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PROTECTING HUMAN CAPITAL IN THE COVID ERA: REVIEW OF EDUCATIONAL SECTOR IN MACEDONIA

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ABSTRACT

Human capital is the engine of intellectual capital, which refers to investing in education. At the macro level, human capital is the driver of national economic activity, competitiveness and prosperity. Investments in education and on-the-job training are the most important type of investment in human capital. For the poorest people, human capital is often the only capital they have. Human capital is one of the key drivers of sustainable, inclusive economic growth of countries. According to the value of the Human Capital Index, the World Economic Forum assesses the success of a particular country in developing the skills and competencies of people through the process of education and learning, as well as the use of acquired knowledge through productive employment. Human capital - the knowledge, skills and health that people acquire throughout their lives is a key factor in sustained economic growth and poverty reduction rates in many countries.

Investments in human capital - the knowledge, skills, and health that people accumulate over their lives-are key to unlocking a child's potential and improving economic growth in every country around the world. COVID-19 threatens to wipe out a decade of human capital gains, leaving an entire generation behind, as countries struggle to contain the virus, save lives, and rebuild their economies. That's why the issue of coping with COVID-19 crisis is very important. The way countries struggling, the measures they use, and the crisis management they practice deserves attention.

KEYWORDS: crisis management, education, human capital, skills
JEL CLASSIFICATION: I21; I25; I26; I28

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INTRODUCTION

The COVID-19 pandemic has sunk the global economy into the deepest recession in eight decades. The COVID-19 pandemic has hit human capital directly in Europe and Central Asia, adversely affecting both education and health. School closures may lead to learning losses equivalent to a third to a full year of schooling, and they are likely to exacerbate inequalities, by disproportionately affecting students from disadvantaged backgrounds. The disease has already killed thousands of people, and some people who survive will suffer long-term damage to their health. Recovery from the pandemic will require strong investment in both education and health. Post-COVID-19 policy initiatives will also need to recognize the challenges posed by increased reliance on remote learning and the need to reduce risk factors for noncommunicable diseases, manage and deliver health services to keep the aging population healthy and active into old age, and promote lifelong learning.

1. HUMAN CAPITAL - REVIEW OF EDUCATIONAL SECTOR IN MACEDONIA

Macedonia is committed to the 2030 Agenda for Sustainable Development and the European Union (EU) integration process[1]. The Government considers education, training, research and innovation to be key determinants of the health of the national economy and wellbeing of citizens.

According to the data of the State Statistical Office obtained on the basis of received reports, there were 51 734 enrolled students in the Republic of N. Macedonia in the academic year 2019/2020, a decrease of 3.6% compared to the academic year 2018/2019[2]. According to the data of the State Statistical Office, the number of students in the regular primary and lower secondary schools at the beginning of the school year 2019/2020 was 187 240, which is a decrease of 0.5% compared to the previous school year[3]. In Macedonia in primary education, from year to year the number of incoming generation in primary education decreases, as well as the total number of students.

[1] United Nations, (2020). Sustainable Development Goals-National Voluntary Review, report for North Macedonia, accessed on 10 september 2020. https://sustainabledevelopment.un.org/content/documents/26388VNR_2020_Macedonia_Report.pdf.
[2] State Statistical Office, (2020). Enrolled students in higher schools and faculties in the Republic of North Macedonia in the academic year 2019/2020 (first cycle of studies). accessed on 10 September 2020. http://www.stat.gov.mk/pdf/2020/2.1.20.26_mk.pdf.
[3] State Statistical Office, (2020), Primary, lower secondary and upper secondary schools in the Republic of North Macedonia at the beginning of the school year 2019/2020, accessed on 15 September 2020. http://www.stat.gov.mk/pdf/2020/2.1.20.09_mk.pdf.

According to the data of the State Statistical Office, there were 186 679 students in the regular primary and lower secondary schools at the end of the school year 2018/2019, which is 1.0% less than the previous school year[4]. The number of enrolled students in primary education in the academic year 2017/2018 is lower by 13.5% compared to 2007/2008. The number of students in the regular upper secondary schools at the beginning of the school year 2019/2020 was 69 980, which is a decrease of 2.3% compared to the previous school year. The situation with enrolled students in secondary education is also declining. The number of enrolled students in secondary education in the academic year 2017/2018, compared to 2007/2008, decreased by 24.4%. The number of students in the regular upper secondary schools at the end of the school year 2018/2019 was 70 025, which is 1.2% less than the previous school year. The number of enrolled students in 2017/2018 decreased by 11.4% compared to 2007/2008[5] .

Competitiveness in today's era of knowledge-based economy depends heavily on the knowledge and skills of the country's population. However, given the relatively low quality of human capital in Macedonia, compared to European Union countries as confirmed by international educational studies, as well as the low quantity, improving the education system and outcomes should be one of the main national priorities. A child born today in Macedonia[6] when he grows up will be productive 56 percent of what he could be if he had full education and full health. This is lower than the average for the Europe and Central Asia region and for high-income middle-income countries. Therefore, it is necessary for policy makers in our country to find solutions for increased investment in human capital through: expanding and improving investment in human capital and development of education systems and training systems that meet the new skills requirements.

Education is of great importance for creating motivation and desire for proper survival in the labor market. The lifelong learning process becomes an important issue that leads to the establishment of certain frameworks for increasing and supplementing the knowledge of the adult population, in order to increase employment opportunities

[4] State Statistical Office, (2020), Primary, lower secondary and upper secondary schools at the end of the school year 2018/2019, accessed on 10 October 2020.
http://www.stat.gov.mk/pdf/2020/2.1.20.05_mk.pdf.
[5] ibid.
[6] Human Capital Project – September, (2020). North Macedonia, Human Capital Index 2020
http://pubdocs.worldbank.org/en/828021600286864506/HCI-2020-1pager-MKD.pdf.

and to provide real skills and abilities during the working life that arise from the need for additional professional development. Education, training, research and innovation are key factors in strengthening the national economy and the well-being of citizens. The adopted Strategy for Education for 2018-2025[7] is aimed at improving:

1. The content of education and its relevance to the development priorities of the Macedonian society (especially when it comes to forming productive and engaged citizens) and the needs of the labor market, as well as the acceptance of multiculturalism, interethnic integration, respect for diversity and democratic values;

2. The infrastructure of the education system, including buildings, equipment, teaching and assistive technologies, in order to provide an appropriate learning environment as a whole and the inclusion of persons with special educational needs;

3. Capacities of human resources, including managers, staff and professional services;

4. The quality and effectiveness of the educational process; 5. Legislation, management and financing[8].

However, the Ministry of Education and Science is the leading body responsible for organizing, coordinating and consolidating the activities, the output results and the realization of the outcomes. At the same time, vocational education and training should be integral and one of the priorities for human capital development and a prerequisite for economic growth, reducing unemployment, better employment and social cohesion in our country.

