient b_i, so that the sum of coefficients of factors with a positive influence can be equal to 1, and the sum of factors with a negative influence be equal to -1.

$b_1 = + 0,7$ – consider that the indicator GDP/capita in current prices reflects the economic growth as a whole and has a major influence on the identification of the aggregated indicator of eco-industry eco-efficiency;

$b_2 = - 0,7$ – since greenhouse gas emissions have a major impact on climate warming, they are also a factor of high negative influence within this system of indicators;

$b_3 = - 0,3$ – since the evolution of the volume of investments in the European eco-industry is mainly an expense, it is thus also a factor of negative influence.

$b_4 = + 0,3$ – since the greenhouse gas emission reduction, following the investment effort, is a determining goal of the European Union, it has a positive influence.

All analyzed factors $X1$, $X2$, $X3$, $X4$ have positive values, and so we will consider their minimum value as 0.

In order to estimate their maximum value, we will consider the Eurostat statistical database. Based on it we will estimate in table 1 below the maximum values of the four factors for the time interval between 2010 and 2020, in order to calculate the values $c1$, $c2$, $c3$, $c4$ and implicitly the values $a1$, $a2$, $a3$, $a4$.

Table 1. Maximum values of the four factors

	min Xi	max Xi	Ci	bi	ai*
X1	0	17000000	5.88235E -0.8	0.7	4.12 E – 08
X2	0	5000000	0.0000002	-0.7	-1.4 E -07
X3	0	20000	0.00005	-0.3	- 1.5 E -05
X4	0	600	0.001666667	0.3	0.0005

Source: Authors' estimate based on Eurostat data (*ai = bi*ci), where i takes values from 1 to 4

Based on hypothetical reference scenarios, we will analyze the evolution of Ieei indicator on the efficiency of the European eco-industry related to the greenhouse gas emission reduction.

3.1. Reference Scenario – Evolution of the European GDP in Current Prices

In order to research the eco-industries – harmful emission reduction binomial we will focus on two scenarios which we deem referential in our paper: *the evolution of European GDP expressed in current prices* and the *volume of investments in the European eco-industry*, considering the above-mentioned established objective.

In this scenario, we analyzed the Eurostat statistical data on the evolution of European GDP in current prices, for the 27-UE, the main target being the analysis of the Ieei indicator evolution for an 11-year time horizon (2010-2021).

First, we will apply the method of smaller squares, determining the parameters of the trend line of GDP in current prices.

The equation of a line is generally written as $Y = \alpha + \beta X$; in our case, we can write the equation of the GDP trend line as:

$GDPt = \alpha + \beta X$, where:

$GDPt$ – is the GDP value at time t

β – is the curve of the GDP trend line

α – is the projection of the GDP trend line at moment t=0

values $\alpha = -7.30E +0.8$ and $\beta = 369408.8$ are provided in the Eviews output in table 2 below.

The deviation of the square average in table 2 has the value of 378262,7, which is considerably lower compared to the average value of the European GDP in current prices, namely 10892844.

Depending on the student test, we will consider the following hypotheses:

$H_0: \beta = 0$

$H_1: \beta \neq 0$

If H_0 null hypothesis is true, there is no connection between the value of European GDP in current prices and the year.

Calculated t = 8.870348

The critical region is calculated $t < -t_{\alpha/2,\ n-2} = -t_{0,05\ /2,13-2} = -t_{0,02510} = -2.633766915$ or calculated $t > -t_{\alpha/2,\ n-2} = t_{0.05/2,12-2} = t_{0,02510} = 2.633766915$

In the equations above, α represents the relevance threshold (we choose it to be 0.05), while n is the number of observations (12 in our case).

In order to determine $t_{\alpha/2,\ n-2}$, we used the value of the calculated t statistical test = 8.870348 with a p- value of 0.0000 (probability); the result is that there is an obvious linear relation (since the probability is lower than 5%, we reject the null hypothesis, which means that the year has a significant influence on the European GDP in current prices).

In order to test α, there is:

$H_0: \alpha = 0$

$H_1: \alpha \neq 0$

Calculated t = -8.739852

Critical region is calculated $t < -t_{\alpha/2,\ n-2} = -t_{0,05\ /2,13-2} = -t_{0,02510} = -2.633766915$ or calculated $t > -t_{\alpha/2,\ n-2} = t_{0.05/2,12-2} = t_{0,02510} = 2.633766915$

Since the value of the t-statistical test is calculated t = -8.739852 with a p – value of 0.0000 (probability), we reject the null hypothesis according to which α= 0, at a 5% relevance threshold. As we have the values of α and β we can estimate the values of the factor European GDP in current prices.

Table 2. Checking the estimated parameters for the factor European GDP per capita in Eviews

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.30E +08	83478203	-8.739852	0.0000
X	369408.8	41645.36	8.870348	0.0000
R-squared	0.907710	Mean dependent var		10892844
Adjusted R-squared	0.896174	S.D. dependent var		1173923
S.E. of regression	378262.7	Akaike info criterion		28.70142
Sum squared resid	1.14E+12	Schwarz criterion		28.76194
Log likelihood	-141.5071	F-statistic		78.68307
Durbin-Watson stat	1.287446	Prob(F-statistic)		0.000021

Source: Authors' processing from the Eviews econometric program

All these scenarios were created considering the objectives mentioned at the beginning of our research, the main goal being to emphasize and compare European trends.

In respect of the objective of greenhouse gas emission reduction, a key role will be played by eco-industry, through the promotion of those "technologies, products and services that will reduce the environmental risk and will minimize pollution" (OECD, EUROSTAT,1999, p9).

Fossil fuel use will continue to have a major relevance in power consumption at European level, and investments in eco-technologies are relatively costly. In the future, eco-industry will continue to be the main source of competitive edge in economy, providing Europe with the role of leader in the field.

If the European Union manages to fully reach the objectives set in the 2020 Strategy with respect to energy and climate changes, this will positively increase the quality of life for European citizens and the entire ecosystem; in the near future, the European Union certainly will take the role of world leader in this sector.

3.2. Reference Scenario – Volume of Investments in the European Eco-Industry

We determine the verification of parameters using the same pattern as for GDP, the new values being $\alpha = -736708$ and $\beta = 373.1985$.

In what follows we will analyze, using the Eviews program, the reliability of the newly estimated parameters.

Table 3. Verification of estimated parameters for the factor volume of investments in the European eco-industry

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-736708.0	267380.3	-2.755282	0.0187
X	373.1985	133.6899	2.791523	0.0175
R-squared	0.414663	Mean dependent var		9689.029
Adjusted R-squared	0.361451	S.D. dependent var		2257.029
S.E. of regression	1803.575	Akaike info criterion		17.97357
Sum squared resid	35781729	Schwarz criterion		18.06048
Log likelihood	-114.8282	F-statistic		7.792602
Durbin-Watson stat	0.675946	Prob(F-statistic)		0.017539

Source*: Calculated by the authors with the Eviews econometric program*

First, we notice that the deviation of the square average is 1803.575, which is considerably lower compared to the average value of resource productivity, namely 9689.029.

We will continue by calculating the t- student test, considering the following hypotheses:

H₀: $\beta = 0$

H₁: $\beta \neq 0$

If the H₀ null hypothesis is true, there is no linear connection between the value of resource productivity and the year.

There is $t_{calculat} = 2.791523$.

The critical region is $t_{calculat} < -t_{\frac{\alpha}{2},n-2} = -t_{\frac{0.05}{2},13-2} = -t_{0.025,11} = -2.593092681$ or

$t_{calculat} > t_{\frac{\alpha}{2},n-2} = t_{\frac{0.05}{2},12-2} = t_{0,025,10} = 2.593092681$.

In the equations above, α represents the relevance threshold (we select it as 0.05), while n is the number of observations (12 in our case).

In order to determine $t_{\frac{\alpha}{2},n-2}$ we used the Excel function *tinv ()*.

As the value of the statistical test is $t_{calculat} = 2.791523$ with a p-value of 0.0175 (probability), the result is that there is an obvious linear relation (since the probability is lower than 5%, we reject the null hypothesis, which means that the year has a significant influence on resource productivity).

In order to test α, there is:

H₀: $\alpha = 0$

H₁: $\alpha \neq 0$

$t_{calculat} = -2.755282$

The critical region is $t_{calculat} < -t_{\frac{\alpha}{2},n-2} = -t_{\frac{0.05}{2},13-2} = -t_{0,025,11} = -2.593092681$ or

$t_{calculat} > t_{\frac{\alpha}{2},n-2} = t_{\frac{0.05}{2},12-2} = t_{0,025,10} = 2.593092681$

Since the value of the statistical test is $t_{calculat}$ = -2.755282 with a p-value of 0.0187 (probability), we reject the null hypothesis according to which $\alpha = 0$, at a 5% relevance threshold.

As we have the values of α and β, we can estimate the values of the factor volume of investments in eco-industries for the entire period (2000-2021) considered in this scenario, according to Figure 1 below.

Investments in nonpolluting technologies have a crucial role in fighting climate changes and can ensure, together with power efficiency, winning solutions for all the parties involved, allowing economic growth and supporting the fight against climate changes.

Figure 1 indicates that the volume of investments in eco-industries registers a slightly upward trend during the period (2000-2021), which is explained by frontloading through the growth rate of community GDP, the growth rate of domestic resource consumption across EU-27, but also through the sustained trend to implement the measures approved by the Sustainable Development Strategy. During this entire period, the European Union has encouraged investments by granting subsidies and fiscal aids to small companies in member states.

Fig.1. Volume of Investments in European Eco-industry (2000 - 2021)
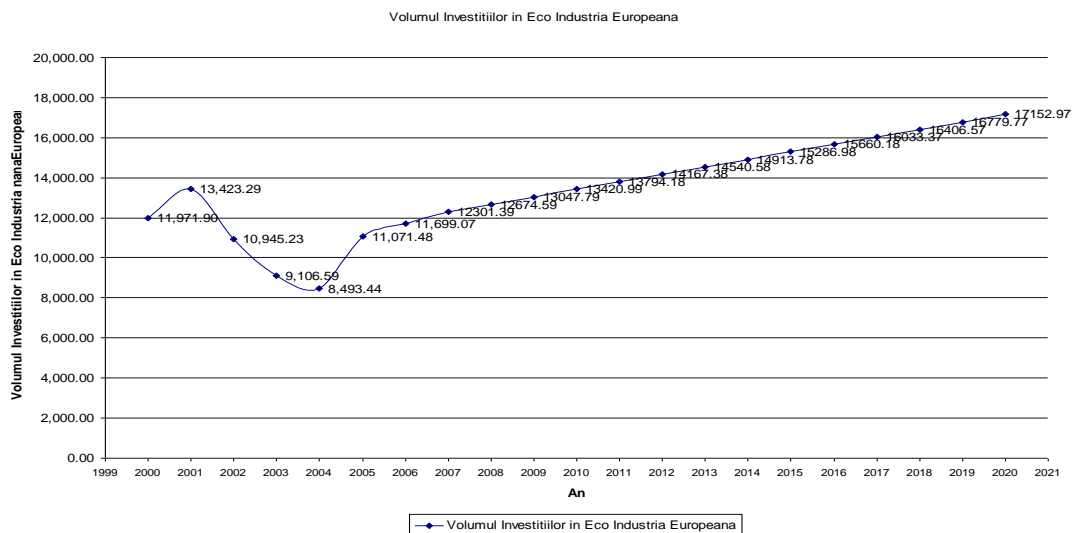
Source: Authors' processing based on Eurostat data

Due to the fact that the 27 European economies are strongly interconnected, and the environmental issues have, by their very nature, a transborder character, the new environmental challenges can be solved through a strategic research agenda, the creation of new European partnerships in the field of innovation for the continual development of eco-technologies necessary to maintain the position of world leader.

Investments in nonpolluting technologies have a crucial role in fighting climate changes, and they can ensure, together with power efficiency, winning solutions for all the parties involved, allowing economic growth and the fight against climate changes to unfold at the same pace.

Worldwide, we have to mention that the European Union is a leader in certain sectors of the environmental agenda through ambitious projects such as, in the area of climate change fight, the promotion of nonpolluting technologies, the protection of biodiversity, the increase of power efficiency and the allocation of important funds through Structural and Cohesion Funds.

4. Advantages of Cost Internalization in Economy in the Environmental Field

In order to internalize environmental costs in economy, there is increasing concern to identify economic indicators that would rigorously reflect such costs. One such example is the conventional GDP, which has a number of drawbacks, it does not always reflect the path to obtaining sustainability or actual productivity, and econometric modelling can lead to "misleading economic implications". Therefore, in order to obtain a GDP increase that would reflect wealth and a stable income, green GDP needs to be used with an adjusted calculation.

Green GDP = GDP - Da – Dn - R – A, where:

Da – depreciation of anthropic capital

Dn – depreciation of natural capital

R – consolidation expenses

avoidance expenses

Green GDP or green PIN / domestic eco-internal product is a modified macroeconomic aggregate, which is conventional GDP minus all the forms of capital depreciation (human, natural or anthropic capital). S.C. Kolm came up with the notion of environment function, using the following formula: $E = E (Y, B)$, where Y is the net internal product, B is the protection budget and E represents the environment quality index. According to Kolm, pollution increases with the economic activity (Y), as protection expenses maintain the environment, having a decreasing trend (B).

A highly significant issue is whether the activity of pollution and environment damage prevention, of restoring environment quality, is solely consuming net domestic product or whether it also generates value, net domestic product.

The activity of environment protection influences positively the increase of domestic income, acting favorably on the physical and mental health of society members and contributing to the increase of labor productivity.

The increase of social labor productivity contributes to the maintenance of the labor quality at a high standard, since it eliminates or reduces sickness periods, which, under pollution or natural environment damage conditions, become frequent and chronic.

A non-polluted environment influences in a positive manner people's health, not to mention the reduction of cases of early retirement due to health issues. Thus, it provides the citizen with the opportunity to carry out a useful activity for a longer period, and people's life in itself becomes more enjoyable and satisfying.

Natural environment protection and maintenance of the high quality thereof also ensure resource protection, since, on the one hand, these actions protect the natural environment necessary for human existence and production, and, on the other hand, they lead to resource economies by removing waste, using resources in a more complex manner through the recycling of waste which otherwise would have been detrimental to the environment. Many times, environment protection activities increase the quality thereof.

It is well-known that environment damage prevention is always less costly than the action of fixing damage which, most of the time, is irreversible.

5. Conclusions

The European Union specifies that although the objectives of Europe 2020 Strategy are representative, they are not exhaustive, being a general idea of the Commission's vision on the situation generated in 2020 by Covid 19, and it is not an approach for all member states.

Each member state is different, but despite disparities among development levels and living standards, the Commission considers that the proposed objectives are generally relevant for all member states.

In order to reach the objectives related to climate changes, it is imperative to diminish carbon dioxide emissions much faster in the decade to follow than in the previous one and to fully use the potential of new technologies such as opportunities to capture and store carbon dioxide.

A more efficient use would have a greater contribution to emission reduction, to making large scale economies and the stimulation of economic growth. To this end all economic sectors are envisaged, not only those generating a high emission level.

Likewise, it is necessary to consolidate the ability of domestic economies to resist the risks of climate changes, as well as the ability to prevent disasters and respond to them.

For the next decades, investments in eco-technologies will continue to grow as a result of subsidies and fiscal stimuli, remaining a main source of competitive edge on the European market, the result being the significant reduction of emissions provided the member states comply with the undertaken commitments.

The European Union's commitment to reduce greenhouse gas emissions is often deemed a cost in respect of economic competitivity, but it can also be seen as an opportunity.

Major investments in green technologies can provide the advantage of "first comer" on global markets for those companies that will first develop environmentally friendly products or services.

The European Union is already world leader in certain areas of the "green economy" such as wind turbine technologies, waste recycling or water treatment systems.

Emphasis must be placed on power efficiency and the rational use of resources, the development and use of new services and technologies with low carbon consumption, the promotion of global prices on carbon emission, so that markets are stimulated to invest in clean technologies.

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Transforming Learning and Talent Operations at Mitsubishi Real Estate in Japan

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Abstract

One of the largest real estate developers in Japan, Mitsubishi Real Estate Co., Ltd. has been going through a series of transformation initiatives in talent operations and organizational architecture. This paper illustrates the organizational efforts behind the corporate initiatives of developing a learning culture sustained by cognitive technology across the business. Furthermore, the authors have analyzed the organizational impact of various initiatives geared at enhancing organizational agility at Mitsubishi Real Estate Co., Ltd. during the Covid-19 pandemic in Japan.

Keywords: Talent, Culture, Organization, Technology, Digital, Management, Covid-19, Collaboration, Japan

1. Introduction

One of the core Mitsubishi companies, Mitsubishi Estate Co., Ltd. (hereinafter MEC) is headquartered in Tokyo (Japan) and is one of largest and oldest real estate developers in the country. Founded in 1937 as a spin-off of the Mitsubishi *zaibatsu* real estate holdings, MEC's main areas of business activity are property management, architecture research and space design. In 1953, MEC was listed in the Tokyo and Osaka stock exchanges. Most of its Tokyo business properties today are located around Tokyo Station in the Marunouchi area and the Yurakucho area, districts purchased by the Mitsubishi *zaibatsu* from the Japanese government in 1890, during the Meiji era. The Mitsubishi *zaibatsu* later transformed these areas into a business district. Most of the Mitsubishi group main

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companies, including Mitsubishi UFJ Financial Group, Mitsubishi Corporation, Mitsubishi UFJ Trust & Banking, MUFG Bank, Mitsubishi Electric, Mitsubishi Heavy Industries, Nippon Yusen, Meiji Yasuda Life, etc., are either headquartered or have offices in this district. The overseas expansion of MEC culminated in the 1990s, starting with the acquisition of the Rockefeller Group in New York City, the owners of the Rockefeller Center, in 1990. In its continuous pursuit for growth, modernization and expansion, MEC announced in 2015 that it would play a major role in a redevelopment project of the north side of Tokyo Station, which would also include a 1,279-foot skyscraper, building which, in 2027, would be the tallest building in Japan. In 2018, MEC was estimated to have the most valuable business portfolio within the real estate business in Japan, amounting to approximately JPY 7.4 trillion (Maeno, 2018).

In 2019, MEC president Hirotaka Sugiyama made an internal announcement that the organization would shift operations to embrace digitalization and to create a transformative culture based on innovation, agility and collaboration. Later, throughout the Covid-19 period, MEC saw an unprecedented investment of resources to embrace cognitive technology at all levels, to redesign organizational architecture and to propel enterprise innovation.

2. Research Objectives, Methods and Objects

Objectives

The authors of this research aim to illustrate the benefits for businesses to develop a cognitive enterprise and to use talent analytics and innovation metrics to drive performance and enhance business agility in Japan. Secondarily, this research will provide examples of successful collaboration with external value creators and providers of professional consulting services in the areas of talent operations, organizational architecture and international business management.

Research Objects

MEC talent managers working in HR, Corporate Planning, Corporate Communications, Talent and Organizational Development, Leadership & Learning, corporate executives and consulting partners.

Research Methodology

The authors conducted research based on an actual business case study, engaging in first-hand participant observation (Yin, 2003) of this change management process. We could, therefore, observe various stages of the change management process, including executive message cascading, cultural disconnection, miscommunication, corporate confusion, leadership re-alignment, training and culture engineering, as well as various stages of

decision making, from the vintage point of in-house, on-the-board team members, at the start of the project until implementation.

The consulting agency appointed for supporting the change management process, IBM Japan, utilized a reiterative combination of "Culture Jam Sessions" and Organizational Design as the "intent behind an outcome". A Design Thinking approach was employed for the organizational engineers and talent operators to better focus on user-centered design, engaging multidisciplinary teams and continuous reinvention around the value creation process for customers, employees, shareholder and society (IBM 2018). Throughout the Design Thinking session, the authors conducted qualitative research through focus group interviews with all participants in an effort to determine in-depth emotions, perceptions and affinity with key cultural symbols. Quantitative data was collected between April 1st 2020 and December 18th 2020, consisting of a self-completed questionnaire.

3. From "Talent as Usual" to "Data-Driven HR"

As he was taking over the organizational reigns as President and CEO at MEC in 2019, Junichi Yoshida knew that there was a greater effort that needed to be accelerated beyond re-engineering the enterprise around cognitive technology and innovation – re-wiring talent and people operations in an agile manner, conducive to collaboration, inclusion and value creation seemed to be an act of ultimate priority. Not only did the organization need to catch up with newly emerging technologies in talent operations and organizational collaboration, the need for adopting a growth mindset and a culture of agility and continuous learning at all layers of the organization was strikingly obvious. Small, incremental changes in the incumbent HR structure had been made over the decades, based on market needs and industrial trends. However, the business was still operating on a strong top-down hierarchical architecture, structure which had been conceived in the 1950s in order to ensure total alignment and response to executive command, inspired by a rapidly growing market domestically in Japan and its local demands. As the business had grown to embrace global markets (US, Asia, Oceania and Europe), there was an increasing need for enhancing visibility across geographies in order to determine emerging talent and to create regional and local succession pipelines, with timely nominations for the right candidacy.

This transformation implied re-engineering the whole HR process – starting with talent acquisition and continuing to talent management and modern leadership development. To ensure the acceleration of the talent and organizational transformation process, Bunroku Naganuma was appointed as HR Senior Executive Officer, in charge of re-engineering talent and enhancing the corporate value of the Group on a medium to long term basis.

The organizational architecture was also re-engineered in order to support this large-scale transformation.
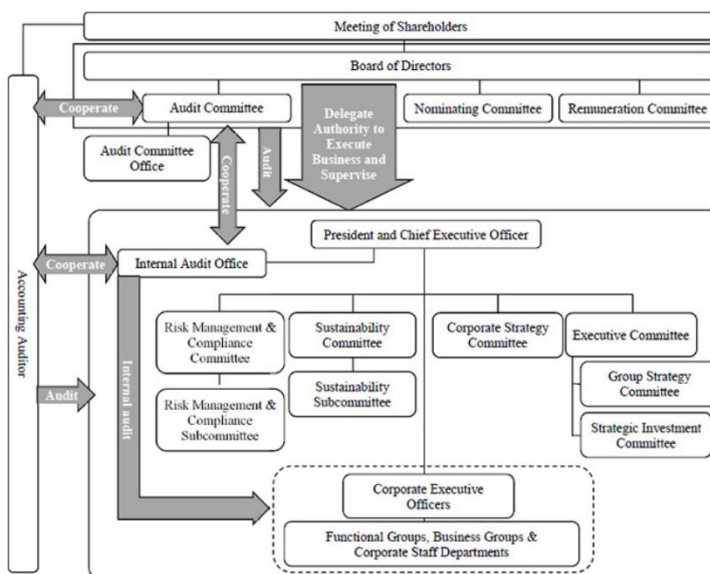
MEC Corporate Governance Organizational Chart (as of April 1st, 2020)

As one of his early change initiatives in talent operations, Naganuma lead the shift from the traditional "one-time hiring" of new graduate students from Japanese universities in April each year to a more flexible and more strategic, all-year-round hiring process of candidates with diverse backgrounds, qualifications, expertise, who had graduated from prominent education institutions from all around the world. A strong internal resistance to this bold transformation was met with an executive commitment to protect the existing environment of operations and executive decision making in the Japanese language, with indications that English (and other languages of business relevance) may be utilized based on need.

As a secondary initiative, Naganuma invited his team of organizational engineers and talent operators to explore emerging cognitive technologies for attracting and managing talent, in order to develop and sustain competitive advantage throughout the global HR strategy. The team was initially reluctant on relying on technology for attracting and managing talent. At this time, 18% of the surveyed population indicated that they would trust digital technology for talent operations, while 36% of the survey respondents indicated that using cognitive technology in their jobs would enable them to achieve enhanced value and complete tasks more efficiently.

Throughout a series of Talent Value Creation jam sessions, the main stakeholders familiarized themselves with a series of emerging cognitive technologies and gradually developed interest in exploring AI, Intelligent Networks, Intelligent Learning Management Systems (I-LMS), Robotic Process Automation (RPA), Intelligent Talent Databases, Blockchain and the Internet of Things (IoT) for global talent attraction, hiring, talent reviews, learning and talent management.

4. Choosing the "Right" Technology

After another series of "Value Jam Design Thinking Sessions" the group agreed that there was not a single technology that was more important than other. Rather, it would be a collective effort of "connecting the dots" between legacy systems and emerging technologies that would enable speed adoption and would render the transformation process successful. Technology was to be chosen and utilized in order to have better visibility and strengthen the decision-making process around "softer" areas of talent operations, such as employee engagement, learning and development, culture, leadership development, talent reviews and business transformation. Employee satisfaction was traditionally measured through on-line insights collected through Survey Monkey, consolidated and shared through Excel files. The possibility of utilizing cognitive technology for overall talent operations was taking the HR conversation to a different level, accelerating the organizational understanding of talent-related issues and offering a new opportunity of monitoring effectiveness in a more timely and agile manner.

5. Executive Discussions and Actions

In order to determine the process of redefining the talent operations strategy and to transform the traditional HR administrative team into a strategic group of organizational engineers, Naganuma adjourned his executive team and invited external corporate advisors to a process of re-designing the business platform concept.

The existing talent strategy had to be revised fast in order to align with the overarching corporate strategy of growth and the brand slogan of "A love for people, a love for the City – Forever taking on new challenges 人を、想う力。町を、想う力。ー私たち三菱地所グループは、チャレンジを続けます。" (*Mitsubishi Estate Co., Ltd.,* 2020). A new and intelligent business platform had to be developed as the new instantiation space for fine tuning the organizational strategy. The executive team decided to invest in the development of an Artificial Intelligence (AI) empowered platform which would constantly monitor change programs and provide timely recommendations on investment opportunities, helping the business shift from legacy operations to future structures and smart organizational architecture. Along with developing such an intelligent integration platform, the executive team decided to invest resources into the creation of a smart ecosystem of collaboration with internal and external stakeholders, such as industrial thought leaders, research institutes, academic organizations, think tanks and other networks and innovation initiatives globally. The smart ecosystem would continuously learn, both through the accumulation of quantitative data and through qualitative insights collected through in-person and on-line human collaborations. These collaborations would be enhanced with big data utilization and machine learning initiatives, in an ultimate effort to collect and process market and insights in a timely manner.
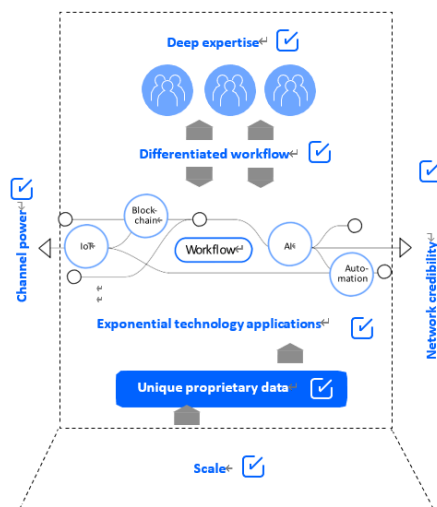
IBM Institute for Business Value (2020)

The live collection of data around employee actions, ranging from happiness and wellbeing to project engagement and participation in wider business operations, supported HR, HR business partners and people managers to develop timely insights and measure the efficiency of new initiatives. With the help of cognitive technology and intelligent platforms, talent operators managed to extract insights necessary for improving people performance, perceived culture and cross-divisional collaboration. Furthermore, the global talent operators could estimate, understand and evaluate the business impact of their people and support the executive leadership board with timely recommendation for talent-related decision-making matters.

During a pulse survey conducted internally in January 2021, 68% of the surveyed population indicated that they would trust digital technology for talent operations, while 89% of the survey respondents indicated that using cognitive technology in their jobs enabled them to achieve enhanced value and complete tasks more efficiently. Most of the population surveyed indicated that cognitive technology brought a significant impact to the business, enabling the organization to better achieve strategic goals.

Throughout Focus Group Interviews (FGIs) and individual executive discussions, further indicated that building a cognitive enterprise at MEC helped executives enhance their visibility of operations globally and make better decisions, based on an influx of live data, business analytics and organizational insights collected globally in a timely and agile manner.

6. Conclusions

1) Testing cognitive technologies and prototyping induction concepts early helps develop

organizational confidence in these technologies and enhance individual willingness to adopt, learn and operate with these emerging technologies.

2) Japanese businesses benefit from revamping, upgrading and adapting legacy systems to intelligent technologies (RPA, Intelligent LMS, Intelligent Data Bases, etc.) and utilize this transformative opportunity to re-skill and up-skill their talent.

3) Covid-19 has proven to be a propeller for cognitive technology adoption in Japan, as businesses could utilize funds initially allocated to fixed-cost initiatives, traditional advertising, promotions and events, to revamp technological infrastructures and to train talent on remote-work practices and collaborative technologies.

4) Working with internal and external collaborators from an early stage of the operational model transformation initiative enhances the speed and the agility of the change management process.

5) Data-driven talent management generates added value to the business through the provision on business-critical insights, collected, clustered and analyzed through a multitude of technological tools and information sources: sensors, analytics, Artificial Intelligence (AI), Robotic Process Automation (RPA), machine learning, intelligent Learning Management Systems (LMS), big data, etc.

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DESIGNING AN IT SYSTEM USING THE UNIFIED RELATIONAL PROCESS

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Abstract

This material presents the Unified Relational Process, which consists of a very comprehensive set of indications regarding the technical and organizational aspects of software systems development, focused on the analysis of system requirements and design. Specifically, RUP is a guide that shows how UML can be used to develop a informatic system.

Keywords: unified relational process, it design

1. Design of an informatic system using "Unified Process - RUP"

Starting from the essential feature of the Unified Process, that of "*practical guide for the realization of object-oriented information systems*" - and, identifying by RUP, "*the most appropriate development method for the UML modeling paradigm*" - it can be said that the RUP are a viable alternative to the limited *one-way approach,* with outstanding results in all phases of realization of an informatic system.

1.1 Features of Rational Unified Process (RUP)

Through its complex structure, *RUP integrate into the life cycle of an informatic system*, *all the fundamental features of object-oriented methodologies*, ensuring the realization of high quality, *robust and reliable IT applications* - through an *iterative approach of the work phases and an efficient correlation of the system objectives with the beneficiaries requirements*, in a *limited type horizon and with predictable budgets*.

The iterative character of *the unified process* assume a new and efficient approach to the development process of informatic systems, but also a *modern character*, innovative in terms of *task structuring and work responsibilities at subproject or subsystem level*.

The development of a project using RUP involves both *an iterative and incremental process*, by efficient decomposition on subprojects and phased sequential iterations, but above all,

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the abandonment of voluminous working documents, in the form of written text and the implementation, in all stages of work, of models and diagrams specific to the Unified Modeling Language (UML).

1.2 Phases and iterations RUP

The life cycle of a project developed with the help of RUP involves the implementation of *four phases of work*, each stage having a *well-established final result* associated with it - depending on the proposed objectives, the system architecture, the implementation of the functionalities and the final launch - but also mandatory elements of control and analysis of feedback type, in order to establish the degree of fulfillment of the objectives (for each phase) and moving to the next stage (conditioned by the full satisfaction of the current implementation requirements).

The *four phases of work described by the RUP* are associated with them - in the process of developing informatic systems - *nine workflows within the phases* (*wokflows*), grouped into *two distinct categories*: *Primary Flows and Support Flows*.

The category of *primary flows* includes all *the basic activities that underpin the development process*, such as: Business Modeling, Requirements Specification, Analysis and Design, Implementations, Hardware Testing and Configuration (Location) - and in the category of *support flows* are integrated the *processes that allow the management of the management of all the activities carried out at the level of the project*, through: Change Management (Configuration-Modification), Project management and Ensuring the Development Environment (Work).

Synthesized, *decomposition of the life cycle of projects*, *on RUP phases and flows*, is represented in the form of the following table (Table 1):
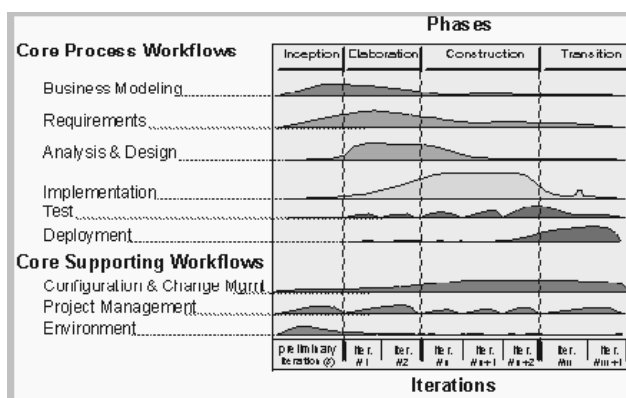
Table - Development Phases and Realization Flows RUP

In accordance with the above, *a working phase* of the *Unified Process - RUP*, is *identified by the time interval between two moments* (*critical points*) *of the project development, setting objectives, the system artifacts are made and the working directions for the next stage are identified*.

From the analysis of the work phases presented in the table, a series of information can be obtained on the *implementation of primary flows and support flows* in within the stages of realization of the new system, highlighting the importance and priority of each process, depending on the current stage of development:

- *Activity modeling* and *specification of requirements* are the primary processes with the largest share in the preliminary phases of *initiation* and *development* of the new informatic system, providing practically the necessary support for *defining the objectives* and *conditions of the project*, taking into *account the field of applicability and the specifications of the beneficiaries*;
- The processes of *system analysis* and *system design* are developed *as a unitary whole* and provide the practical foundation for the *elaboration* phase;
- Subsequently, once the *construction* and *transition* phases have taken place, the project is becoming more and more complex and advanced in terms of implementation, so that *the primary flows of hardware deployment*, *testing and configuration* now become a priority; these flows *complete the execution cycle of the informatic system* and offer solutions related to the *programming code*, *the qualitative characteristics of the product*, *the distribution and presentation of the beneficiaries*;
- In terms of *support flows*, it is observed that they are more *frequent in the final phases* of development according to the RUP (and implicitly, less used in the preliminary phases), because, with the iterative development of the project and reaching the final stages of implementation and testing of the new software product, *the management activity* (coordination, planning, management, etc.) intensifies at the system level and becomes a priority for the correct substantiation of the process of updating the changes or of efficient integration of the components made in parallel;
- The *support flow* regarding the *project management* takes place almost constantly at the level of all the implementation phases according to RUP, as it focuses on general system life cycle issues - such as: organization, management and monitoring - having, therefore, "*responsibilities*" at the level of each stage of development;
- Unlike *project management*, the *support flow* on *change management* is much more intense in the final stages of implementation, it`s overwhelming importance being directly proportional to the degree of development of the project and the complexity of the requested changes;

Software Development Process (RUP), through a *sequential and repeated approach to primary and support flows*, it is structured in four work phases: *the initiation phase*, *the elaboration phase*, *the construction phase and the transition phase*.

So:

1. **INCEPTION PHASE**
- Is the initial phase of the iterative-sequential process RUP, aiming to carry out a detailed preliminary study to identify the requirements of the future system;
- Starting from the purpose and objectives of the business, an opportunity analysis of the system is performed, which identifies: the field of the project, the solutions to be implemented to guarantee the forecasted results - by establishing efficiency criteria (for assessing success), correct assessment of potential risks and correct estimation of necessary resources;
- Considering that this stage is the first in the software development cycle, and taking into account the technical aspects mentioned above, the analysis performed in this phase will be completed by making a preliminary schedule of system execution, reflecting an overview of the project, by coordinating all four phases of work;

2. **ELABORATION PHASE**
- Within this stage we start from the *business field* (identified in the previous phase) and develop the *system architecture*, by establishing the *work plan and efficient optimization of the designed architecture*;
- Although the system architect may have different views on how to approach the system to be built, it`s *decisions must be homogeneous and define a clear and well-defined picture* of the whole system, by highlighting *the static and dynamic* aspects of the developed product;
- Decisions on the architecture of the system, within this stage, are defined on the basis of the requirements correctly specified by the beneficiaries and are implemented within the system, through *business use cases*;
- Once the use *cases are defined* and the *major risk factors of the project are eliminated*, concrete objectives can be set to be achieved for *optimizing the quality of the system architecture*, by *integrating the functionalities of the product* (reflected by the practical aspects established by the use-case specifications) in a *correct form* (system architecture), representative of the beneficiaries' requirements;

3. **CONSTRUCTION PHASE**
- In this phase, *a complex project can be structured* in several *subprojects*, each subproject representing an *iteration* in the development of the RUP, but also a permanent improvement of the functional aspects of the new system;
- Through this *iterative and incremental approach*, the risk of developing a malfunctioning system is progressively reduced, by rigorously planning the functionalities of the system, identification and elimination of risks regarding the inefficiency of the system and the implementation of error control and correction operations, through specific feedback actions;
- In the construction phase takes place the description of the requirements not specified in the development stage, the detailed design of the system, and finally, the realization and testing of the functionality of the developed system;

- *Each iteration* carried out in the construction phase, involves the implementation of *three types of fundamental works*: <u>Resource management and process control</u>, <u>Development and testing of program components</u> and <u>Evaluation of iteration results</u>;
- By carrying out these works, *the program components* (system artifacts) *will be established*, *location planning and iterative transition of the system will be performed and the user manual will be written*;

4. **TRANSITION PHASE**
- This stage of work completes the development cycle of an RUP project and has as its main objective, *delivery of the IT product to end users*;
- Depending on the degree of satisfaction of the requirements initially expressed by the beneficiaries (or their subsequent requests), during this phase, *activities will be carried out to test and improve the product made*, in order to determine the non-functional aspects of the system and to identify possible errors;
- The system version under test will be an experimental one, which will be gradually replaced by the final version, once all corrections have been made, in accordance with the results obtained in the test step;

1.3 Requirements for the development of an IT system according to the RUP

According to the implementation phases presented by RUP, for the development of an information system must be covered, in one iteration, the following primary flows: *business modeling*, *requirements specification*, *analysis and design*, *implementation and testing*.

For the actual realization of the diagrams from the design stage, the CASE – Enterprise Architect tool, developed for UML, will be used.