In the report from the World bank Group, economic update fall 2020 - *COVID-19 and Human Capital*[9] for Macedonia it is pointed that moreover, a large share of the non-poor population remained at risk of fall-ing into poverty if hit by a shock, such as the current COVID-19 crisis. Weak education and workforce skills persistently undermined human capital which, together with total factor productivity, has been the lowest in the Western Balkans. Only 50 percent of working-age Macedonians is employed, while low birth rates and emigration are shrinking the work-force. In terms of governance, the

[7] Ministry of Education and Science, (2018), Strategy for Education for 2018-2025, http://mon.gov.mk/page/?id=2048.
[8] ibid.
[9] World Bank Group, (2020) COVID-19 and Human Capital, Europe and Central Asia Economic Update, Office of the Chief Economist, Fall 2020, accessed on 12 october 2020. https://openknowledge.worldbank.org/bitstream/handle/10986/34518/9781464816437.pdf.

country trails peers in categories such as polit-icalstability,voiceandaccountability,rule of law, and control of corruption. Finally, the current economic model, generous in public support for growth through subsidies and broad tax exemptions, is not sustainable. Though counter-cyclical fiscal policies helped growth and employment, the COVID-19 crisis depleted fiscal buffers.

2. CRISIS MANAGEMENT AND EDUCATIONAL GAP

When we talk about human capital in Covid era, we must take into account the time dimension in terms of the impact of the crisis on the current human capital and what is its impact to the future human capital. In this sense, we must distinguish the consequences that Covid crisis has on:

- condition, functionality, protection and utilization of current human capital in the institutions;
- generating a knowledge, skills and capacities as future human capital.

In the first case we are talking about the working conditions and the threat to the health of the current staff in the educational institutions, while in the second case it is about the opportunities that the current conditions provide for knowledge transfer and building of future human capacity. These two moments are significantly determinate by the quality of crisis management and decisions making.

The imperative for reducing of consequences is the existence of comprehensive approach of crisis management. This principle of comprehensiveness is universal for any crisis and includes the following 4 (four) stages[10]:

- Mitigation – the action taken should be sustainable and long-lasting to reduce the risk;
- Preparedness – creating crisis management and staff equipment for efficient management of the upcoming hazard;
- Response – emergency operation to protect human life;
- Recovery – rebuilding the communities and recovery to normal and independent operation, also providing a long-term protection in the case of recurrence of the crisis.

[10] Fagel, M.J., and Krill Jr., S.J., (2012), "Introduction: Why plan for Disasters?", Fagel, M.J. (Ed.) *Principles of Emergency Management: Hazard Specific Issues and Mitigation Strategies,* Taylor & Francis Group, LLC, Boca Raton, Florida, p.5.

The problem is that very often policy makers do not have necessary experience and face certain situations for the first time.[11] This is the case with the Covid crisis, the world is facing a pandemic of this type for the first time and the uncertainty is very high with many unknown factors and possible future events. That's why it is very important the plan for dealing with the crisis be widely accepted and respected from the whole community.

Lack of the public awareness is the number one reason for undermining crisis management efforts. Exactly this problem is one of the key ones that disturbs the balance and controlled flow of the events in Macedonia, which has a more pronounced impact on the education system, because the decision and awareness of individuals are reflected in the community in which they belong and exist.

The quality of crisis management depends of the degree of coherence. From the theoretical point of view, coherence is defined as a function of the conflict that exists between the interest of individuals and the constitutional norms.[12] Such interest driven from the personal beliefs and needs has led to the division of the education system. Part of students worried about their health demanded on-line classes, while the other part preferred classes with physical presence.[13] This division also affected the quality of teaching, because the teaching staff should meet the need of both types of classes at the same time. If we add the fact that the part of the participants in the process have chronic diseases, disabilities, socially disadvantaged citizens, the situation becomes complex, and the quality of the process is questionable. The disturbed control of the educational process reflects on the current teaching staff, but to a large extent limits the opportunities for transfer of quality knowledge and creation of future staff.

The coherence is essentially the absence of contradiction.[14] The measures applied to the crisis in Macedonia are with dose of contradiction from the very beginning of the crisis. Apart of the contradiction that exists between the personal interests and defined norms, conflict and rivalry are also noted between the institutions and their policy.

[11] ibid, p.5
[12] Koenig, N., (2016), *EU Security Policy and Crisis Management: A Quest for Coherent*, Routledge, p. 157
[13]Ministry of education and science, (2020), Announcement, accessed at 6 November 2020,http://mon.gov.mk/content/?id=3369&fbclid=IwAR3RYO0x6CYEDmafKxhBO6po_b393RcAopBWar6n049o11RZmNlxiQOa-Z8; Ministry of education and science, (2020), Announcement, accessed at 6 November 2020,http://mon.gov.mk/content/?id=3393
[14] ibid, p. 157

Exactly this disrupts the consistency of the measures and reduces their quality, and the consequences for the education system in the long run are greater in Macedonia compared to other countries.

If for the first wave of the epidemic, the lack of this type of experience was a fundamental weakness for successfully dealing with challenges in education, the time has shown that gained experience is not used at all.

The period between two school years was not used to solve the problems and to use the experiences; on the contrary, in the new attempt the policy makers repeated the same mistakes with late decisions, lack of the resources and unprepared schools.

CONCLUSION

The importance of the human capital can be seen in the fact that the first thing countries in the world will face after COVID-19 crisis is to rebuild of their economies. That's why the crisis management issue deserves attention. The situation in education system in Macedonia shows that it is inevitable to improve coherence of the system, and decision should be making without pressures. The leadership and decision making in the case of crisis is key moment regardless of the type of the crisis, whether it is health, security or other type of crisis. The decision making should be free from pressures and tight interest, while the leadership should be present at multiple levels. In line with the EU's commitment to security management, which is largely compatible with dealing the health crisis, special attention should be paid to leadership. The leadership in the case of crisis means precisely defining the idea of crisis policy, then strengthening the responsibility of institutions and finally practical application/implementation of established policy.

This is the only way to successfully deal with the crisis and reduce the harmful effects on education and human capital. Once the underlying operational difficulties caused by COVID-19 crisis are remedied, it can be move on the higher goals.

There is crucial need for new ways of operating and they must to adapt to the environment and virtual world. In the next period Government must focus on the following objectives: identify priority areas to increase quality within the education sector; upgrade the VET programmes, including postsecondary education and adult education and to establish Regional VET Centers for harmonization between education and labour market needs and revise the VET curricula to fit market needs.

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VARIANCE RATIO TESTS OF THE RANDOM WALK IN THE LAC REGION

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ABSTRACT

The global pandemic of 2020 (Covid-19) has affected the global economy and financial markets alike. In the light of these events, the aim of this essay is to test the hypothesis of an efficient market, in its weak form, in the main markets of the LAC Region, especially the stock markets of Argentina (MERVAL), Brazil (IBOVESPA), Chile (IPSA), Colombia (COLCAP), Mexico (BOLSAA MX), Peru (BVLAC) and the USA (DOW JONES), from 1 July 2019 to 20 October 2020. The results suggest the existence of mean-reversion and the rejection of the random walk hypothesis. In corroboration, DFA exponents show the presence of long memories in the Latin American and US stock markets. In conclusion, we consider that prices do not fully reflect available information and that price changes are not i.i.d. This has implications for investors, as some returns can be expected, creating opportunities for arbitrage and abnormal returns. These findings also open space for market regulators to take action to ensure better information in these regional markets.