SPECIFICATION OF REQUIREMENTS

The *stage of specifying the requirements*, presupposes a more precise and correct definition of what the future system must ensure (according to the final objectives of the beneficiaries, specified in the previous stage of business process modeling) and involves carrying out the following groups of activities:

1. **Identification of candidate requirements**
   a) Assume, *the correct and complete establishment of the requirements of the beneficiary organization for the realization and implementation of the information system*;
   b) The (theoretical) substantiation of the imposed requirements is achieved, both directly, *through the analysis of the technical documentation*, as well as from the *information provided by the client* (*during the "system analysis" stage*), the most important situation;

2. Organize the system using packages

a) *The structuring of complex systems*, in small areas, is necessary, both for a better *maneuverability of the resulting subsystems*, especially for *the detailed study of the analysis and design stages of the identified (sub) activities*;

b) The basic idea of *organizing large software systems into small subsystems*, *structured on fields of analysis*, consists in *establishing units of behavior in the physical system*, by identifying a part of the subsystem specification (consisting of *operations*, *use cases*, etc.) and a *part of the implementation of the system* (consisting of the *definition of classes, relationships and restrictions that ensure their implementation*) - the links between the elements of the two parties being defined through a *set of collaborations*;

c) Once these specifications are met - through the rules, concepts, and restrictions imposed by *Unified Modeling Language* (UML) diagrams - it can be considered that a *first stage in the realization of the computer system has been completed* (*successfully!*);

d) For *structuring information systems into smaller subsystems and areas of analysis*, the UML language introduces the notion of <u>*package*</u> - *as an entity for grouping elements with the same design and design specification, in order to divide the system into areas*: <u>from the lowest level of approach of the new system</u> (with the *definition of the participating classes and objects and the correct establishment of the interactions between the actors and the system, by defining use cases*), u<u>p to the highest level</u> (*the stage where the actual structuring of the system by fields of analysis and the grouping of object classes in packages is performed*);

2. Designing the quality control system for bearing production - using the CASE tool "Enterprise Architect"

According to the requirements of the *Rational Unified Process* (RUP), for the realization of an information system, the following primary processes must be completed: *requirements identification*, *analysis*, *design*, *implementation and testing*.

Next, *the requirements identification activities* will be exemplified, *analysis and design* in the case of "*automated bearing quality control system*".

IDENTIFICATION OF REQUIREMENTS

The main activities to be completed in this stage are:

a) Identification of candidate requirements;
b) System structuring (using packages);
c) Deepening the understanding of the context;
d) Identifying functional requirements;

e) Identifying non-functional requirements;

IDENTIFICATION OF CANDIDATE REQUIREMENTS

The project initiation documentation (vision) identifies the possible requirements for the project.

STRUCTURE OF THE SYSTEM USED IN "PACKAGES"

One of the fundamental tasks of *software system modeling* is to "*structure the system into small areas*" that are easier to handle.

The units of grouping and logical structuring proposed by the UML language are: *packages and subsystems*.

IDENTIFYING SYSTEM REQUIREMENTS WITH THE HELP OF "CASES OF USE"

Use case modeling is the most effective technique *for identifying requirements from a user perspective*.

Use cases are used to model *the mode of operation of the current system or the mode of operation of the system desired by users*.

Use cases are generally the starting point in object-oriented analysis using the UML language.

OBJECT-ORIENTED ANALYSIS

The main activities to be completed at this stage are:

- Refining the use case diagram;
- Modeling the system dynamics (using the sequence diagram);
- Modeling the static structure (using the class diagram);

REFINE DIAGRAM OF USE CASES

At this stage, other use cases and other actors can be identified, at another level of detail.

SYSTEM DYNAMICS MODELING - SEQUENCE DIAGRAMS

Sequence diagram is one of the most suitable types of diagrams for *modeling the interactions between system objects*.

In a sequence diagram, *the objects involved in the scenario are represented by vertical dotted lines*, and the messages transmitted between them, *through horizontal vectors. The messages* are represented chronologically from top to bottom, the horizontal spacing of the objects being arbitrary.

During the analysis, *the message is named from the existing system*. Subsequently, during the design, it is replaced by *the name of the method of the called object. The called or invoked method belongs to the class instantiated by the object receiving the message.*

Also, the primary role of the analyst is to decide, after the execution of each iteration, the direction in which the analysis process will continue or, as the case may be, if it is necessary to interrupt the process.

MODELING THE STATIC STRUCTURE THROUGH CLASS DIAGRAM

The class diagram is the main tool for *analyzing and designing the static structure of the system. The class diagram* specifies *the structure of the system classes*, *the relationships between the classes and the inheritance structures*.

During the analysis process, *the class diagram* is constructed with the aim of obtaining an *ideal solution*. When designing, the same diagram is used and modified, to comply with the implementation details.

OBJECT-ORIENTED DESIGN

For this stage are defined a series of activities that must be completed for the good development of the statistical analysis process regarding the quality control of the production:

- Static structure modeling (using class diagram);
- Modeling the system dynamics (using the status diagram or activity diagram);
- Refining the use case diagram (using the activity diagram);
- Modeling the system architecture (using the component diagram);

SYSTEM DESIGN WITH THE HELP OF CLASS DIAGRAM

During the design, the class diagram is modified to take into account a number of concrete details of the system implementation.

The category of these details includes the graphical user interface, represented by the interface objects.

BEHAVIOR MODELING THROUGH STATUS DIAGRAMS USE OF ACTIVITY DIAGRAMS

The status diagram is used *to model the dynamic behavior of a single object or class of objects*.

The status diagram captures *the sequence of states* that an object of the class goes through during its entire life cycle, in response to the stimuli received, but also the object's own responses and actions.

A status diagram will be defined for each class that exhibits significant dynamic behavior.

REFINE THE DIAGRAM OF CASES OF USE WITH THE HELP OF THE ACTIVITY DIAGRAM

The activity diagram provides a *graphical tool for modeling the processes of a use case*. *The activity chart* is similar to a *flow chart*, the significant difference being that, *the activity diagram can represent parallel processes*.

3. MODELING THE SYSTEM ARCHITECTURE

The system architecture includes the most significant *static and dynamic aspects of the system*.

The system architecture has its origins in <u>user requirements</u>, effected by <u>use cases</u>, but it is influenced by many more aspects, such as:

- The software platform on which the application will run;
- Database management system;
- Structural considerations;
- Legal regulations;
- Non-functional requirements;

The architecture of the system reflects *an image of the whole project, which highlights the essential parts, ignoring the details*. This is illustrated by *the component diagram*.

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REPLICATING IMPULSE-BASED PHYSICS ENGINE USING CLASSIC NEURAL NETWORKS

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Abstract

The high costs for creating and using traditional simulators induced both by technical effort, which extends over a long period, but also by the need for permanent updating during this period, to improve accuracy by using a limited range of settings, bring to the fore an alternative, namely: data-based methods for physical simulation; they are a much more attractive option for interactive applications in terms of their ability to trade precomputation and memory footprint for better performance while running. Also trained physics engines might come to offer better simulations as the networks can be configured to take as input data from real-world measurements, thus it can combine the best from the real-time simulation engines that emphases on fast simulations but do not offer a real-world-like simulation, and high accuracy simulation engines and targets real-world simulations but require high computational resources. This paper aims to construct a neural network that learns how the impulses between two objects react when they make a contact, by using an already implemented physics engine for generating the training datasets and to compare the results of the trained engine versus the original one. Although this has been done successfully, the proposed neural network managing to score a prediction rate with values between 55 and 89% depending on the test "scenario", improvements can be made to increase performance and to obtain a suitable accuracy (over 90%, even 95%), thus achieving the goal of completely replacing the physics engine.

Keywords: Neural Networks, Physics Engine, Collision Optimizer.

1. Introduction

State-of-the-art physics engines [1]-[3] use different equations of motions, or a combination of them to simulate how objects with defined parameters like mass and volume behave, especially in contact with each other. Some of these equations are Lagrange multiplier [4],

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Jakobsen [5], Impulse dynamics [6], and so on. These engines can also be split in two types: high-accuracy physics engines, and real-time physics engines [7].

The first type of physics engines has more complex defined equations of motions to simulate an environment as best as possible, but with the cost of high performance, also needed from the systems where the simulations are running.

The latter type is much faster [7], usually being used in video games or movies where the frame rates per second matter for a better user experience, but they also come with more inaccurate simulations, as they make predictions instead of complete calculations.

The idea to use neuronal networks and machine learning comes quite naturally, as once the network is trained, the predicted result is made almost instantaneous, especially on a parallel system like a GPU [8].

As a physics engine, in this paper it is used a lighter version of the *Box2D* [9], which is a simple rigid body engine that works only with simple 2D objects like squares and circles and implements the impulse dynamics equations of motion. This engine consists of three modules, namely: Common, Collision and Dynamics. The first module refers to code for allocation, math, and settings; the second module defines shapes, a broad-phase and collision functions/queries; and the final module gives the simulation world, bodies, fixtures and joints [9]. The main loop of the *Box2D-Lite* physics engine is illustrated in Fig. 1.
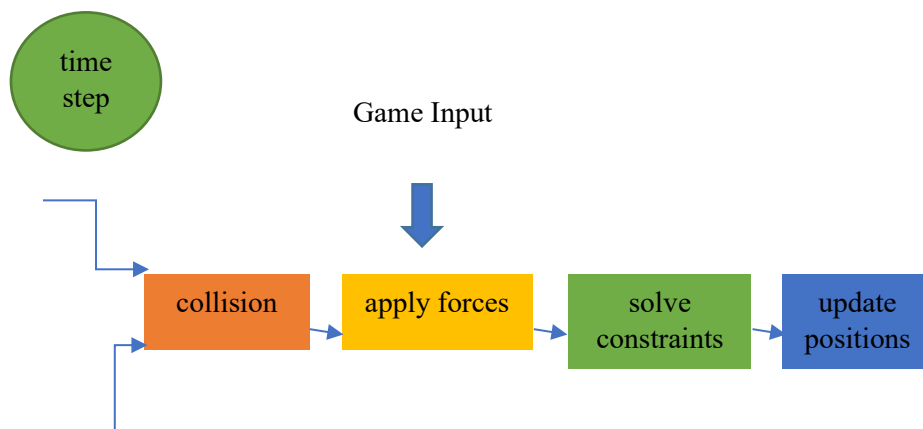
Fig.1. The main loop of the *Box2D-Lite* physics engine.

The collision detector comes with two phases: a broad phase, and a narrow one [9]. The broad phase finds pairs of overlapping boxes and creates arbiters for every pair. Each created, or updated arbiter performs a narrow phase collision, where it searches for the normal vector with the minimum penetration, as can be observed in Fig. 2.
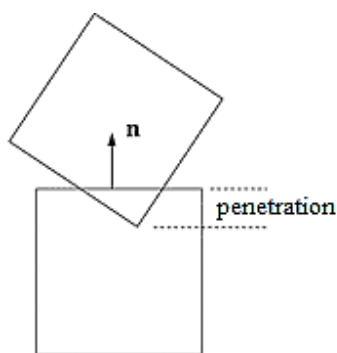
Fig.2. Narrow phase, box versus box collision.

The next step, after the collision detection, is applying the forces on the two collided bodies. In this step, the engine applies Newton's 2nd law for velocity and angular velocity on each object in the scene.

The third step is the "solve constraints" step, where the impulse between the two objects is calculated using Newton's 2nd and 3rd laws for the relative velocity at the contact point. From this step, the direction and magnitude of the impulse are obtained and thus the new instantly changed velocities of the objects after the contact can be calculated [10].

The initial velocity and angular velocity of the two objects that are about to collide are taken as inputs for the proposed network, and the "solve constraints" step that calculates the resulting velocity is replaced with the network that predicts these results. Several random tests are generated, with objects in different situations, for all these inputs and their corresponding *Box2D-Lite* engine outputs (the changed velocity and direction) a dataset is created which is then used to train the neural network.

2. Related works

In [11] data-driven methods simulate deformation effects, including external forces and collisions, allegedly 300× to 5000× faster than standard offline simulation, using the same approach for collecting training data through an offline engine and feeding it to the neuronal network.

Paper [12] describes a hybrid engine consisting of a standard physics engine for the new cases, and the "learned" engine for fast calculation of results for the "already met" cases. The standard physics engine takes new unseen inputs, calculates the output, and feeds the neuronal engine so that it can learn from the new experience. This process is illustrated in Fig. 3.
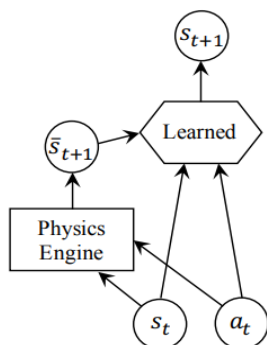
Fig.3. *SAIN* - A simulator-augmented interaction network, where s_0 is the initial state, a_t is the action at time t and $\underline{s}_t$ is the prediction by the physics engine at time t [12].

In [13] is trained an engine for fluid-based simulations using the authors' framework for neuronal networks called Graph Network-based Simulators (GNS). The aforementioned framework is used to perform particle simulations, by mapping every particle in a graph and using a messaging system in the graph between particles for exchanging energy and momentum among their neighbors. The accuracy of the computed predictions obtained by this engine, versus their ground truths, can be observed in Fig. 4.
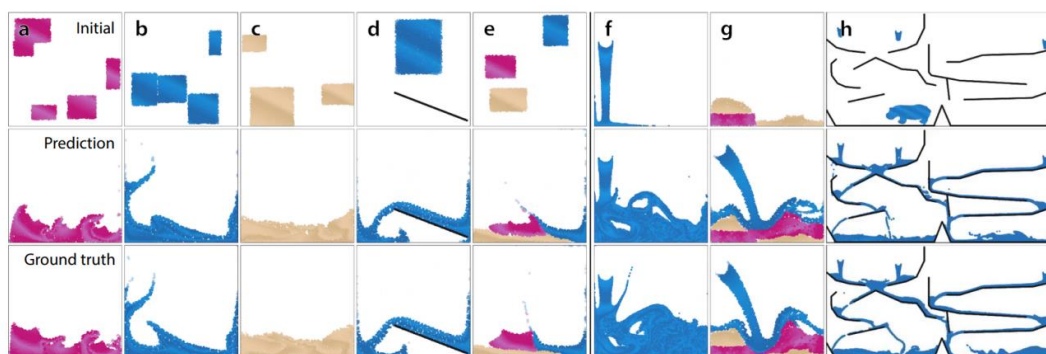
Fig.4. Prediction made by the trained engine versus the ground truth of the Navier-Stokes equations for fluids (**a.** "goop"- a viscous, plastically deformable material; **b.** water; **c.** sand; **d.** their interaction with rigid obstacles - *WaterRamps* domain; **e.** multiple materials and their interaction - *MultiMaterial* domain; **f.** high-res turbulence, trained on *WaterRamps*; **g.** multi-material interactions with unseen objects, trained on *MultiMaterial* and **h.** generalizing on larger domains, trained on *WaterRamps*); image taken from [13].

In association with [11], [12], [13], neuronal networks promise to deliver both accurate and fast simulation, which is a big improvement in many scientific domains. Also, the neuronal networks tend to be more prone to parallelization than some numerical methods that are used in standard simulations. They may use more naturally multi-core technologies like GPUs, which now come with special computing units for machine learning, an example, in

this case, being the latest generations of *NVIDIA* graphics cards equipped with tensor cores [14].

Considering the above, in this paper, it is shown that even simple engines like the proposed one, can be enhanced, as the network may receive training input from both the initial source and a more accurate one, so that simulations can surpass the original engine in both speed and accuracy.

3. Proposed solution

The proposed system uses a fully connected neural network fed with the raw velocities that the objects are having. As a proof of concept, a simple physics engine [15] that uses Newton's laws in applying impulses between colliding objects is employed. This engine is acting as a data generator for the neuronal network. Positions, velocities and angular velocities of the two objects before and after the collision are used, as these are the only values that the physics engine is manipulating when applying an impulse between them. After this, a fully connected neural network, with an input layer of 10 neurons (for the positions, velocities and angular velocities as all these values matter before a collision) and an output layer of 6 neurons (only for the resulting velocities and angular velocities of the two objects) is employed.

During the preliminary tests, there were analyzed and tested different configurations varying from one hidden layer and up to four hidden layers, with several neurons around the average between the input layer and the output layer. Once an accuracy of more than 90% is obtained, the network configuration is saved and loaded in the physics engine, thus replacing the traditional code where the relative velocity at contact is calculated.

A. *Demonstrator application architecture details*

For the network to be trained, it is necessary to input and output data that would correctly represent the logic used by the actual physics engine to calculate the collision between two objects and what the resulting velocities of these bodies are, after the contact.

Keeping this in mind, data was collected from the running physics engine under some demo tests ("scenarios") where objects were colliding randomly, and the positions of the two objects were extracted as input data, as well as their velocities and angular velocities between the impact, and as output data, the resulting velocity and angular velocity after the contact were extracted.

As this data is represented in the *XY* coordinates, the initial data was not very helpful for the neural network as the differences between two sets of inputs for example (and the same thing for the corresponding sets of outputs) were too big, and the neural network was failing to learn from them. So, another representation of the data was made by choosing to extract the difference between the positions of the bodies for input, and the relative velocity

resulted from the impact as output. Thus, the inputs and the outputs between two different collisions were a lot smaller and the neural network could learn from it.

The *Box2D* [15] physics engine was very helpful in generating the data because in a "scenario" where multiple objects may collide, the physics engine is splitting the whole scene into pairs of two objects colliding and updates for each pair the resulting velocities. An example for collecting data for training can be seen in Fig. 5.
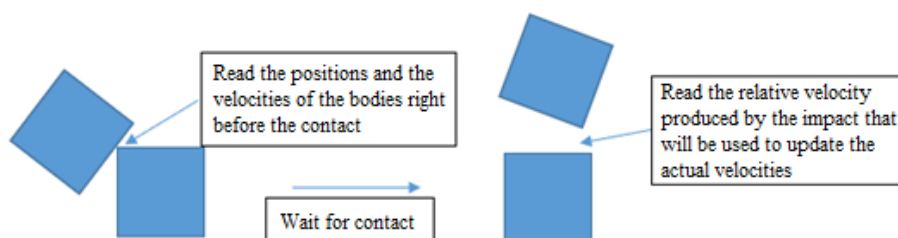

Fig.5. Generating training data from the physics engine.

The collected data is then divided by the *80/20* rule for training/testing of the neural network. From training it was discovered that the data could not be used in its raw format as it was again, not good enough for the neural network to learn. In its raw format, it was possible to obtain a maximum of 60% accuracy, even with different learning rates, activation functions used, or a different number of hidden layers and neurons per hidden layer.

One problem that needs to be taken into account is the presence of different intervals between the generated outputs, and the outputs the activation function was able to produce. The outputs generated from the "scenarios" used were somewhere between *[-300, 300]* range while classic activation functions such as *sigmoid* or *tanh* or *ReLU* (Rectified Linear Unit) were producing outputs that could not map the generated one. Although these activation functions may not produce the desired output on the last layer, they still can be used in the hidden layers. One approach for resolving this interval mapping would be to standardize the data [15], by calculating the mean value and standard deviation of the output and rescaling the distribution of values so that the mean of observed values is *0* and the standard deviation is *1*.

After the network predicts an output, one can reverse the data standardization process to bring it to the original output generated by the physics engine. Another step used to increase the network accuracy and minimize the loss function was to use the linear activation function on the output layer as this can map the desired interval.

This increased the accuracy to almost 90% without using any optimizers for the neural network hyperparameters. The next step to increase the accuracy as most as possible is adding optimizers on the neural network to help it converge to the global minimum for the loss function.

B. Preliminary performance measurements

Currently, without any optimizations on the neural network learning, the accuracy is under 90%. This may sound enough, but it is not, as the loss function for this accuracy is above 0.1 and the predicted relative velocity is still not close to the real one.

There was applied the same optimization techniques were applied in [12] and managed to minimize the loss function below *0.05* after only 1000 training iterations. Here, hyper-parameters like the number of neurons and the number of hidden layers could be adapted as the target is to go under a *0.001* loss function.

It was chosen a one hidden layer network of 10 neurons, while the input layer is also 10 neurons because of all the used input data, and the output layer is two neurons because of the velocity derivative used to calculate the final velocities of two objects colliding (the velocity is expressed in bot *Ox* and *Oy* axis). Both hidden and output layers use the classic sigmoid activation function.

Of course, one problem arises and that is the fact that the output generated by the physics engine can be in any floating interval of values (in the presented "scenarios" going from *-300* to *300* in the *(x, y)* coordinates), while the sigmoid function can output data in the *[0, 1]* interval. For resolving this problem, the output data is normalized before feeding it to the neural network for training from the minimum and maximum available values to the *[0, 1]* interval so that this new output can be compared to the output of a sigmoid function [15]:

$$y = \frac{x - min}{max - min}$$

(1)

In equation (1), the *x* value represents the initial output obtained from the generated data set, and *y* represents the normalized output that fits in the *[0, 1]* interval.

C. Fine-tuning the neural network

For achieving a smaller loss function some fine-tuning was needed to be applied to the training data set as this is the biggest factor that influenced the accuracy of the neural network. It has passed from using randomly generated data sets to well-defined generated data. This was done by selecting an interval of points where the launched object (called the "bomb") was generated. In the first iteration, this set of *(x, y)* points was generated randomly in the interval *[15, 15]* for the *Ox* axis. The *y* point was maintained fixed at the value of *15*. The angular velocity and rotation were also generated randomly.

With this approach, there was obtained loss functions close to the intended one, but in a realistic simulation of the neural network inside the engine (the logic that was used to calculate the derivative velocity at contact was replaced by the neural network), there were still cases where the network did not perform as intended. This is because of the random

nature of the generated data set that might have been generated more around some cases and less around others.

Keeping this in mind, randomly generated data sets were left behind and an iterative method that would cover a set of cases equally was chosen. This was done by iterating through the initial *Ox* interval of *[-15, 15]* with a small step of *0.05*. To help the network even more, this interval was reduced in *[-5, 5]* and incorporate two different "scenarios": one where a single box was hit by the "bomb" box, and one where a stack of 10 boxes was hit by the same "bomb" box (this meant that the "bomb" was launched from the same position for both "scenarios").

Another constraint applied to the training phase was to go with a fixed angular velocity and rotation because the random nature of the generated ones produced the same outcome, where the network performed well for some cases and bad for others.

After applying these constraints, generating the training data upon them and training the neural network with the data set there were obtained loss functions in the range of *10-4* after 5000 iterations of training. The table below (TABLE 1) indicates the loss function resulted in a training cycle of 2000 iterations.

Iteration	Test Score	Train Score
0	0.102988	0.103005
10	0.051049	0.051049
50	0.017851	0.017834
100	0.008923	0.008907
1000	0.001305	0.001304
2000	0.000803	0.000800

TABLE 1. Loss function resulted in a training cycle of 2000 iterations with the described constraints for the training data.
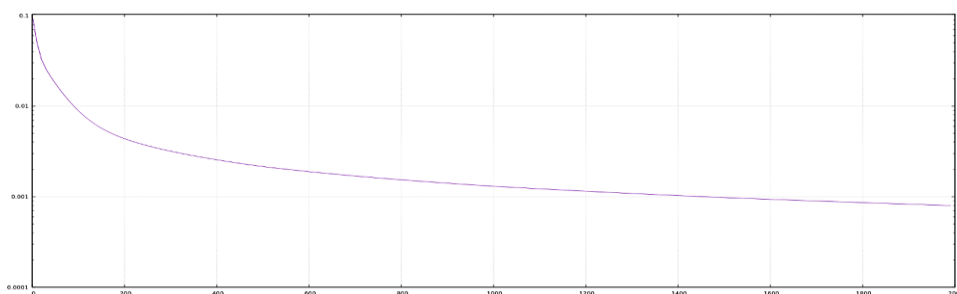
Fig.6. Evolution of loss function over the 2000 iterations with dynamic learning rate. On *Oy* axis is the loss function and on the *Ox* axis is the number of training iterations.

4. Results

In Fig. 7 it can be seen the two "scenarios" used for generating training data for the neural network (single object – first row and stack - second row). Along with these two, is a more complex "scenario" (pyramid – third row), all of these being later used as a reference for checking how well the network behaves after it has been trained.
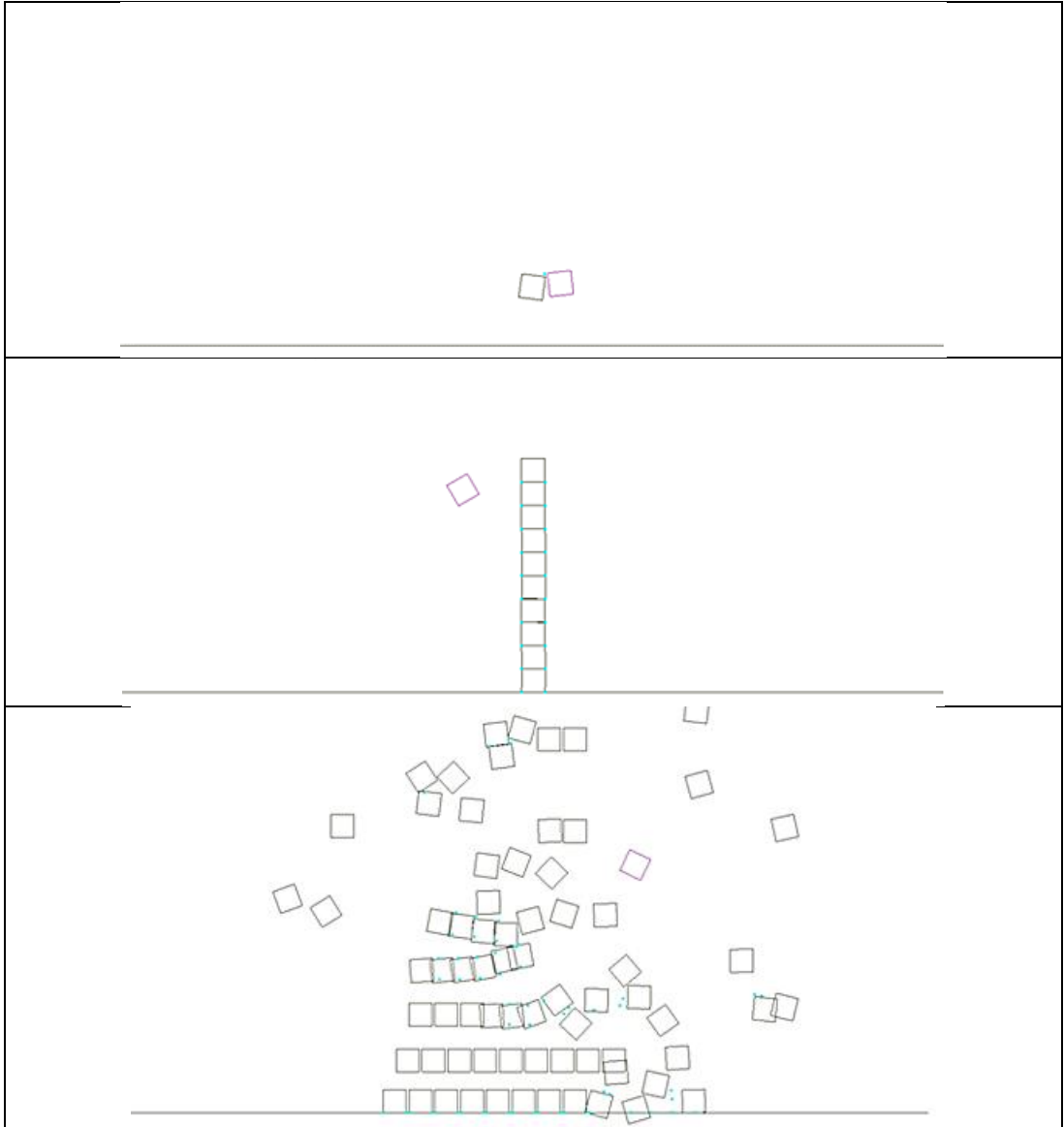
Fig.7. "Scenarios" denoted 1 (first row) and 2 (second row), that generate training data by simulating contacts between two objects ("scenario" 1) and an object and a stack of other ten objects ("scenario" 2); "scenario" denoted 3 (third row) consisting of a pyramid of 66 objects.

The generation of training data consists of launching an object (the purple square called the "bomb") into another object, or a stack of ten objects. The bomb starts from the position *(-5, 15)* and iterates through the final position *(5, 15)* with a step of *0.05*, getting data from both "scenarios" with the same position of the "bomb" object. The input data collected represents the positions of two objects that are about to collide (in Cartesian coordinates), and their velocities, angular velocities, and rotations. The output data represents the derivative (in Cartesian coordinates) that are then applied to the initial velocities before the contact resulting in the final velocities (and directions) of the objects after the contact.

The loss function is the MSE (Mean Square Error) function, and it is about *10-4* for the network. With this loss function value, still there are errors as it can be expected, because this value does not reflect an accuracy of 100% which would mean a perfect replica of the physics engine used for training.

The network also adds a performance impact on the physics engine. This is expected, as the neural network presents a higher level of computation than the original physics engine that used a simple Newtonian equation to calculate the derivative of the velocity. For simple "scenarios" like "scenario" 1 and "scenario" 2, this impact is not observed as both the physics engine and neural network obtain the same performance, but for a more complex "scenario" with a big number of objects interacting ("scenario" 3), the computation necessary for the neural network prediction is way bigger than what the traditional engine would calculate, and this has an observable impact on the graphical performance.
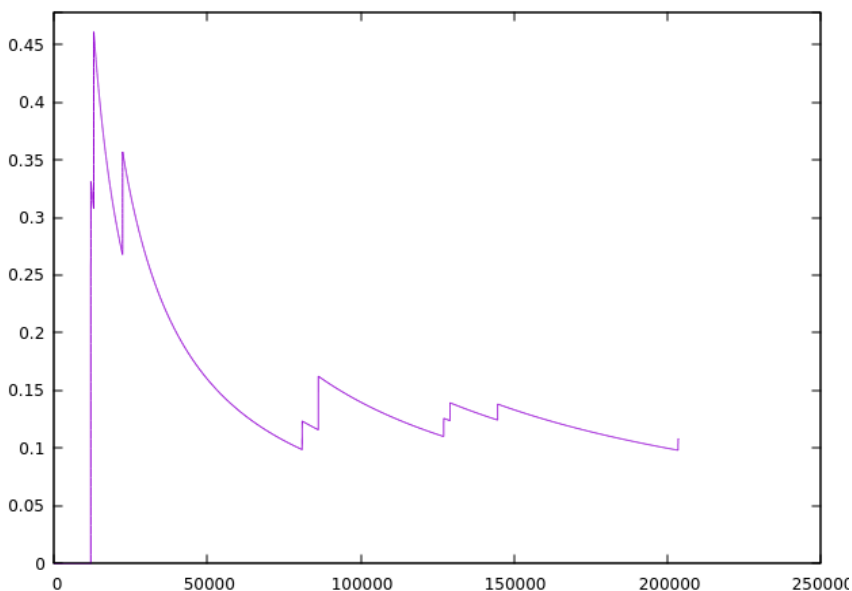
Fig.8. Evolution of prediction fail percentage over the total number of randomly generated simulation tests. On the *Oy* axis is the failure percentage of the neural network prediction and on the *Ox* axis is the total number of simulation tests.

As it can be seen in Fig. 8, the neural network achieves a successful prediction rate between 55% and 89% depending on the test "scenario". Unfortunately, this is not a desirable prediction rate, especially because there is not a constant percentage for all test "scenarios". This shows that classic neural networks are not suitable for this kind of application as it needs an accuracy of over 90% (even 95%) to be able to accurately replace the physics engine.

5. Conclusion

It is possible to use a neural network for replicating a physical engine in certain scenarios at an acceptable accuracy (the one obtained here could be improved by generating a bigger data set, by using a longer training time, and by tuning hyper-parameters, but the classic approach (especially the classic activation functions) cannot fully replace the physics engine. Also using a neural network just for predicting the collisions of objects for this case is not favorable as the performance is impacted and for a simple engine such as the presented one, it is better to use the traditional ways of expressing the physics equations.

Acknowledgement

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CYBER RANGES, THEIR ROLE IN SECURING SMART BUILDINGS

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Abstract

IoT devices are already part of our day-to-day life, and their role increases every day. Buildings and all kind of other constructions will be managed by, or with support or IoT/ICS/ICT equipment, that must be protected 24/7/365 as some of them quickly become obsolete. In terms of cybersecurity, this equipment represents potential doors to the safety of buildings, their inhabitants or users, and their personal or confidential data. People, the society and the market need to prepare to manage risks brought by the usage of millions of old, unpatched, unmaintained ICS and ICT devices. Considering the accelerated rhythm of technology adoption, new cybersecurity technologies, such as cyber ranges, already provide the basis for future approaches to intelligent and knowledgeable management of cybersecurity in IoT contexts.

Keywords: ICS, ICT, cybersecurity, smart building, cyber range

1. Introduction

Cybersecurity of modern constructions presents o series of risks encountered, until recently, only in managing aspects of critical infrastructures. These risks are generated by the usage at an increasingly larger scale of measuring and control technologies such as IoT, IIoT or SCADA in most human activities, among which the construction sector stands out as foundation for all other economic sectors. Regardless we are talking about residential constructions, offices, production facilities, bridges, or other physical built infrastructures, they represent the foundation of more than 60% of the entire modern human activities in time spent inside or in the proximity of constructions, as well as considering the volume of activities. According to World Economic Forum [1], "For nearly the entire population of the world, the built environment heavily influences quality of life. In the United States, for instance, people on average spend nearly 90% of their time indoors.". Considering the importance of the construction sector itself, the same source highlights the fact that „The construction industry serves almost all other industries, as all economic value creation occurs within or by means of buildings or other "constructed assets". As an industry, moreover, it accounts for 6% of global GDP. It is also the largest global consumer of raw materials, and constructed objects account for 25-40% of the world's total carbon

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emissions.". "The State of European Cities 2016. Cities leading the way to a better future" report of the European Commission [2] also acknowledges the increased trend of urbanizing population within the European Union, observing that the population in urban areas (cities, towns and suburbs) increased from 65% to 72% between 1961 – 2011. This aspect reflects not only in living areas, but also in working and utilities infrastructures, increasing the impact construction sector have.

Improving cybersecurity of built infrastructures represents a major concern for all their administrators. In many implementations modern technologies mix with old, obsolete technologies posing a higher-than-normal risk to both, inhabitants, and users, as well as the infrastructures itself. Technologies not updated present similar risks to owners, administrators, or users of buildings.

Several tools emerged in the last decades facilitating learning and protection when dealing with cybersecurity of buildings, but more are still to be made. The mix between cyber ranges and artificial intelligence is among the best aids market can provide to increase the security of smart buildings and other smart infrastructures.

2. Cybersecurity of smart buildings

The technological advancements of last decades lead to an accelerated introduction of modern measuring and control technologies in management of buildings and other built infrastructures. Smart constructions include complex systems to monitor their technical and functional parameters and report on working conditions, deviations, malfunctions, or other situations of interest, such as utility provisioning, environmental parameters, etc. As buildings are used by humans mostly for living and working, providing appropriate safe conditions required for people is mandatory, considering legal requirements and business considerations. Therefore, interior, and exterior lighting, emergency lighting, air conditioning, air circulation, plants watering, utilities provisioning, control access, etc., are things that can be managed by automatic systems in smart buildings. Smart utility constructions have different requirements focused more on the functional aspects and the proper functioning of their components, but the cybersecurity requirements remain similar.

Considering buildings relevant, a good example is given by Wendzel and others in the paper "Cyber security of smart buildings" [3] defining a smart building as "a building equipped with integrated technology systems like building automation, life safety, telecommunications, user systems, and facility management systems. … The main goal of a smart building is to connect data, people, and systems.". The same authors [3] highlight the following as main sub-systems of a typical smart building:

- Heating, ventilation, and air conditioning (HVAC) systems;
- • Access control systems in a smart building;
- • Lighting control systems;
- • Fire alarm systems;

- Video surveillance systems;
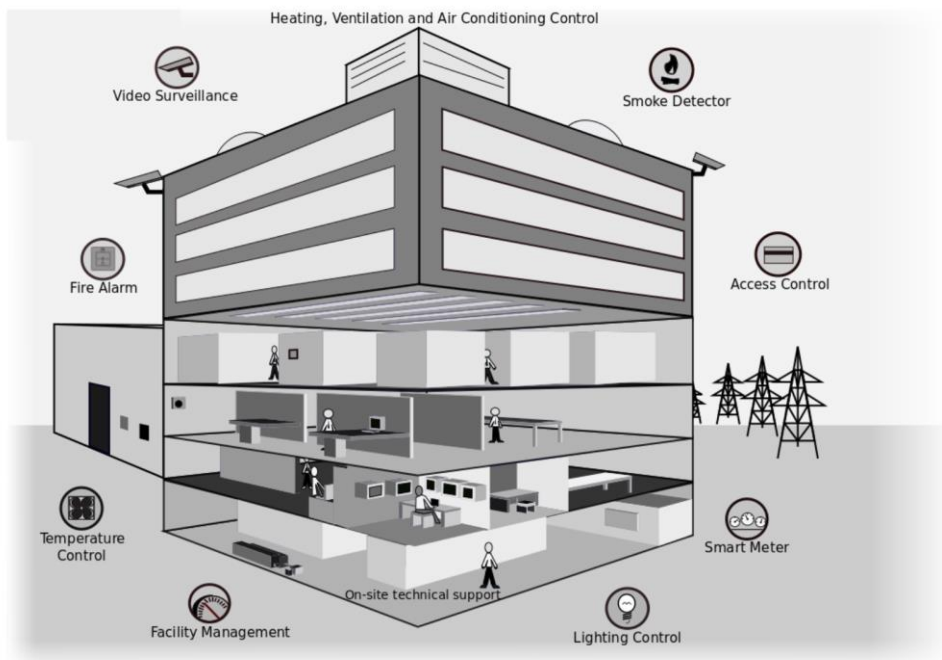- • Facility management systems.

Figure 1.1 Example of a smart building with its components [3]

In addition to the enumeration above, also considering a larger application of technology, we believe it is necessary to extend the architecture of a smart system for buildings and other built constructions with few other sub-systems on functionalities and protection of the infrastructure but not only, such as:

- Utilities provisioning systems – systems dedicated to facilitating and monitor intelligent distribution of utilities to a smart building's interior and dependences. The most common example of such sub-systems are smart metering systems for the necessary utilities, like water, gas, heat, electricity, also represented graphically in the image above. Smart energy generation systems are, as well, good examples of utilities provisioning systems.
- Waste management systems – systems dedicated to automatically monitor, store and report waste deposits generated by inhabitants and users of buildings. A common example are smart waste bins systems capable to compress wastes, rotate bins and report for collection when full.
- Safety control systems – systems monitoring weather, climatic conditions and other relevant parameter, and automatically managing windows, doors, water leakage. Fire detection and control, also represented by the above-mentioned authors, may be considered a component of safety control systems for people and infrastructures. As well, dangerous gas detection, air quality and purification/sterilization, or emergency lights and exits.

- Integrative or interoperability systems – IT&C systems facilitating integration or interoperability between different systems and functionalities of a smart building. Due to technological progress, different types of modern automation systems for buildings management tend to overlap in functional and technological layers (infrastructure management, invoicing, ordering, networking, cybersecurity, etc.), while differences tend to diminish, especially in technological aspects, considering technological convergence, system architecture, TCP/IP based data protocols, etc. These include BMSs (Building Management Systems), FMSs (Facility Management Systems), and other categories of state-of-the-art automation systems handling business and functional processes of a smart building.
- Cybersecurity systems – dedicated systems specially designed and implemented to protect IT&C and smart infrastructures ((I)IoT, SCADA, etc.) from cyber-attacks. These systems include customized firewalls, intrusion detection and intrusion prevention systems, automatic recovery, intelligent traffic analysis, etc.