KEYWORDS: Information efficiency, Emerging markets, Long memories, Portfolio diversification.

JEL CLASSIFICATION: C4, C46

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1. INTRODUCTION

International financial markets have seen a succession of major setbacks in recent months, triggered by the Covid-19, followed by a series of collapses, the oil war, and currency fluctuations. The economic turmoil associated with the coronavirus pandemic in 2019-2020 has serious repercussions on financial markets, notably the stock, securities and commodity markets (including crude oil and gold). The main events were an oil price war between Russia and Saudi Arabia, after no OPEC agreement was reached, leading to a collapse in oil prices, and a significant drop in stock markets in March 2020 (G.Sudha and V.Sornaganesh, 2020).

The Efficient Market Hypothesis (HME) argues that security prices reflect all available information and that investors cannot obtain abnormal returns by trading on this information (Fama, 1970). HME is an essential concept for financial institutions, individual and institutional investors and government regulators. An investor's investment strategy is highly influenced by market efficiency. Market efficiency also determines the regulatory measures to be developed to ensure the development and organised management of a country's markets (Shirvani and Delcoure, 2016).

Different work has addressed the issue of market efficiency, analysing the assumption of predictability of returns, through the analysis of reversion patterns to average stock prices, inspired by the seminal work of Poterba and Summers (1988), Fama and French (1988), which documented the average reversal in stock market yields over a period of more than one year.

The theme of the market efficiency hypothesis is that the current price of the asset reflects all available information at a given time and the price adjusts quickly as new and unforeseen information reaches the market. The average-reversion hypothesis, also called negative series correlation, has been interpreted as an efficient correction mechanism in developed markets and, a sign of speculative bubble in emerging financial markets (Summers, 1986; Fama and French, 1988).

The aim of this trial is to test the hypothesis of an efficient market, in its weak form, in the main markets of the LAC Region, especially the stock markets of Argentina (MERVAL), Brazil (IBOVESPA), Chile (IPSA), Colombia (COLCAP), Mexico (BOLSAA MX), Peru (BVLAC) and the USA (DOW JONES), from 1 July 2019 to 20 October 2020. The purpose of this analysis is to assess whether the crisis and the global pandemic of

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2020 have reduced the efficiency of regional markets in Latin America? The results suggest that the randow walk and efficiency hypotheses, in their weak form, are rejected in the financial markets of the LAC region, USA. These findings show that investors will be able to obtain anomalous returns without incurring additional risk, but this study did not analyse anomalous returns in these regional markets.

This research adds relevant contributions to the literature and is related to the analysis of efficiency, in its weak form, in the financial markets of the LAC Region, and the US, with the objective of gauging the memories of the price indices, that is, whether these regional markets are predictable when applying adjusted trading strategies. As far as is known, the authors, Urrutia (1995) Grieb and Reyes (1999), Ojah and Karemera (1999), Karemera and Cole (2010), Righi and Ceretta (2011), Chortareas, Garza-Garcia and Girardone (2011), Nsiah and Fayissa (2013) Worthington and Higgs (2013), Duarte Duarte and Mascareñas Pérez-Iñigo (2014), analysed the average reversal in the financial markets of the LAC Region, testing the randow walk hypothesis and, of an efficient market in its weak form, however, the approach was essentially different from that followed in this test.

2. STATE OF ART

Market efficiency has many implications for investors and regulators. Market regulators will limit their intervention when the securities are reasonable. If the market is not efficient, regulators should regulate the operations and the capital allocation process to ensure that prices are correctly evaluated, with the purpose of efficiency in financial markets (Fama and French, 1988; Fama, 2006).

The authors Urrutia (1995), Ojah and Karemera (1999), Grieb and Reyes (1999), Mansilla (2001), Delfiner (2002), Maya and Torres (2004), Hasan, Kadapakkam and Ma (2004), Worthington and Higgs (2006), Hatgioannides and Mesomeris (2007), Tabak (2007), Freitas, De Souza and de Almeida (2009), Charles and Darné (2009) analysed the financial markets of the LAC Region, testing market efficiency in its weak form. Urrutia (1995) was one of the first to assess the markets of Argentina, Chile and Mexico in the period 1975 to 1991 in the context of market efficiency in its weak form. The author argues that the markets reject the randow walk hypothesis. Subsequently, the authors Ojah and Karemera (1999) analysed efficiency in its weak form in the financial markets Argentina, Brazil, Chile and Mexico in the

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period 1987 to 1997. The authors used tests of variance ratios, and integrated mobile averages, and showed efficiency in these regional markets. In the same year, the authors Grieb and Reyes (1999) reviewed the presence of randow walk in Brazilian and Mexican stock prices. The results reveal reversion to the average in Mexico at both the index and company levels. On the other hand, the Brazilian market shows a greater trend towards market efficiency, in its weak form, however, the results suggest average reversal in companies. The Mexican and US markets are evaluated between 1996 and 2000 by Mansilla (2001), through the exponent of Hurst. The author shows efficiency, in its weak form, which is normal considering the dependence on the market. Delfiner (2002) studied the behaviour of Argentine market assets in relation to the US market. The author shows that local assets have a certain statistical dependence, which could facilitate arbitrage and therefore the possibility of anomalous returns without incurring increased risk. Later, Maya and Torres (2004) have analysed the Colombian market, showing that this market is efficient in 1999. Hasan, Kadapakkam and Ma (2004) examined the presence of predictability in the financial markets of Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru and Venezuela. The authors used local gilt closing prices to avoid distortions caused by exchange rate behaviour. The results indicate that the markets of Argentina and Costa Rica follow the assumption of market efficiency, in its weak form, robustly. However, the Peruvian market is not efficient in its weak form, regardless of the frequency of data used. In addition, the results for the remaining markets fluctuate due to the frequency of the data used, daily, weekly or monthly. Subsequently, Worthington and Higgs (2006) analysed 27 emerging markets, namely three in Africa (Egypt, Morocco and South Africa), ten in Asia (China, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Sri Lanka, Taiwan and Thailand), four in Europe (Czech Republic, Hungary, Poland and Russia), seven in Latin America (Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela), and three in the Middle East (Israel, Jordan and Turkey). The results suggest that most emerging markets are inefficient in their weak form. On this basis, only Hungary, Jordan and Israel are efficient in their weak form. However, the markets of Egypt, Korea, Malaysia and Argentina show mixed results. In complementarity, Tabak (2007) and, Freitas, De Souza and de Almeida (2009) analysed the financial market in Brazil. The authors show that this market is not efficient in its weak form in the period between 1998 and 2007. Hatgioannides and

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Mesomeris (2007) find efficiency in its weak form in the markets of Argentina, Brazil, Chile and Mexico, but not in Indonesia, Philippines, Taiwan and Thailand in the period 1988-2002. Charles and Darné (2009) analysed the financial markets of the LAC region, arguing that the markets of Argentina, Brazil, Chile and Mexico reject the hypothesis of efficiency, in its weak form, already in the market of Ecuador the results are mixed.