A different category of smart equipment to be more and more found inside a building is represented by consumers' smart devices, that don't come with the building, but with the inhabitants and users of a building. These devices come in a wide range of categories, varying from smartphones, smartwatches, and other kind of portables to smart appliances, multimedia, gaming, or equipment for elders, ill people, or persons with disabilities. Despite this obvious diversity, much equipment integrate on different technological and functional layers with existing ICT/ICS infrastructure, such as: wired or wireless TCP/IP data network, device management layers, voice command, access control, surveillance systems, data exchange, automatic ordering and/or invoicing software, etc. Moreover, these systems may come to function interdependent with each other. Approaching a gate by a car may activate plate recognition software inside a video surveillance system, opening of the gate and activate certain other sub-systems, such as exterior and interior lighting, garage opening, or interior heating. Similarly, when entering a building face recognition software may recognize a person, deactivate security alarms, and activate lighting, elevator, heating, bring up a ramp for a wheelchair, open TV, etc. Therefore, due to the purpose and wide applicability of IoT systems and equipment, their usage is currently generalizing in all relevant human activities.

As technology evolves and weight of software increases in modern systems, down to field equipment, their associated cybersecurity risks increase as well in both, diversity, and complexity. Until recently, automation infrastructures were independent devices, dedicated systems handling only few aspects usually industry oriented with cybersecurity concerns caused mostly by difficult remote management access to equipment, a reduced rate and level of technological updates: simple predictable architectures, low complexity of equipment, reduced automation functionalities. Still, hardware-based implementation made hacking attempts quite difficult to perform. Current technology is changing, with more and more functions performed at software level instead of hardware, and automatic functionalities of smart constructions are increasingly managed by complex ICT/ICS systems capable to integrate and manage different kind of sensor and actuating equipment. Both, commercially and openly licensed standards and technologies get more and more traction in managing production and data processes in most industries, increasing also technological complexity and diversity in equipment and implementations. Therefore,

while technology develops and spreads, new risks emerged and need to be managed, related to remote access, software bugs, loose implementations, loose interoperability, or loose security. Consequently, we are observing a corresponding increase in cybersecurity attack surface on these kinds of technologies, as well as a considerable increase in volume, diversity, and complexity of cyber-attacks. As well, technological diversification and complexity will deepen the issues encountered in managing smart constructions, facilitating the introduction of new potential cybersecurity breaches or vulnerabilities.

It is important, therefore, to observe the continuous convergence of traditional and modern technologies on conceptual and technological levels, as well as the convergence of ICS and ICT technologies, leading to common technological approaches and a deepening sharing of benefits and risks in initially different scope technologies, such as ICT and ICS.

Considering all above, we believe cybersecurity of ICT and ICS systems already need to be redefined on integrative bases, capable to ensure security on separate layers, and to function integrated. The similarity with the ISO/OSI model and the TCP/IP stack implementation cannot be overlooked, as they are some best examples in terms of standardization on separate layers and integrated functioning.

3. Incident simulation in cyber security

Smart buildings and, generally, smart infrastructures, provide a higher level of comfort for their users, but also may provide a higher degree of risk to personal data and private life. Smart buildings and other smart infrastructures are physical infrastructures whose functionalities were enhanced with help or ICT and ICS technologies. Some of the most representative technologies currently used by people are, considering their categorization, the following:

- ICT equipment: smartphones, computers/laptops, tablets, Wi-Fi routers/Internet access, etc.
- ICS equipment: wearables (smart watches, smart trackers, etc.), smart TVs, content streaming devices, smart energy and lighting appliances, voice control devices, etc.

They are supplemented with other ICS equipment used in smart buildings, such as: different kinds of smart sensors, video monitoring systems, actuators, etc.

All these equipment and countless more have information about us, our habits, our location, our data. And most of them are already connected to Internet using Wi-Fi devices or GSM technologies. With a lifetime of about 5 years or more, while probably being properly secured at purchase time, all these equipment quickly become obsolete in terms of cybersecurity. In two years or less we all end up with daily used technologies that may represent a vulnerability to us, our properties, and our data. Moreover, many Wi-Fi or other Internet-connection devices end up in the same way, with unpatched vulnerabilities and open gates into our properties, infrastructures, and data.

While many appliances and applications are continuously created to help us protect the things we own, little effort was put into education of common IT users, administrators, or managers of smart buildings. Two advanced tools that are getting accessible and handy are represented by infrastructure modelling and simulation software, and cyber ranges.

Modelling and simulation software concentrate on functionalities related to modelling ICT and ICS infrastructures in their virtual representations on computers and simulating their proper functioning. National Instruments LabView, and Schneider's IGSS (Interactive Graphical SCADA System) are representative solutions for modelling and simulation of, mostly, ICS infrastructures. They allow the transposition of industrial control systems and the creation of control software in virtual environments, mostly by mouse, drag-n-drop and right click, requiring limited programming skills for common tasks. They allow working scenarios to be built and run, object libraries to be created and reused, and provide limited functionalities related to ICT systems.

Cyber ranges add a separate layer of cybersecurity and educational functionalities. While both categories share many functions, the present paper concentrates on the more advanced solutions represented by cyber ranges. Cyber ranges provide an augmented experience for users, allowing them to dynamically interact with the simulated infrastructures, re-run scenarios and monitor real time effects following their actions and interactions.

According to NIST, cyber ranges are „interactive, simulated representations of an organization's local network, system, tools, and applications that are connected to a simulated Internet level environment." [4]. In their same material NIST also defines a cyber range as a „Realistic simulation of the internet, systems, applications, and devices in a training environment". NIST definitions reflect the widely accepted positioning of cyber ranges as simulated IT environment and infrastructures, with a substantial role in learning and incident management processes, as it also results from NIST's The Cyber Range: A Guide [5]. The papers lean deeply on roles of cyber ranges but, in our opinion, fail to look further in the future of cybersecurity and this kind of technology.

Moreover, considering the potential impact of cybersecurity tests on ICT/ICS infrastructures there are numerous substantiated arguments for not testing live infrastructures on common bases. Instead, virtualizing ICT and ICS architectures, modelling common behavior of equipment inside data networks and simulating ICT/ICS/cybersecurity incidents have the large benefits of not raising potential risks of damaging live infrastructures, and allow the repeatability of simulations over and over again in controlled, risk-free environments. The similarities with game theories principles cannot be ignored, in this perspective [6]. Also, a large number of games are simulating, for already more than 20 years and in very realistic details, different management situations and scenarios (cities, businesses) [6], transportation technologies (trains, cars, plains) [7], large and very large structures (solar system, galaxies) [8], or behavioral scenarios (cybersecurity, businesses) [9-11].

Technological advancement made augmented simulation the next logic step in learning through gaming, cyber ranges being one of the most relevant examples. In this perspective, cyber ranges are virtual, physical, or augmented representations of ICS and ICT systems in

controlled environments, meant to facilitate testing different cybersecurity incident scenarios and their impact on the respective infrastructures. Most cyber ranges are entirely virtual, in virtualized environments replicating desired scenarios. Still, small scale physical infrastructures, or a mix of real and virtual equipment may be used, considering the needed scenario's requirements. Obviously, virtual cyber ranges provide the most desirable conditions for risk free environments, and repeatability conditions. Virtualized environments and infrastructures may be 1:1, scaled up or scaled down, to a resolution capable to keep results relevant considering the physical infrastructure and, also, the purpose of the tests.

Several very important functionalities need to be provided by cyber ranges when dealing with simulating cybersecurity incidents in virtual environments, such as:

- High degree of fidelity, representing the ability to provide the most accurate replica of the physical systems, from functions and ports to network communication and programmable behaviors.
- High level of standardization, representing the ability to use standardized data structures, data interfaces, or protocols.
- Flexibility, representing the capacity to model different ICT/ICS infrastructures and scenarios without altering main functionalities of the systems.
- Infrastructure's segmentation, representing the ability to segment the simulated ICT/ICS infrastructures by physical and logical criteria, based on scenario's requirements (e.g., networking, sensing, actuating, server, application, or other layers).
- Reusability, representing the capacity to allow users to reuse virtual items in different architectures and scenarios.

Other relevant functionalities relate to usability, accessibility for disabled people, or multilingualism.

Several cyber range solutions are available at time of writing, with a variable palette of functionalities. Most of them include functionalities, such as: modelling ICT and ICS infrastructures, simulating their functioning and data exchange, preparing, managing, and running incident scenarios, as well as providing the necessary interaction for learning processes. Some examples are: CyberGym's CTTA (Cyber Training and Technologies Arena), Silensec Cyber Range (provided by Silensec), Cyberbit Range (provided by Cyberbit), CASTLE (Cyber Security and Learning Environment provided by the Austrian Institute of Technology), etc. These solutions are only few examples of cyber ranges applied technology and provide commercially the above-mentioned functionalities as services on premises or cloud computing infrastructures.

Thus, due to their functionalities, cyber ranges can facilitate design of smart infrastructures, test their cybersecurity, or educational processes. While currently cyber ranges still represent a niche subject in the ICT and IoT world, being more closely related to professional environments, they are bound to become one of the most important learning tools in cyber security for everyone. Therefore, while still needing specialized knowledge

on cyber security, we appreciate cyber ranges will become more and more accessible for common people, and processes automation will drive the next step in their evolution to smart, integrating, adapting cybersecurity software solution.

4. Conclusions

Autodesk estimates [12] that only in urban areas about 11100 new buildings were built daily in 2018 in the entire world, and approx. 14700 new buildings to be built daily by 2050. This numbers adds to all the existing buildings, leading already to a countless number of constructions. This amount represents, also, the number of physical infrastructures that need to be protected from cybersecurity incidents. People using those buildings and their data need to be protected, as well.

As buildings become more and more accustomed to smart technologies, the need for extended cyber security services raise exponentially. The quantity and quality of knowledge necessary to protect a huge, unknown number of buildings, people and data exceeds the possibility of the market now, and in 2050. The only reasonable solution is to automate current technologies to provide relevant information and knowledge, as well as necessary actions, to ensure automatic responses to cyber incidents, and to automatically protect people and data inside the building.

A potential solution, already at hand for several of the needed functionalities, is represented by cyber ranges. Augmented solutions able to model ICT and ICS infrastructures, simulate functions and behavior and, possibly, protect against cyber incidents and detect unexploited vulnerabilities of obsolete equipment with support from AI technologies, cyber ranges will also provide specialized knowledge for people with administration and protection of respective buildings.

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Issues and challenges in mobile internet in Sri Lanka

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Abstract

The development of telecommunication is an essential factor to the economic sector while having an impact on opportunities. For communication among economic acts all around the world as well as inside a country. Nowadays, network providers give quality connections and opportunities to retrieve information by different technologies, traffic plans, and their service has become an essential part of society. Examining the leading network provider in Sri Lanka by using theoretical findings of telecommunication and technologies of communication is the main aim of this research. The monographic method, induction deduction method, and graph comparison method have been used in the research. Theoretical features of telecommunication, leading mobile network providers in Sri Lanka, financial performance indicators of those network providers, service and traffic schemes given by them, and competitiveness among them have been described in the research. Investigating the mobile traffic schemes and services provided by various network providers, it has been visible that they are almost similar in comparison but looking at each offer more closely revealed that some variations are essential to the customer and things that must overlook. After looking at the competitiveness among these network providers, it can conclude that in Sri Lanka, Dialog scored the most number points. In contrast, Mobitel and SLT scored points to become second and third in the race, respectively. By looking at the main factors in this comparison, Dialog must improve its ratings in areas like discounts given to the customers, the charge of the service, and supply of the service where others scored more points than Dialog.

Keywords: Information Communication Technologies, Internet Speed, Internet Cost, Signal Strength, Economy, Sri Lanka

1. Introduction

Sri Lanka is a small island located in the south of the Indian ocean, nearly has a population of 22 million, which is contained with a total area of 65 610 km^2 [1-2]. Twenty-six years have passed since Sri Lanka got unrestricted commercial internet access. In South Asia, Sri Lanka became the first country to do so. Since then, there has been rapid growth in telecommunication companies [3]. Because of that, communication opportunities have been developed and still developing for the economic side. In earlier days, people used a dial-up modem to access the web and manipulate electronic mail, internet relay chat and

text-only web pages. But these days, the life pattern has changed drastically, and the internet has become an indispensable part of everyone's day-to-day life and in our economy. In 2021, there were nearly 15.60 million internet users in Sri Lanka, as shown in the data given by the Telecommunication Regulatory Commission [4] of Sri Lanka. Differences between various traffic plans given by multiple mobile communication.

Providers in Sri Lanka are nonsignificant. Comparing mobile internet [5-7]in Sri Lanka can be done under main categories like the speed of the internet connection, signal strength of the internet connection, Affordability of internet connection. Throughout the last decade, the evolution of telecommunication has given Sri Lanka opportunities in the economic sector which have not been there before. By taking assets of cellular telecommunication, businesses and financial moves can make sure speedy and efficient communication. Companies located in Sri Lanka can provide high-quality communication to their targeted customers and provide their services to the global market. The increase of telecommunication companies has been immense in Sri Lanka in the past few years. Due to that, opportunities in economic moves in communication develop rapidly and improve frequently. Today cellular telecommunication companies provide high-quality telecommunication and data recuperation opportunities by various services, technological features, and data traffic plans called necessary network providers. Investigating the leading cellular network service provider in Sri Lanka by using theoretical innovations of telecommunication and cellular communication technologies is the primary purpose of this current research. Main tasks of this research.

1. To investigate hypothetical findings of telecommunication and technologies of communication.

2. To investigate the dominant cellular communication service benefactors in Sri Lanka, and services are given by them, and the competitiveness among them.

The following conditions have been shown: Differences between the mobile traffic plans given by these dominant cellular network providers in Sri Lanka can be neglected because the differences are not considerable. The monographic method, induction and deduction method, graphic method, comparison method, and competitive assessment method determined from the competitive index are used in this research. Information in this research paper has been extracted from specialist literature, research papers written according to telecommunication and communication technologies, other public resources, and trustworthy internet resources. Covid 19 has become the leading health issue worldwide and Sri Lanka [8-10]. The number of patients is increasing daily .in a situation like that, the internet will be a crucial part of everyone's life to use the internet to use services like E-banking and E-studying until people around the world are vaccinated. So having and quality mobile internet connection will play a significant role in everyone's life due to the world's present situation.

2. Theoretical characteristics of telecommunication and technologies of communication.

Telecommunication has been considered as a tool in this research for developments in remunerative and communal sectors throughout humanity by magnifying the aspects of ICT (information and communication technologies) for advancements, and telecommunication can be used as a part of that.

Information and communication technology giving many opportunities to change the social environment around people is an obvious fact that has can be proven by looking at the world these days. Quality internet, smartphones, and social media, which are parts of information communication technology, are becoming popular among people these days. Those parts affect people's perspectives, society and its culture, strategies, and policies made by people or the governing bodies and usually winners or losers in different subjects. Whether people use these parts of information communication technology to bring a good change in society is still questionable and has been challenged continuously over time.

Information technology can be stated as a comparatively young subject to the people which opens up a massive number of opportunities to the world. People forget to think and ask what the primary purposes of using information technology in their lives can be due to its modernity. Those are things that can be executed literally with it.

Dispersion of information communication technology has no value if the user can't decide which is the best way to use it for good and at the same time for his benefit. Then rises a crucial question from the potential and perspective: things that can be done to our capabilities through information technology? It is frequently written in communal and economical experimental writing that the world's frugality is recently going to develop into an informational economy. Additionally, this economy is increasing worldwide in its scope. Furthermore, it can be stated that those economic schemes which are not connected to these informational Networks around the world will have a crucial time to withstand in the long run of their career, as a result of increased competition in merchandise reaching everywhere [11]. While the first decade of this millennium was over, it became very clear that a leading subdomain of international and national scholarships in Sri Lanka, policies and practices in Sri Lanka has been information and communication technologies. Information and communication technology has already arisen inside and outside the wide area of telecommunication and communication, advancements, and communal changes. Nevertheless, the acts of information communication technologies in improvement were addressed in later part of the 19th century as if sated correctly in nearly 1980s and 1990s, and the hastened spreading of digital communication technologies throughout the world within such shorter period of time enhanced the possibilities to share the information globally around the world and enhanced development. This Millennium is going forward with many technological changes and enterprises that inspired thoughts and discussions. Academics and activists have criticized information communication technology for development for making the same mistakes over and over again which has been doing in earlier decades, while information communication technology for development tends to focus on the things that countries and global regions bear and the things that they don't have, ignoring the differences within those countries and those regions [12]. The technological opportunities given by this new and enhanced underlying infrastructure aids limitless transmission capacity on the famous and more reliable optical fiber networks. These advancements will have an impact on a more profound convergence on cellular and

fixed-line networks [13]. There are many mobile groups all over the world, not only in developed countries but also in developing countries. Countries in the Europa union and countries in Asia are the best examples with powerful institutions that help economic exchanges through a standard industry regulation [14]. Over time computing and telecommunication technologies have been gathered, the capabilities in businesses worldwide and good social networking programs have increased rapidly. Social programs are growing at an unimaginable rate compared to the earlier days of networking. These nettings differ from each computer network or the neighborhoods in that given network of benevolences is overlapped on the existing geographic neighborhood. This can be accomplished by implementing electronic benevolences and strategies to communicate in addition to maintaining the current inhabitants of the given area but to intensify it by designing an appealing way of living of inbuilt true and implicit benevolences [15]. The electronic telecommunication division is uncommon as it depends on particular technological characteristics that present frequent significant investment issues. The transformation which is happening is that switching from traditional cellular telecommunication systems to all internet protocol packet exchanged data grids will confront electronic communication systems entrepreneur's business schemes further. Due to that, entrepreneurs must be modernized or substitute their existing network to accommodate the implementation of fifth-generation (5G) frequencies [13]. Due to the growth of pervasiveness in cellular communication and swift modernization in the cellular market, the media market became highly capricious, where customers must adjust again and again to changeable stages and ever-developing priorities. Around the same moment, the increase of using smartphones in Sri Lanka and other instrumental media leads to additional complications and enrichments in cellular communications [16]. This research describes and explores the dominant cellular communication provider in Sri Lanka, their services given to the customers and traffic plans given, and the competitiveness between them. The dominant cellular network provider in Sri Lanka was determined by using the information provided in the annual report of each given companies and rank is shown according to them.

3. DOMINANT CELLULAR COMMUNICATION PROVIDER OF SRI LANKA: SERVICES, PACKAGE PLANS GIVEN BY THEM AND COMPETITIVENESS AMONG THEM

Over time, Dialog became the most prominent and dominant cellular operator in Sri Lanka when considering the number of clients, annual turnover, network coverage given by companies, and wideness of the customer service. In Sri Lanka, all network providers offer limited connection, so that looking at some other countries is an area that these companies need to address. As the dominant entrepreneur in the business, Dialog gives a more extensive range of formidable quality telecommunication services to their clients, such as voice communication, limited but high-speed internet connections. And also, a service called Dialog tv to watch foreign tv channels and Sri Lankan tv channels and some other services. Due to the factor that Dialog became the dominant provider of cellular communication in Sri Lanka, Dialog became an essential component in the social sector and economic sector in Sri Lanka. Sri Lanka Telecom (SLT) and Lankabell became the main competitors to Dialog In the meantime. Due to this competitiveness, these cellular

service providers were driven to have a good effective communication with the clients and create new ideas to make this competition more challenging for other companies. Annual turnovers of the given companies are shown in the table given below [17-24].

Company	2018 turnover (billion rupees)	2019 turnover (Billion rupees)	2020 turnover (Billion rupees0	Difference between turnovers (Billion rupees0
DIALOG	109.2	116.8		7.6
SLT	81.45	85.95	91.12	5.17
LANKA BELL	2.96	2.96	2.72	-0.24

Table 1. Annual turnover of the company

By looking at the table, it can be stated that dialog became the leader in the cellular communication market, considering the turnovers and profit. But in the time span of 2018 to 2019, SLT made a significant increase in turnover. By viewing the indicator shown in this table, we can say that SLT increased its investments in its network and development, which allowed the clients to choose this network and improve their trust in this corporation.

The cellular communication benevolence providers offer a larger number of benevolences such as selling cellular phones, laptops and personal computers, smarts assistance and dwarfish-scale domestic equipment across quality voice communication and high-speed internet connection. In Sri Lanka, cellular companies divided the allocated data of some traffic plans as daytime and nighttime data except traffic plans with unlimited data. Traffic plans provided by the given cellular communication providers for voice communication are summarized in the table below [25-27].

Dialog			
Name of the Traffic plan	Price of the traffic plan (Rs Per Month)	GB included in the traffic plan (Day Time)	GB included in Traffic plan (Night time)
Starter package	900 + tax per month	20	20
Lite package	1400 + tax per month	35	35
Lite plus package	2900 + tax per month	80	80
Ultra-package	3900 + tax per month	110	110

Office ultra-package	6900 + tax per month	200	200
Office plus package	9900 + tax per month	300	300
Booster package	16400 + tax per month	500	500
Booster plus package	29900 + tax per month	1000	1000
Sri Lanka Telecomm (SLT)			
Name of the Traffic plan	Price of the traffic plan (Rs Per Month)	GB included in the traffic plan (Any Time)	GB included in the traffic plan (Free data)
Any beat	1290	36	
Web family plus	1490	36	54
Any flix	1790	53	
Web family active	1990	45	65
LTE unlimited	2250	unlimited	
ADSL unlimited	2450	unlimited	
Any blaze	2490	72	
Web family extra	2690	60	90
Lanka Bell			
Name of the Traffic plan	Price of the traffic plan (Rs Per Month)	GB included in the traffic plan (Any Time)	GB included in Traffic plan (Night time)
Starter pack	950	27.5	27.5
Intro pack	1350	38.5	38.5
lite pack	1900	55	55
Family pack	2650	77	77
Family lite	3800	110	110

Family max	7600	220	220

Table 2. Various traffic plans and their prices

By looking at the cellular traffic plans given by these three cellular communication companies, It can be seen that there are some differences between them. By evaluating those differences, it can be seen that some information was important to the users, which they must pay attention to before choosing an operator.

By summarizing the overall table, data given below was gathered:

- SLT is the only company among these three companies gives unlimited internet connections.
- In Dialog traffic plans excessive amount must be paid due to the government tax, but in the other two companies, they have been already added that tax to the amount shown in the table.
- Rather than the price of Dialog traffic plans, traffic plans given by the other two companies are cheaper.

Sri Lanka Telecomm provides an ADSL connection with a speed of 8Mbps-16Mbps while Lanka bell provides a 4Mbps connection and Dialog provides an 8Mbps connection.

By looking at the above details, Sri Lanka Telecomm and Lanka bell offers are more likely to attract new clients. Those offers have a good impact on those companies. By summarizing these traffic plans, it can be effectuated that the range of cellular communication benevolences is wide, and every client will be able to choose the most suitable preference for them. When choosing a network service provider, clients always tend to look at the things such as coverage, price, and their need. But more often, client's decisions are influenced by various other factors like advertising campaigns of these companies, discounts given by these companies, recommendations given by people around you such as friends, and the company's creditability. These reasons can force clients to take an emotional decision without looking at it in a strategical view by not analyzing the advantages and disadvantages of that service provider.

Main factors of competitiveness	Given weight	Dialog		SLT		Lanka Bell	
		Rating	*points*	*Rating*	*Points*	*Rating*	*Points*
Quality	0.1	7	0.7	8	0.8	7	0.7
Price	0.1	7	0.7	9	0.9	8	0.8
Opening hours	0.1	8	0.8	8	0.8	7	0.7
Benevolence	0.1	7	0.7	8	0.8	6	0.6
Corporation image	0.1	7	0.7	8	0.8	6	0.6
Price reduction	0.1	6	0.6	9	0.9	6	0.6
Advertisement expedition	0.07	8	0.56	8	0.56	7	0.49

Corporation development	0.03	7	0.21	8	0.24	7	0.21
Professional manpower	0.1	7	0.7	8	0.8	7	0.7
Expertise	0.03	8	0.24	8	0.24	7	0.21
Implementation of modern technologies	0.07	7	0.49	8	0.56	7	0.49
Wide range of service	0.04	8	0.32	9	0.36	7	0.28
Monetary stability	0.06	8	0.48	8	0.48	7	0.42
Points gained	1	95	7.2	107	8,24	89	6.8

Table 3. Comparison among the network providers

By looking at the above table SLT scored 8.24 points and became the most economical and user-friendly network provider in Sri Lanka, while Dialog and Lanka Bell gained the Second and Third places respectively while scoring 7.2 and 6.8 points, respectively. According to table 3, Dialog needs to improve on their discount system compared to SLT.

Other key factors affecting this competition are given below:

1. New innovations and the progress of wireless broadband technology (increment in speed and quality of data transmission services)
2. Newly invented devices in the commuinication sector (advanced and value-added services has been provided)

Customers are keen to use more devices with a mobile connection.

4. Conclusion

Today in the world, telecommuinication companies that provide quality information and communication services by various traffic plans, higher technological features and services are known as important telecommuinication providers. Throughout the time, SLT became the leading telecommuinication provider in Sri Lanka while Dialog and Lanka Bell viciously competed to increase the number of clients and to gain the leading service provider spot in Sri Lanka. SlT will have to make new offers to customers, which will increase the value of the company as well as his faith in the clients towards their company. By looking at the traffic plans of each company it can be stated that overall traffic plans are similar but saying that when investigating throughly there were some small differences among them. All these companies should do innovations to their infrastructure as well as

introduce new technologies such as 5G and improve the technologies which they are using right now.

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SOLAR POWERED SATELLITE INTERNET FOR RURAL AREAS IN SRI LANKA

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Abstract

This article proposes a high-speed communication system. Past few years ago, all people witnessed the internet, networking, and communication system as one of the most valuable parts of our life. So people will be able to use high-speed satellite internet. In the modern world, people must consider how much data and internet speed are needed. When more people use internet service at the same time will be required more data and internet speed. Satellite-internet covered hard-to-reach rural areas where Digital Subscriber Line (DSL), a cable, may not exist yet. In the rural areas of Sri Lanka, one of the main problems is, supplying electrical power. In this paper, how to power up satellite connections by using solar energy will be discussed. Primarily, rural village areas of Sri-Lanka where there are no terrestrial internet services available can provide significant achievements for improving the villager's life standards of poor village people of Sri-Lanka. Here discusses how to get many opportunities such as e-learning, e-commerce, e-health, e-entertainment, e-banking and other internet opportunities.

Keywords: satellite-internet, solar, power, economy, Srilanka

1. INTRODUCTION

Sri Lanka is democratic, socialist an independent nation. Sri Lanka is an island located in the Indian ocean with approximately 21.9 million citizens, a total land area of about 65,610, with 2,905 of water area and 62,705 of the land area [1]. The nation is split into nine provinces and subdivided into twenty-five districts for administrative purposes. Sri Lanka rich is in natural resources. After thirty-year violence struggles between the Sinhala and Tamil communities, the country's economy increased by an average of 6.4 percent between 2010 and 2018. This country has been one of the fastest increasing economics in South Asia. The island has a tropical climate. The monthly temperature average is between 22 ^0C-33 ^0C in the lowlands and between 7 $^0C - 21$ ^0C in the highlands [02]. Sri Lanka's majority of people are poor, live in rural village areas. Many rural village areas in Sri Lanka have no access to the internet.

The COVID-19 pandemic situation has continued around Sri Lanka, By mid-April 2020. The pandemic situation daunting challenge for more people from rural village areas. Sri Lanka-wide school closures, the impact of the covid-19. This situation most impacts

students from rural village areas in Sri Lanka. More schools, some education institutes, and some universities have adopted an online learning system. However, students from rural villages still face more challenges with internet networks and data speed Because many rural villages in Sri Lanka have no internet network system. This pandemic situation influences the health and economy of rural village areas in Sri Lanka [2-5].

This article has been discussed how to access provide internet services for rural village areas in Sri Lanka. Modern-day internet services have one of the greatest important parts of human life because it provides a lot of opportunities. Especially the main purpose how this internet services can be provided for rural village areas. So using satellite communication, these internet services are provided for rural village area users like in Sri Lanka because these methods are more simple, reliable, and affordable. Satellite internet is provided to make peoples life very easy and comfortable, like education services, health services, bank services and a lot of social works [06]. As the people live in rural village areas, they cannot move to urban areas due to long distances. So they can use their services by using satellite internet communication system. The impact of satellite internet communication services in the rural village areas will create more opportunities, and standard living life will also increase. In the last twenty years, the annual electricity growth rate between 5-6% in Sri Lanka. Now present-day more rural villages have not distributed electricity in Sri Lanka. When the Norochcholai power plant breaks down in Sri Lanka, Daily electricity power cuts have been arranged across the country. So the solar power system in rural village areas can be introduced. According to the Starlink project, there are a planned approximately 11943 satellite constellations in low orbit. The goal is to provide satellite internet and deliver the beta services coverage of people everywhere in the world. They consider it about near the future all over the people can use the internet service any time and anywhere. Satellite internet services will be established that faster (50 Mb/s to 150 Mb/s), low latency (20ms to 40 ms), and reliable internet service should be provided to rural village area's users at more possible very low cost. So how internet service through satellite can be provided and what future advancements opportunities can be arranged for improving the lives of rural village areas in Sri Lanka will be discussed. The major mission is to provide reliable, high-speed internet service using satellites in rural village areas in Sri Lanka.
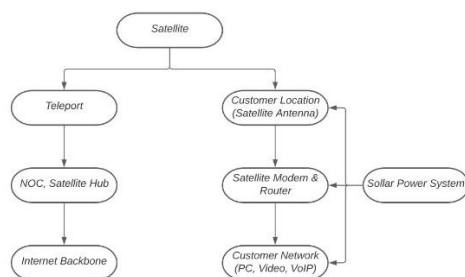
Figure 1 - Satellite internet network overview

2. CHARACTERISTICS OF SATELLITE INTERNET

Sri Lanka is surrounded by the sea. Present-day, this region has internet network access using a dial-up connection, which impacts Sri Lanka's development. Modern-day satellite internet network services are used in more developed countries in the world. Satellite internet can be set up faster than terrestrial networks because

- The infrastructure can be grown independently of geography features because satellite internet networks do not have to depend on location. Any location people live, they can be connected internet through satellite communication.
- They can be developed freely, establishing terrestrial infrastructure because satellite internet technical equipment can be taken around and located anywhere.
- The major part is that satellite internet service can at once publish an individual copy of data to more destinations.

The development of satellite internet service is changing as internet technology, and the satellite continues to evolve.

3. OPPORTUNITIES FOR RURAL VILLAGE AREAS

The satellite internet technology can allow the following opportunities for the people of the rural village areas in Sri Lanka. This technology improves more business opportunities and a standard lifestyle in rural village areas [8-10].

- E-learning system.

Satellite internet network service can provide more content of E-learning system for rural village areas peoples. It makes it easy to balance their work with family work. An online lesson can be given to people. They will become educated. They can take part in the progress of their motherland.

- Internet banking and Online marketing.

E-banking service allows people of various financial instructions and more features. So people from rural village areas do not need to move long distances for going to cities for banking and shopping. People from rural village areas can online order more of their things from the internet and collectively ship for them.

- Telephone acess.

The people from rural areas do not migrate to urban areas. They can work from their houses for many companies. They can create small offices in their houses and can access connectivity with the main branch across the internet network service supplied across the satellite.

- E-entertainment.

By supplying internet network services across satellite will give various new more entertainment services for people of rural village areas in Sri Lanka, like internet radio, Internet Protocol television (IP TV), and high definition (HD) videos.

- Telehealth technology

By supplying internet network services across satellite can be available expert doctors for them from cities. Patients can be checked, and their problems can be solved by using telehealth technology.

4. INTRODUCING SATELLITE INTERNET CONNECTION FOR RURAL VILLAGE AREAS

Sri Lanka faces various technological problems developed in rural village areas in Sri Lanka. With an estimated 10.9 million internet users online, but more than 49.2% of the people without access to the internet in January 2021. The number of internet users in Sri Lanka grew +7.9% (800 000) between 2020 and 2021 [20]. In developed countries no more difference between rural and urban areas because they have widespread internet service. Sri Lanka is a developing country. The majority of people are poor and live in the rural village area. People from rural village areas have very low living standards, education, health, medical care, and transportation infrastructure. Sri Lanka has more different geographical areas like a mountain, terrains, small islands, forests providing internet services across wired connectivity (like fibre optical, wire, and so on). It becomes an extremely challenging situation. So the satellite internet system is the most suitable platform for rural village areas in Sri Lanka [11].

The last few years saw an increase in more satellite industry. In Sri Lanka, the most suitable platform using by low earth orbit (LEO) satellite for satellite-based internet systems. The billionaire Elon Musk is CEO of Tesla Motors and chief designer of the SpaceX project. This Project is planning to establish Starlink Satellite internet sooner and provide internet service all over the world through satellite. So then, this paper will propose to collaborate with the Starlink project of Elon Musk. Low Earth Orbit (LEO) satellites are located around 160-2000 km above the earth's surface [12].

SpaceX's Starlink has installed over 1553 LEO satellites since May 2021. They are planning to constellate 11943 LEO satellites for Global coverage internet service because their footprints are much smaller, but Low Earth Orbit satellites are closer to earth. So transmission power level and necessary antenna size are much smaller. These Low Earth Orbit satellites move at high speed because they are relative to the earth's surface. They are planning to provide an internet network speed as very high as 1 Gigabit per second through Low Earth Orbit Satellites because these satellite's roundtrip delay is 20-27 ms. The Low Earth Orbit satellites are established near the earth's surface. So the data latencies are better than fibre optical. The Low Earth Orbit satellite internet has high speed, quality, reliable services, and long-distance communication. Because Low Earth Orbit Satellite

performance better than traditional satellite internet. SpaceX's Starlink Low Earth Orbit satellites can deliver high-quality internet service to the location where connection has been unavailable or unreliable. This method for the most suitable platform for rural village areas in Sri Lanka to access the internet.
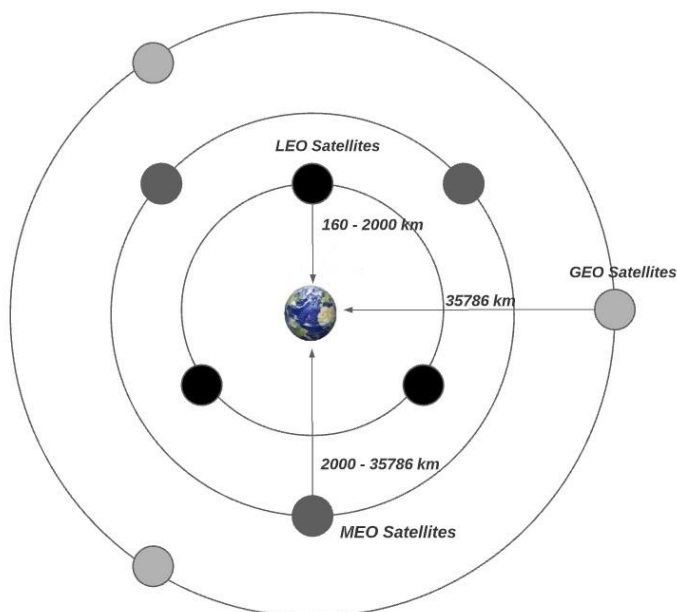

Figure 2 - Comparison of Satellite; GEO, MEO, LEO

Satellite Type	Distance (km)	Orbital Period	Latency (ms)	Necessary to Number of Satellites	Cost per Satellite (Approximately $)	Effective Years of Satellite
Low Earth Orbit	160-2000	88-127 min	20-27	100-1000 (depend on distance)	0.5-45 million	5-10
Medium Earth Orbit	2000-35786	127 min-24h	27-477	5-30 (depend on distance)	80-100 million	10-15
Geostationary Earth Orbit	35786	24 h	477	3	100-400 million	15-20

Table 1 - Comparison of Satellite Internet; GEO, MEO, LEO

According to the table, LEO Satellite system is one of the greatest opportunities for internet services. SpaceX's Starlink project pricing offered during the internet is 99$, speed between 50-150 Mbps per month, and data latency between 20-40 ms. Another advancement of this service, it's easy to set up. The one-time equipment set price is 499$, including a Wi-Fi router, power supply, mounting tripod, and cables [13-18].

5. INTRODUCING SOLAR POWER SYSTEM FOR ELECTRICITY GENERATION

Sri Lanka's power demand was supplied by thermal generation and hydrogeneration. Annual Sri Lanka's electricity consumption and demand percentage are an increasingly more in the last few years. Sri Lanka's more population live in rural areas, but Sri Lanka's Electricity Board can't supply the necessary electricity demand consistently and reliable more rural village areas in Sri Lanka. Some rural village area's geographical infrastructure was very complicated. So Ceylon Electricity Board can't reach to provide electricity demand for some rural areas. Sri Lanka is situated near the equator. So Sri Lanka receives solar radiation over the year. Solar power is a renewable energy system and can provide the necessary Electricity usage in rural village areas. The solar power system is the most suitable medium for generating electricity for rural village areas in Sri Lanka because solar power is free natural resources, low-cost value-generating electricity, and the most eco-friendly renewable energy resources [19] [20].

	Equipment	Watts	Using Hours	Watt hours (W h)
For Telecommunication Devices	Computers	150	12	1800
	Smart Phones	25	3	75
	Router	10	24	240
Domestic Usages	Bulbs	500	12	6000
	42inch LCD TV	120	6	720
	Refrigerator	150	24	3600
	Oven	2200	0.5	1100
	Toaster	1500	0.5	750
	Kettle	3000	1	3000
	Iron	1100	0.25	275
	Rice Cooker	700	1.5	1050
	Fan	70	4	280
	Washing Machine	2000	1	2000
Total				20890

Table 2 - Electricity usage per day in house

According to the table, approximately electricity usage in the house per day 21 kWh nearly around. So,

Annual, monthly electricity usage $= 21$ kWh $* 30 = 630$ kWh

systems were installed throughout the country.

6. CONCLUTIONS

Sri Lanka is a small island and developing country. More people are poor and live in rural village areas and People from rural village areas life standard very low. It is a very big problem for face to Sri Lanka Government. So this paper aims for using solar power to generate electricity and provide internet services through satellites in rural village regions. The benefits of this project can be stated very easy to arrange, service sustained and established wherever because it generates electricity using by solar-powered.

Currently, Sri Lanka Telecom is mainly an internet provider in Sri Lanka. They can't provide internet service in more rural village areas. But satellite internet services can provide internet anywhere. Satellite internet services are better than typical Sri Lanka telecom internet services. Because satellite internet services access anywhere, have High Data speed, and low latency, people can achieve more opportunities through internet services, like mainly improving the majority of people living standards of rural areas. It makes their life very easy and comfortable. There are several options for establishing satellite internet services in Sri Lanka. Currently, the best choice is Sri Lanka to collaborate with SPACEX'S STARLINK PROJECT and build an LEO satellite internet system as soon as possible.