Later, the authors Righi and Ceretta (2011), Sierra Suárez, Duarte Duarte and Mascareñas Pérez-Iñigo (2013), Worthington and Higgs (2013), and Duarte and Mascareñas Pérez-Iñigo (2014) studied the efficiency of the markets in the LAC Region. Righi and Ceretta (2011) used the daily prices of the S&P500 index, Ibovespa, Merval and IPC, from January 2005 to December 2010. The sample was divided into three parts, corresponding to the previous periods, during and after the 2007/2008 subprime crisis. The results show that the financial markets of the LAC region do not reject the hypothesis of efficiency, in its weak form. However, the US market generally rejected this assumption during the crisis period. This indicates that during the period of turbulence, there was the possibility of financial arbitrage in the US market, i.e. there was an opportunity to obtain higher profitability without incurring risk. Sierra Suárez, Duarte Duarte and Mascareñas Pérez-Iñigo (2013) sought to demonstrate chaotic behaviour in Colombia's stock market. The results show that the assets show signs of chaotic behaviour in upward and, random in downward periods, supporting the fractal market hypothesis. These findings may support the use of non-linear models for predicting prices in rising periods and reject the efficiency of the Colombian stock market. Worthington and Higgs (2013) examined the financial markets of Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. The authors show that the efficient market hypothesis is rejected. Duarte and Mascareñas Pérez-Iñigo (2014) reviewed the top 5 financial markets in Latin America from January 2002 to August 2012. The authors show that the five main Latin American economies have undergone a shift from non-efficiency to efficiency in recent years, according to the following chronological order: Mexico (2007), Brazil (2008), Colombia (2008), Chile (2011) and Peru (2012). Ruiz-Porras and Ruiz-Robles (2015) analysed the returns on Mexican shares in the period 2000-2012. The main results suggest that the Mexican stock market is inefficient in its weak form, and this efficiency has declined since 2007.

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3. METHODOLOGY

DATA

The data are the prices index of the stock markets of Argentina (MERVAL), Brazil (IBOVESPA), Chile (IPSA), Colombia (COLCAP), Mexico (BOLSAA MX), Peru (BVLAC) and the USA (DOW JONES), and were extracted from the Thomson Reuters platform. Quotes are daily and cover the period from 1 July 2019 to 20 October 2020. Quotations are in local currency to mitigate exchange rate distortions.

Table 1: The name of countries and their indices used in this paper.

Countries	Indexes
Buenos Aires/Argentina	MERVAL
São Paulo/Brasil	IBOVESPA
Santiago/Chile	IPSA
Bogotá/Colombia	COLCAP
México City/México	BOLSAA MX
New York/EUA	DOW JONES
Lima/Peru	BVLAC

Source: Own elaboration.

METHODOLGY

The development of research will take place in several stages. We carry out market graphs, in levels, to estimate the evolution of the markets under analysis. The characterisation of the sample will be carried out using descriptive statistics to check that the data follow a normal distribution. To ensure that time series follow a white noise (mean = 0; constant variance), we will use unitary root tests on Hadri (2000), Breitung (2000), Levin, Lin, and Chu (2002). To evaluate the stability of the variance we will estimate graphs to the waste. In order to answer the research question we will use the methodology of variance ratio proposed by Lo and Mackinlay (1988), for the purpose of assessing the autocorrelation between the profitability series. Such methodology can be classified as a parametric test. The efficient market hypothesis, in its weak form, establishes that it is not possible to predict future prices based on historical prices. The author Rosenthal (1983) argues that if a market is efficient in its weak form, then there should be no linear dependence between returns lagging both statistically (no autocorrelation) and economically (no positive returns after taking

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transaction costs into account). The model of Lo and Mackinlay (1988) defines P_t as the price of an asset at t and X_t as the natural logarithm of P_t, the random walk hypothesis is given by:

$$X_t = \mu + X_{t-1} + \epsilon_t \quad [1]$$

Where μ is an arbitrary motion parameter and ϵ_t is the random error term. The authors show that an important feature of the random walk process is that the variance of increments grows linearly according to the observation interval. In order to validate the results of the random walk hypothesis we will use *Detrended Fluctuation Analysis (DFA)*. DFA is an analysis method that examines time dependency in non-stationary data series. This technique by assuming that time series are non-stationary avoids spurious results when the analysis focuses on the long-term relationships of data series (Bashir, Yu, Hussain, and Zebende, 2016; Dias, da Silva, and Dionísio, 2019). The *Detrended Fluctuation Analysis* (*DFA*) gives the following interpretation:

Table 2: *Detrended Fluctuation Analysis* (DFA)

Exponent	Type of signal
$\alpha_{DFA} < 0.5$	long-range anti-persistent
$\alpha_{DFA} \simeq 0.5$	uncorrelated, white noise
$\alpha_{DFA} > 0.5$	long-range persistent

Source: Own elaboration.

4. RESULTS

Figure 1 shows the evolution of stock markets, at levels, from 1 July 2019 to 20 October 2020, and we can see the existence of marked volatility in the markets of the LAC Region and in the US, due to the uncertainty and pessimism experienced in international financial markets due to the global pandemic of 2020 (Covid-19).