Sri Lanka's electricity demands more increase in near future. Ceylon Electricity Board can't supply electricity all over the country consistent and reliable. Sri Lanka's more power plants are present-day using diesel, natural gas, and furnace oil. Using these fuels expands the very harmful effect on the environment. So modern-day more countries are introducing solar power systems. This is the best option for Sri Lanka. Because solar power is free energy resources and environment friendly. So then Sri Lanka's people from rural areas achieve high living standards, a beautiful and happy future as soon as possible.

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Finding Loops Invariants by a Backward Method Using Inductive Assertions and Proving them Correct Using Mathematical Induction

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Abstract

The method of proving programs correct has been an endeavor of computer scientists for decades now. However, little progress, in comparison, with some other aspects of computing, has been made on this respect. The current method using Hoare' Triple and the Dikjstra' pre- and post-conditions are not easy to follow by most students. The method of Inductive assertions has been tried too to find loop invariants using the so-called 'forward method." The author has found that this 'forward method" is still difficult and, for some program, even more difficult to follow than the Hoare's Triple and Dijkstra' pre and post conditions. In this paper the author proposes a "backward method" using Inductive assertion which starts at the end of the program and works its way up to the beginning of the program. This method has been proven successful the author's classes where the student has found the method easier to use and understand.

Keywords: inductive assertions, Hoare triple, Dijkstra conditions

1. Introduction

Because an incorrect program can lead to disastrous results, a large amount of methodology has been constructed trying to verify the correctness of the programs. Ideally, we would like to write program the ways engineers can put a building, it is not necessary to put it up first to verify that it would stay that way. During the last decades there here have been many attempts to write programs to emulate the way the engineers design a building. However, whereas engineers have been putting up building for centuries, computer programmers have been writing programs for a few decades now, so the science is not mature enough to be able to emulate the work centuries of the engineering experience. All these programming attempts generally fall under the umbrella of program verification or proof of correctness. Many approaches have been used such as Hoare's Triples and Dijkstra Pre and Post conditions [1, 2] Additional efforts have been devoted to automating program verification so that it can be carried out using a computer. However, only limited progress has been made toward this goal. Indeed, some mathematicians and theoretical computer scientists argue that it will never be realistic to [automate] the proof of correctness of complex programs." [3]

2. Defining the Correctness of a program

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A program is said to be **correct** if it produces the correct output for every possible input. The usual way of proving a program correct is subjecting it to intensive testing. Notice that definition of correctness by testing the program using input values seem futile even for a simple program like adding two integer numbers. How many pair of integers can be used to be sure that the program works correctly? If we represent each integer in its 2's complement notation and use 32 bits internally for their representation, then we will need almost 2^{64} possible combinations to test that the addition produces the right results. Even with a very fast computer this would take an excessive amount of time. So, obviously, a better way is needed to even prove that a program as the one just mentioned is correct. It is the purpose of this document to use Inductive Assertions [1] along with the method of Mathematical Induction to prove small loops correct. Although the programs used as examples seem elementary, it is the method used what the author is trying to explain.

3. How to prove a loop correct?

To prove a program that uses a loop to perform a task is necessary to show that:

- First, that the program produces the correct answers (partial correctness).
- Second, prove that the program terminates. (Loop termination)

The author will use the method of Mathematical Induction to prove partial correctness once the invariant has been determined [5,6]. Next, he will use the Archimedean Principle applied to integer numbers for loop termination. All problems presented here only use variables and constant of type integer, hence the adaptation of the Archimedean Principle only to integer numbers instead of reals [3]. Although the programs used as examples could be made more complex by the addition of conditional of different types within the loop, we have avoided them because the author is interested in showing how an invariant can be found and proved. In a later paper, the author intends to show that the methods explained here also wells with conditional statements of different types within a loop.

4. What is needed to prove a loop?

The key to proving a loop is discovering the "loop invariant", although most authors use Tony Hoare's definition of a loop invariant [1], we will define a "**loop invariant**" as an "*expression that it is true when the execution of the program reaches the loop for the very first time and true when the loop reaches its last statement and goes back to test the termination condition of the loop.*" Somewhere, between the first statement and the last one, the loop invariant may be false but what is important is that is true at the beginning and at the end of the loop. Notice that proving that the loop terminates is a different task that needs to be performed following the proof of partial correctness. The notation of Tony Hoare's assumes all what I said about the partial correctness of a loop, but it is presented more

formally using the notion of triples (his notation) and an inference-rule like notation which student seem not to understand very well.

5. How do I go about finding and the proving the loop invariant?

There are several questions and actions that we need to ask and perform to find the loop invariant of a loop. These questions and actions are:

1) What does the program do? That is, what is to be produced when the program ends. Express this result in terms of the outputs of the program.
2) What variable holds the output of the program?
3) What variable controls execution of the loop?
4) What is the final value of this variable?
5) Find an expression that ties up the variable that holds the final result and the one that control the loop. This expression should be such that when you substitute the final variable of the variable that controls the loop produces the expression that you determined in step 1
6) See what variables change within the loop and add the necessary subscripts to prove using mathematical induction the expression of step 1.
7) Once the partial correctness of the loop is found, show that the loop ends using the Archimedean Property adapted for integer numbers.

6. What is the Archimedean's Property?

According to Reference [4], the Archimedean property is a theorem for the real number system which modified for the integer numbers may be stated as follows:

"If $x > 0$ and if y is an arbitrary integer number, there exists another positive integer n such that $n*x > y$"

What this property means in geometric terms is that any line segment (y), no matter now long, may be covered by a finite number of line segments of a given positive length. In other words, a small ruler (x) used often enough (n) can measure arbitrarily large distances (y). Archimedes realized that this was a fundamental property of the straight line and stated it explicitly as one of the axioms of geometry.

For us, when proving a loop, the application of the Archimedean property can be applied as follows: Let's say that a loop is controlled by a Boolean condition involving a variable M such as ($M < 100$). In this case, the current value of M is what controls the execution of the loop; by extension we will say that the variable M controls the loop. Let's also assume that M is increased by a fixed positive amount every time the loop is executed. If this is the case, then, M eventually, assuming no other errors will stop the execution of the program, will

reach the value of M or surpass it. This last statement depends on whether M is increased by 1 or some other positive quantity. In this document, we will assume that the Archimedean property has been proved true elsewhere as shown in Reference 3.

7. Two Examples

For this first example we will take a program snippet from Reference No. 1 to find the loop invariant, its proof, and the loop termination. The programs are presented in pseudo-code using # to indicate inline comments. The statements in the snippet are basically self-explanatory.

Example No. 1

Find the loop invariant to prove that the program snippet shown below computes the nth power of real number x for a given positive integer n.

input n # a positive integer

input x # a real number

power := 1

i := 1

while i $\leq$ n $\leftarrow$ I

  power := power * x

  i := i + 1

endwhile

Following the steps indicated in Section 5 of this document we will have that:

1) the first question to ask is what does the program do? In this case the answer is trivial because the program snippet calculates x^n.
2) The output of the snippet is hold by the variable *power*. That is, at the end of the program power $= x^n$.
3) What variable controls the execution of the loop? Here, the variable i is used to determine the number of iterations of the loop.

4) What is the final value of i, the variable that controls the loop? Whatever the value of n is, the loop will terminate when $i > n$. Because i is incremented by 1 every time the loop is executed its final is $i = n + 1$.

5) We now need to find an expression that involves the variable that holds the final result, *power*, and the final value of i, the variable that controls the loop, i, in such a way that, when we replace i by its final value, we obtain the output of the program. We claim that the invariant is: power $= x^{i-1}$.

Notice that if we replace in the previous expression i by its final value $n+1$, we obtain the output of the program. That is,

$$power = x^n$$

6) The variables that change within the loop and which are of our interest are *power* and i. Therefore, let's add the corresponding subscripts and claim that the invariant is:

$$power_n = x^{i_n}$$

We will prove this invariant using Mathematical induction on n. The invariant must be true the first time the execution of the program reaches the top of the loop. This is indicated in the snippet with (I). Therefore, for $n = 0$ (the basis of induction) we will have the following:

$power_0 = 1^0 = 1$ (Notice that by the assignment statement *power* $= 1$ and any real raised to 0 is equal to the unity)

Therefore, the invariant is true the first-time execution reaches the top of the loop.

Now as the Hypothesis of induction, we will assume that $n = k$. We will interpret this as having gone through the loop k times already. That is, we are assuming that $power_k = x^{i_k}$ is true. (II)

To prove that the invariant is true for $n = k + 1$, we will have to assume that we go around the loop "one more time."

When we do this, we find the following conditions based upon how assignment statements work in programming, that is, the new value of *power* is its "old value" multiplied by x.

$$power_{k+1} = power_k * x. \text{(III)}$$

Replacing (II) in (III) and using the exponential laws we have that

$$power_{k+1} = x^{i_k} * x = x^{i_k+1} \quad \text{(IV)}$$

However, within the loop we also have that $i_{k+1} = i_k + 1$. (V). Again, the new value of i is its old value increased by 1.

Knowing this and replacing (V) into (IV) we obtain that

$$power_{k+1,} = x^{i_{k+1}}$$

Which proves that the invariant is true.

Now we need to prove that the loop terminates. To do this we need to apply the Archimedean Property noticing that every time we go through the loop, the variable i is incremented by 1. Therefore, eventually, according to the Archimedean Property I will reach a value that surpass the value of n. Notice that it is not necessary to know what the initial value of n is, except that is a positive value.

Example No. 2
(from Reference No.3)

Prove that the following program snippet computes the value of M! for (M > 1).

input M # read positive value M

i := 2

j := 1

while i ≤ M

  j := j * i

  i := i + 1

endwhile

print j

The program snippet asks for the calculation of M! and from the snippet itself we can see the j = M! at the end of the program. Therefore, the first two questions are already answered.

The variable that controls the loop execution is i and its final value is i = M + 1 because the loop executes as long as i ≤ M.

Knowing which variable holds the result, j, and the variable that controls the loop, i, we need to look for an expression such that when we replace i by its final value produces the factorial that the program calculates.

Following similar reasoning as on Example No. 1 we can claim that the invariant is $j_n = (i_n - 1)!$ which we need to prove using Mathematical Induction. Notice that if we replace i by its final expression, we get $J_n = M!$

According to the conditions of the program, the first-time execution reaches the top of the loop we have that j = 2 and i = 2. Therefore, the basis of induction for n = 0 is as follows:

$$j_0 = ((i_0 - 1)! = (2\text{-}1)! = 1$$

So, the basis of induction is true.

The Hypothesis of Induction $j_k = (i_k - 1)!$ assumes that we have executed the loop k times. Let's call this expression (I)

To prove that the invariant is true for n = k + 1 we need to go around the loop one more time. Inside the loop we have that the new values of j and i based on the definition of an assignment statement is

$$j_{k+1} = j_k * i_k \quad \text{(II)}$$

And $i_{k+1} = i_k + 1$ (III)

Replacing (I) in (II) we have that $j_{k+1} = (i_k \text{-}1)! * i_k$

According to the definition of factorial we have $j_{k+1} = i_k!$ (IV)

However, from expression (III) we have that $i_k - 1 = i_{k+1}$ (V). Now replacing (V) into (IV) we have that

$$j_{k+1} = (i_{k+1} \text{-}1)!$$

This final step shows that the invariant is correct.

To prove loop termination, we use again the Archimedean Property. Observe that every time that the loop is executed, the variable i is incremented by 1. Therefore, eventually, i will reach the reach and surpass the value of M.

8. Conclusion

These two small examples illustrate that the inductive assertion is easier to initially figure out a possible loop invariant if we work "backwards" starting from the end of the program and reaching the first statement of the program snippet. The fact that Mathematical Induction can be used to prove an invariant is a much powerful tool than any testing that can be done no matter how many numbers we try on.

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DIGITALIZATION OF THE TAX SYSTEM - AN IMPORTANT STEP TOWARDS TAX EFFICIENCY

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Abstract

Against the background of a rapid technological evolution, the challenges currently facing the real economy and implicitly the fiscal system through its component the fiscal apparatus, are varied and in order to face them it is necessary to implement innovative solutions such as digitalization. The digital transformation of the fiscal apparatus both centrally and territorially, in a world where business activities mean anytime and anywhere requires innovation, robustness, security, optimized processes and immediate availability to meet the expectations of taxpayers, whether natural or legal persons or of the state itself. Thus, the component public institutions of the fiscal apparatus must be prepared to accept that digitalization is everywhere and represents a continuous challenge.

Keywords: fiscal system, digital transformation, optimized processes, digitalization

1. General aspects regarding the structure of the fiscal system and the fiscal apparatus

The fiscal system represents a set of concepts such as: system of taxes and duties, fiscal mechanism, fiscal apparatus to which are added the relations between them, as well as the objectives of this system and their realization in order to ensure public financial resources. In other words, the following components take place in the structure of the fiscal system:

- ✓ the totality of taxes, fees and contributions collected by the fiscal bodies based on the legal regulations;
- ✓ the fiscal mechanism that refers to the trim of the tax system and that includes the methods, techniques and fiscal instruments that ensure ascertainment, sizing, registration and tracking of receipts, taxes, fees and other contributions due to the State Budget;
- ✓ the fiscal apparatus which presupposes the fiscal administration and the fiscal control / fiscal inspection.

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Thus, the fiscal system schematically includes in its structure:
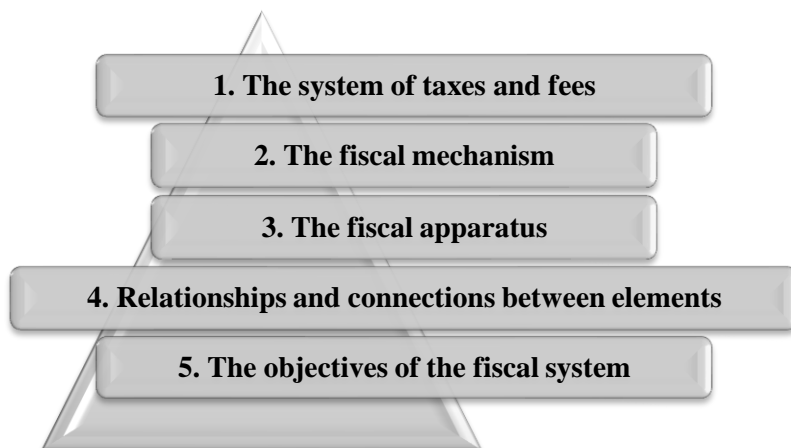
The financial policy of the state involves the establishment, pursuit and collection of taxes and duties, control of the correct application and observance of the fiscal legislation. Carrying out these tasks involves a vast activity of organization, guidance, and control, carried out both centrally and territorially, this being done through the fiscal apparatus.

The fiscal apparatus includes the set of financial and control bodies of the state that are charged by law to ensure the implementation of taxation, monitoring and collection of taxes and fees, as well as the control of compliance with the specialized legislation in force.

The fiscal apparatus through its central and local bodies carries out the following types of activities: monitoring and controlling the observance of the legislation and the fulfillment of the fiscal obligations; as well as the actual collection of taxes and fees, their collection and recording in the budgetary accounts. The activity with the most concrete role is the collection of taxes, fees and other fiscal revenues, and the control activity drives the way in which these fiscal revenues are collected from the state budget.

Also, the fiscal activities carried out by the fiscal bodies of the state are closely related and, therefore, they must be seen as a unitary whole, thus resulting that the bodies that perform them are part of a common apparatus, the fiscal apparatus. In this sense, the collection of taxes and duties (the final purpose of the fiscal activity) is conditioned by the characteristics of the legislation, by the quality of the guidance and by the exigency of the control.

The fiscal apparatus is represented by the Ministry of Public Finance, which includes the central and territorial bodies in the fiscal field and ensures the unitary coordination of these fiscal activities. Also, under the subordination of the Ministry of Public Finance there are a number of bodies, of which the National Agency for Fiscal Administration (ANAF) plays the most important role in collecting the state's public financial resources.

2. The role of ANAF in the structure of the fiscal apparatus

The National Agency for Fiscal Administration (ANAF), a specialized body of the public administration, with attributions in the application of the fiscal administration policy, carries out its activity in the field of budgetary resources administration, through the procedures of management, collection analysis and fiscal control.

The mission of ANAF is to ensure the resources for the public expenditures of the society by efficient collection of taxes, fees, contributions and other amounts due to the state budget, as well as to provide the information necessary to outline the economic policy of the Government.

ANAF, in the current context, fulfills its mission acting in three main directions:[68]

1. Preventing and combating tax evasion and fraud by promoting standardized and quality tax control, which involves:

✓ intensifying the cyber monitoring of the domains with high fiscal risk (strengthening the surveillance of the movement of excisable products, of fiscal warehouses and of other operators with excisable products, monitoring of intra-community transactions);
✓ extension of computerization and improvement of information systems used in the tax inspection activity (improvement and updating of databases; implementation of IT security policy; connection to interoperable trans-European IT systems);
✓ implementation of e-commerce control;
✓ strengthening the customs control through a series of dedicated measures according to the European norms as well as the digitalization of the General Directorate of Customs (DGV) and of its territorial structures;
✓ the creation of a unique system for monitoring the notifications regarding the facts of the nature of the crimes transmitted to the investigation and criminal investigation bodies;
✓ cooperation with the competent structures in combating tax fraud and evasion; improving the control act;
✓ prevention of tax evasion in the collection phase; dynamization of enforcement measures, with emphasis on the application of seizures.
✓ detecting unregistered taxpayers who carry out commercial activities.

2. Increasing the efficiency and dynamics of collecting taxes, fees and contributions by:

✓ reducing the volume of arrears, especially preventing the formation of new arrears;
✓ accelerating the process of digitalization of the fiscal file;
✓ stimulating the online submission of electronic declarations and payments;
✓ setting up electronic seizure on third parties;
✓ conducting auctions of seized real estate of debtors online;

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[68] Ministry of Public Finance, National Budget Fiscal Strategy, mfinante.ro

✓ standardization and computerization of the forced execution activity.

3. Encouraging voluntary compliance to prevent tax fraud, by diversifying and increasing the quality of services and ensuring simplified procedures:

✓ stimulating the online submission of declarations and the making of electronic payments;
✓ communication of administrative documents to taxpayers using the online environment.

3. Aspects regarding the digitization of the fiscal apparatus

Digitalization is the process by which we replace the classic working methods with direct interpersonal action with the use of innovative technologies, in order to carry out our daily activities more safely and efficiently. This means that in the current activity we use several means / compatible technical solutions to bring added value to the work performed. Plus value refers to greater efficiency in time and accuracy, consolidated data, effectively coordinated reporting at both individual and business level.

Digitalization is also the first step towards transforming data into technical solutions, as we use them today, underlying modern technology. Digitalization is represented by the phenomenon of transposing information on a physical, fixed or mobile memory medium, or on a virtual medium (cloud). Nowadays, communication and the ways of transmitting information have developed a lot, using different digital devices that have an interface built according to the user-friendly concept. Digitalization means fast operation. That is, access to information with a high degree of accuracy, in real time, in a way that is as transparent and secure as possible in terms of confidentiality and all data that takes place between the applicant and the holder of the information, in order to produce a effect, which, from a fiscal point of view, can mean the definition of a new financial-fiscal relationship between the state and the taxpayer.

Technological transformations, the pressure generated by the need to align with the new financial-accounting reports as well as the obligation to apply IFRS standards have accelerated the digitalization process of institutions in the financial area (private companies, tax system). At the same time, the role of the fiscal function became more and more important, investments in technology for fiscal use became an attribute of risk reduction and optimization of information provided by financial-accounting institutions, customers in the situation of fiscal controls, on the background of communication efficiency, between authorities and taxpayers.[69]

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[69] Caşu A., Constantin G., Digitalization - a new step on the scale towards fiscal efficiency and not only, May 19, 2021, https://www.ey.com/ro_ro/news/2021/5/digitalizarea---o-nou-treapt-pe-scara-ctre-eficientizarea-fiscal.

When we talk about the digitalization of the fiscal system, in terms of efficiency, in fact we should talk about the digitalization of the fiscal apparatus, as a component of the fiscal system. In other words, if we now want to achieve a high degree of fiscal efficiency, this goal can only be achieved through a reform of the fiscal system. Thus, one of the methods of reforming the fiscal system can be the digitalization of the state fiscal apparatus.

At present, the process of accelerating digitalization has become necessary throughout society amid the restrictions imposed by the COVID-19 pandemic to limit the spread of the virus, including in public administration.

Thus, the authorities need to pay more attention to the relationship with taxpayers by simplifying the relationship with the tax authorities so as to encourage voluntary compliance with taxes.
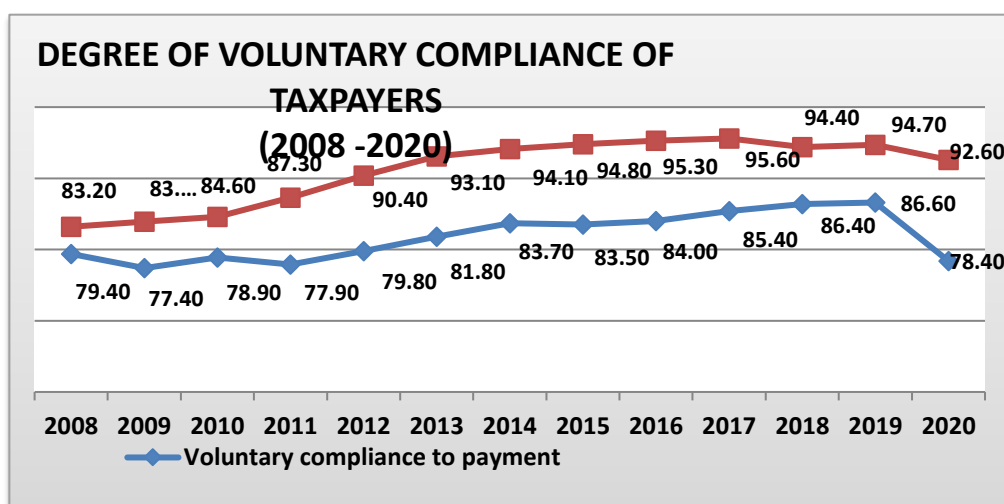
Source: Made on the basis of data from the ANAF Performance Reports 2008-2020

However, as we can see in the chart above in the analyzed period, the level of both voluntary compliance to payment and to submitting tax declaration grows. But is interest to notice that the level of voluntary compliance to submitting tax declaration is higher than the voluntary compliance to payment and the difference is about 10%.

According to the National Recovery and Resilience Plan (PNRR), the tax authorities must ensure the increase of the level of collection of tax obligations through a "digitalization plan of the fiscal apparatus and a permanent mechanism for assessing taxpayers' satisfaction with ANAF services".[70]

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[70] Boeriu V., Digitization of ANAF, essential for the protection of taxpayers and for reducing the pressure on the state budget, Deloitte Romania, April 21, 2021,

The current context no longer allows for delays in implementing effective measures to increase budget revenue collection, given that the business environment needs incentives to overcome the financial difficulties caused by the COVID-19 pandemic.
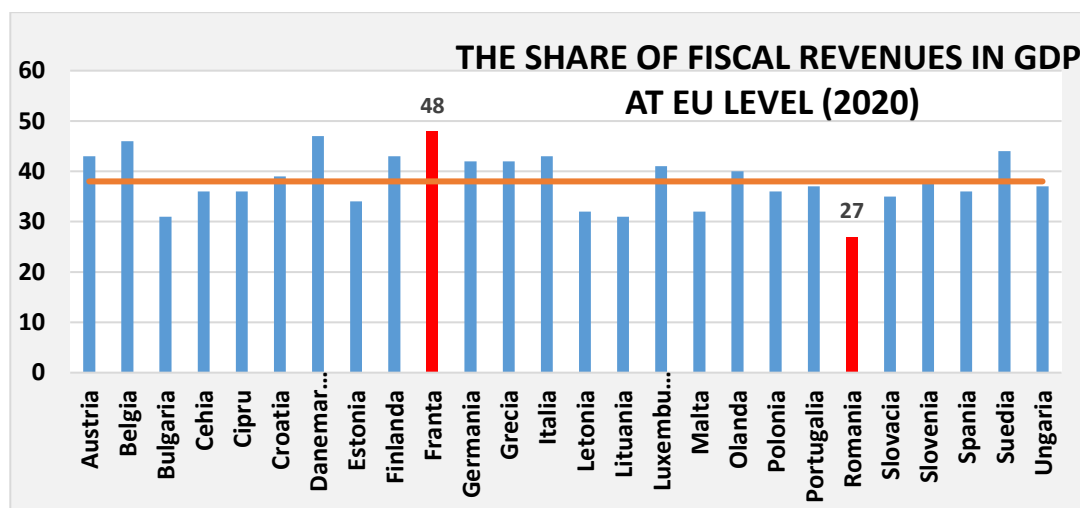
Source: Made on the basis of data provided by Eurostat

Thus, increasing the collection of tax liabilities is absolutely necessary given that Romania is on the penultimate place in the EU depending on the share of tax revenues in GDP (27% of GDP compared to the European average of 40% of GDP).
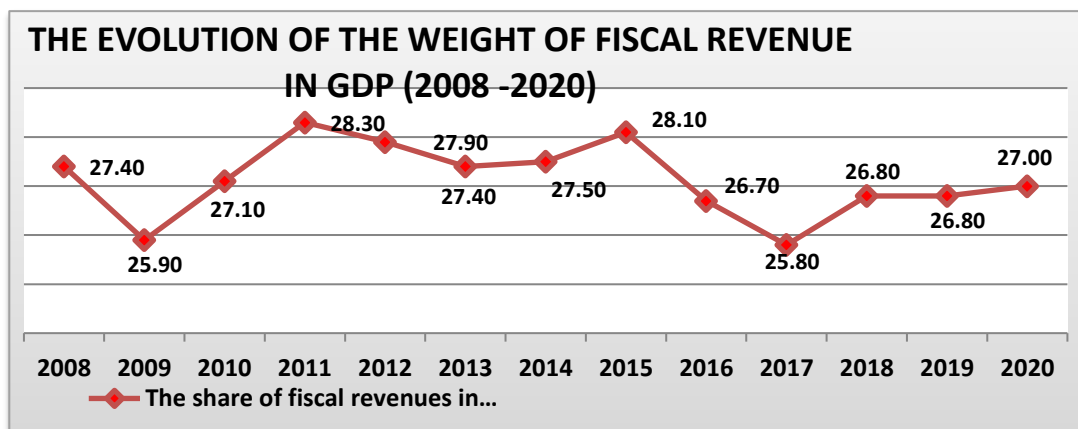
Source: Made on the basis of data from the ANAF Performance Reports 2008-2020

https://www2.deloitte.com/ro/ro/pages/tax/articles/digitalizarea-anaf-esentiala-pentru-protejarea-contribuabililor-si-pentru-reducerea-presiunii-pe-bugetul-de-stat.html

The chart above shows that in analyzed period the evolution of fiscal rate, calculated by report between total fiscal revenues and GDP it's relatively constant, with an average of 27,13%, a minimum of 25,80% in 2017 and a maxim of 28,30% in 2011.

It has also been shown that an increase in the degree of fiscal pressure does not generate the expected effects in terms of increasing the collection of revenue from the budget and reducing tax evasion, as long as they are not accompanied by computerization and digitalization of the tax administration.[71]

4. Digitalization of ANAF, essential for the fiscal system and taxpayers

As for the process of digitalization of the domestic tax system, it has dragged on, but has resumed at a faster pace since 2020. According to the "Digital Strategy 2021-2025", digitalization is more than ever necessary to serve taxpayers more efficiently and to ensure the coordination of the fiscal apparatus's efforts with the way taxpayers use digital technology, to increase the performance of tax administration services and to facilitate communication between ANAF and taxpayers.[72]

According to the official statements of ANAF, so far, the authorities have adopted several measures to digitize and debureaucratize the fiscal apparatus, measures that mainly aim at:[73]

✓ implementation of the SAF-T system (Standard Audit File for Taxation) created by the Organization for Economic Cooperation and Development (OECD) and which ensures the electronic transfer of financial-accounting data from taxpayers to legal entities, for more than 15 years at European level and which should have started operating in Romania at the end of 2020. This standard control file contributes to improving the quality of the administrative act, supports voluntary tax compliance of taxpayers, ensures the reduction of tax fraud and evasion and allows a risk analysis more efficient;
✓ digital transformation of the fiscal apparatus by connecting the fiscal electronic cash registers used by the economic operators to the ANAF servers. Thus, the financial-fiscal information will be received in real time, and the data will be used in the process of analysis, forecasting and administration of financial-fiscal information;
✓ development of an electronic seizure system in order to streamline the process of recovering outstanding tax obligations;

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[71] Bâldea R., Zipiş M., Digitization of the Romanian tax administration, on the right track. What measures are we waiting for in 2021?, January 12, 2021, https://www2.deloitte.com/ro/ro/pages/tax/articles/digitalizarea-administratiei-fiscale-din-romania-pe-calea-cea-buna-ce-masuri-asteptam-in-2021.html
[72] National Agency for Fiscal Administration, Digital Strategy 2021-2025, www.anaf.ro
[73] Oncu M., Digitization of the fiscal system - connecting cash registers, SAF-T, simpler payments, new sites at ANAF and finance, July 1, 2020, https://www.profit.ro/taxe-si-consultanta/digitalizarea-sistemului-fiscal-conectarea-caselor-de-marcat-saf-t-plati-mai-simple-sitre-uri-noi-la-anaf-si-finante-19408337.

✓ simplifying the payment of fiscal obligations by facilitating the making of payments with the bank card on the ghiseul.ro portal and by interconnecting the Virtual Private Space (SPV) with the ghiseul.ro portal;

✓ modernization of the mfinante.gov.ro and anaf.ro platforms by creating interfaces according to the use friendly concept;

✓ online programming for taxpayer assistance at the headquarters of the tax administration units as well as the digital transformation of the tax administration by eliminating travel and queues at physical counters which will lead to a simpler interaction of taxpayers with the authorities. The results of digitization will translate ânto a high degree of transparency, an efficient collection of tax obligations, a low rate of tax evasion, as well as the efficiency and debureaucratization of the tax system.

Given the experience of other European countries, the introduction of the SAF-T system could increase voluntary compliance with payment, being beneficial both for taxpayers (simpler control procedures, automation of data preparation for declaration and control, reduction of unfair competition), and for tax administration (permanent access to all transactions carried out by taxpayers, reduction of tax evasion due to the rapid identification of transactions with a high risk of fraud). Therefore, analyzing the impact generated by the implementation of SAF-T in the economies of other states, its introduction can be considered a first step in digitizing the Romanian tax system, which will increase state budget revenues.[74]

The SAF-T system has undoubtedly contributed to a better collection of tax obligations in the countries where it was implemented, but this was not the only tool used to improve the situation of public finances. Thus, some EU Member States currently use: electronic reporting of documents, carry out online tax audits and have implemented electronic cash registers. The transition of these administrative-fiscal procedures in the online environment leads to the increase of the mutual trust between the fiscal administration and taxpayers, ensuring a high level of transparency between the parties, as well as the simplification of the bureaucratic process of preparing the necessary documents for a fiscal control.[75]

The digitization process of ANAF, provided in PNRR, starts from the awareness that, in order to reduce the budget deficit, there is a need to streamline revenue collection and improve the relationship with taxpayers. Thus, the reform plan must ensure increased voluntary compliance through the development of digital services (priority digital interaction, through VPS and the use of pre-completed forms; creation of the mechanism for assessing taxpayer satisfaction in relation to NAFA) and improving the processes of managing fiscal obligations, including by implementing integrated risk management by

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[74] Bâldea R., Zipiș M., Digitization of the Romanian tax administration, on the right track. What measures are we waiting for in 2021?, January 12, 2021, https://www2.deloitte.com/ro/ro/pages/tax/articles/digitalizarea-administratiei-fiscale-din-romania-pe-calea-cea-buna-ce-masuri-asteptam-in-2021.html

[75] Ibidem.

interconnecting the IT systems of NAFA with those of the European Commission and the Member States (SAF-T).[76]

Regarding the impact, the digitization process on taxpayers we can say that new technologies allow taxpayers legal entities to identify a number of ways to streamline certain operations with fiscal impact. In other words, the digitalization process offers legal taxpayers the opportunity to improve certain financial and fiscal indicators.

Digitalization is a critical element for corporate taxpayers because strict and rigorous financial-accounting and fiscal reporting pushes them towards the development and use of new innovative technologies.

Accounting standards (IFRS) also require such alignment. They require companies to coordinate their financial, risk and business data by implementing digitized processes.

From a fiscal point of view, a new reporting is to be implemented - the standard SAF-T audit file, which ensures the real-time access of the tax authorities to the transactions carried out by the taxpayer.

It should also be noted that, in the current context, the tax function is outlining an increasingly important profile in the business structure of companies, and the role of specialized staff in the tax area is becoming increasingly important and complex. The factors that led to this "status quo" are: the need to standardize processes in order to streamline them, and the automation of these processes. Thus, the decision-making role regarding the fiscal function, as well as the one regarding the assessment and mitigation of fiscal risks have become more and more important lately.[77]

5. Conclusions

The transition to a predominantly digital institution will allow ANAF to adapt much more efficiently and quickly to socio-economic and legislative changes, and the modernization and computerization of its activities will contribute to improving the processing of financial and fiscal information, to allow fair and transparent approaches. concerns the collection of fiscal revenues to the state budget.

We can certainly say that digitalization, including taxation, will be on the rise in the coming period, and the success of a business will be largely based on the use of advanced

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[76] Boeriu V., Digitization of ANAF, essential for the protection of taxpayers and for reducing the pressure on the state budget, Deloitte Romania, April 21, 2021, https://www2.deloitte.com/ro/ro/pages/tax/articles/digitalizarea-anaf-esentiala-pentru-protejarea-contribuabililor-si-pentru-reducerea-presiunii-pe-bugetul-de-stat.html

[77] Caşu A., Constantin G., Digitalization - a new step on the scale towards fiscal efficiency and not only, May 19, 2021, https://www.ey.com/ro_ro/news/2021/5/digitalizarea---o-nou-treapt-pe-scara-ctre-eficientizarea-fiscal.

technology and the creation of a digital ecosystem that reduces the costs of operation and to offer customers the most optimized and customized products and services. On the other hand, an in-depth analysis of the evolution of tax regulations will help both to standardize and streamline tax reporting, but also to strengthen the relationship of taxpayers with tax authorities.

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THE ROLE OF DISRUPTIVE TECHNOLOGIES IN HIGHER EDUCATION DIGITIZATION

Ioan-Matei Purcărea [78]

Abstract

The COVID-19 pandemic has proved that digitization is an imperative in higher education and the ability to adapt to the next normal will represent a powerful competitive advantage in the industry. This paper analyses the possibilities in establishing new practices in transforming higher education by implementing and using disruptive technologies, taking advantage from the collaborative nature between digitization and disruptive innovation. The pandemic is urging digital transformation of higher education institutions, forcing professionals in identifying opportunities, changing value propositions or developing new operating models for the challenges higher education faces. Growing interest in the academic communities for disruptive technologies adoption highlights the need for higher education institutions to become more agile and plan for the post-pandemic future. With a relevant digital strategy, the University is able to drive efficiency, create superior digital offer, enable curriculum improvements and meet students' digital expectations.

Keywords: Disruptive technologies, Digitization, Higher Education, COVID-19, Next normal

1. Introduction

On the path to the next normal, digital collaborations have been mandated by Covid-19, emphasizing digital collaborative technologies, redefining student engagement by using the collaborative learning concept which has gained even more power through breakout rooms that are providing a fruitful environment full of opportunities for students, allowing even more meaningful digital activities. The role of breakout rooms is to stimulate knowledge and engagement, providing "sense-making" avenues with case studies to summarize, situation analysis, problem-solving assignments, to support deeper learning, taking advantage of the available digital tools. The combination between digital and interpersonal collaborations will most likely continue to advance learning in the next normal.

According to the European Commission's "Digital Education Action Plan (2021-2027)" public consultations' results:

• 95% of the respondents consider that the use of technology in education and training will continue even after the COVID-19 pandemic;

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• around 60% had not used online learning before the COVID-19 pandemic;

• respondents agree that online learning content and resources should be more relevant, easy to use and interactive;

• more than 60% of the respondents consider that they had improved their digital capabilities during the Covid-19 pandemic and more than 50% wish to do more.

2. Higher Education in the Next Normal

In this context, IoT is at the core of digitization, powering organizational transformation, creating research-and-innovation hubs. Emerging technologies like 5G and machine learning are enabling huge achievements to efficiency and control, both in the workplace and University.

Gartner's "2020 Magic Quadrant for 5G Network Infrastructure for Communication Service Providers" highlights top 10 market leaders, from Samsung and Cisco to Huawei and Ericson. The Quadrant ranks companies based on "execution and completeness abilities" regarding vision, placing them in four major categories: "Niche Players" (low vision, low execution), "Visionaries" (good vision, low execution), "Challengers" (good execution, low vision) and "Leaders" (outstanding in vision and execution).[79]

At *CES 2021*, 5G benefits for education were highlighted. The multinational telecommunications conglomerate Verizon underlined the impact 5G will have on immersive experiences, including education and the fact that by the end of this year, at least 100 schools will be provided with 5G capabilities, along with Virtual Reality (VR) and Augmented Reality (AR) for low-income schools.[80]

Also, at *CES 2021*, AR and VR advantages were spotlighted by *Healium*, the company that helps manage "U.S. Air Force mental health" using these disruptive technologies to combat mental health concerns and stress. Recently, the U.S. Air Force made the announcement that *Healium* was awarded "SBIR Phase 1 contract" to explore AR and VR, deploying its products to U.S. service members.[81]

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[79] Haranas M., "Gartner's Top 10 Global 5G Network Infrastructure Companies" (March 26, 2021). Retrieved from: <https://www.crn.com/slide-shows/networking/gartner-s-top-10-global-5g-network-infrastructure-companies/2>
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[81] CES, Healium Helps Manage Air Force Mental Health (April 28, 2021). Retrieved from: <https://www.ces.tech/Articles/2021/April/Healium-Helps-Manage-Air-Force-Mental-Health.aspx>

In education, according to "*eLearning Industry*", AR enables professors to highlight virtual examples of various concepts and add digital elements to provide even more support to class materials, this way, enabling students to efficiently engage, learn easier and faster.[82]

Benefits of AR in education include:

- *easy access anywhere and anytime*, AR has the advantage of offering support for traditional physical forms, printed textbooks/brochures;
- *engage students and raise interest*, improving capabilities and increasing collaboration between students, providing opportunities in making learning effortless and interesting;
- *immersive learning*, helping students connecting in real-time with experiences and control the outcomes;
- *effective learning*, helping students improve their knowledge base with the help of immersion and visuals regarding the subject.

Through Immersive Learning, students have the possibility to deeply immerse, eliminate all distractions by entering the virtual world, increase their motivation and emotionally connect in a highly engaging realistic environment, and benefit from the personalized learning approach.

Another relevant and efficient way to improve remote learning is by enhancing it with VR that has the advantages of increasing student engagement and retention, while VR headset prices are quite low and increased quality of the content through the devices is being provided. Often VR headsets used in remote learning include: Samsung Gear VR, Oculus Go and HTC Vive.[83]

The main benefits of experiential learning with VR devices include the following:

- *Student learning acceleration*, learning can significantly improve by visualizing the learning material;
- *Safe learning digital environment*, if students mistake during the digital journey, the effects are minimum as they happen in a controlled virtual world;
- *Removes the theory - practice gap*, students can experience what they learn in a 3D virtual environment, providing them with more relevant learning experiences;
- *Increases engagement,* students have the possibility to virtually collaborate and learn from one another*.*

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[82] Sinha S., "Augmented Reality In Education: A Staggering Insight Into The Future" (January 2, 2021). Retrieved from <https://elearningindustry.com/augmented-reality-in-education-staggering-insight-into-future>

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Despite the fact they are closely related, experiential learning shouldn't be confused with immersive learning[84], the main differences being highlighted in Table no. 1

Table no. 1 "Differences between immersive learning and experiential learning"

Immersive Learning	Experiential Learning
Crucially leverages technology, such as Virtual Reality, Augmented Reality, mobile devices, etc.	Technology is not typically required
100% thinking capacity of learners is required	Usually requires less than 100% thinking capacity of learners
Always implements gamification in learning	Not necessarily game-based
Dynamic mechanics	Static mechanics
Learning happens by enabling a realization	Learning happens by enabling a skill
A single activity can lead to multiple iterations	Multiple activities make up a single iteration

Source: Kumar J., "Everything You Need To Know About Immersive Learning" (January 24, 2020). Retrieved from <https://elearningindustry.com/everything-need-know-about-immersive-learning>

Nowadays, innovative content creation, as well as life experiences creation is easier thanks to more accessible emerging technologies. In this context, strategic digital curriculum alongside with intuitive applications and digital devices dependence will benefit learning and design education for everyone.
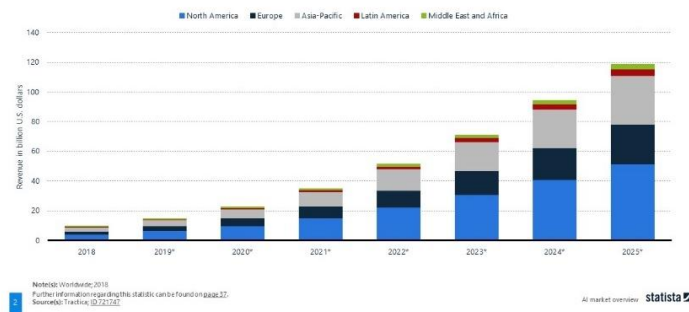
Fig. 1. "Revenues from the artificial intelligence software market worldwide from 2018 to 2025, by region (in billion U.S. dollars)"

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[84] Kumar J., "Everything You Need To Know About Immersive Learning" (January 24, 2020). Retrieved from <https://elearningindustry.com/everything-need-know-about-immersive-learning>

Source: "AI use in marketing", "Statista Dossier"
<https://www.statista.com/study/57404/artificial-intelligence-use-in-marketing/>

Figure no. 1 highlights "Revenues from the artificial intelligence software market worldwide from 2018 to 2025, by region (in billion U.S. dollars)" ***Tractica*** forecast, North America is the regional market leader with major increase in expected revenues, followed by Europe and Asia-Pacific, other major regional performers regarding AI software, expected as well to have a major market growth.[85]
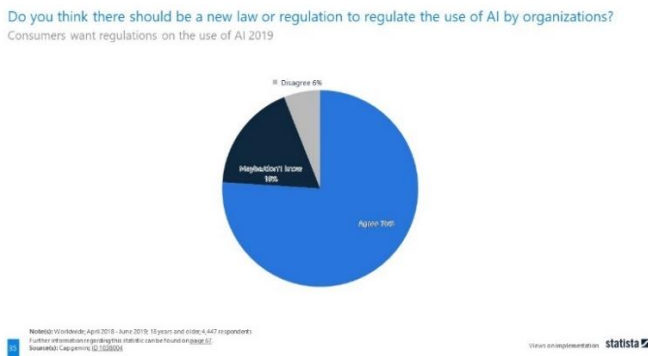
Fig. 2. "Do you think there should be a new law or regulation to regulate the use of AI by organizations?"
Source: "AI use in marketing", "Statista Dossier"
<https://www.statista.com/study/57404/artificial-intelligence-use-in-marketing/>

A ***Capgemini*** survey conducted worldwide between April 2018 to June 2019 (Fig. no. 2) on 4,447 respondents, 18 years or older, highlighted consumers' needs (76% of the respondents) regarding the existence of a "law or regulation to regulate the use of AI by organizations".[86]

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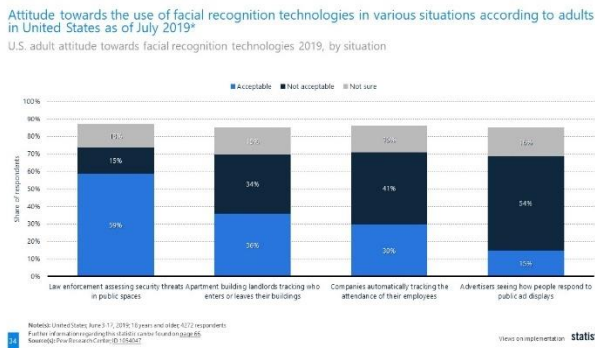
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[86] "Statista Dossier", "AI use in marketing". Retrieved from
<https://www.statista.com/study/57404/artificial-intelligence-use-in-marketing/>

Fig. 3. "Attitude towards the use of facial recognition technologies in various situations according to adults in United States as of July 2019"
Source: "AI use in marketing", "Statista Dossier"
<https://www.statista.com/study/57404/artificial-intelligence-use-in-marketing/>

A *Pew Research Center* survey conducted in June 2019 (Fig. no. 3) on 4,272 respondents from the United States, highlighted the fact that 59% of the respondents accept the "use of facial recognition technologies by law enforcement" when there are concerns regarding security threats in public, while the level of acceptance regarding "advertisers' use of this technology" is quite low, only 15% of the respondents.[87]

The post-COVID-19 pandemic world means better use of new analytics technologies to make better decisions for the future, improving agility and resilience, while considering the evolving digital behavior, as well as aligning the digital strategy with the evolving consumer expectations.[88]

Fig. 4. "COVID-19 NERVE CENTER"

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[87] "Statista Dossier", "AI use in marketing". Retrieved from
<https://www.statista.com/study/57404/artificial-intelligence-use-in-marketing/>
[88] PURCAREA, I.M., 2021. "The Disrupted Retail and the Innovative Technology: Connecting Data..," Romanian Distribution Committee Magazine, vol. 11(4), pages 32-42, January.

> Source: "Coronavirus and the campus: How can US higher education organize to respond?" <https://www.mckinsey.com/industries/public-and-social-sector/our-insights/coronavirus-and-the-campus-how-can-us-higher-education-organize-to-respond#>

Figure no. 4 shows **McKinsey & Company's** proposition for an "integrated nerve center" at the beginning of the Covid-19 pandemic, a flexible, simple and multidisciplinary construct designed to easily adapt and rapidly respond to changing conditions.[89]

The above figure shows a framework highlighting areas of responsibilities for the "Covid-19 nerve center", organized around the core of it, and consists of the "Covid-19 nerve center"; Students; Teaching and research; Faculty and staff; Campus operations; Finance and legal; External communications.

Four types of actions are being considered in the "Covid-19 nerve center", organized around teams with specific areas regarding responsibilities:

1. **Discover** from a relevant perspective on the situation and make use of the economical and epidemiological available information, also seeking data from leaders, faculty, students, alumni and other stakeholders;
2. **Decide** what actions are needed right away, while securing agreement with the university and community values;
3. **Design** a pragmatic portfolio with immediate strategic directions;
4. **Deliver** efficient solutions, while ensuring flexibility.

Massive changes have occurred as a result of the unprecedented disruption produced by the Covid-19 pandemic, experiencing radical transformation of higher education with accelerated change in record time. Relevant infrastructure and technological platforms with solid servers hosting them are required for the digital education process in order to efficiently assist the virtual workload. Results of a recent research paper reveals the use of a plethora of technological platforms and tools such as video-conferencing, streaming conferences, educational applications, instant messaging and Massive Open Online Courses (MOOCs), to provide support for new methodologies in enabling learning processes, new alternatives for traditional learning.[90]

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[89] Illanes P., Law J., Mendy A., Sanghvi S., Sarakatsannis J., "Coronavirus and the campus: How can US higher education organize to respond?" (March 30, 2020). Retrieved from <https://www.mckinsey.com/industries/public-and-social-sector/our-insights/coronavirus-and-the-campus-how-can-us-higher-education-organize-to-respond#>

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doi: 10.3389/fpsyg.2021.616059

3. Conclusions

1. With a relevant post-pandemic digital strategy, the University has the opportunity to redefine student engagement by using collaborative learning, to drive efficiency, create superior digital offer for students, build a digital campus, as well as a long-term digital learning environment, enable curriculum improvements and meet students' digital expectations, to advance learning in the next normal.
2. Following the unprecedented disruption as a result of the Covid-19 pandemic, the disruptive innovation has proven to be a powerful way in obtaining innovation-driven growth. While adapting to the next normal, evolving higher education digital behavior ensures better planning of the curriculum and better decisions for the future.
3. Growing interest in the academic communities for disruptive technologies adoption highlights the need for higher education institutions to become more agile and plan for the post-pandemic future, while providing relevant support for new methodologies in enabling new learning processes.
4. In the post-COVID-19 pandemic world, Higher Education has to deliver the latest organizational digital capabilities for effective digital planning and relevant digital learning content with advanced digital skills.

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Teaching and training the millennials: offline and an e-learning perspective

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Abstract

Millennials or Generation Y refers to the group of individuals who are born between the 1980s to the mid-2000s.This generation has seen several important technological events like the rise of personal computers, laptops, and tablets, the rapid increase of internet connectivity and wifi, the increasing use of mobile phones and later smartphones, telecom boom just to name a few. We note that each of these events has had an impact on the education sector and how learning and teaching take place. There has been a significant change in technology which the millennials have witnessed and the same changes have enabled a plethora of methods for both the students, the teachers & their trainers. This paper aims to study the learning styles of this generation and also the teaching/training styles which must be used to most effectively transfer knowledge and skills to the millennials. The paragraphs below discuss most of the preferred methods of learning by the millennials and how teachers/trainers can customize their pedagogy to engage this generation in the educational settings (both inside and outside the classroom)

Keywords: Education, Teaching Styles, Academics, Learning, Millennials, Technology based Learning

1. Introduction

"Give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime" – Maimonides

"You educate a man; you educate a man. You educate a woman; you educate a generation."
— Brigham Young

"Education is the most powerful weapon which you can use to change the world."
— Nelson Mandela

The above four quotes reveal the power of education in the modern world. Great Leaders all over history have realized and emphasized the power of education to cut across barriers like class, dogma, caste, prejudice. It has been called the great leveler in terms of opportunities for growth in the domains of power, wealth, prestige, and so on. Hence it is natural to see that people aspire to be educated and gain qualifications, skills, abilities & knowledge to capitalize on the opportunities opening in the job market. Earlier education

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was limited largely to the higher class, male, white men whereas now we see education to be much more accessible to all races, women, and all classes. This change has seen accelerated growth in the recent past especially with the millennials. Millennials or Generation Y refers to the group of individuals who are born between the 1980s to the mid-2000s. This generation has seen several important technological events like the rise of personal computers, laptops, and tablets, the rapid increase of internet connectivity and wifi, the increasing use of mobile phones and later smartphones, telecom boom just to name a few. We note that each of these events has had an impact on the education sector and how learning and teaching take place. There has been a significant change in technology which the millennials have witnessed, and the same changes have enabled a plethora of methods for both the students and the teachers.

2. Literature Review

Learning styles of Generation Y and effective methods of teaching for the same,

- A sizable chunk of generation Y has been found to place a fair degree of emphasis on continuous learning and personal growth. (Terjesen, Vinnicombe, & Freeman, 2007). These people possibly use resources like e-books, the internet, e-libraries, YouTube, podcasts, and so on to keep themselves updated in terms of knowledge and to stay motivated. These resources were not available to the previous generations during their college. Further, with online book retailers coming up like Flipkart and Amazon coming up, individuals of this generation can get access to most books from most areas. Further, these books are increasingly available at discounted prices which makes them relatively more accessible to even the middle classes.
- Experiential learning is one of the most preferred learning styles for generation Y (which involves a high degree of hands-on activities followed by a reasonable amount of time spent in reflection about the same). Further, a high degree of interactive assignments and a lot of activities taking place within the class itself are a part of the preferred pedagogy for teaching this generation. (Shih & Allen, 2007)
- Generation Y has also been used to learning using a high degree of technology which facilitates the same being entertained at the same time of being educated (Jonas-Dwyer, & Pospisil, 2004). There are several channels on YouTube which present education in a highly entertaining manner. The use of multimedia greatly facilitates the understanding of students. Channels like TED talks, Khan Academy, PBS Nova are all very popular in their respective domains. This makes the students used to a very high level of entertainment being combined with education which might not be easily reproduced in the traditional university settings)
- Generation Y also prefers to learn in a group setting where there is a high emphasis on teamwork and collaboration which can be executed in the form of group assignments to be presented in the class (Shih & Allen, 2007)
- Generation Y students exhibit characteristics like being conventionally motivated and showing respect towards elders and teachers. Generation Y students score high

on traits like conscientiousness (especially in the field of academics) and display high levels of responsibility. (Elam, Stratton, & Gibson, 2007).

- An emphasis on learning activities that are a part of daily life and the perspectives related to the same must be included in the academic curriculum to make the students more effective in dealing with their own lives (Partride and Hallam, 2006). Further, the same authors found that the curriculum for the generation Y students must be flexible in terms of its contents and must be customizable to meet the demands and requirements of each section of the students. (Partride and Hallam, 2006).

- Moreover, Wilson and Gerber (2008) posited that generation Y should be given plenty of opportunities to choose their combination of courses and students must be allowed to make their understanding, insights, and meaning from their courses rather than being force-fed by instructors. (Wilson & Gerber, 2008).

- The students of Generation Y want to learn consist of multiple dimensions with a mix of pedagogies that produce extremely diverse learning experiences (Kipnis & Childs,2004). This could mean that the teachers to Generation Y must be competent in many diverse pedagogies right from the traditional methodology of lecture-based teaching to teaching through case studies and real-world examples storytelling, experiential learning, demonstrations, and so on. Simply planning to complete an entire course through the traditional lecture method is no longer going to work (McGuire, & Gubbins,2010) despite the relative ease and convenience of conducting the lecture method. Kipnis and Childs (2004) have noted that the students of Generation Y dislike remaining passive recipients in the settings of the classroom in the school and university settings.

- The students of generation Y want their learning to pertain to the current societal and world situation to remain relevant and further, they want their knowledge, skills and abilities learned to be marketable in terms of jobs. (Kipnis & Childs, 2004). Thus few people in generation Y seem to pursue knowledge for its own sake and seem extremely professional in their outlook towards education and its outcomes.

- The students of generation Y are strongly competent with the handling of multimedia. (Brown,2000). They have a relatively higher degree of handling visual-spatial information and hence can prefer to understand the information in the forms of graphs, charts, and so on, rather than in terms of plain text. Hence, we posit that the teachers for generation Y must be able to present knowledge in visually rich two-dimensional and even three-dimensional forms. PBS Nova, a popular Science YouTube channel, for example, is very compelling in terms of representing even very complex Physics concepts visually to enhance student learning.

- The students of generation Y are extremely good at multitasking. They prefer to study at their own choice of time and at their own pace and hence video lectures and podcasts are extremely popular among them (Skiba & Barton, 2006). These students are commonly found to do multiple activities at the same time, like going through a written lecture/ppt while listening to music or listening to a lecture podcast while at the gym or doing some other (cognitively simple) work or even listening to a lecture or an e-book while driving. Hence the teachers to the generation Y could develop academic content (like video lectures or podcasts) which the students can learn from even while performing some other tasks.

- Generation Y students are used to getting any information required in real-time and immediately. They have very little patience for getting information after long periods of delay (Skiba & Barton, 2006). These students routinely check up on information from the internet if they do not understand a certain concept in a classroom setting or otherwise. Hence, we can expect most students of this generation to look up websites where the information is presented in the most accessible and interesting manner and hence there is competition among many players for the attention of the generation Y students. Hence there is immense pressure on the teachers of today to present their information in an accessible and interesting manner just to get the attention of the students.

- Generation Y students have an extremely high degree of confidence and also display similar levels of optimism. They usually have very high goals and are very confident that they would achieve the same. However, not many of them are clear about the path that they would have to take to achieve the same goals (Monaco and Martin, 2007). Hence teachers of the generation Y students must teach them planning skills which would enable them to devise pathways by which they can achieve their own goals (as difficult goals would be useless without the generation of plans and possible pathways which would get them to achieve the same). Further, it would be reasonable to teach them the importance of prudent (and possibly some degree of negative thinking) which would enable them to probably anticipate the possible roadblocks which they might encounter during one of their paths to achieve their goals, and to proactively plan for overcoming the same.

- Generation Y is an extremely pressurized generation. They feel the pressure not only from people whom they perceive as evaluating them but also by the pressure they put on themselves to achieve. (Monaco and Martin, 2007). Hence teachers need to impart skills like setting up of personally meaningful and intrinsically motivating goals (goals which are possibly closer to their values or doing things which they love) rather than setting up goals that are relatively more extrinsic (like goals that are purely materialistic or to prove a point to somebody else or goals which lead to burnout in the long run). A further skill that enables the individuals to effectively handle the pressure and stress needs to be taught at schools and universities.

- Partridge & Hallam (2006) contend that most of the generation Y students have a very low tolerance to boredom and must be constantly engaged just to have their attention. This is further complicated because the same have very low attention spans. This generation has a high degree of exposure to video games that are highly engaging and interesting. Hence this generation is used to being entertained and engaged by high-quality graphics and animation. They expect the same levels of engagement and entertainment in the academic classroom settings, which makes it very challenging for teachers and trainers who usually struggle to keep up with the very high levels of expectations that students have from them

- Generation Y view works as an integral and a central part of their lives and wants a personally meaningful and fulfilling form of life (Meister, & Willyerd, 2010). Hence it becomes very vital for the students belonging to this generation to choose the right kind of education which would involve their interests, their strengths, and what is meaningful/valued them. Hence, they need the right kind of guidance and

mentoring from their teachers to choose courses that would go on to fulfill their requirements for meaning and fulfillment in the future

- Generation Y is very comfortable (not shy) with conversing with elders when it comes even to intellectual topics. Further, their opinions on such matters are much more valued when conversing online when it is difficult to find the age group to which they belong (Tapscott, 1998). Hence institutions must create forums where intellectual topics can be discussed relatively anonymously and opinions can be shared without being discriminated against based on age, sex, race, religion, etc. This is a trend that has been seen to emerge on many online platforms (sometimes involving moderators too). These sorts of interactions hold promise if they are effectively implemented.

- The teachers are increasingly being seen as facilitators of the classroom rather than being seen as pure disseminators of information. (Tapscott, 1998). Hence, teachers need to be very proficient in terms of skills like facilitating, questioning, moderating, guiding, and so on rather than just limiting themselves to disseminating information.

- Generation Y students are much more multicultural, respect diversity, and are tolerant towards differences (Gorman, Nelson, & Glassman, 2004). Hence this generation is more open to learning from each other's cultures and backgrounds rather than being closed and narrow-minded which a characteristic of many of the previous generations was. This helps in them having a multiplicity of perspectives and views and in general more open to ideas and opinions which do not conform to those of their backgrounds.

- Generation Y also tends to associate higher education with further opportunities in life (Wesner, & Miller, 2008). Hence this generation is relatively much more motivated to pursue their education both in terms of formal and informal education. Thus, they actively seek many opportunities presented to educate themselves in many diverse forms and methods

- Tapscott (1998) posits that there has been an increasing shift towards education being moved from teacher-centric to being learner-centric. In this form of education, the learner is the focal point. The same author posits that education is increasingly moving to become a process of construction combined with discovery from being merely being driven by instruction.

- Another drawback of Generation Y students is that a sizable population of them rarely devotes time to read. (This could be possibly due to this generation of students being exposed to highly stimulating activities like computer media, video games, etc.). They are also inclined to not remain seated at the same place for a long time. (Feiertag & Berge, 2008). Thus, teachers of generation Y must somehow generate the reading habits into their students. This can be done through
    - Allowing the students to develop their methodology of reading by giving them the freedom about reading anything and everything
    - Introducing discussion sessions after reading
    - Regularly inviting authors to the universities to interact with the students and to inspire them
    - Teaching reading strategies to students
    - Sharing of their own reading experiences
    - Socialization based on reading habits

> ▪ Listening to audiobooks to start off with
>
> Source:https://www.edutopia.org/blog/cultivating-love-reading-students-elena-aguilar

- Lack of sufficient critical thinking: Despite the access to a vast ocean of information on the internet the generation Y students cannot fully benefit from the same as they don't have the critical skills to evaluate which part of the information, they can access is reliable, trustworthy, useful and applicable. Students lack questioning habits while reading and this creates a huge roadblock to effective learning. (Lorenzo, & Dziuban, 2006). Hence schools and colleges need to impart sufficient critical thinking skills to effectively deal with the avalanche of information on the internet. Thus, it becomes vital that information literacy skills must be imparted at a very young age and children must be gently guided about developing the same over time (Lorenzo, & Dziuban, 2006).
- Generation Y lacks sufficient communication skills both in terms of written & verbal communication skills. Most individuals of this generation struggle to put their ideas into clear and concise words and thus fail to communicate their ideas in most cases (Feiertag & Berge, 2008). Thus, teachers must actively make the students come out of their comfort zones of communicating through instant messengers and so on to writing *formally* and communicating verbally in a cogent and compelling manner.

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THE NATURE SMART CITY – Finding the Next Urban Vision

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"Every story of yourself in the future is a form of fiction. But if it aligns with where you want to go, it's called a vision." -John Maeda

ABSTRACT

In the era of digitalization, we have increasingly moved from real-life experiences towards virtual experiences. Consequently, we have lost our inherent connection to nature and our natural ability to understand the natural world around us. The human-nature connection has lost its meaning in urban life. There is a real need to find a new vision for the post-pandemic city that is different than the pre-pandemic city: we are moving from the tech-driven smart city to Nature Smart Cities with an emphasis on human connection and nature connection.

Howard Gardner, who created the theory of multiple intelligences, later on added to his list naturalistic intelligence or nature smart. This particular form of intelligence manifests itself in an individual's sensitivity to nature and the world. People endowed with this form of intelligence are the people who see both the forest and the trees. Restoring and rebuilding our interdependence with environmental systems is the very essence of human and planetary wellbeing. How to design cities for happiness, doing and living well, in harmony with humans and nature?

Keywords: Architecture, Urban Planning, Nature Smart City, Eco Smart City, Biophilic City, Scenario Planning, Futures Thinking, Design Thinking

1. INTRODUCTION: Towards the New Urban Narrative

FutureSprint 2030 is a project and a co-creation process for rewriting the future narrative of architecture and the roles of the future architect. The study, executed by the authors between February 2020 and May 2021, was supported by a grant from the Finnish Cultural Foundation. The project was executed in collaboration with the Finnish Association of Architects (SAFA) and the outcome of the study was shared with the working group

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responsible for the Finnish Architecture Policy Programme (Apoli2020)[95] by the Ministry of Education and Culture.

During the pandemic year 2020-21, a set of interactive virtual workshops were conducted both with a Finnish and an international audience and participants. As a result, a new urban narrative for the post-pandemic city was co-created based on discussions and trend research.

The findings from the research and the discussions demonstrated how *rethinking the future role of the architect and architecture* is globally significant at this unique post-pandemic "reset moment". Architects could have a more meaningful and important role in creating future societies to better reflect the needs of the people, society, and the planet. The subject needs more research, since there is a significant lack of timely future scenarios related to architecture and the architect's role in the future. From the systemic point of view, architects cannot do their job alone and architecture cannot be created by architects only. We need more systems thinking when approaching designing, building, and planning the built environment. This kind of holistic view is still very weak in any research on the future of architecture. Through imaging and visioning the future, we can challenge current trends and create alternatives for the betterment of future society.

Architects' strength has always been their ability to solve complex problems – an ability stemming from their education. However, architects are absent from the public eye, and struggle to communicate their unique expertise to wider audiences, which is of some concern. Another concern is the future development of digitalization, AI-powered design and data literacy, which are all beyond the traditional curriculum/skill set of architects. The more complex the systems of building, planning and planet become, the more leadership skills and co-creation skills are needed by architects. In the future, it is not only the game that will change, but the rules, and, therefore, the outcome, too. In this study, we wanted to look beyond the current architecture practice and see the bigger picture of the future post-Covid urban development: what will the post-pandemic city look like and *what is the essence of the new urban vision*?

2. METHOD: Combining Design Thinking with Futures Thinking

The overall method – named *FutureSprint* by the authors – is an approach combining the DesignSprint method based on design thinking with scenario planning based on futures thinking. The process allows participants to co-create a future narrative and a shared vision for the future. The pre-created drafts of the scenarios are used as a tool to represent the overall framework of plausible futures based on trend research.

This approach was initially piloted and tested with the City of Helsinki in 2016-2017. Anne Stenros and Minna Takala planned and conducted the scenario planning process for the City of Helsinki by organizing and facilitating a dozen workshops for 250 leaders of the city.

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[95] https://minedu.fi/en/apoli2020

The project was based on four future scenarios and four citizen personas. The outcome of the process was a shared future vision and strategy for the city. The scenario process introduced a new element in the traditional strategy planning process of the city. The future narrative approach was an important tool for value discussions with diverse groups of civil servants. The narratives were also accessible to citizens for comment.[96]
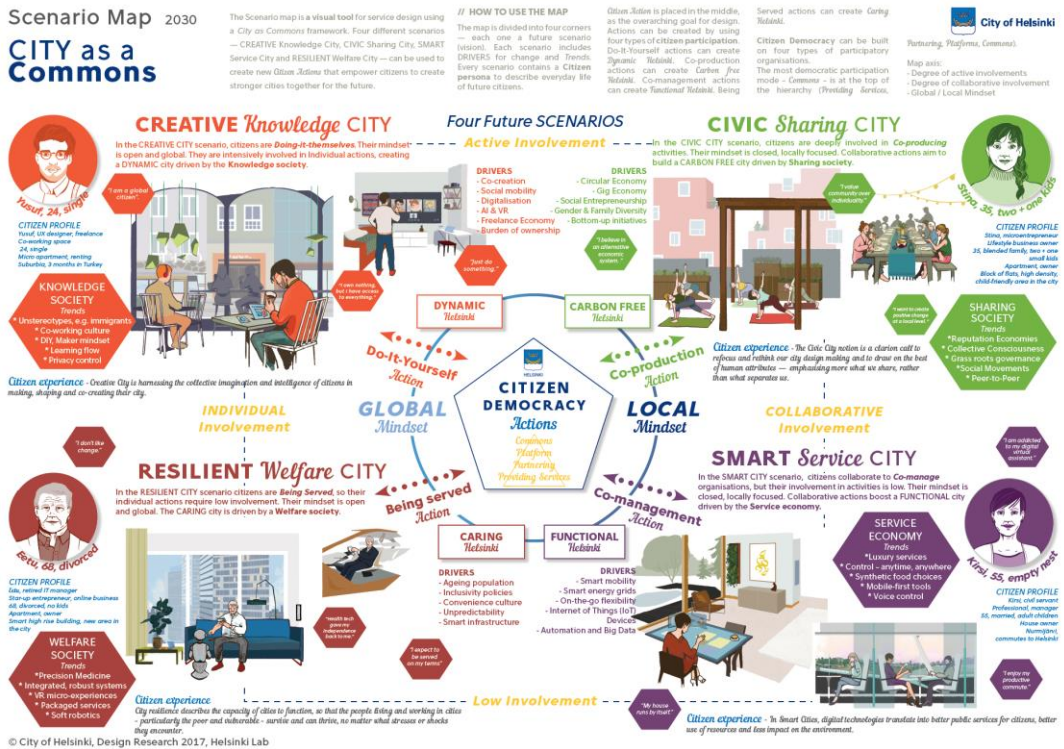
Picture 1. Helsinki City Scenario Map 2030. Stenros & Takala 2017. City of Helsinki, Helsinki Lab

According to the acknowledged report of future scenarios by the Rockefeller Foundation and Global Business Network (2010): "Scenario planning is a methodology designed to help guide groups and individuals through the creative process of future visioning. The process begins by identifying forces of change in the world and combining them in different ways to create a set of diverse stories — or scenarios — about how the future could evolve. Scenarios are designed to stretch our thinking about both the opportunities and obstacles that the future might hold. Together, a set of scenarios captures a range of future possibilities that are plausible. Scenarios are not predictions, but they are thoughtful hypotheses that

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[96] https://www.hel.fi/static/helsinki/kaupunkistrategia/skenaariokartta-kaupunkistrategia-2017.pdf

allow us to imagine, and then to rehearse, different strategies for how to be more prepared for the future — or more ambitiously, how to help shape better futures ourselves."[97]

Scenarios are based on storytelling. A story helps illuminate the past, present, and future, thus lighting up the paths of change. Stories are built upon shared values, actions and emotions and they carry insight, concepts, and experiences. Collective stories have neither a beginning nor an end; they grow like trees: they are here before us and will stay long after us. Stories are man-made, but at the same time they reflect everything around and beyond us. Stories are a powerful way to engage people in a strategic change in the future.

In a co-creation, such as a design sprint, a story has many different qualities that make it useful. It is a direct route to our emotions, it creates meaning out of patterns, it engenders empathy across difference, and it enables the possible to feel probable in ways our rational minds cannot comprehend. Stories are essential strategic tools: when it comes to changing the values, mindsets, rules, and goals of a system, a story is foundational.[98]

There is a famous tradition of visionary future stories by architects: Italian Futurism (1909-1944), Frank Lloyd Wright (1867-1959) and Buckminster Fuller (1895-1983) in the US and the Archigram group (1961-1974) in the UK, among others. Contemporary visionaries include Rem Koolhaas, Bjarke Ingels, Carlo Ratti, and Liam Young, to name but a few.

The *FutureSprint 2030* study and the workshops were based on the scenario process, where four different scenarios of the future of architecture were developed as a basis for discussion. In addition, four related architect personas, one for each scenario, were created to support a more empathic and in-depth approach. The scenarios and the respective personas were discussed in the workshops to better understand the challenges and opportunities of each scenario, and the future role of an architect as a *changemaker* in that context.

The persona stories were created to illuminate new pathways for an architect's role in specific scenarios. Personas show the more individual and detailed perspectives of the general level scenarios. Personas also serve as reflection points for a value discussion in evaluating different alternative paths towards the future from an individual point of view. Creating personas is applying the human-centric approach of design thinking to scenarios.

97

https://www.academia.edu/42904542/Scenarios_for_the_Future_of_Technology_and_International_Development

[98] https://ssir.org/articles/entry/using_story_to_change_systems#
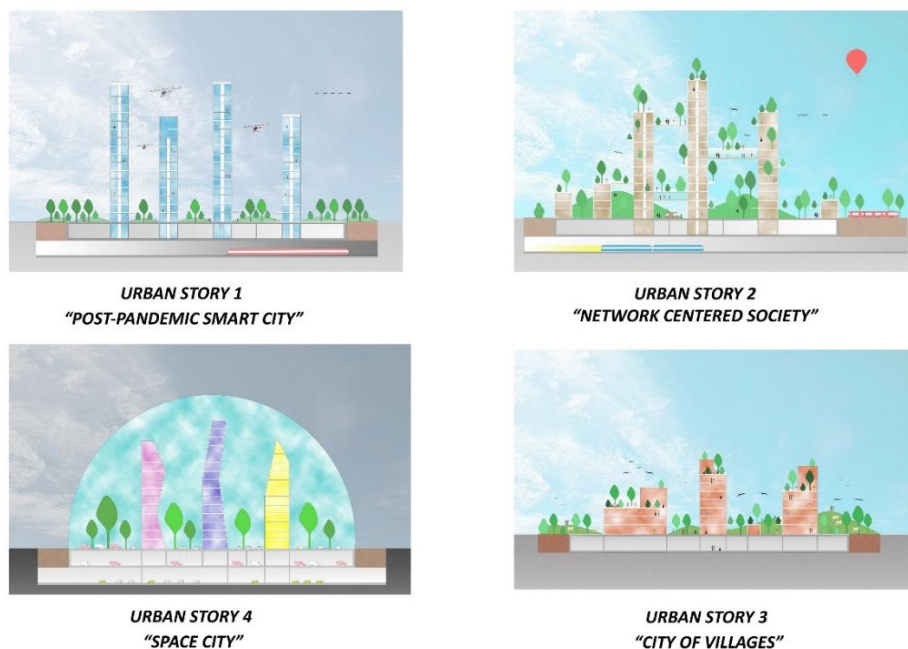
Picture 2. FOUR URBAN STORIES: The four scenarios of the future of architecture.
FutureSprint 2030. Stenros & Geitel & Takala, 2020-21.

3. EXECUTION: Cocreating and Sensemaking Together

During the project, altogether four virtual workshops took place with different groups of participants. The first workshop was for Finnish architects, the second for international architects, the third for a group of global MBA students from Aalto University, and the final one for an invitation-only audience of Finnish architects. In each workshop, the scenarios and personas were tested and later redesigned. Specifically designed virtual canvases were used during the workshops. In the end, we had four major scenarios and architect personas based on an interactive and iterative process. The four scenarios represent the current understanding of the future of architecture as seen during the times of COVID-19 and its aftermath.

In the FutureSprint process we approached the theme on three different levels: micro, meso, and macro.

1) Micro Level – Understanding People, Place and Context: Identifying and creating future personas by *redefining* primary actors, their needs and desires with a focus on lifestyles, practices, hopes and concerns.

2) Meso Level – Co-creating Future Stories: *Reframing* the key scenarios for the future vision with a focus on trends, frameworks, challenges, and opportunities embedded in the context.

3) Macro Level – *Rewriting* the Future Narrative: Specifying elements, patterns, requirements and solutions for the vision concept with a focus on values, ideologies, and economics driving the future architecture and urban planning.

1) Micro Level: The Personas

The impact of the pandemic on the next generation of young architects is evident – the fear and loss, the peculiarities and wonders of virtual schooling, the added responsibilities they face as the world recovers. What are the consequences of the pandemic to the students starting their architectural studies in 2020? How are they going to rebuild a society that is more resilient, more inclusive, more sustainable, and more just? *Generation Snowflake* – as they are also called – values authenticity, simplicity, honesty, and humour. They are creative, energetic, and resilient even in the face of fear and uncertainty. How are they rediscovering and reimaging a radically different future in the post pandemic times?[99]

As two examples of future architect personas, we introduce (A) *Ada* and (B) *Jacob*:

(A) *ADA – Living and working in a small town:*

Ada lives in a co-housing apartment building – a pioneering project from the early 2020's. She oversees the Best Planet chapter in her town and is actively involved in local building initiatives and policies for a more resilient and fairer world. She chooses to travel by land and volunteers in several locally important grassroot actions. After graduating, she travelled by train around Asia from village to village, gathering local knowledge on building and materials. She considers herself an architect with a collective mindset and a shared vision of a better planet. She believes in doughnut economics and supports the next generation feminists with a twist. Her idols are Julia Watson (Lo-TEK, Design by Radical Indigenism) and Greta Thunberg. Her driving forces are empathy and helping others by building an open culture of trust. "We stepped into the world as it was starting to fall apart". Her motto: Be the change you want to see. – Ada is changing the world through her inspiration, step by step. Ada is A CATALYST with a Visionary Mindset and a strong sense of purpose.[100] (Scenario: *City of Villages*)
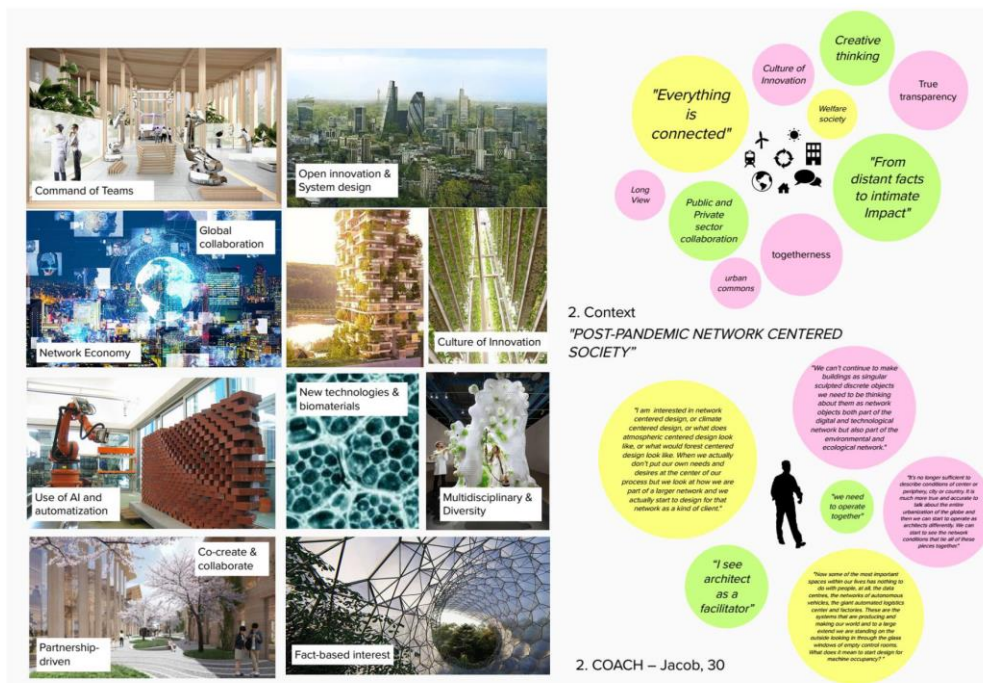

Picture 3. FOUR URBAN STORIES: *Persona ADA*. Example of the materials (virtual canvases) used in the co-creation workshops. FutureSprint 2030. Stenros & Geitel & Takala, 2020-21.