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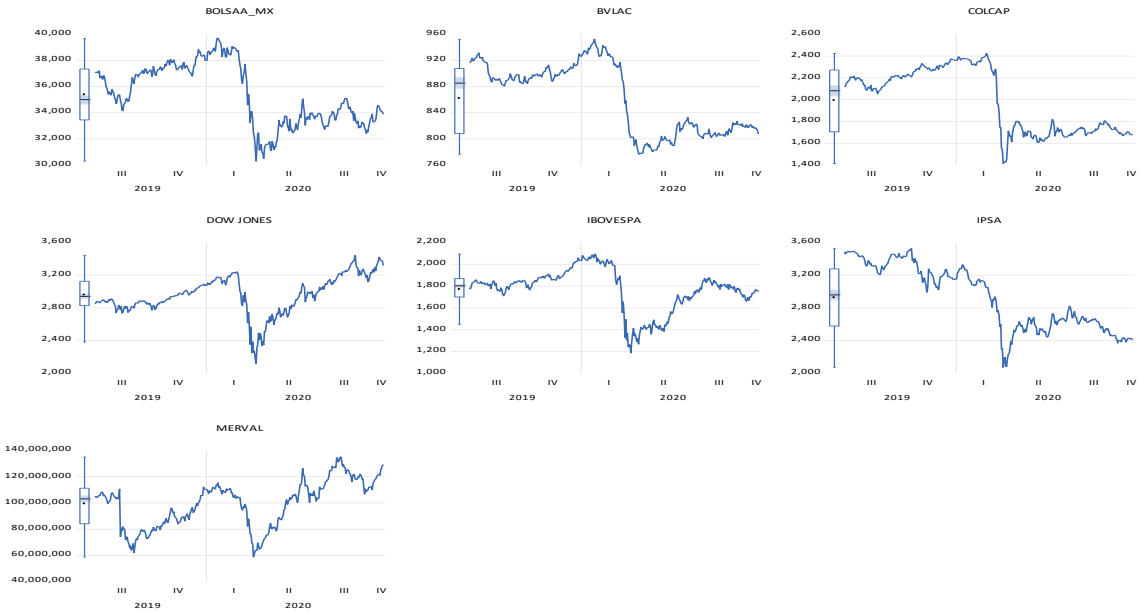
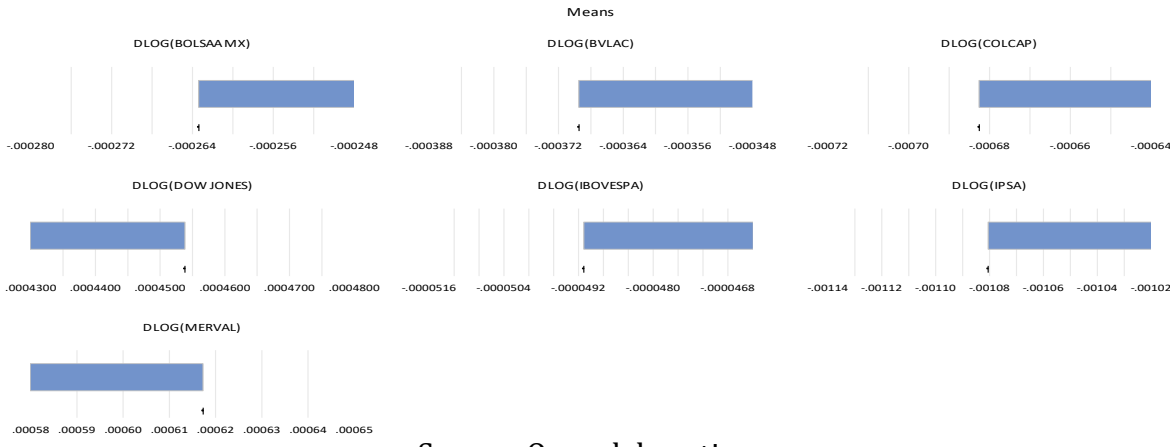
Fig. 1: Development in levels of the 7 foreign exchange markets from 1 July 2019 to 20 October 2020.



Source: Own elaboration.

Figure 2 shows the average returns of the stock markets of Argentina (MERVAL), Brazil (IBOVESPA), Chile (IPSA), Colombia (COLCAP), Mexico (BOLSAA MX), Peru (BVLAC) and the US (DOW JONES). The stock exchanges BOLSAA MX (-0.000250), BVLAC (-0.000356), COLCAP (-0.000681), IBOVESPA (-4.30E-05), IPSA (-0.001082) show negative returns, while the stock markets DJ (0.000473), MERVAL (0.000608) show positive returns.

Fig. 2: Evolution of average returns of the 7 stock markets, from 1 July 2019 to 20 October 2020.



Source: Own elaboration.

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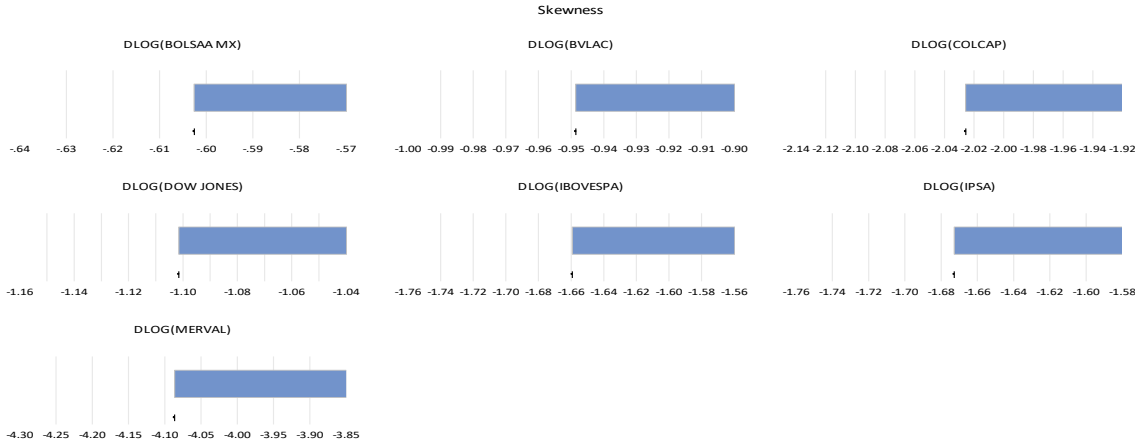
Figure 3 shows the standard deviations for the 7 financial markets under analysis. The stock market MERVAL (0.036725) shows the sharpest standard deviation, while the stock market indices IBOVESPA (0.022096), DJ (0.019010), COLCAP (0.016328), IPSA (0.016095), BOLSAA MX (0.010579), BVLAC (0.004977) show less sharp deviations.

Fig. 3: Evolution of standard deviations of the 7 stock markets, from 1 July 2019 to 20 October 2020.

Source: Own elaboration.

Figure 4 shows the skewness of the 7 financial markets under analysis and we can see that the stock market indices MERVAL (-4.091737), COLCAP (-2.029045), IPSA (-1.674896), IBOVESPA (-1.662460), DJ (-1.105487), BVLAC (-0.952199), BOLSAA MX (-0.606600), show negative asymmetries. These results indicate that the stock market data series do not follow a normal distribution (Skewness = 0).

Fig. 4: Skewness evolution of the 7 stock markets, from 1 July 2019 to 20 October 2020.



Source: Own elaboration.

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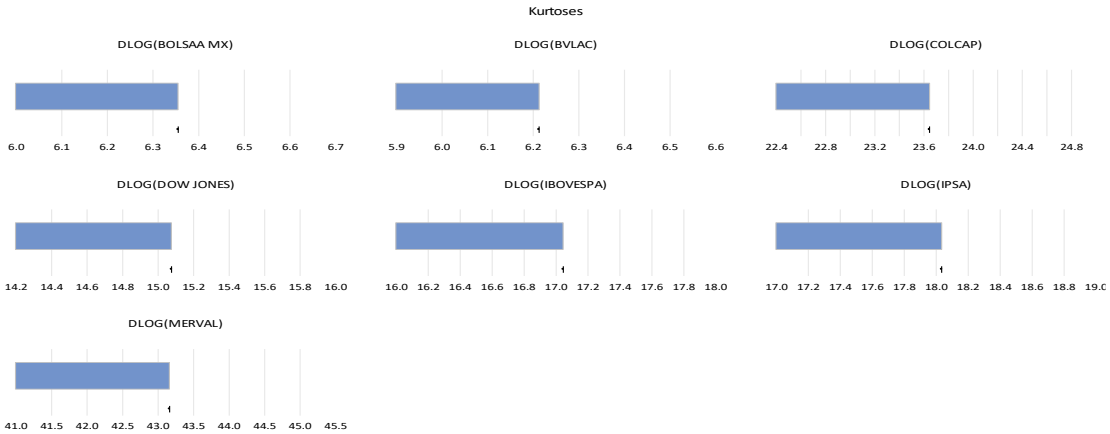
Figure 5 shows the Kurtoses of the 7 stock markets, and we can see that the Argentinean index MERVAL (43,28088) shows the sharpest kurtosis, while the stock markets COLCAP (23,71495), IPSA (18,08510), IBOVESPA (17,09541), DJ (15,11293), BOLSAA MX (6,369275), BVLAC (6,212086) show less marked values. These results validate that the time series do not follow a normal distribution, as the asymmetry and the short ones are different from the reference values (Skewness = 0; Kurtoses = 3).