(B) *JACOB – Living and working in a mid-size city:*

Jacob is enthusiastic about facts vs. fake. Already as a student, Jacob focused on fact-based topics of his architectural studies: engineering, new technologies and biomaterials, and the use of AI and automatization in designing and building. His passion is to work collaboratively and to co-create the change needed for a more resilient society, world, and planet. He has spent several summers abroad in architectural master classes for students and is building a strong network of like-minded young colleagues. Recently, he applied to the doctoral program at the local university to study agile co-creation and self-organisation in architecture. His idols are Christopher Alexander (Pattern Language) and Ed Catmull (Creativity Inc.). His driving force is building a strong team culture between different partners and helping others to thrive. "I'm considering taking a gap year to study more – a lot of my friends have as well." His motto: Together we are stronger. – Jacob is changing the world by guiding others. Jacob is A COACH with a Creative Mindset and the sense of collective ideas and innovations.[101] (Scenario: *Network Centered Society*)

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[101] Ibid.

Picture 4. FOUR URBAN STORIES: *Persona JACOB*. Example of the materials (virtual canvases) used in the co-creation workshops. FutureSprint 2030. Stenros & Geitel & Takala, 2020-21.

2) Meso Level: The Scenarios

The detailed context of the architecture scenarios in 2030 is further imagined based on the guideline scenarios published in recent years, such as Arup's *2050 Scenarios* (2019)[102] and the *Scenarios for the Future of Technology and International Development* (2010)[103] by the Rockefeller Foundation. Both are based on a framework presenting four plausible futures.

Urban Story 1 – Post-Pandemic Smart City: Redefining Big Tech

In the <u>Post-Pandemic Smart City</u>, everything is digitalized, well organised, safe, and carefully controlled. The balance between technology and people is under constant scrutiny. Are people serving the technology and not the other way around? Government has far-

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[102] https://www.arup.com/perspectives/publications/research/section/2050-scenarios-four-plausible-futures

[103] https://www.academia.edu/42904542/Scenarios_for_t
he_Future_of_Technology_and_International_Development

reaching powers, and countries collaborate to maintain control. Actions to slow down climate change and improve planetary health are enabled by strict rules and regulations.[104]

Megatrends: Digitalization, Automatization, Rethinking Density, Big Tech

Drivers: Safety & Security, Trust & Transparency, Big Data, Big Health, Tech Innovations

Urban Story 2 – Network-Centred Society: Redesigning Public Space

In a Network-Centred Society, everything is connected and considered part of a larger ecosystem. Societal conditions and planetary health co-exist in harmony and build up each other for mutual progress and benefit. Governments engage in cross-border collaboration, and partner with private sector actors to advance their causes. Everything is highly digitalized, and technology and AI serve the people, not the other way around. Society is safe and conducive to innovations, and the level of education globally is high. Planetary health is taken into consideration in all decision-making. Sustainability is no longer considered a separate entity or issue, as it is accepted that everything is connected and impacts everything else. Human centric design has morphed into network centred design.[105]

Megatrends: Welfare Society, Long View, Network Economy

Drivers: Global Collaboration, Open Innovation & Systems Design, Social Innovation

Urban Story 3 – City of Villages: Rebuilding Community

In the City of Villages societal conditions advance at the cost of planetary health. Governments are acting independently with occasional cross-border collaboration. All reforms are slow in the making, people and grass root actions are needed to support change and challenge the status quo. Digitalization is slow and different kinds of low-tech solutions are common, also off-the-grid style living, moving to the countryside and working remotely are gaining popularity. Local services are decentralized, and cities are becoming networks of small walkable villages. Urgent action to slow down the deterioration of the planet is vital, and a lot of initiatives to that end are made, but their execution is scattered to different actors, as there is no coherent global strategy to tackle these issues.[106]

Megatrends: Decentralized Local Services, Circular/Doughnut Economy, Nation State

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[104] The *Scenarios* created for the *FutureSprint 2030 – Four Urban Stories* project
[105] The *Scenarios* created for the *FutureSprint 2030 – Four Urban Stories* project
[106] Ibid

Drivers: Stakeholder Capitalism, Planet Centric Design, Hacking Innovation

<u>*Urban Story 4 – Space City: Reimaging the City*</u>

In the <u>Space City</u>, the public sector is extremely weak and almost everything is run by the private sector. There are no coherent visions on the global or local level. Security is severely compromised everywhere. Gated communities are a global phenomenon. The health of the planet and societal conditions are deteriorating rapidly, and no real measures have been taken to prevent it. Gene manipulated crops take an increasingly important role as the greater part of the world's arable land is slowly turning uncultivable. Innovations are dependent on private funding and lack any control or benefit for the greater good. Outer space offers tempting opportunities to create the cities of the future.[107]

Megatrends: Global Uncertainty, Diversity, Rethinking Building Types

Drivers: Entrepreneurship, Alternative Financing, New Markets, Provocative Innovation
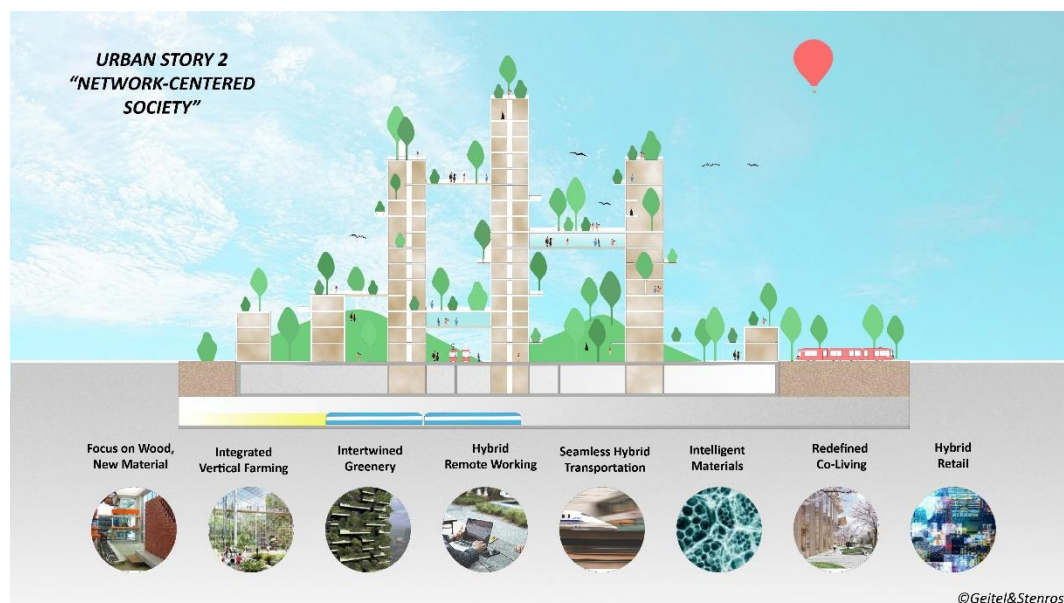
Picture 5. FOUR URBAN STORIES: *Urban Story 2 – Network-Centered Society*. Future Architecture Scenarios 2030. FutureSprint 2030. Stenros & Geitel & Takala, 2020-21.

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[107] Ibid

Picture 6. FOUR URBAN STORIES: *Urban Story 3 – City of Villages*.
Future Architecture Scenarios 2030. FutureSprint 2030. Stenros & Geitel & Takala, 2020-21.

3) Macro Level: The Next Narrative

In a transformation or systems change, the first thing is to understand the *Now,* then the *Transformation* itself and finally the *After*. Sometimes we can even sense and see the *Next*. All these elements create the narrative from present to the plausible future.

The Now:

It is obvious that the pandemic has compressed time in our present life. We have witnessed what were only weak signals suddenly become strong trends with fast progress, such as the upheaval of remote work and the new virtual normal, or the health and safety issues that come with social distancing. All these work and lifestyle changes will have an impact on the future development of architecture and urban design. Living through these times of several crises in health, social, and climate will have a major impact on and change urban development.

Many studies show that we have a severe wellbeing crisis. It is clear the pandemic took a toll on emotional wellbeing. Mental health was one of the casualties both of the pandemic and of the resulting lockdowns. As the pandemic struck, there was a large and immediate decline in mental health worldwide. A major element in COVID-19 policy has been

physical distancing or self-isolation, a significant threat to people's social connections, which are vital for their happiness.[108]

The Change:

The more we understand the future drivers and the emerging needs and desires, the better we can adapt and solve emerging crises through architecture, design, and urban planning. In the future, the discipline of architecture, design, and planning will be based on systems thinking and will focus more on innovative goal setting than solving unique problems. The latter will be done by technology and especially by AI-driven design solutions. Creativity will be needed first and foremost in leading data- and digitally- driven design: how to set the goals and the constraints in such a way that the result is a built environment which is more human, sustainable, equitable and inclusive.

The After:

In architecture and urbanisation, there are four plausible future directions: (1) The new version of a smart city, where human-centredness, the natural environment and local culture are the key building blocks of urban design. (2) A network-like collaborative ecosystem of independent neighbourhoods and/or cities sharing knowledge and learnings. (3) A bottom-up, village-like, inclusive and experimental urban living lab and (4) A range of utopias designed by famous architects as unique solutions for a particular location and context. All these visions have *an emphasis on the wellbeing experience of individuals, community and nature,* and therefore focus on *the human-nature connection and a strong sense of community spirit*.

The first concept emerging to the wider discussion is the idea of the *15-Minute City* by Professor Carlos Moreno. The mayor of Paris suggested that the entire city should be developed based on this idea. According to Moreno, the 15-minute city is the key to sustainability, resilience, and place identity in future post-pandemic cities. Moreno advocates for an urban set-up where locals can access all their basic, essential services at distances that would not take them more than 15 minutes by foot or by bicycle. The urban built landscape needs to be restructured to ensure that it complies with components such as proximity, diversity, density and ubiquity, which Moreno opines to be major concerns in the pursuit of cities offering an urban life that could be categorized as being of high value.[109]

The second major idea is the *Biophilic City,* paving the way for rebuilding the human-nature connection in urban environment. The network of Biophilic Cities partners with cities, scholars and advocates from across the globe to build an understanding of the value and contribution of nature in cities to the lives of urban residents. The partner cities work collectively to pursue the vision of a "natureful" city within their unique and diverse environments and cultures. This concept acknowledges the importance of daily contact with

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[108] https://happiness-report.s3.amazonaws.com/2021/WHR+21.pdf; p. 10

[109] https://www.mdpi.com/2624-6511/4/1/6/pdf

nature as an element of meaningful urban life, as well as the ethical responsibility that cities have to conserve global nature as shared habitat for non-human life and people.[110]

Finally, architect Bjarke Ingels and BIG launched the *Masterplanet* vision, which is an attempt to redesign earth and stop climate change. Masterplanet is a concept for designing a more sustainable way of living for the entire world. Approaching Earth like an architect master planning a city, Ingels calculates that even a predicted population of 10 billion people could enjoy a high quality of life if environmental issues were tackled holistically.[111]

There is a growing public interest in urban renewal, showing the way towards the *post-pandemic city which is more human-centric, sustainable, and nature-driven by character.* All recent ideas emphasize the role of green and blue spaces, parks, nearby nature, and sustainability as a core element of the urban development. The positive effect of nature is not only seen as a human health issue but also an aspect of holistic wellbeing. The revitalizing, regenerative and restorative effect of nature is seen as essential for human and planetary wellbeing. Supporting community spirit and neighbourhood health is also part of the overall wellbeing experience and quality of life. All these aspects are also tackling the current crises that we have: the presence of pandemic, climate, and wellbeing crises.

4. VISION STORY: The Next Urban Narrative

There is a strong connection between happiness and human-nature connection. Growing evidence in psychology suggests that being exposed to green, natural environments improves mental wellbeing, including a reduction in stress, a rise in positive emotions, cognitive restoration, and positive effects on self-regulation. Green, natural environments also have an indirect positive impact by encouraging certain behaviors, for example physical exercise or social interaction, through the provision of public, open space, which improves mental and physical health and longevity, and thereby overall happiness.[112]

In his valued book *The Nature Principle – Reconnecting with Life in a Virtual Age* (2012), journalist Richard Louv presented already ten years ago the idea of living in *a restorative city*, by stating that there is a natural urban renewal movement, following the footsteps of the Garden Cities movement. According to Louv, in the twenty-first century, the most vibrant cities will be those that integrate the population into an urban environment enriched by both natural and re-natured habitat. This idea of rewilding cities – not only creating green infrastructure, but also consciously increasing the wildlife population and urban biodiversity – is in the very heart of the future city.[113]

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[110] https://www.biophiliccities.org/our-vision
[111] https://www.dezeen.com/2020/10/27/bjarke-ingels-big-masterplanet-climate-change-architecture-news/
[112] https://happiness-report.s3.amazonaws.com/2020/WHR20_Ch5.pdf
[113] Louv, Richard. The Nature Principle – *Reconnecting with Life in a Virtual Age*, 2012, p. 197-200

The origin of restorative, nature-centric cities is the Garden City movement. One of the modern versions was the Tapiola neighborhood in Espoo, Finland, which was built in the 1950s and 1960s on the principles of Ebenezer Howard's garden city. Tapiola was the largest and most valuable example of 1960s city planning and building ideologies in Finland. Tapiola was also one of the first post-war "new town" projects in Continental Europe. The original city plans and the buildings were designed by a group of prominent Finnish architects. Tapiola was a result of close teamwork in the fields of architecture, sociology, civil engineering, landscape gardening, and youth welfare.[114]

The strong Nordic heritage of building in balance with nature leads to the more general idea of *nature wisdom in planning, building and living*. The importance of urban green spaces and blue spaces as well as the meaning of community bond, belonging, and the sense of place are essential for the healthy habitat. *The Next Urban Narrative is returning to our collective roots of living together, not only among human beings, but with all living things. To see the world through the lens of oneness to the whole is the lasting way to climate adaptation and the path towards the sustainable development of the urban humankind.*

All four urban scenarios presented in our study fit well under the umbrella of nature-centric cities. Since cities can be seen as forests: they are individuals, they have an identity and personality like any other ecosystem. The more diverse they are, the better their resilience, and therefore their diversity should be sustained. The growing network of biophilic cities, eco smart cities and eco villages are all parts/ecosystems of the overall urban system.

The four elements of nature-centric cities are (1) BLUE: Regenerative spaces designed for holistic wellbeing, (2) GREEN: Revitalizing spaces of healthy habitat and living, (3) RED: spaces supporting community spirit and resilience, and (4) WHITE: Restorative spaces creating pause in time and the sense of oneness with nature. The overall impact of these elements is rebuilding not only the human-nature connection, but the holistic sense of happiness: doing and living well in harmony with nature. Supporting this nature-centric approach with circular design and biophilic design, micro localism, and the idea of circular and doughnut economy, lead to the idea of the next urban future: the *Nature Smart City*.

The four principles of redesigning the Nature Smart City are:

1. *Redefining* Smart & Sustainable: the *SLOC* (Small-Local-Open-Connected) model by Ezio Manzini[115]

2. *Rebuilding* Community Spirit: *Placemaking* as an approach and philosophy for planning and co-creating with local people

3. *Rethinking* Social Wellbeing: *Inclusive Design*, empathy design and design for all

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[114] https://en.wikipedia.org/wiki/Tapiola
[115] http://www.ecologiapolitica.org/wordpress/wp-content/uploads/2014/03/Resilient-systems-and-cosmopolitan-localism.pdf p. 5-6

4. *Reimaging* Human-Nature Connection: *Biophilic Design* and biophilic architecture

The best urban environment supports feelings of safety and belonging, as well as strong human-nature connection. This kind of environment is creating and nurturing *the resilience of the community and the resilience of nature*.

5. CONCLUSION: Towards the Nature-Smart Society

Psychologist Howard Gardner, who has created the theory of multiple intelligences,[116] added later to the list the 'eight intelligence': *naturalistic intelligence* or *nature smart*. This intelligence is about how sensitive an individual is to nature and the world. People endowed with this form of intelligence typically are interested in growing plants, taking care of animals or studying animals and plants. They care about the environment and like to be in touch with nature. They express a desire to understand how things work, and they find patterns in nature. These are the people who see both the forest and the trees.[117]

One aspect of nature wisdom is learning from the past, much like mother trees in the forest are sharing knowledge through their underground roots. Learning from Vitruvius, who saw architecture as an imitation of nature and the proportions of the human body as an ideal model for the entire city, or the way indigenous people used to build their adobes – all the way to the garden city movement and the future of rewilding cities. We should listen to and learn from the local wisdom of designing, planning, and building in a specific location by respecting its nature. *Architecture and cities should be seen part of the mother tree tradition: sharing the long-lasting wisdom on how to live in harmony with one another and nature.*

Already ten years ago, Ezio Manzini presented a resilient model for human habitat, social wellbeing and innovation. He stated that resilient systems and cosmopolitan localism are two sides of an emerging scenario which he called the SLOC scenario, where SLOC stands for Small, Local, Open, Connected. Each one of these adjectives and its implications are easily understood, but together they generate a new vision of a sustainable, networked society. In his view, this SLOC scenario could become a powerful social attractor, capable of triggering, catalysing and orienting a variety of social actors, innovative processes and design activities.[118]

The recent article on nature-based solutions (NBS) applied in architecture and urban planning shows several urban design projects that introduce NBS to provide sustainable management of ecosystems to tackle different environmental challenges. The article shows how these solutions can reconnect the local population with nature, mitigate air pollution, improve thermal comfort in the cities, reduce the effect of urban heat islands, and manage

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[116] The Theory of Multiple Intelligences was first presented in 1983 by Howard Gardner in his book *Frames of Mind*.

[117] https://www.iberdrola.com/talent/naturalistic-intelligence

[118] http://www.ecologiapolitica.org/wordpress/wp-content/uploads/2014/03/Resilient-systems-and-cosmopolitan-localism.pdf p. 5-6

stormwater runoff, among many other benefits to the environment and to the physical and mental health of urban dwellers.[119]

These examples of a naturalistic approach in designing and building communities, neighbourhoods, and entire urban areas call for a new kind of thinking and doing, knowledge and skills. In our current digital and virtual world, we have lost our inherent connection to nature and our natural ability to understand the natural world around us. The human-nature connection has lost its meaning in people's life. In the digitalisation era, we have moved from real-life experiences to virtual experiences. Interestingly, based on latest customer insight, we are moving towards more tactile life at home as a contrast to the digital world. *The question remains how to harvest our naturalistic intelligence and wisdom?*

The post-pandemic world is based on the balance of the human and planetary wellbeing. Rewilding and oneness with nature are the new building blocks of holistic wellbeing, healthy life, and a healthy planet. Restoring and rebuilding our interdependence with the environmental systems is the very essence of this development. *How to design for future happiness, doing and living well, in harmony with nature?* – That is the grand challenge of our time and the future. In an era of great reinvention, we are moving from a tech-smart society to a *nature-smart society* – and we must learn how to *think like a naturalist*.

Our narrative of architecture futures started from the role of an architect and developed during the pandemic year to the question of the ethical values of architecture in relation to human beings, discipline, environment, and planetary boundaries. The only thing that is solid in this ongoing change is the old truth by architect Louis I Kahn: *"Architecture Is"*.

When considering Nature Smart City as a system of co-existing ecosystems, there are still many questions to be answered in the future:

- Urban ecosystem management
- Ecosystem dynamics
- Ecosystem complexity
- Multi-layered ecosystems
- Balancing ecosystems
- Monitoring ecosystems
- Ecosystem narratives

We are only beginning to understand the opportunities afforded by naturalistic intelligence in designing nature smart urban ecosystems and society. We should contemplate the wisdom of Japanese botanist Akira Miyawaki, who created the famous Miyawaki method of planting trees and growing natural urban forests for restoring biodiversity:

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[119] https://www.archdaily.com/964460/6-urban-design-projects-with-nature-based-solutions?utm_medium=email&utm_source=Notifications&utm_campaign=daily&kth=5883860

"I am still only eighty-six years old! It is a sign of vitality that I continue to work. I'll plant trees with people for the next thirty years".[120]

- Akira Miyawaki

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GENERAL CONSIDERATIONS REGARDING THE DEVELOPMENT OF GAMES USING UNITY TECHNOLOGY

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Abstract:
Video game development platforms represent a specialized work environment that contains a multitude of properties and tools that help game creators in designing and making applications in this field. The market for game development platforms is currently booming, offering a diverse range of options. Anyone with motivation and ideas can start creating and developing a game using popular platforms such as Unreal Engine, Unity, Game Maker or RPG Maker VX Ace. Today, every platform for game development is supported by a vast basic documentation but also by a huge public community that provides game creators with all the tools they need to create high-performance games. If an experienced or even less experienced developer finds himself in a situation where he cannot solve a problem on his own, he has the opportunity to find the answer to the problem encountered, on the community forums corresponding to the technology used in creating the game, or he will find someone who has faced a similar situation and can give him answers/advice for the specific situation. Depending on the purpose of the final product, the game creator has the opportunity to choose the platform he will use in creating it. Unity is the most popular video game development platform due to its cross-platform capability. Unity can be used both in making 2D or 3D games, but also in the film, automotive, architecture, engineering, and construction industries.

Keywords: game development, cross-platform, Unity

1. Introduction

Unity is a cross-platform game engine developed by Unity Technologies, launched first in June 2005, exclusively for MacOS X. It can be used to create games in bidimensional, tri-dimensional, virtual, and augmented reality environments – including simulations [1]. The latest stable version, 2019.2.17, has been launched in December 2019. Even since 2018, Unity has been utilized to develop approximately half of the new mobile games brought to the market and around 60% of the content developed for augmented reality and virtual reality. The programming languages employed in conjunction with Unity are C# and JavaScript. For these two programming languages an integrated development environment is available within Visual Studio of MonoDevelop, as code editors [2].

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Unity Technologies, as well as the community members, actively create *assets*. Unity Asset Store is a growing library of such assets, hosting thousands of free and low-price elements that can help save both time and effort for Unity developers. Inside the store there are many types of different assets, including textures, animations, fully-fledged models, complete projects, tutorials and editor extensions. This blend of both free and easily accessible assets (low-cost ones) represents a hugely important feature for Unity, because the developers can download them and insert directly into their project [2]. Today, in pandemic conditions worldwide, for the development of any game the sound component is very important and helps produce a captivating and emotional game experience. Finding the perfect soundtrack that best matches a game application is a very important element to attract and retain players (customers). To this end, Unity offers an extensive library of both free and low-cost audio elements, music and sound effects, so that the game developer should only identify exactly what matches as best as possible to his game. [2][3].

Unity offers a very intuitive user interface that invites developers to experiment with the multitude of options and features offered for content creators. There are three different version of this interface: Personal, Plus and Pro. There also exists an Enterprise version, similar to the Pro one but bundled with an Enterprise environment package.

2. New updates and features in Unity

Unity has brought updates, new features, and tools for the 2D game developers. It added support for maneuvering of animations directly from the "timeline", for animation preview and modification [2][4]. The application interface is very well organized and very easy to understand and use (see Figure. 1).
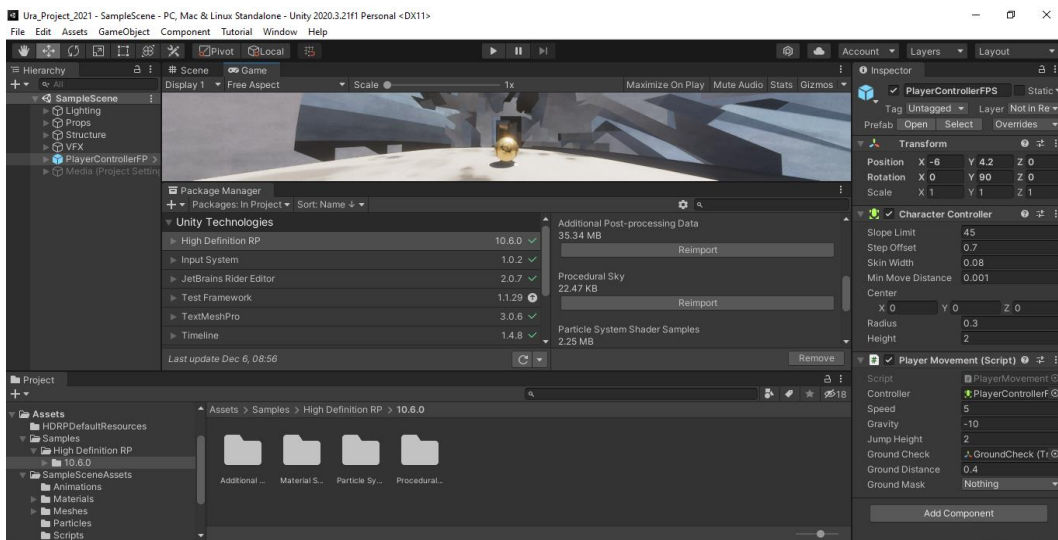
Figure 1. Main Unity user interface

The interface comprises many different options, among which we notice the following main ones: Project (which shows the assets), Hierarchy (through which developers see all elements inside the game environment), Console (shows errors, warning messages or help

error-tracking through the debugger), Asset Store (used for adding diverse objects/assets for the game), Prefab (for different effects for the camera/view, field etc.), the Scene window (where developers can edit all aspects of the current project), and the Play, Pause, Forward buttons. Unity also makes available to the game creators many different scripts that can add functionalities, in the "Tilemap Editor" section, as well as new brushes and tiles which can be accessed from the 2D Extras package [1][5]. The 2D editor for tile maps is not available by default when first installing Unity, but it can be downloaded from the Package Manager section. An important added feature was introduced in Unity as the 2D Sprite Shape component, meant to help create curved fields. The facility goes together with an editor that allows the definition of margins and fillings, as well as the automatic creation of colliders [2]. 2D PSD Importer component permits the import of sprites directly into a third-party application like Photoshop, keeping the image layering – fact that allows layer-by-layer animation design without the need to individually import each individual layer.

MonoBehaviour is the basic class of all scripts meant to be attached to a game object and it is used for faster code creation, lighting manipulation, and development of Artificial Intelligence (AI) modules without extensive previous AI knowledge [2][6].

The main widely used functions of the MonoBehaviour class are:

1. Start() – is represents a function called only once, inside the first frame after script activation, before any Update type function
2. Update() – represents a function called at each individual frame
3. FixedUpdate() – represents a function called regularly for physics calculations (by default every 0.02 seconds)
4. Awake() – a function called only once on all scene objects, before all Start functions, when the script instance is loaded

Useful properties with wide usage can also be mentioned:

1. enabled – when a certain object is marked as active it can be refreshed through the use of an Update function
2. gameObject – it refers to the object to which the component is attached to
3. tag – it refers to the tag associated to the object (it can be added to more objects at the same time, as a category descriptor) and it can be used to compare objects
4. transform – offers access to the position, rotation, and scale of the object and to their manipulation
5. name – it represents the name of a certain object, used for calling it in different scenarios

Important methods also widely used are:

1. GetComponent(Type objectType)
2. SendMessage(string methodName, object value)
3. Destroy(Object object) – it destroys the object

4. DontDestroyOnLoad(Object object) – the object will not be destroyed at the loading of a new scene
5. Find(string name) – it will identify the respective object [2][8].

3. Unity Tools and Technologies

The C# programming language is a general-purpose language, in the category of "strong typing" programing languages, component and object oriented. It was developed in 2000 by Microsoft as part of the .NET project and allows programmers to develop applications that run on top of this system. With the help of C# used within Unity one can define new component, can extend existing components, can define player interactions as well as enemy behavior, can model moving objects or it can actually model the entire game [2][6][7].

Main C# characteristics are:

*   Garbage collection – a mechanism that automatically frees the memory occupied by unused objects
*   Exceptions management – offers an organized environment for detection of errors
*   Focuses on versioning for ensuring computability of different programs during development phases
*   Through a Microsoft backed project, called Mono, C# became quite versatile from the point of view of portability. Mono represents an open-source development platform based on .NET, the ECMA standards for C# and the common infrastructure language CLI (Command Line Interface). This fact makes possible the porting of applications on different other platforms, such as Linux-based ones, macOS, Sony PlayStation or Xbox consoles.

Encapsulation, known also as the concept of "data hiding", is defined by the grouping of the code together with the data it manipulates, thus restricting the access to these data from outside the class. Among the advantaged of the encapsulation method, we mention hiding the class implementation (code) from external users, flexibility and modularization possibilities.
C# code is reusable and easily editable. The inheritance concept, within the object-oriented paradigm, permits the defining of derivative classes from a master class or overloading of its functions. Polymorphism represents the third basic concept of object-oriented programming, and it is defined as the overloading of the master class methods in order to purposely manipulate objects from the derivative class [2][8].

Scripting and its role

Scripts are a key ingredient in implementing any Unity application. A script is built from a list of commands that are executed by a certain program. Those commands are used to

automatize processes. In Unity, C# or JavaScript scripts are attached to scene objects in order to determine their behavior. For adding a script to an object component, one has to use the Add Component button from the inspector section. The Unity engine uses for any implemented script a system of event methods which are predefined (they exist even if not specifically declared inside the script class). Unity permits developers to create their own components by using scripts to trigger game events but also to modify game components' properties [6][8].

A unity script is created and implemented as shown within Figure 2.
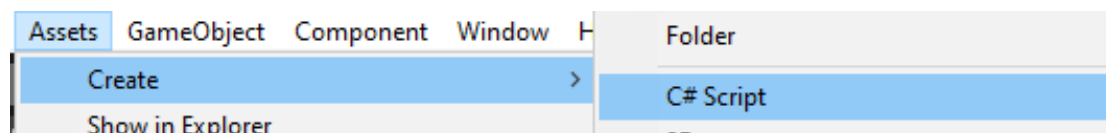
Figure 2. Creation of C# script in Unity

The script is created inside the folder selected from the Project panel. By default, Unity will use Visual Studio for script editing, but one can select any other editor from the Preferences -> External Tools section (see Figure 3).
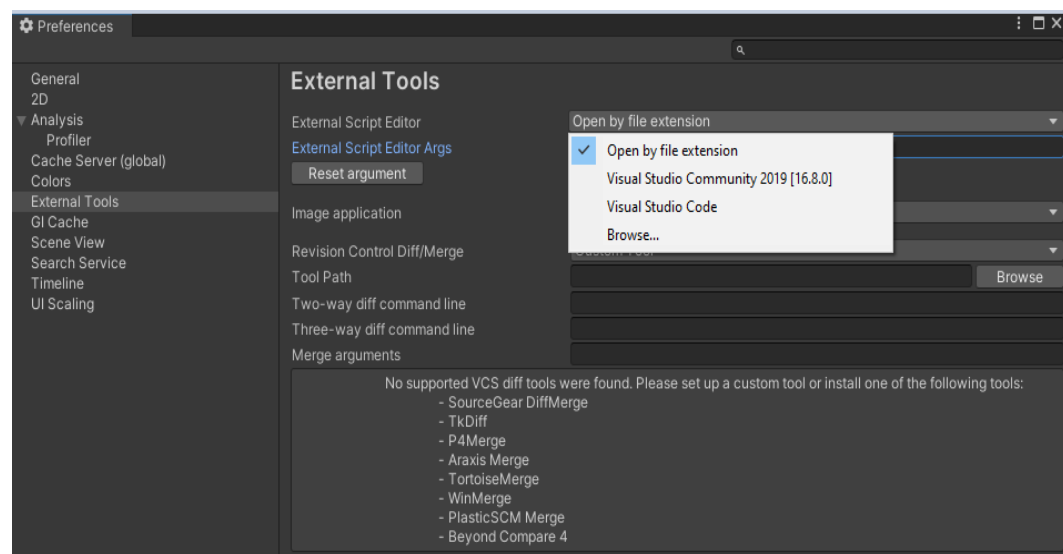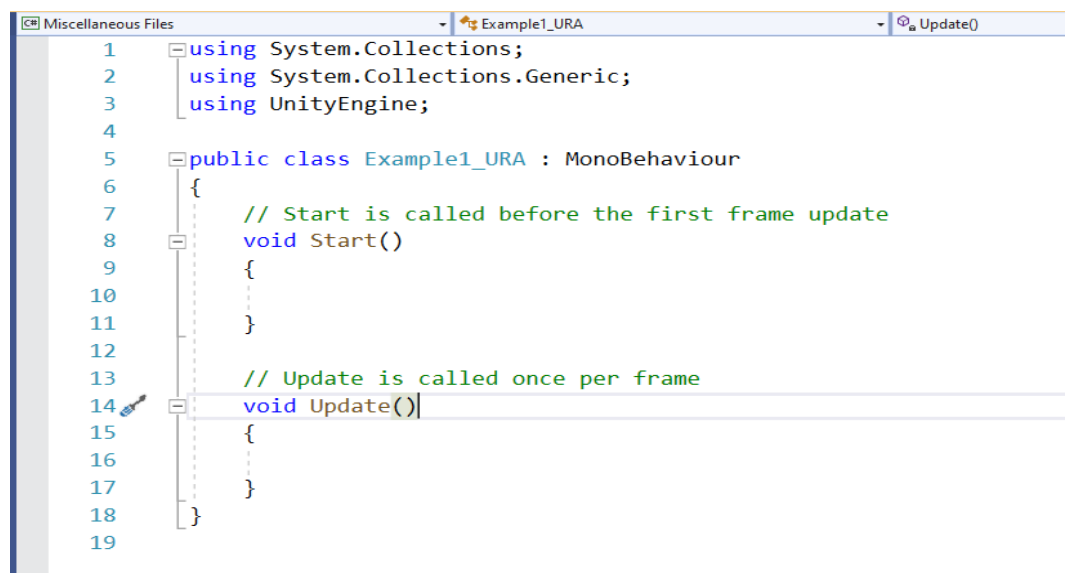
Figure 3. Setting the editor for script creation/editing

The initial content of the script file looks like Figure 4. The script makes the link with the internal Unity engine by implementing a class that derives from the encapsulated Unity native class MonoBehaviour.
If one attaches a script component to a game object, this creates a new instance of the project defined object. The name of the class is taken from the name given when creating the script

file. The name of the class and the name of the file must be the same in order to allow the attachment of the script component to the game object [2] – in our example the name used is "Example1-URA", as seen inside Figure 4.

The Update() function is the place that hosts the code which will take care of the frame update for the game object. This process includes the movement, triggering of actions and answers to user input. It is also very useful to be able to configure variables, read preferences and create connections with other game objects before any action actually takes place inside the game. The Start() function is used to cover all initializations and will be call by Unity before the first call of the Update() function.

```csharp
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class Example1_URA : MonoBehaviour
{
    // Start is called before the first frame update
    void Start()
    {

    }

    // Update is called once per frame
    void Update()
    {

    }
}
```

Figure 4. Default content of a Unity script

Inside Unity, initializing of an object is not done by using a constructor function, because the instantiation of the objects is managed by the editor and does not take place at the beginning of the game only. One can attach a script by dragging the script inside a game object, from the hierarchical panel or inside the selected game object inspector. The predefined element acts as a template based on which we can create new instances of that predefined element. A scene is an interactive "window" from Unity to the current game being developed. This contains the hierarchy of the inserted objects, the camera, the lights, the canvas, prefabs etc. Immediately after a scene is created it must be added to the scenes array, accessible from the File -> Build Settings tabs (see Figure 5).
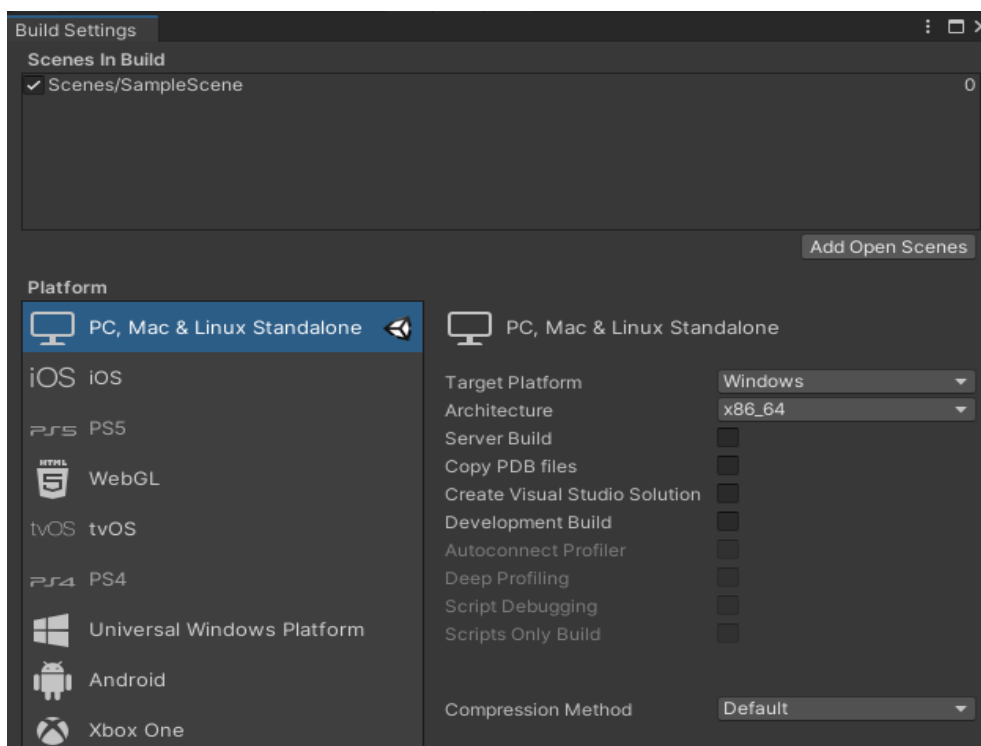
Figure 5. Build Settings tab

The order of the scenes is very important because the passing from one to another can be done only from top to bottom. The prefab is a template type object which permits the storage of an object with all its elements, to be later reused anytime one needs. The prefab can be used as a game object inside scripts, is saved with all its settings, components and added scripts. Saving a prefab requires overwriting as long as it is not directly accessed from the prefab editor interface [10].

The Prefab system in Unity allows for creation, configuring, storing of a game object [2][4] with all its components. If one intends to reuse a game object configured, for example, as a character or a landscape – in different locations within the same scene or in several distinct scenes of the project, it must be converted to a prefab. This is a recommended course of action, and not just the copy/paste procedure for a game object, because the Prefab system allow for automatic keeping of all copies synchronized. In order to create complex hierarchies of objects it is useful to imbricate prefabs into other "container" prefabs, because there is the possibility to overwrite the settings for individual prefab instances. The use of Prefab system is also useful when one needs to instantiate game objects. In order to instantiate a prefab during execution time, the code of the script must contain a reference to that respective prefab. One can create this reference by creating a public variable inside the code for storing the Prefab reference. The public variable from within the code is shown as an attributed field inside the Inspector. Later, we can assign the real prefab that we want to use, inside the Inspector.

Lights and lightning inside Unity game engine

The Unity game developers can create a very realistic lightning that matches very well to a vast array of art styles. In Unity lightning is implemented by approximating the way real light behaves in the real world, because Unity uses very details models about lightning processes for an as realistic result as possible, or simplified models for a more stylized result. The lightning created inside Unity can be direct or indirect and for more realistic lightning results, one must simulate both direct and indirect light sources. The direct light is the light that is emitted, hits a surface and it then reflected directly into a sensor (e.g., a camera). Indirect lightning represents the light that hits different surfaces more times or the sky lightning [2]. Unity can calculate direct illumination, indirect illumination or both direct/indirect illumination and the techniques used by Unity depend on the mode the game creator configures the Unity project settings. Instruments for illuminating the scene use quite easy to configure parameters, as observable from Figure 6.

Figure 6. Panel for setting lightning parameters

The main properties used for defining lightning in Unity are also shown in Figure 7.
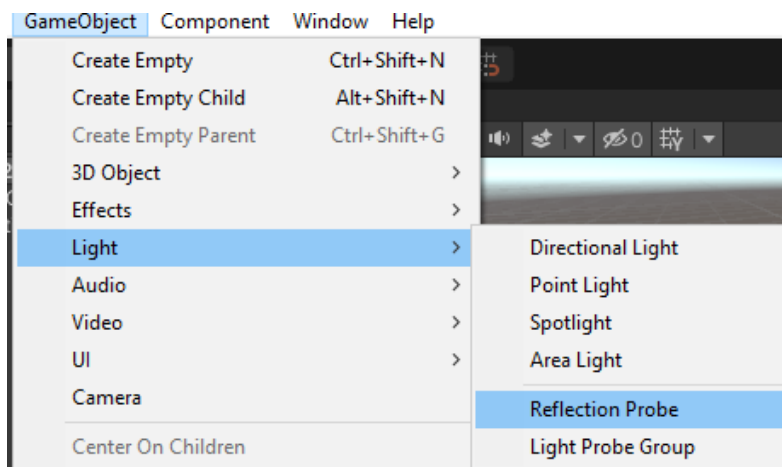
Figure 7. Light types in Unity

Identifying main characteristics for different types of lightning

- Point lights

A point light is localized in space in a certain, individual/single point. This type of light sends the light towards all directions (in a spherical shape) in equal parts, as shown in Figure 8. This correlation is known as the "law of the inverse of the square" and it is similar to the way real light behaves in real world. The point lines are useful for simulating lamps and other local light sources within a scene and can be used to create sparks or explosions for convincingly illuminate the surroundings inside a game environment [2].
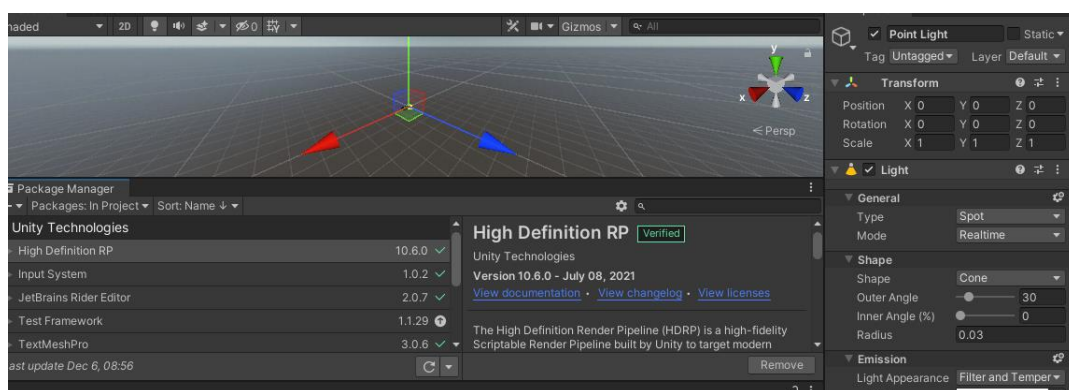
Figure 8. Point Light in Unity

- **Spotlight**

A spotlight has a specified location and a set interval after which the light goes off. Nevertheless, the spotlight is limited to an angle, which creates a cone-shaped illumination region. The center of the cone indicates the forward direction (Z) of the lightning object. The light diminishes, also, towards the margins of the light cone. The spotlights are used for artificial light sources, such as lanterns, headlights etc [2]. The settings for the spotlight illumination are shown in Figure 9.
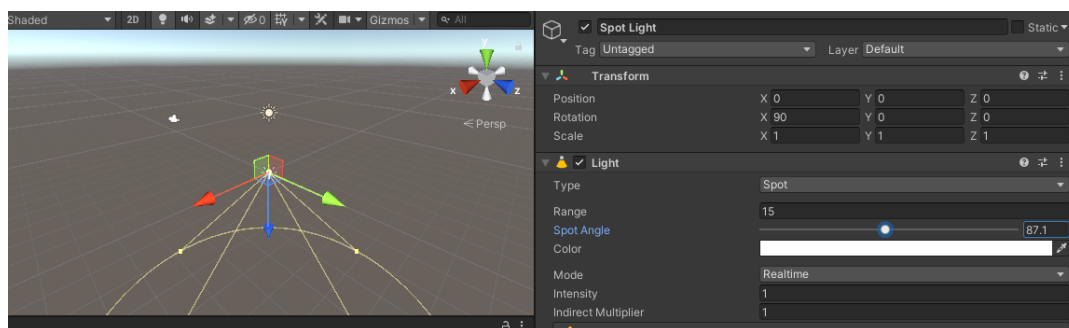
Figure 9. Spotlight in Unity

- **Directional lights**

Directional lights are used to create effects, like the sun light, and can pe deployed as far-away light sources, which exist somewhere at an infinite distance from the objects. All objects inside the scene are illuminated like in a scenario where the light always comes from the same and one direction. The distance between the light and the object being enlightened is not specifically defined, thus the light intensity remains unchanged all the time. Directional lights represent big, far-away, sources of light that come from somewhere "outside" of the world envisioned inside the game-development project. Inside realistic scenes, this approach would be used in order to simulate the sun's or the moon's light, while in abstract games this type of lights would allow shades addition without specifying an exact source of lighting [2].

By default, each new Unity scene contains a directional light. Rotation of the default directional light (the "sun") triggers the "skybox" update. When the light would be inclined laterally, but still parallel to the ground-line, the sunset-like effects can be obtained. Moreover, directing the light towards up makes the sky dark, as if the scene time would be night. With the light inclined down, the sky inside the game-development project will resemble normal/real daylight conditions. In case the skybox element is selected by the developer as Ambiental source, the Ambient Light will be changed in correlation with its colors (see Figure 10).
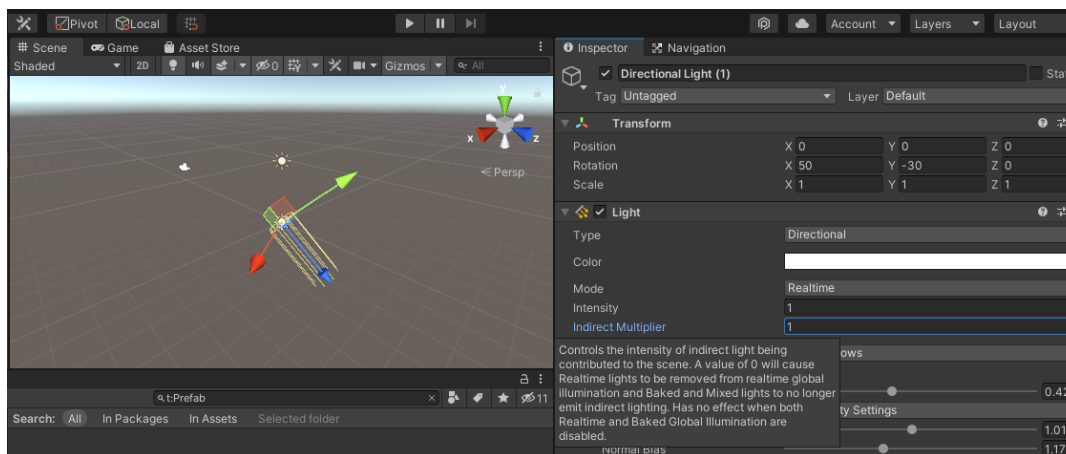

Figure 10. Directional lights in Unity

- **Zonal lightning**

An area-light is in fact defined by a rectangle-shape in space. In this case, the light which would be emitted is spread towards all directions, in a uniform manner on the surfaces, but only from one side of the rectangle. There is no manual control for the range of a lighting area, even if the light intensity will diminish according to the inverse square rule, as it

moves away from the source. The setting of an area light parameters can be seen in Figure 11.
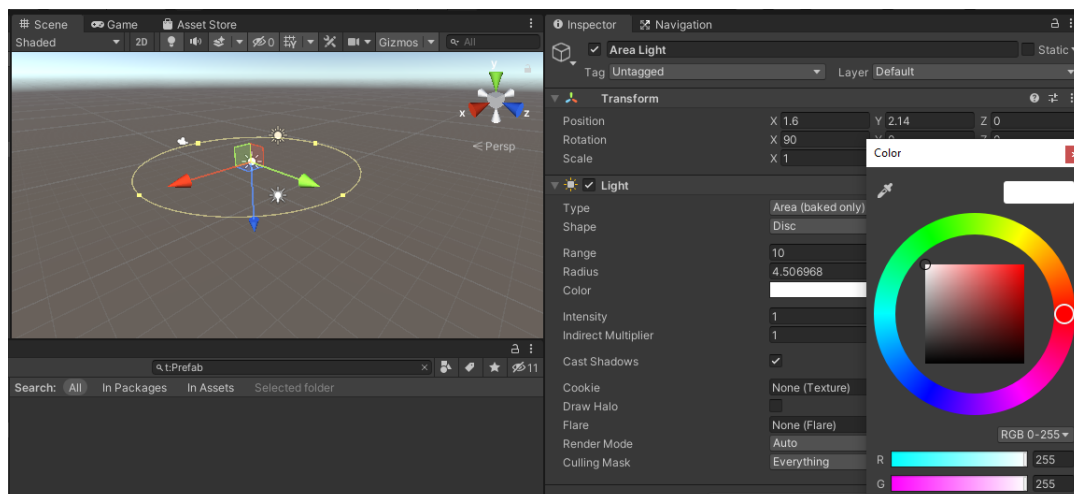

Figure 11. Area Light in Unity

4. Users' attitude to the Unity game engine

Because the evolution of computer/electronic games is a very fast paced one, we were interested in identifying the users' interest, especially within the current pandemic context, towards the game development technologies. By analyzing Figure 12, we can see a comparison of some of the most widely used technologies in this field: Unity, Blender and Maya, from the point of view of the Google engine searches of these elements in Romania. The Unity technology, probably due to its flexibility and intuitive approach, ranks first.
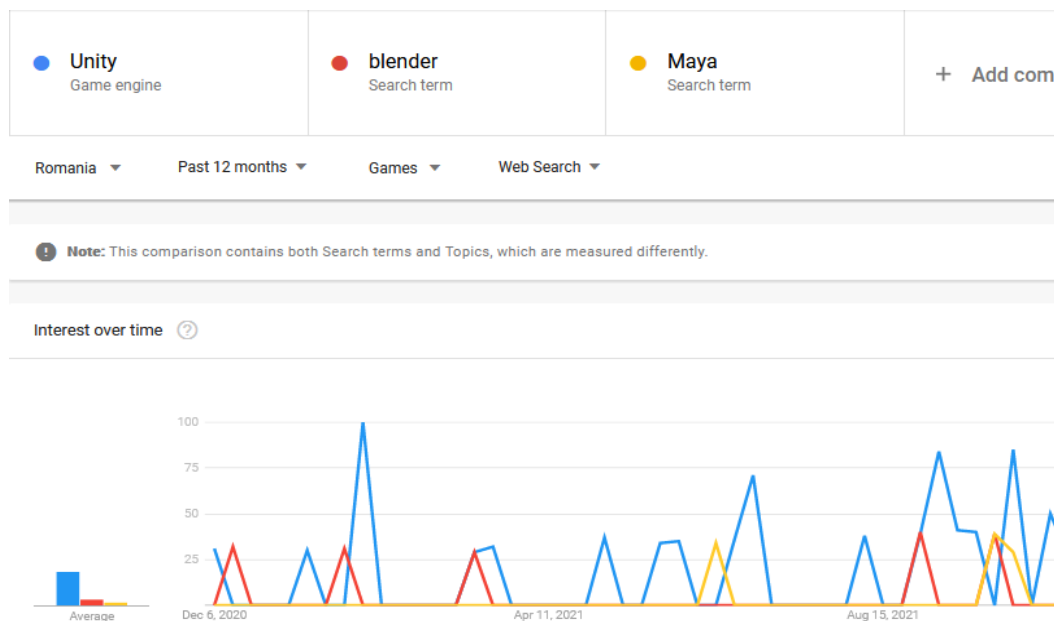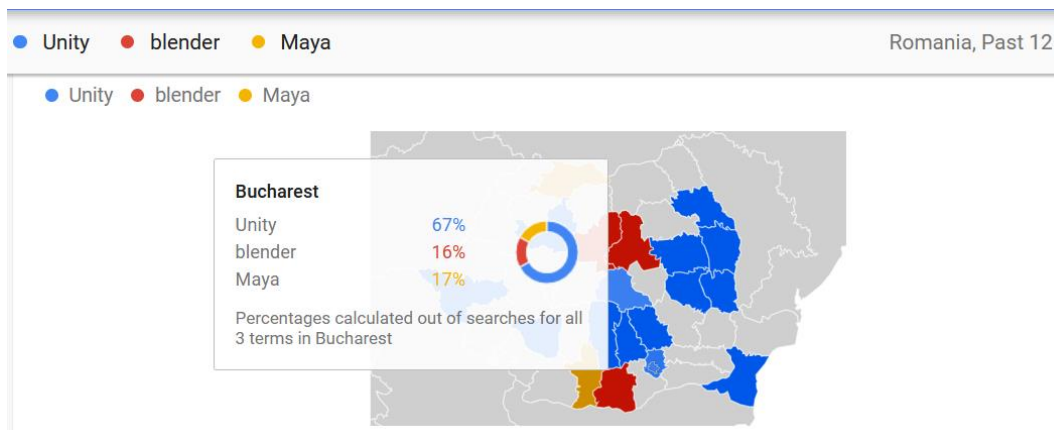
Figure 12. Evolution of Unity, Blender, Maya game development technologies searches according to Google Trends (for Romania)

Inside Figure 13 we can observe the worldwide users' interest towards Unity technology, in comparison with the other two technologies chosen, and the place of Romanian users on this search statistics. Again, Unity is way over the other two technologies, in several points even overpassing the sum of both other variants put together.
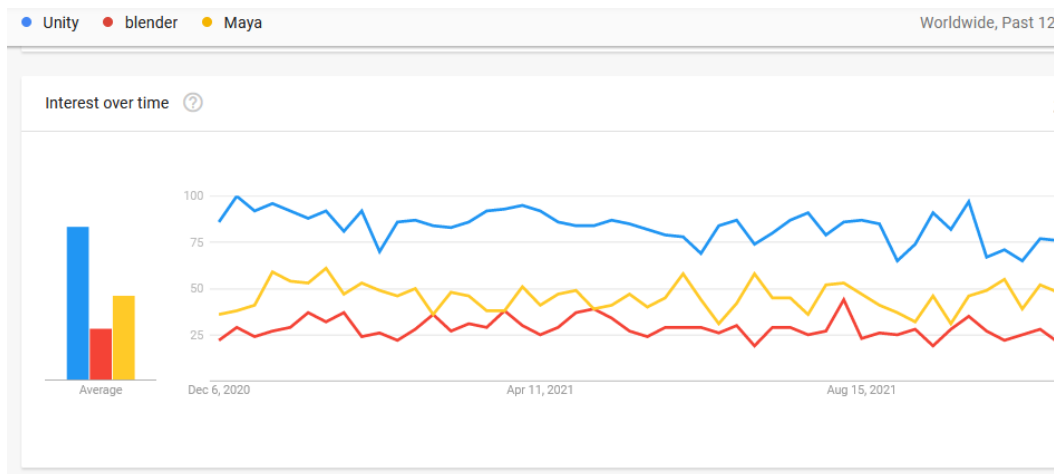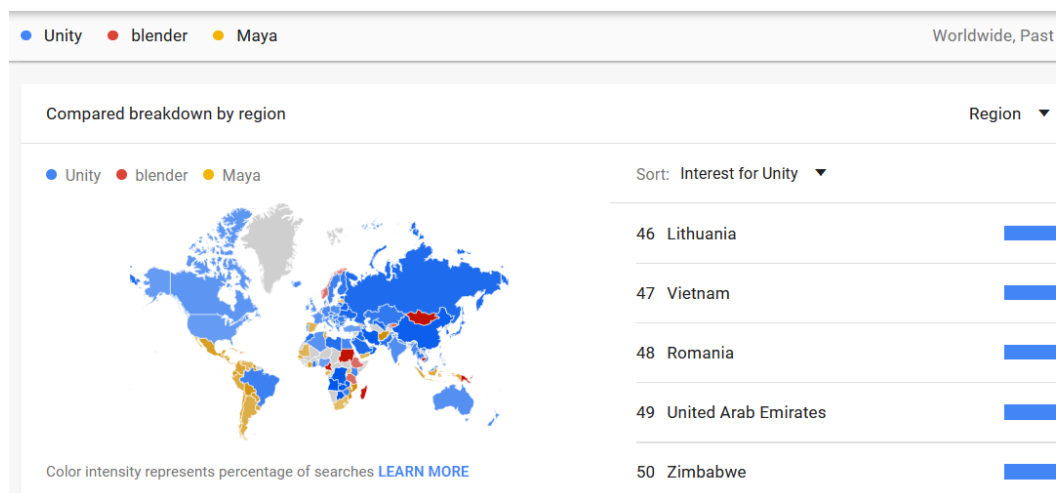
Figure 13. Last 12 months comparison for the Google searches on the Unity, Blender and Maya game development technologies

Considering the Unity Technologies Report of 2021[124], if we consider the entire niche of applications developed for mobile devices, the Unity engine usage amounts to a staggering 61% of the market. The second most widely used solution, based on native/custom engines is only rated at 15%, and the third option is represented by GameMaker Studio / Unreal / AppGameKit all with a share of 5% (see Figure 14).
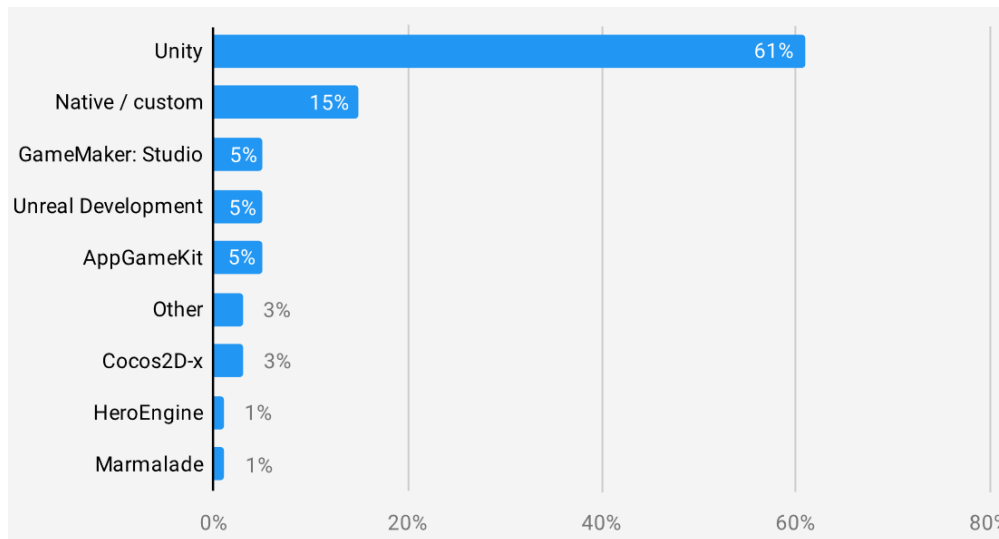

Figure 14. Unity engine market share for mobile devices applications, as of 2021 Gaming Report from Unity Technologies

Going a little bit more in depth with the analysis of the Unity game engine technology usage today, based on the AppBrain[125] public statistics, we can certainly argue that Unity

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[124] https://create.unity3d.com/2021-game-report
[125] https://www.appbrain.com/

is by far the most widely used solution for game development also for the Android apps niche, available through the Google Play store. As we can see in Figure 15, the Unity-based games from the Google Store cover almost 12% of the total number of listed applications in this category. Moreover, the total number if installs is even bigger, amounting to 16.16%.

As a further argument for the prominence of this game development technology, Unity has a market share of over one third of the most important apps in Google Store (top 500, as listed on December 9, 2021).
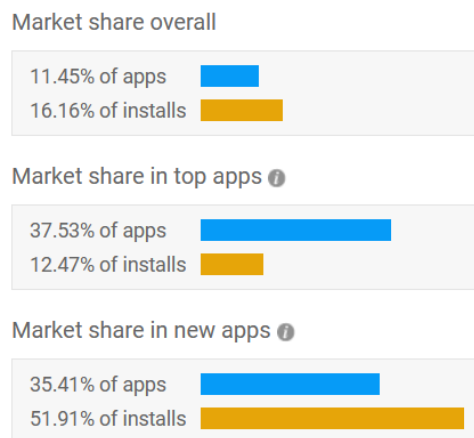

Figure 15. Market share statistics for Unity games in Google Play store[126]

Supporting the previous statements regarding the increased interest in Unity during the current pandemic context, the statistics show a strong Unity-based batch of new applications coming to the Google Play store constantly. No less than 35.41% of the new applications published during the last 30 days[127] inside the Google Play store were built upon the Unity game engine.

Next, seeing the game platform development from the business point of view – for its users – we have researched the different monetization solutions available to the developers. Within this category of applications there are two main concepts used for monetization purposes: ads and in-app purchases. In Figure 16 we have the picture of the current advertising providers for the mobile applications. Even though the first place is unsurprisingly held by Google and the third place in the medalists' top is also not a surprise with Facebook, the second-place contender is again Unity. The ease of use and seamless integration into the Unity engine, together with the ever-increasing diversity of available advertisements and the new tools and features of the latest Unity engine iterations made it possible for Unity to compete on par with the two greatest companies in the field at this moment.

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[126] https://www.appbrain.com/stats/libraries/details/unity/unity-3d
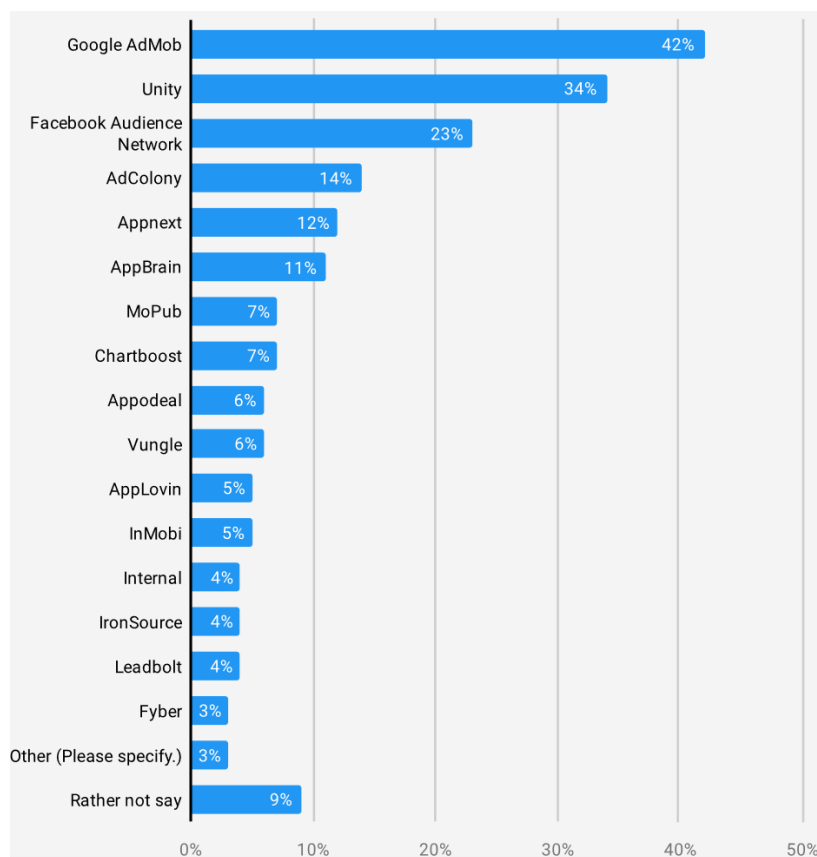
[127] as of December 9, 2021

Figure 16. Advertisements providers for mobile applications in 2020,
as of 2021 Gaming Report from Unity Technologies

The second solution for monetizing one Unity developed application is through the use on in-app purchases. For this path, Unity offers the possibility of the developers implementing in-app purchases on their own. Nevertheless, all professionals are almost unanimously in accord that this solution would be the best way. Inside the Unity engine environment there are several established plugins, widely used and trusted, that can take care of most technical aspects of the implementation of such a system. These plugins offer all the same basic features, the difference being usually made on five key aspects:

- only including an in-app purchases library or including an entire framework that supports creation of an fully fledged in-game economic system
- platform availability, some plugins being cross-platform while others are targeting only a certain platform
- support, as some plugins have only limited support (at least for the free/entry level versions) while others offer producer's support and/or community support
- market-share, as some plugins are more popular than others
- pricing, as everybody is in the end interested in the best ROI possible for their acquisition of a certain software element to increase future income; some plugins are free, some have free and paid versions, and some are only available as commercial versions.

Among the best plugins available for in-app purchases monetization within Unity we can mention:

- Prime31[128] – a long-time established plugin, very popular, with different versions for Android and MacOS, offering an in-app purchases library
- Unibill[129] – a popular in-app purchases library with cross-platform capability, available to handle simultaneously Apple's App Store, Google Play, Amazon, Samsung, and Windows Store
- IronSource[130] – a cross-platform plugin with extended capabilities as both in-app purchases library and fully fledged SDK for building an entire in-game economy system.

5. Conclusions

Unity offers its users the possibility to create 2D and 3D games, based on a game engine that contains a basic API for scripts written in C#. Unity provides support for bump mapping, reflection mapping, parallax mapping, spatial occlusion on the screen, dynamic shadows using shadow maps but also full-screen post-processing effects. The game developers can become editors within the assets shop and can even sell their creation thorough it. Unity Assets Store can be visited from the Unity website as well as directly from the Unity Game Engine. Today, especially within the pandemic context which overwhelmed the entire world with online/electronic content, there is a clear trend towards using and developing game engine platforms. This fact is supported also by the search terms analysis from the Google search engine for Romania. By comparing the evolution of searches regarding Unity, Blender and Maya game development technologies, as reported by the Google Trends tool, and presented in Figures 12 and 13, we can discern a seasonal trend for Romanian users. This fact is due to the influence of the periods of time during which educational activities are more active.

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Importance of cyber security awareness and e-learning motivation for cyber security in reshaping the education

Milos Tisma[131]
Jasmina Andric[132]

Abstract

Everyday use of information and communication technologies by the global society that was accelerated by the virus COVID-19 pandemic has led to a drastic increase in the number of cyber-attacks, frauds and other security threats in cyberspace. Society as a whole has faced lack of cyber security professionals, low knowledge of threats in the cyber spaces and depths of the web with no existence of effective way of gathering cyber security intelligence and informing and warning the public on the threats.

This paper will present the possibilities of boosting information security and cyber security awareness in the education and e-learning that will motivate future cyber security professionals to take their career path. We will also preview how we can use information on cyber-attacks and with machine learning models for security analytics that will contribute to better understanding of threats and threat intelligence. The aim of this paper is to show the possibilities of cyber security education and importance of awareness on the security threats in the process of reshaping the education. Paper should provide an overview of current state in cyber security area and technologies in this area as well as a proposal for the possible development of cyber security educational strategies based on machine learning and security analytics models.

Keywords: Security, cyber security, information security, security analytics, threat intelligence, e-learning, machine learning

1.Introduction

Everyday use of information and communication technologies by the global society that was accelerated by the virus COVID-19 pandemic has led to a drastic increase in the number of cyber-attacks, frauds and other security threats in cyberspace. There are problems that the global community is facing and some of them are:

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- Society as a whole has faced lack of cyber security professionals,
- low knowledge of threats in the cyber spaces and depths of the web,
- no existence of effective way of gathering cyber security intelligence and informing and warning the public on the threats,
- there is a large use of multiple terms related to security in I(C)T that can bring confusion to public as well to the potential candidates that would take career path in these areas.

There is average of 40 000 000 cyber-attacks daily and 82% of employers report a lack of cybersecurity skills, 61% of companies feel that their cybersecurity candidates are not qualified, 66% of cybersecurity professionals struggle to define their career paths, 60% of cybersecurity professionals are dissatisfied with their current job. These data were presented by ISSA17, which conducted this research. In addition, the unemployment rate in cyber security is estimated to be 0% and is projected to remain there until end of 2021 when it is projected that there will be 3.5 million vacancies in cyber security globally [1].

As solution of this problems, we the possibilities of cyber security education and importance of awareness on the security threats in the process of reshaping the education. We will give and brief overview of current state in cyber security area and technologies in this area as well as a proposal for the possible development of cyber security educational strategies based on machine learning and security analytics models.

2. Definition of basic terms

As we need to view current state in the area of cyber security, we need to define some of the basic terms as it follows:

The example of definition that we use for cyber security is IT security that emphasizes on providing computer networks, data, programs, and computers from unauthorized or unwanted variation, loss, changes, or access [2]. The elements that are binding to cyber security are protection, provision of unauthorized entry, loss of assets, changing content, illegal activities, information systems, technology, hardware (machines, computers, media ...) and other systems that depend on information, data and software. What we recognize in these definitions is that the accent of cyber security is placed on cyber space and systems dependent on information, while events and actors in the real world are in another plan.

Information security also has a wide range of understanding, so many theorists start from CIA (confidentiality, integrity, availability) and AA (appropriate access) definition -CIA: some information I am sure if, only if all parts of me keep the confidentiality, integrity properties availability. AA: The facility is safe for the role holder H if and only if: for each agent A and each part of P of O and has only an appropriate approach to preltive H. [3]. Unlike cyber security, the security of information refers to information in any form, treating them as assets, with three pillars related to confidentiality, integrity and availability. So that information is engaged in real world and cyberspace, with an emphasis that they are only

available to those who are intended, which is also the main task of information security, to protect information from its creation to its destruction or if become obsolete.

I(C)T security- Security of information and communication technologies are most binding to the safety of critical infrastructures of countries and includes the intersection of information and cyber security. Its definitions are all those used in information security definitions and cyber security with the addition of critical part of the area they protect. For example The Law on Information Security of the Republic of Serbia has been adopted to protect state against security risks in information and communication systems, and under them implies (1) electronic communication networks in terms of law regulating electronic communications; (2) Devices or groups of interconnected devices, such as in the device, ie within at least one from the device group, automatic data processing using a computer program; (3) data that is kept, stored, processed, searching, or transmitted funds from the under case. (1) and (2) of these points, and for the purpose of their work, use, protection or maintenance; (4) organizational structure through the ICT system; (5) all types of systemic and application software and software development tools; [4] We see that ICT security protects the state and its citizens.

Threat Intelligence- Cyber threat hunting is the activity of cyber security and active defenses. It is a "process of proactive and iTerative search through networks to detect and isolate advanced threats that avoid existing security solutions"[5]. This is unlike traditional threat management measures, such as fivers, intrusion detection systems, sandy software and Siem systems, which usually include evidence-based data on the potential danger. Intelligence work on threats[6] plays an incredibly important role as a component of cyber security. It provides vital information for use in security analytics, then this information can help identify and determine the priorities of suspicious activity. It also helps security administrators in quality intelligence by providing insight into the history of certain IP addresses, domain names, etc. The same information can be invaluable to respond to the threat management component. Security administrators can use intelligence on threats to learn more about nature and the threat they are investigating. Organizations are increasingly using intelligence on threats from a third party to improve their ability to manage threats as well as other aspects of their security. For example, one of the most common use of performance intelligence sources is improving the accuracy of discovering and determining the priorities of Siem technology. Whether information on threats come into an organization through Siem or other route, it is important that it is connected by automated means with an organizational safety intelligence and analytical platform. Connecting allows you to fully integrate with other related to threats of information that organizations provide better insight into the nature of suspicious activities that include their systems and networks.

Intelligence - The term Intelligence means the entire process of intelligence activity, intelligence, counter-intelligence activities and secret actions, subversive effects. It concludes that in modern intelligence theory, the understanding of the notion of intelligence unites everything that in some other countries calls the forms of intelligence services, i.e. special activities of intelligence services [7]. Intelligence services and their work in the literature would be a "organized activity or organization, at the request and intentional political forces, assesses the leading classes of class or state, protects their own interests from opponents and engages On other activities that contribute to the realization of certain

political goals "[8]. As we see intelligence or intelligence, which under the guidance of management-management, attracts, analyzes and interprets the information on the other party's intentions (enemy, competitor, etc.) to prepare the rest of the system to react, increase resilience Resilience), save the answer and protect your interests on time and thus prevented an attack or some other type of malicious activity, plotting the normal functioning and development of the system.

Data Science - Data Science is defined as use of scientific methods to obtain useful information from data, especially large amounts of data set (data set is aggregated data from a particular database that can be used for various purposes, and we will use it for research purposes.)

By defining what is what and how to use state of the art tools is crucial in rising capacities of human resources with non-formal education and e-learning. It will also help in motivating students or junior cyber security officers to take the career path if they better understand the importance of their work. Work in the scientific field is also needed and defining basic terms globally will contribute to development of science. A lot of experience is needed for one to become a cyber security expert and one of the key elements is constant education and learning, of which e-learning is one of the main points where this can be done, especially in the crisis times (Covid, disasters etc.)

3. Cyber security awareness, human resources and education

As we have already mentioned, in a large number of researches, people are marked as the weakest actors of the systems that defends (cyber security) and are used by systems that attack (hackers, states etc.), while in addition the professional staff in cyber security is in absolute deficiency. Demand for cyber security professionals continues to grow together with the attack number (official statistics more companies say that cyber-attack occurs every 39 seconds or 2244 times a day) and by increasing the actor's budget. The imbalance of the number of qualified workers in cyber security degrades the lack of framework and social security skills. Anyone who wants to hire cyber security professionals is in a problem because their deficit has already given results through the numbers of successful attacks during Covid-19 pandemics. To make a new professional, the strategy and will of all actors for the training of people for cyber security with educational, research and military institutions and professional associations are launched by the sharing practices, training and knowledge transfers to find new talents. A good step and example of this is the launch of a project by several universities in Serbia called, Information Security Services Education in Serbia – ISSES, which with support of the EU needs to develop a Curriculum for Master Studies that needs to deal with cyber-security [9]. Under this program there were competitions, hackathons, e-learning and other activities that were on-line and that engaged students and participants.

It is assumed that about 500,000 data protection officers were employed only in the EU since the implementation of GDPR. For example, this is an excellent opportunity that Serbia is currently using to build a new generation of specialist in cyber security. There are master

programs developed specifically for the industry needs, that were initiated by the government of Serbia and started the project Master 4.0[10]. This programs also showed how people are easily engaged with e-learning and can boost their knowledge, and many people used this opportunity due to COVID-19 pandemic and restrictions imposed for health reasons.

Research Centre for Defence and Security [11] also had experience with raising awareness on cyber and information security through trainings and practice that was organized on faculties. Students tended to be very active and engaging in practical workshops and using tools over distance learning platforms.

One of the key elements in developing good education and curricula is hands on materials and practical tools, code, practice, competitions, and simulations. With ENISA and other international bodies that work on cyber security it is crucial to invest in educational strategies connected to cyber security that are reshaped by today's needs.

4. Data gathering and machine learning in cyber security

Threat hunting, unlike traditional threat management measures, such as fivers, intrusion detection systems, sandy software and Siem systems, which usually include evidence-based data on the potential danger. Intelligence work on threats [12] plays an incredibly important role as a component of cyber security. It provides vital information for use in security analytics, then this information can help identify and determine the priorities of suspicious activity. It also helps security administrators in quality intelligence by providing insight into the history of certain IP addresses, domain names, etc. The same information can be invaluable to respond to the threat management component. Security administrators can use intelligence on threats to learn more about nature and the threat they are investigating. Organizations are increasingly using intelligence on threats from a third party to improve their ability to manage threats as well as other aspects of their security. For example, one of the most common use of performance intelligence sources is improving the accuracy of discovering and determining the priorities of Siem technology. Whether information on threats come into an organization through Siem or other route, it is important that it is connected by automated means with an organizational safety intelligence and analytical platform. Connecting allows you to fully integrate with other related to threats of information that organizations provide better insight into the nature of suspicious activities that include their systems and networks. For example, gathering the information from open sources, intelligence services, networks, media and other sources and gathering data for data sets for testing machine learning models. Intelligence can be gathered on multiple levels (national, international, local, CERT) for reports and gathering code data for developing recommendation systems. Although very vulnerable, cyber security experts point out the need for opening of data sources for the simple fact that machine learning models can be used for better understanding of cyber threat landscape, and also help in the intelligence work. Knowledge of data science and machine learning can raise the capacities of cyber and information security experts, given them an opportunity to have early warning

systems, to gather information on cyber threats, to learn machines in recognizing most of the malicious software and social engineering attacks or to develop code.

We will examine simple experiment with basic NSL KDD [13] data set example. We will use Anaconda platform and Jupiter Notebook to write Python code and examine data.