Fig. 5: Evolution of the Kurtoses of the 7 stock markets, from 1 July 2019 to 20 October 2020.



Source: Own elaboration.

In table 3 we can see the results of the Jarque-Bera test which validate the results of asymmetry and kurtosis, that is, we are dealing with data series that do not follow a normal distribution, since the null hypothesis is rejected at a significance of 1%.

Table 3: Jarque-Bera test, concerning the 7 stock markets, from 1 July 2019 to 20 October 2020.

	BOLSAA MX	BVLAC	COLCAP	DJ	IBOVESPA	IPSA	MERVAL
Jarque-Bera	182.7401***	198.7053***	6349.473***	2160.463***	2988.733***	3402.633***	24075.64***
Observations	342	342	342	342	342	342	342

Source: Own elaboration.
Note: ***. **. *. represent significance at 1%. 5% and 10%. respectively.

As we are estimating time series, we should examine the stationary nature of the 7 stock market data series under analysis. The unitary root tests in Breitung (2000), Levin, Lin, and Chu (2002) have the null hypothesis that all panels contain a single root, while the Hadri (2000) postulates stationarity in the null hypothesis. The interception of the stationarity tests shows the stationarity of the time series, in first differences (see tables 4, 5 and 6).

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Table 4: Unit Root Tests on Breitung (2000), applied to the 7 stock markets from 1 July 2019 to 20 October 2020.

Method			Statistic	Prob.***
Breitung t-stat			-27.8920	0.0000
Series	S.E. of Regression	Lag	Max Lag	Obs
D(BOLSAA MX)	503.709	0	16	340
D(BVLAC)	4.76837	1	16	339
D(COLCAP)	31.9066	1	16	339
D(DOM JONES)	46.0238	8	16	332
D(IBOVESPA)	53.0728	0	16	340
D(IPSA)	49.2698	1	16	339
D(MERVAL)	5042598	0	16	340
	Coefficient	t-Stat	SE Reg	Obs
Pooled	-0.69157	-27.892	0.025	2362

Source: Own elaboration.
Notes: ***. **. *. represent significance at 1%. 5% and 10%, respectively.

Table 5: Unit Root Tests on Levin, Lin, and Chu (2002), applied to the 7 stock markets, from 1 July 2019 to 20 October 2020.

Method				Statistic		Prob.***	
Levin, Lin & Chu t*				-42.6549		0.0000	
Series	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
D(BOLSAA MX)	-0.95950	131611	2625.5	0	16	101.0	340
D(BVLAC)	-0.71433	17.267	1.5689	1	16	23.0	339
D(COLCAP)	-0.65823	796.60	115.22	1	16	15.0	339
D(DOM JONES)	-0.78290	1974.4	292.03	8	16	13.0	332
D(IBOVESPA)	-1.21703	1099.3	227.21	0	16	9.0	340
D(IPSA)	-0.80924	1789.7	110.54	1	16	33.0	339
D(MERVAL)	-1.13859	1.E+13	7.E+10	0	16	331.0	340
	Coefficient	t-Stat	SE Reg	mu*	sig*		Obs
Pooled	-0.96206	-38.924	1.015	-0.504	0.722		2369

Source: Own elaboration.
Notes: ***. **. *. represent significance at 1%. 5% and 10%, respectively.

Table 6: Unit Root Tests on Hadri (2000), applied to the 7 stock markets from 1 July 2019 to 20 October 2020.

Method	Statistic	Prob.
Hadri Z-stat	-0.53291	0.7030

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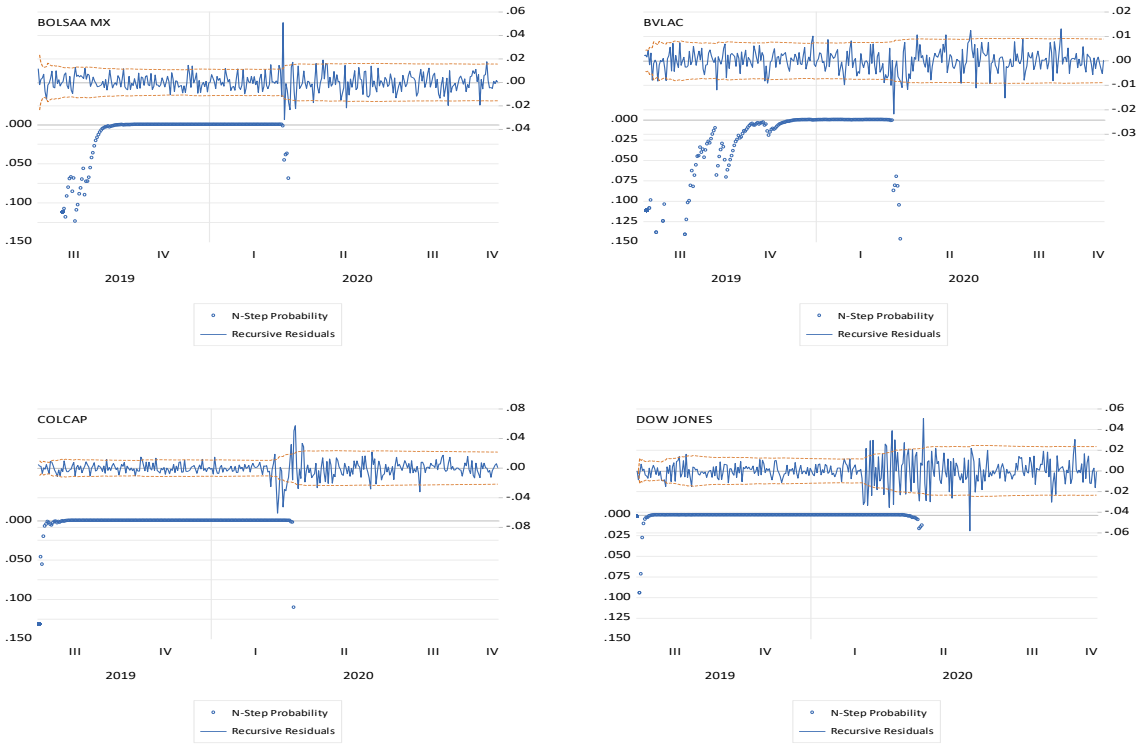
Heteroscedastic Consistent Z-stat			0.36478	0.3576

Series	LM	Variance HAC	Bandwidth	Obs
D(BOLSAA MX)	0.0877	125663.7	3.0	341
D(BVLAC)	0.1007	37.94083	10.0	341
D(COLCAP)	0.0669	1896.688	11.0	341
D(DOM JONES)	0.0643	1906.865	6.0	341
D(IBOVESPA)	0.0907	1217.410	9.0	341
D(IPSA)	0.0384	2558.533	8.0	341
D(MERVAL)	0.0583	1.02E+13	6.0	341

Source: Own elaboration.
Notes: ***. **. *. represent significance at 1%. 5% and 10%, respectively.