We first use the instructions from the data set and after basic data processing using plotting and other methods, we got results of identified threats that are shown on picture 1. and that are usage of Neptune, Satan, Nmap, buffer overflow etc.
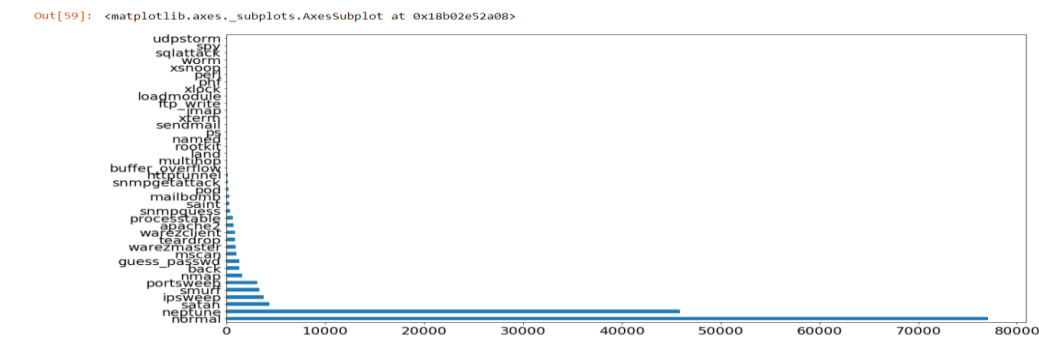

Figure 1 Most common threats in NSL KDD

Figure 2 Categories

After this step, a preprocessing was performed, and then we examined correlations among attributes and removed the weakest correlations. After that, selecting an attribute that has four categories (Figure 2) using the Dummy coding (entered these four categories through the labeling turn into numbers 1 to 4, with the following values

```
R2L_df=newdf[~newdf['label'].isin(to_drop_R2L)];
U2R_df=newdf[~newdf['label'].isin(to_drop_U2R)];

#test
DoS_df_test=newdf_test[~newdf_test['label'].isin(to_drop_DoS)];
Probe_df_test=newdf_test[~newdf_test['label'].isin(to_drop_Probe)];
R2L_df_test=newdf_test[~newdf_test['label'].isin(to_drop_R2L)];
U2R_df_test=newdf_test[~newdf_test['label'].isin(to_drop_U2R)];
print('Train:')
print('Dimensions of DoS:' ,DoS_df.shape)
print('Dimensions of Probe:' ,Probe_df.shape)
print('Dimensions of R2L:' ,R2L_df.shape)
print('Dimensions of U2R:' ,U2R_df.shape)
print('Test:')
print('Dimensions of DoS:' ,DoS_df_test.shape)
print('Dimensions of Probe:' ,Probe_df_test.shape)
print('Dimensions of R2L:' ,R2L_df_test.shape)
print('Dimensions of U2R:' ,U2R_df_test.shape)

Train:
Dimensions of DoS: (113270, 123)
Dimensions of Probe: (78999, 123)
Dimensions of R2L: (68338, 123)
Dimensions of U2R: (67395, 123)
Test:
Dimensions of DoS: (17171, 123)
Dimensions of Probe: (12132, 123)
Dimensions of R2L: (12596, 123)
Dimensions of U2R: (9778, 123)
```

Figure 3 Test, train sets

From this, a new set of data was created, which we compose from categorical and numerical data from which we then share on four train and test splits and determine X and Y for each data frame for each attack category. Using SCALER-scaling for the new data frames.

The K-Means algorithm collects data trying to separate samples in N groups of equal variances, minimizing criterion known as inertia or "Within Cluster of Squares". This algorithm requires a number of clusters. It is well measured on a large number of samples and is used in a large number of areas of application in many different fields. The K-Means algorithm divides the NI samples X in K "discs" described through "Mean" samples in the cluster. These are usually called Cluster Centroids. K-Means algorithm aims to choose centroids that reduce the inertia or sum of square criteria within the cluster. Clustered four groups of attacks, and the results for DOS attack are shown.

The clusters on the plate (Figure 4) show, in order to see the "elbow" in the graph. Point of fracture:
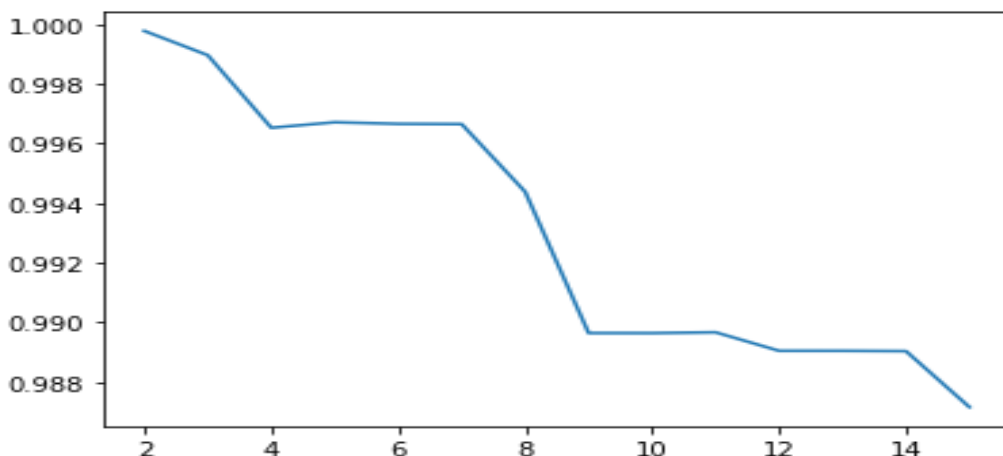

Figure 4 K-means iterations

In this graphic, it is seen that "elbow" is at the 7th cluster, so it can be concluded that the optimal number of clusters 7.

Then the univariate selection of attributes that separates the best attributes for each of the four categories separates.

After this step, we apply the recursive feature elimination technique of attributes to which of four categories of attack we want to extract the best. We got the following information here:

[(1, 'same_srv_rate'), (2, 'count'), (3, 'flag_SF'), (4, 'dst_host_serror_rate'), (5, 'dst_host_same_srv_rate'), (6, 'dst_host_srv_count'), (7, 'dst_host_count'), (8, 'logged_in'), (9, 'serror_rate'), (10, 'dst_host_srv_serror_rate'), (11, 'srv_serror_rate'), (12, 'service_http'), (13, 'flag_S0')]


```
Features selected for DoS: ['logged_in', 'count', 'serror_rate', 'srv_serror_rate', 'same_srv_rate', 'dst_host_count', 'dst_host_srv_coun
t', 'dst_host_same_srv_rate', 'dst_host_serror_rate', 'dst_host_srv_serror_rate', 'service_http', 'flag_S0', 'flag_SF']

Features selected for Probe: ['logged_in', 'rerror_rate', 'srv_rerror_rate', 'dst_host_srv_count', 'dst_host_diff_srv_rate', 'dst_host_sa
me_src_port_rate', 'dst_host_srv_diff_host_rate', 'dst_host_rerror_rate', 'dst_host_srv_rerror_rate', 'Protocol_type_icmp', 'service_eco_
i', 'service_private', 'flag_SF']

Features selected for R2L: ['src_bytes', 'dst_bytes', 'hot', 'num_failed_logins', 'is_guest_login', 'dst_host_srv_count', 'dst_host_same_
src_port_rate', 'dst_host_srv_diff_host_rate', 'service_ftp', 'service_ftp_data', 'service_http', 'service_imap4', 'flag_RSTO']

Features selected for U2R: ['urgent', 'hot', 'root_shell', 'num_file_creations', 'num_shells', 'srv_diff_host_rate', 'dst_host_count', 'd
st_host_srv_count', 'dst_host_same_src_port_rate', 'dst_host_srv_diff_host_rate', 'service_ftp_data', 'service_http', 'service_telnet']
```

Figure 5 Recursive features

Now that we have a separate best attribute, we prepare them to build a model.

By further working on the NSL KDD set, a model that leads to this is to be exerted to recognize these attacks and thus make models for attack recognition models. We will first for each category of attacks from which we single out attributes do a classification using decision tree. Then we will apply the classifier over the data not seen from the test set and then make a mixture of confusion and so for all four types of attacks. Here we get a confusion matrix and we see the sole of the envisaged attacks and real attacks by looking at the true positive, false negative, falsely positive and true negative.

Figure 6 Confusion matrix

From the algorithms of machine learning to which the model will be prepared, decision trees are selected as the most important algorithm and after naive bayes.

The decision tree for each of the four categories of attack we get the following results

ДОС-Accuracy: 0.99732 (+/- 0.00251) Precision: 0.99679 (+/- 0.00464)

Recall: 0.99705 (+/- 0.00356) F-measure: 0.99692 (+/- 0.00288) Проб-Accuracy: 0.99085 (+/- 0.00559) Precision: 0.98674 (+/- 0.01180) Recall: 0.98467 (+/- 0.01027) F-measure: 0.98565 (+/- 0.00872)

Р2Л-Accuracy: 0.97451 (+/- 0.00906) Precision: 0.96683 (+/- 0.01316)

Recall: 0.96069 (+/- 0.01547) F-measure: 0.96367 (+/- 0.01300)

У2р- Accuracy: 0.99652 (+/- 0.00319) Precision: 0.87747 (+/- 0.15709)

Recall: 0.89183 (+/- 0.17196) F-measure: 0.87497 (+/- 0.11358)

Naive Bayes gave poorer results:

ДОС-Accuracy: 0.9032515636783037, Recall: 0.959167770591444, Precision: 0.88135471860232, F1: 0.918616366282324

Проб- Detection Rate: 0.939235201676270, Recall: 0.9785898855666297, Precision: 0.9701492537313433, F1: 0.898696366282324

This short experiment was prepared so it can show how easily we can prepare and recognize threats if we have intelligence and data, the next step is to use security analytics to better understand given data. Machine learning models can also be used for recommendation of cyber/information security education pathways that could reach potential candidates and it can also be used to learn code or social engineering attacks and prevent breaches/cyber-attacks. Also, little experiments like these can be motivating for the students or participants, as they will get a new interesting view on cyber security.

5. Security analytics

Analytics is a multidimensional discipline that has found its application in a significant number of sciences. Today it is used equally in the social and natural sciences. Thus, for example, due to the constant discovery of new knowledge in the field of physiology, pathophysiology, biochemistry and molecular biology, new analytical methods and techniques are being developed that enable monitoring of physiological and biochemical

changes in patients - biochemical analytics or market analytics that studies the attractiveness and dynamics of a particular market in a particular industry [14].

However, given the global trends of challenges, risks and threats, security analytics as a special type of analytics has become increasingly important. In fact, it may be more correct to state that this significance is more and more recognized and acknowledged today, and that it has always existed. Considering that every state tries to cover up its own, and finds out other people's secret intentions [15], it is not questionable that analytical skills have been important for its survival and development since the creation of the state.

This special type of analytics refers to a narrow circle of state authorities: diplomacy, army, police, intelligence and security services, civil protection in which the analytical service is organized and analytical work. In all these state bodies, analytical processes are determined by their activities, so it is the source of its specificity, which is reflected in the following:

- First, security analytics has its strictly legal, illegal or semi-illegal work.

- Second, security analytics is closely linked to politics and political action.

- Third, security analysts are dealt with by specially trained and trained personnel, selected according to strict criteria and a complex procedure.

- Fourth, the results of the work of security analytics are a secret for the external and internal public, which is often mystified.

- Fifth, security analytics uses a specific set of working methods that are special and characteristic of this type of special analytics. [16]

Due to the frequent overlap of analytical and intelligence work, not much data can be found in the literature on how analytical services function. However, what is noticeable is that the authors singled out the basic phases of security analytics within different classifications. By crossing different classifications, these phases can be roughly defined as follows:

- setting (defining) an analytical task,

- data collection,

- processing of collected data and preparation of reports (answers) to the analytical task,

- dissemination (delivery) of the answer to the analytical task.

Data can be classified in various ways and by various criteria, and it is common to classify them according to the criteria of the subject, role, function, usability, truthfulness (reliability), confidentiality and sufficiency. [17] In the data processing phase, those data that are not directly related to the analytical task and which cannot contribute to the solution of the set task are rejected. Although there are different understandings of this phase of

intelligence analytics, it is usually realized through three steps: (1) assessment of source reliability and accuracy, (2) classification and comparison of data and (3) stacking in databases. [18]

Today, analytics is often linked to information technology, where it relies on the application of statistics, computer programming and operational research, which are processed quantitatively. Increasingly, analytical processes take place with the use of certain software, which are suitable when it is necessary to process a large amount of data (so-called Big Data). Large amounts of data can be a problem for many companies that work through the transaction system "online" and as a negative result, large amounts of data are obtained in a very short time interval. [19] Then software takes over the role of analyst and in that context advanced analytics is mentioned.

In addition to advanced safety analytics, the term predictive analytics is also associated. Predictive analytics is a set of advanced tools and techniques used in the analysis of large series of past and present data to predict future events based on identified patterns of behavior. [20] This type of security analytics makes it easier to prevent future events that could jeopardize the security of citizens.

During the analytical processing, the analyst uses all his / her available knowledge and skills as well as the new data he / she came to in the data collection phase in order to reach the analytical conclusions. The choice of the type of conclusions in security analytics is influenced by several properties, among which the two are the most important. First, it is available data on socially deviant phenomena and second, it is the purpose, meaning and goals of security reports. [21]

Using security analytics in processing information from data sets and after data science analysis can give more meaning to data and ability to learn and counter threats. Thus, incorporating security analytics into curricula and e-learning in the areas connected to security can imbue the ability to counter threats.

6. Conclusion

Examining all presented, education is the only way, being formal or non-formal in developing a secure cyber space. Multi sectoral approach is very much needed especially coming from IT and Security sciences. Developing strategies on international (EU, UN etc.) and national levels for development of diversified human resources that can use e-learning to imbue their knowledge daily, but also to give them a scientific basic which they can use for the development of future practitioners and curricula. In the fast passed and everchanging environment pushed by geopolitical earthquakes that shake the multipolar world of today education must become a foundation that will withstand modern security threats, risks and challenges and create new professionals that primary purpose will be to protect the citizens and counter threats lurking in the cyberspace and reality.

Planning of development of cyber security programs has to be an imperative, but also to coordinate and to add security analytics aspect to curricula. As threats are diverse, so it should be education and counter actions. For example, well-educated security analyst with humanities background can be much efficient in countering social engineering attacks and in management of information. For example, if you examine ISO 27000 or other information security standards, you can easily see the security services background in the procedures, controls etc. Sometimes IT professionals can oversee security flaws coming from these areas, but with additional education from humanities, they will develop their abilities and improve resilience of systems they work in.

Motivating current junior, intermediate and senior developers for continuation of their career in cyber security in the state and business environments can contribute in raising the capabilities of personnel. It can be done with benefits, high salaries, but also giving them a perspective trough constant education.

Possibility of individuals with higher education to prequalify to information security, cyber security, not just from computer, information and other hard sciences, but also can come from humanities with basic knowledge of ICT systems (economy, security etc.) can have a good result, as there are such examples in some national programs in Europe.

There is no absolute security and threats are multiplying everyday, especially in cyber and information security. Thus, only multisectoral approach and education can counter them.

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APPLICATION OF MODERN METHODS IN THE ECONOMIC-FINANCIAL ANALYSIS OF ECONOMIC ENTITIES

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Alice Emilia ȚÎNȚA[135]

Abstract

Applications of modern methodologies and the economical – financial methods of analysis used for increasing the performance and competitiveness of economic entities play an increasingly important role in optimizing financial performance of economic entities. Among the most used by such modern methodologies are the ABC method (Activity Based Costing) and the linear regression method. The modern methodologies apply modern methods for optimizing the economic-financial analysis of the economic entities and for obtain relevant results in measuring their performance.

Keywords: methodologies of economic-financial analysis, ABC method, linear regression method, financial performance

1. Introduction

The use of methodologies and methods that would lead to the optimization of the economic-financial analysis of the entity represented one of the most important scientific achievements.

The presentation of modern methodologies joins the ABC method to support the specific analysis from the perspective of allocating costs and the elements that generated them. The linear regression method is used to develop the regression equation by which the turnover dependent variable is explained by the independent variable the average number of employees identifying a significant correlation. The linear regression model is validated by the Sig F Change value that falls within the reference level.

2. Literature review

The purpose of the economic-financial analysis consists in obtaining a maximum profit and achieving an efficient activity, thus ensuring the survival of the entity for a long period of

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time. Achieving these goals required the emergence of modern methodologies and tools for economic and financial analysis. The origin of modern methods usable in economic or financial analysis is found in the U.S.A. with the elaboration of "The Hidden Factory" by Jeffrey G. Miller and Thomas E. Vollman. The two authors subjected to a critical analysis the sectors and places of common costs (indirect), reaching the decision that the next step for controlling these costs is to develop a model that presents in detail and structures the causes of these costs. Those who make a first attempt for such a model, in 1987, are Robert S. Kaplan, Robin Cooper and Thomas H. Johnson. It's the time when in the U.S.A. the Activity Based Costing system appeared and in Germany, after the publication of the book "Calculation of costs by processes" (1989, P. Horvath and R. Mayer) began the development of the method of calculating process costs. While it followed, in different countries, the changes regarding the strategic positions of the enterprises but especially the increasing requests for information from their management, led to the development and application of modern methods to optimize the economic-financial analysis of the entity.

3. Research methodology

The scientific approach focuses on an analysis of company performance model based on the Profit and Loss Account.

The methodology gives validity to the research process, as in the case of this study, the methodology includes both general and specific approaches to the way of generating information through the economic-financial analysis of the entities in the field of constructions. Thus, the methodology aims to address ways to optimize the economic and financial analysis and thus increase the relevance of information resulting from the application of modern methods. The aim was to analyze and present solutions applicable at a practical level and not just theoretically.

The research methods used represent a combination of longitudinal and transversal methods, these being used to lay the foundations of a descriptive research, substantiating at a theoretical and conceptual level aspects of financial analysis by calculating performance indicators based on information supply, ways to capitalize on information and their usefulness in the decision-making process, to then move on to empirical research, studying the performance of economic entities on how useful and helpful is the information provided by the analysis in making decisions that contribute to improving the business.

This research study, related to the objectives, was based on documentation in international and domestic literature, identification and collection of information that may be useful in research, analysis and processing of information collected, interpretation of results. The data at the level of the selected entities were processed applying modern methods in optimizing the economic-financial analysis of the economic entities and the obtained results presented as relevant in measuring their performance.

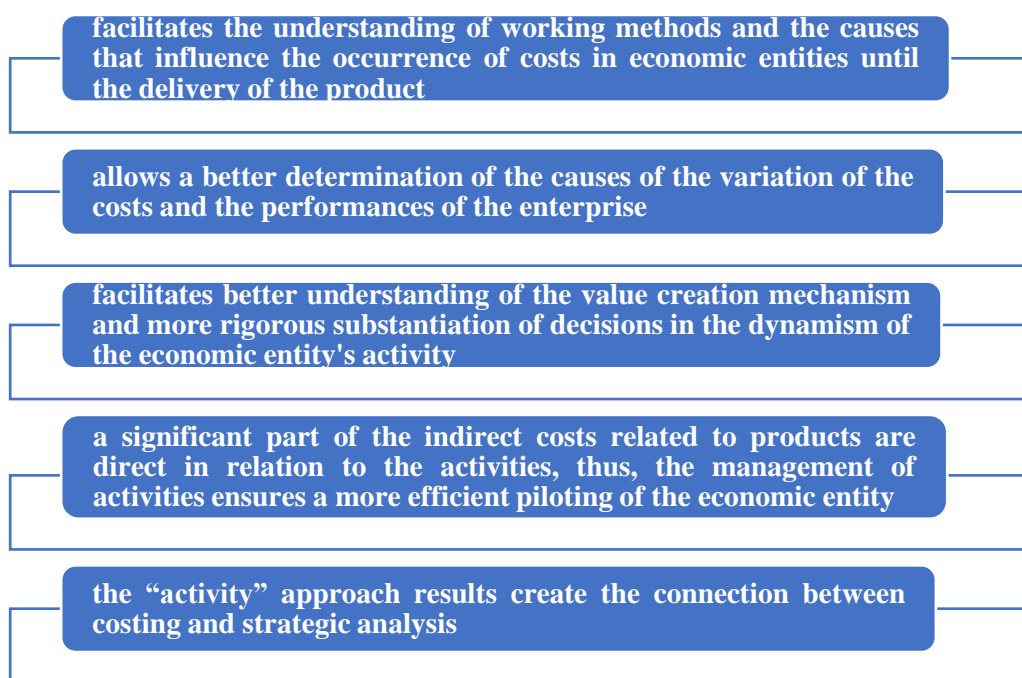## 4. Application of modern methods in the economic-financial analysis of an economic entity

4.1. ABC method

According to ABC method, any economic entity with directly productive activities involves in addition to these secondary activities.

The set of raw materials, people, methods that are used in obtaining a product or a work/service is the concept of activity related to the ABC method. Directly productive activities are activities whose production is delivered and visible outside the economic entity, while secondary activities are those aimed at supporting the main activities.

In the literature in the economic field are presented the following advantages of the ABC method[136] synthesized by Figure no.1:

Figure no.1. Advantages of the ABC method

facilitates the understanding of working methods and the causes that influence the occurrence of costs in economic entities until the delivery of the product

allows a better determination of the causes of the variation of the costs and the performances of the enterprise

facilitates better understanding of the value creation mechanism and more rigorous substantiation of decisions in the dynamism of the economic entity's activity

a significant part of the indirect costs related to products are direct in relation to the activities, thus, the management of activities ensures a more efficient piloting of the economic entity

the "activity" approach results create the connection between costing and strategic analysis
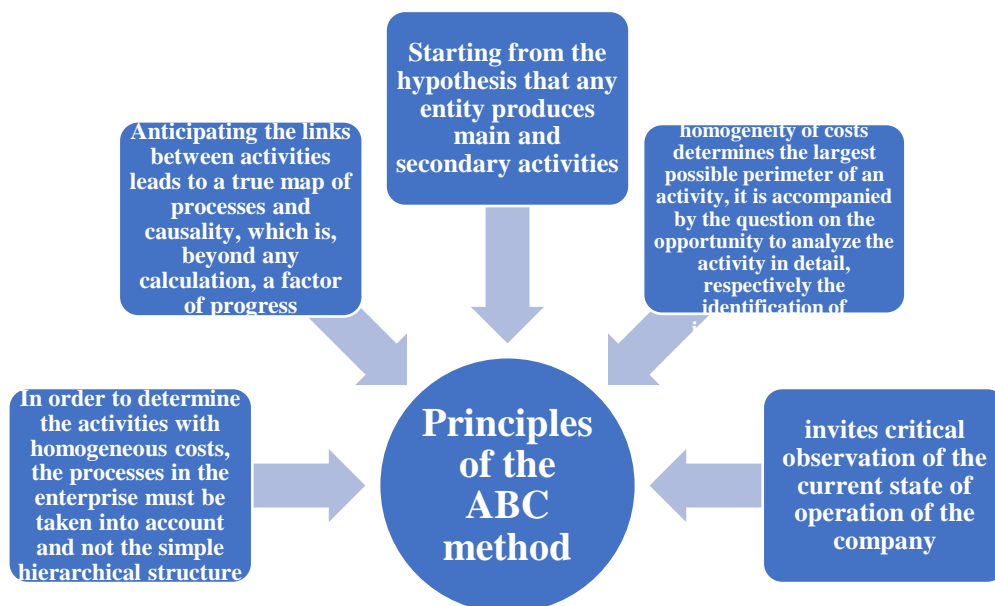
Source: Processing by: Cucui I., Costurile și importanța lor în controlul gestiunii firmei, Arves Publishing House, Craiova, 2008, page 233

The ABC method implies the observance of the following principles synthesized in Figure no.2.

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[136]Cucui I., *Costurile și importanța lor în controlul gestiunii firmei*, Arves Publishing House, Craiova, 2008, page 233

Figure no. 2. Principles of the ABC method

Source: Processing by: Cucui I., Costurile şi importanţa lor în controlul gestiunii firmei, Arves Publishing House, Craiova, 2008, page 233

For our scientific study we collected data from an entity, regarding the costs related to quality, that are presented in Table no.1.

Table no.1. Analysis of costs related to quality in a construction entity

Category	*Measurement units*	*Unit costs (lei)*	*Total costs (lei)*	*% of turnover (15.000.000 lei)*
0	*1*	*2*	*3=1x2*	*4=3/CA*
Preventive expenses:				
Elaboration of the documentation necessary to obtain the construction permit	500 h	460	230.000	1,53
Supplier evaluation	200 h	80	16.000	0,1
Training of employees in the field of quality	500 h	150	75.000	0,5
Design and improvement of quality equipment	800 h	350	280.000	1,87
Total preventive expenses			**601.000**	**4,0**
Evaluation expenses:				

Category	Measurement units	Unit costs (lei)	Total costs (lei)	% of turnover (15.000.000 lei)
0	1	2	3=1x2	4=3/CA
Raw materials and materials destroyed during the tests			818.854	5,46
- timber	230 mc	850	195.500	
- brick	12.980 buc	6,41	83.201,80	
- concrete	680 mc	250	170.000	
- iron concrete	68.800 kg	5,14	353.632	
- nails, wire, other materials	2.360 kg	7	16.520	
Salaries of test and inspection staff	260 h	200	52.000	0,35
Test equipment adjustments	50 h	250	12.500	0,08
Total evaluation expenses			**883.354**	**5,89**
Internal expenses				
Recoverable scrap	80.800 buc	1	80.800	0,64
Unrecoverable products	25.000 buc	1	25.000	0,16
Expenditure on inventory control and rescheduling	100 h	100	10.000	0,06
Total internal expenses			**120.800**	**0,86**
External expenses				
Loss of future orders	3 buc	500.000	1.500.000	10
Total external expenses			**1.500.000**	**10**
Total expenses			**3.105.154**	**20,7**

Source: Own Processing using as model Gheorghe (Damian), A., Damian, D. F., Increasing the Quality of Accounting and Financial Information through the use of Cost Management Systems Products, VJES, Vol.7 (21), Issue 1/2016, page 67

The estimation of the consequences following the application of quality costs is presented as follows (Table no.2):

Table no. 2. Estimation of the consequences following the application of quality costs

0	Before applying the quality costs		After applying the quality costs		Cost savings
0	1	2	3	4	5=4-2
Supplier evaluation - brick purchase	(45,000 pcs x 6,82 lei) x 12 months	3.682.800 lei	(45.000 0 kg x 6,4 lei) x	3.456.000 lei	226.800 lei

0	Before applying the quality costs		After applying the quality costs		Cost savings
	1	2	3	4	5=4-2
			12 months		
Employee training - productivity/year	1 pcs x 100,000 lei x 250 days	25.000.000 lei	1 pcs x 95.800 x 250 days	23.950.000 lei	1.050.000 lei
Quality equipment - maintenance/year				38.000 lei	-38.000 lei
Staff salaries/year	200 pers. x 3.000 lei x 12 months	7.200.000 lei	170 pers. x 3.000 lei x 12 months	6.120.000 lei	1.080.000 lei
Loss of raw materials and materials (timber standard)	(5 % x 50 m3 x 850 lei) x 250	2.125x250 = 531.250 lei	(3% x 50 m3 x 850 lei) x 250	1,275 x 250 = 318.750 lei	212.500 lei
Total cost saved					**2.531.300 lei**
Total differences					**2.531.300 + 3.105.154 = 5.636.454**

Source: Own Processing using as model Gheorghe (Damian), A., Damian, D. F., Increasing the Quality of Accounting and Financial Information through the use of Cost Management Systems Products, VJES, Volume 7 (21), Issue 1/2016, p.67

Examining the implementation of the ABC method within an economic entity in the field of construction by inserting specific costs related to quality, there is a significant improvement in production costs, including: raw material procurement costs, staff salary costs, related technological losses with raw materials and consumables and at the same time an improvement in labour productivity and increasing the quality of finished products.

Regarding the costs of purchasing raw materials, the costs of supplying the brick were tracked, due to the fact that this type of material has the highest frequency. The purchase of high-quality brick at low prices was made by making profitable contracts with suppliers, after estimates and assessments were made on the suppliers' market. The mentioned price of 6.41 lei/piece is an average price. Regarding the same amount of brick for a period of one year, the value of 226,800 lei was saved.

The new production equipment introduced and the improvement of the personnel in the field of quality in order to use this equipment, directly determined a significant increase of the labour productivity at each house built, which led to an increase of the annual turnover by 1,050,000 lei. On the other hand, the number of employees decreased from 200 people to 170 people in the conditions in which the labour productivity increased, thus obtaining a reduction of the salary expenses of 1,080,000 lei. At the same time, technological losses and scrap were significantly reduced from 5% to 3% for raw materials and consumables, which led to a decrease in costs by 212,500 lei.

Following the entire process of implementing the ABC method in economic entities in the field of construction, by going through all stages and the results obtained it is observed that this method led to the optimization of economic and financial analysis with significant influences in terms of performance and competitiveness.

4.2. Linear regression method

In order to optimize the economic-financial analysis within an economic entity in the field of construction through the linear regression method, the correlation between turnover and average number of employees[137] was studied, by going through the following stages:

Stage 1: Construction of a series of data on the evolution of turnover and average number of employees (Table no.3):

Table no. 3. Evolution of turnover and average number of employees

	Year	Turnover - lei	Average number of employees
1	2018	15.668.025	179
2	2019	16.312.321	180
3	2020	16.848.714	189

Source: own processing

Stage 2: Studying the evolution of indicators. Analyzing the period 2018-2020 showed an (medium) average turnover of 16.276.354,30 lei with a peak value in 2020 of 16.848.714 lei and a minimum value in 2018 of 15.668.025 lei, which corresponds to a deviation standard of 690,907.32 lei (Table no. 4):

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[137]*Anghel, M. G., Calotă L. M., Model statistico-econometric utilizat în analiza performanţei firmei, Romanian Journal of Statistics - Supplement no. 10/2016, pp. 25, available at:*
https://insse.ro/cms/sites/default/files/field/publicatii/revista_romana_de_statistica_supliment_nr10_2016.pdf

Table no. 4. The standard deviation of turnover

Descriptive Statistics			
	N	Mean	Standard Deviation
Turnover	3	16,276.354.3	690,907.31858
Average number of employees	3	182.66	5.85947

Source: own processing according to the SPSS application

Substage 2.1. - Evolution of turnover. During the period under analysis, the economic entity in the field of constructions knows an insignificant evolution of the turnover. As can be seen from Chart no. 1, the distribution of turnover follows a normal distribution.
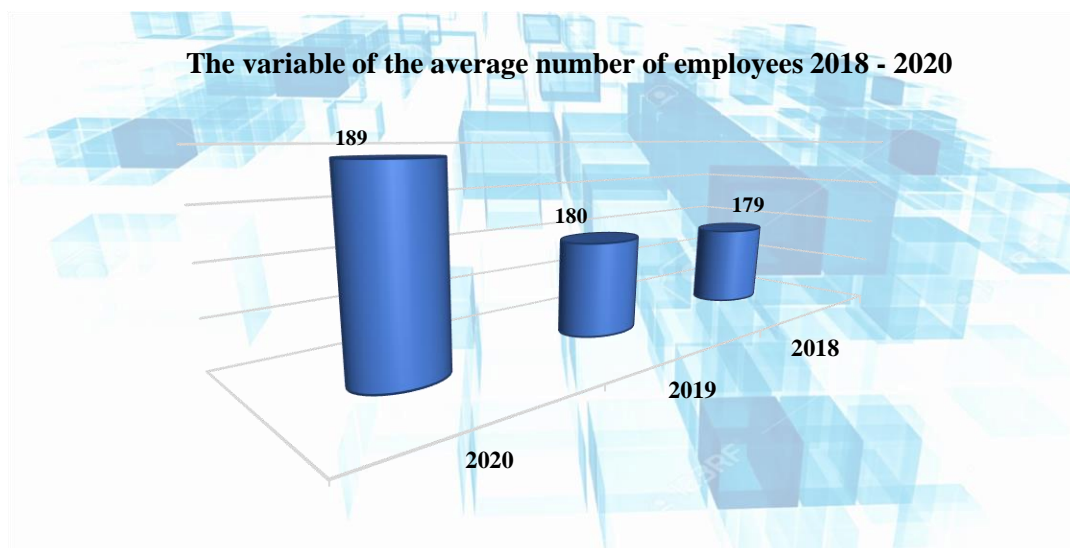
Chart no.1. Graphic representation on turnover distribution
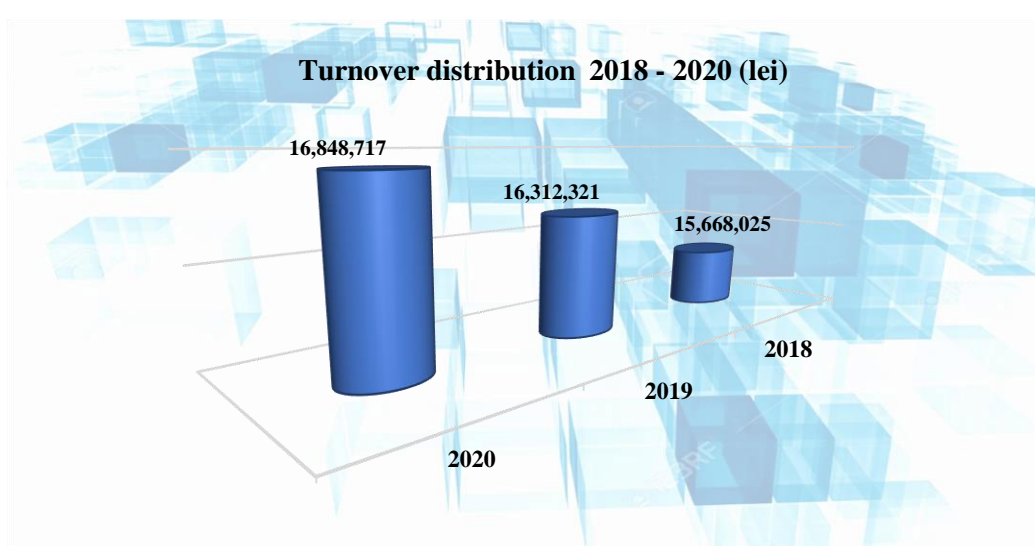
Source: own processing according to the EXCEL application

Substage 2.2. - The evolution of the explanatory variable average number of employees. The number of employees increased during the 3 years from 179 to 189, registering a favorable evolution with a standard deviation of 5.85. (Chart no. 2)

Chart no. 2. Graphical representation regarding the evolution of the variable of the average number of employees

The variable of the average number of employees 2018 - 2020

189

180

179

2018

2019

2020

Source: own processing according to the EXCEL application

The distribution of the number of employees does not follow a normal distribution, the values between 190 and 198 being missing from the series. An analysis similar to the turnover distribution is also performed for the explanatory variable average number of employees, respectively the data series regarding the evolution of the number of employees (Table no. 5.):

*Table no. 5.* Case summaries on the average number of employees

Case summaries		
		Average number of employees
Total	N	3
	Mean	192.3333
	Standard Error of Mean	3.38296
	Grouped Median	190.0000
	Sum	577.00
	Minimum	188.00
	Maximum	199.00
	Range	11.00
	First	188.00
	Last	199.00
	Standard Deviation	5.85947
	Variance	34.333
	Kurtosis	-
	Skewness	1.508

Source: own processing according to the SPSS application

Stage 3 - Application of the linear regression method

The linear regression method involves a correlation between two or more variables, in this case between the two variables turnover and the average number of employees. The correlation chart between the two variables shows us a direct connection, of linear type between them (Chart no.3)

Chart no. 3. Correlogram Turnover - Average number of employees
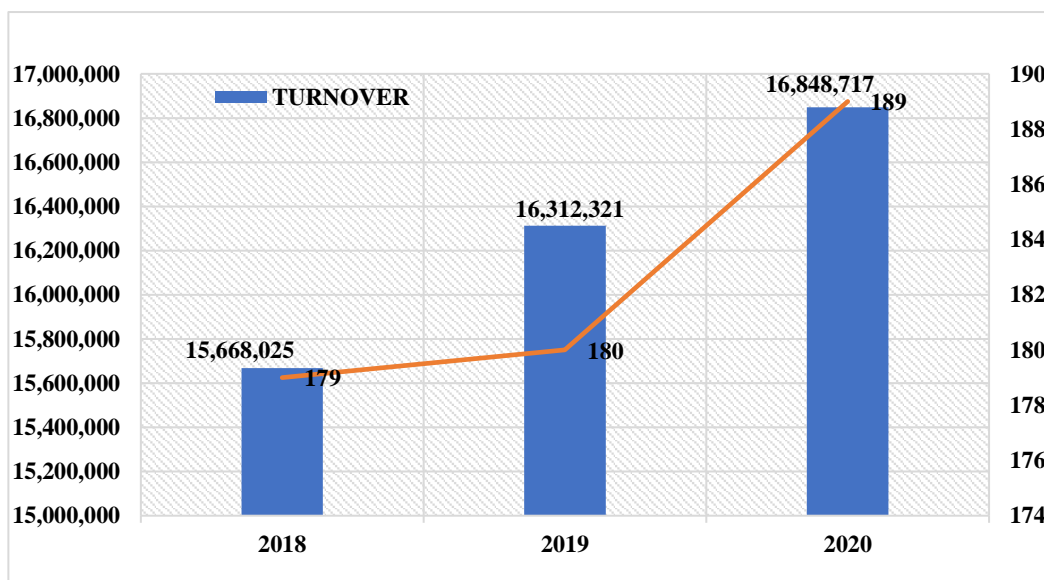
Source: own processing according to the EXCEL application

The two variables are positioned as follows: the turnover variable is the dependent variable, and the average number of employees' variable is the independent variable.

The equation used in the simple linear regression is as follows: $y_= \alpha + \beta \cdot x$

Where:

y = dependent variable, respectively the resultant characteristic

x = independent variable, respectively explanatory characteristic

α, β = parameters of the linear regression model

Specifically, the equation used in the linear regression applied in the economic entity in the field of constructions is: $T = \alpha + \beta \cdot No.employees$

Where:

T = Turnover

No. employees = Average number of employees

α, β = parameters of the linear regression model

The determination of the parameters of the linear regression model is usually done by the least squares method.

Table no.6. Determining the parameters of the regression model

Coefficients [a]								
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		
	B	Std. Error	Beta				Lower Bound	Upper Bound
1 (Constant)	-6429751.709	6997396.310		-.919	.527		-95340101.838	82480598.421
Dependent variable	112163.631	36370.360	.951	3.084	.200		-349965.604	574292.866
a. Dependent Variable: Turnover								

Source: own processing according to the SPSS application

Table no. 7. Summary Turnover model

Summary Model [b]							Durbin-Watson
Model	Change Statistics						
	R Square Change	F Change	df1	df2	Sig. F Change		
1	.905[a]	9.511	1	1	.200		2.762
a. Predictors: (Constant), Average number of employees							
b. Dependent Variable: Turnover							

Source: own processing according to the SPSS application

Following the interpretations of the results from the tables obtained with the help of the SPSS application, it was obtained:

α = - 6,429,751.709

β = 112,163.631

T = - 6,429,751.709 + 112,163.631 x No. employees

The determination coefficient R Square shows the share in which the dependent variable - turnover - is explained by the independent variable - average number of employees - the value of 0.905 and the proportion of 90.5% of turnover can be explained by increasing the average number of employees.

The linear regression model is validated by the Sig F Change value that falls within the reference level, being 0.20.

5. Conclusions

The economic entity must be approached as a unit providing specialized information necessary for both its internal and external environment. The conditions of the current economic and political environment, at national and international level, determine the continuous development of the information system as the main source of economic and financial information. The derivation of the accounting model is not accidental, it depends on the difficulties faced by the economic entity and on the advantages developed by the modern methods, techniques and analysis tools used additionally. Their adoption will allow to cover the interests of the categories of information users and together with the existing traditional accounting systems will allow the application of a quality accounting model. In an uncertain and complex environment, information needs never decrease but diversify and the accounting model becomes a privileged source of information conditioned by the permanent adaptation of tools and practices used to optimize economic and financial analysis within the limits imposed by legal regulations. The economic-financial analysis must be focused not only on the reporting of the information required by regulations but also on the key aspects related to the full satisfaction from the informational point of view and chosen by the need to highlight the degree of performance of the entity and the measures challenge for its growth.

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