Figure 6 shows the stability tests carried out on waste from Europe's stock markets in order to corroborate the presence of structural breaks. The determination of structural breaks is relevant as it has a potentially similar effect to unitary roots. Through graphical analysis we can assess the existence of disturbances in variance. Additionally, by examining the graphs and the 95% probability limits we verify the existence of a breach of the probability limits, thus, time series show an unstable behaviour.

Fig. 6: Stability tests carried out on waste from the 7 stock markets, from 1 July 2019 to 20 October 2020.



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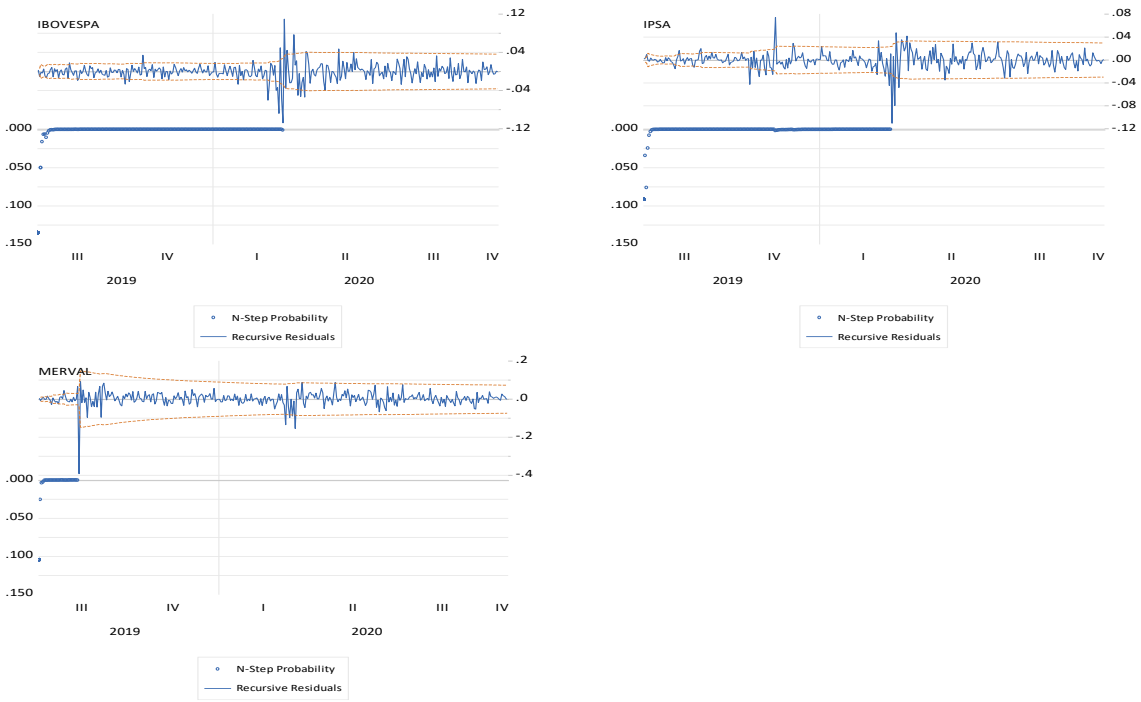

Source: Own elaboration.

Table 7 presents the results of the variance ratio methodology proposed by Lo and Mackinlay (1988), or the purpose of assessing the autocorrelation between the profitability series. In both cases, the statistics were calculated for the lags of 2, 4, 8 and 16 days. Taking into account the results of the variance test, the random walk hypothesis is rejected in all stock market indices. The results therefore support the conclusion that the random walk hypothesis is not supported by the financial markets analysed in this global pandemic period. The values of the variance ratios are lower than the unit, which implies that returns are autocorrelated over time, and there is a reversal to the mean. Under these conditions, markets tend to overreact to information and eventually correct it in the following days, whether it is good news or bad news. The high sensitivity of prices to the arrival of new information is due to the climate of pessimism and uncertainty experienced by investors during the sample period studied. In addition, the hypothesis of informational efficiency of financial markets could be questioned.

Table 7: Tests of the variance ratios, return, for the 7 stock markets, from 1 July 2019 to 20 October 2020.
Null Hypothesis: BOLSAA MX is a random walk (Variance Ratio).

Joint Tests	Value	df	Probability
Max |z| (at period 2)	7.611301	341	0.0000

Wald (Chi-Square)		59.07411	4	0.0000
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.587825	0.054153	-7.611301	0.0000
4	0.335285	0.101311	-6.561129	0.0000
8	0.257678	0.160187	-4.634102	0.0000
16	0.232050	0.238366	-3.221731	0.0050

Source: Own elaboration.

Null Hypothesis: BVLAC is a random walk (Variance Ratio).

Joint Tests	Value	df	Probability
Max |z| (at period 2)	8.504159	341	0.0000
Wald (Chi-Square)	72.41801	4	0.0000
Individual Tests			
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.539474	0.054153	-8.504159	0.0000
4	0.316806	0.101311	-6.743527	0.0000
8	0.189359	0.160187	-5.060595	0.0000
16	0.101721	0.238366	-3.768493	0.0000

Source: Own elaboration.

Null Hypothesis: COLCAP is a random walk (Variance Ratio).

Joint Tests	Value	df	Probability
Max |z| (at period 2)	9.310973	341	0.0000
Wald (Chi-Square)	89.14525	4	0.0000
Individual Tests			
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.495783	0.054153	-9.310973	0.0000
4	0.333054	0.101311	-6.583153	0.0000
8	0.268523	0.160187	-4.566402	0.0000
16	0.180403	0.238366	-3.438402	0.0010

Source: Own elaboration.

Null Hypothesis: DOW JONES is a random walk (Variance Ratio).

Joint Tests	Value	df	Probability
Max |z| (at period 2)	10.63865	341	0.0000
Wald (Chi-Square)	119.1585	4	0.0000
Individual Tests			
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.423885	0.054153	-10.63865	0.0000
4	0.275245	0.101311	-7.153761	0.0000
8	0.164874	0.160187	-5.213448	0.0000
16	0.096553	0.238366	-3.790172	0.0010

Source: Own elaboration.

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Null Hypothesis: MERVAL is a random walk (Variance Ratio).

Joint Tests		Value	df	Probability
Max |z| (at period 2)		9.311422	341	0.0000
Wald (Chi-Square)		87.09800	4	0.0000
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.495758	0.054153	-9.311422	0.0000
4	0.276669	0.101311	-7.139708	0.0000
8	0.178267	0.160187	-5.129838	0.0000
16	0.097684	0.238366	-3.785429	0.0000

Source: Own elaboration.

Null Hypothesis: IBOVESPA is a random walk (Variance Ratio).

Joint Tests		Value	df	Probability
Max |z| (at period 2)		9.145528	341	0.0000
Wald (Chi-Square)		83.91492	4	0.0000
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.504742	0.054153	-9.145528	0.0000
4	0.284329	0.101311	-7.064099	0.0000
8	0.197887	0.160187	-5.007360	0.0000
16	0.174084	0.238366	-3.464913	0.0000

Source: Own elaboration.

Null Hypothesis: IPSA is a random walk (Variance Ratio).

Joint Tests		Value	df	Probability
Max |z| (at period 2)		7.572251	341	0.0000
Wald (Chi-Square)		58.50411	4	0.0000
Individual Tests				
Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.589940	0.054153	-7.572251	0.0000
4	0.327692	0.101311	-6.636076	0.0000
8	0.225531	0.160187	-4.834786	0.0000
16	0.180126	0.238366	-3.439566	0.0000

Source: Own elaboration.

Table 8 shows the results of the Detrended Fluctuation Analysis (DFA) exponents, and we find that financial markets show signs of (in) efficiency, in its weak form, showing persistence in yields, i.e. the existence of long memories, validating the results of the variance test of Lo and Mackinlay (1988), which show the rejection of the random walk hypothesis. These findings show that prices do not fully reflect available information and that price changes are not i.i.d. This has implications for investors, as

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some returns can be expected, creating opportunities for arbitrage and abnormal returns, contrary to the assumptions of random walk and information efficiency.

Table 8: DFA exponent for return. The values of the linear adjustments for αDFA always had $R^2 > 0.99$

Index	DFA exponent (Covid-19)
MERVAL	0.60 ≅ 0.0059
COLCAP	0.74 ≅ 0.0119
IPSA	0.65 ≅ 0.0037
IBOVESPA	0.63 ≅ 0.0143
DOW JONES	0.59 ≅ 0.0119
BOLSAA MX	0.58 ≅ 0.0014
BVLAC	0.76 ≅ 0.0085

Source: Own elaboration.
Note: The hypotheses are H_0: α = 0.5 and H_1: α ≠ 0.5

5. FINAL CONSIDERATIONS

The overall conclusion to be retained and sustained in the results obtained, through tests performed with econometric and mathematical models, demonstrates that the global pandemic has a significant impact on the memory properties of the markets analysed. The results suggest that the randow walk hypothesis is rejected in all markets. In all cases, the values of the variance ratios are lower than the unit, which implies that the yield series show a negative series correlation, and there is a reversion to the mean, in all indices. The exponents Detrended Fluctuation Analysis (DFA), indicate significant long memories, i.e. they validate the results of the Lo and Mackinlay parametric test. In conclusion, we consider that the prices do not fully reflect the available information and that the changes in prices are not i.i.d.. This has implications for investors, as some returns can be expected, creating opportunities for arbitrage and abnormal returns. These findings also open space for market regulators to take action to ensure better information in these regional markets.

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ETHICAL DECISION-MAKING AND GAME THEORY APPLICATIONS FOR CYBER SECURITY IN THE INSURANCE MARKETS: A SURVEY

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ABSTRACT

Over the years, the application of game theory in social sciences has gained interest amongst researchers and has been used as a method of applied mathematics for understanding various phenomena and strategic interactions between agents in fields such as economics, politics, biology, computer science. The process of ranking alternatives, choosing the one which maximize oneself payoff and act accordingly, has unnoticeably collided with the modern hedonism and in some cases, caused deviant workplace behavior. Insurance companies accumulate considerable amounts of private and confidential policyholder information which obligates insurers to deliver protection of the integrity and confidentiality, transparency and accuracy of the gathered data as primary data protection principles of the industry. By providing a comprehensive overview of the recent game-theory applications, the aim of this paper is to identify a link between game theory and corporate ethics in the insurance industry, and thus, explore various approaches and possibilities of applying game theory for determining the cyber risks and privacy issues in the insurance industry to achieve equilibrium strategy to persevere unanticipated cyber-attacks and data breaches.

KEYWORDS: game theory, insurance, corporate social responsibility, ethical decision making, cyber security.

JEL CLASSIFICATION: C7, G22, M15

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Introduction

Over the past years, corporate ethics has been considered to be an evolving topic to various analyses in the field of organizational management. Businesses worldwide actively seek innovative approaches, strategies and principles of governing in order to better their managerial performance and improve the business processes. Despite of this progress, we are surrounded with information about ethical collapses such as deliberate deception, theft and unlawful conducts, disregard of company policy and immoral behavior in the business sector on daily basis. Depraved behaviors are oftentimes overlooked or are mildly sanctioned by the top management which not only worsens the company reputation and causes frustration amongst overall population but further encourages these unethical actions to become routines in the workplace. When business processes in organizations become more complicated, the increased need for moral values and a proper ethical code is an inevitable and prioritized action and should be implemented in representative's daily activities in order to successfully avoid or alleviate deterioration in customer attitude towards the business itself. If actions are not taken, customer's bad perception of the company gradually accumulates and passively affects their future purchase decisions. Despite of the strong theoretical background, organizational management is in continuous battle when it comes to pursuing ethical behavior to the employees. Insurance companies conduct operations on the financial market by collaborating with various market actors, including the investors, managers and employees of insurance undertakings, insurance brokers and agents, private and institutional clients, banks, reinsurers, providers of business support services, research and development organizations and the host community. The concepts of game theory provide a language to formulate structure, analyze, and understand strategic scenarios (Turocy and Stengel, 2001). Otherwise speaking, a game refers to a mathematical modeling of strategic interactions between two or more rational or irrational agents. The insurance sector encounters significant amount of cyber threats and risks due to the fact that insurers gather vast amount of personally identifiable information such as social security number, driver's license number, bank account number, passport number which are oftentimes outsourced to third-parties by insurers for the fulfilment of the business needs and that might result in an increased exposure to cyber risk. The cybersecurity

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disturbances in the insurance can lead to adverse effects such as loss or corruption of confidential data, disruption of business, financial loss and reputational damage (International Association of Insurance Supervisors, 2016). In order to survive potential cyber-attacks and data breaches, insurers should develop appropriate long term and high-level management practices as a part of an efficient governance mechanism to deal with the challenges implied by the cyber risks. In that manner, this paper aims to identify potential game-theoretic approaches to prevent and minimize cyber risks in the insurance industry, dominantly from the perspective of the employees.

Literature overview

Game theory is defined as mathematical modeling of rational agents and is used for analyzing various situations where conflict of interests between two or more agents is present and tries to find proper decision-making strategy for achieving outcome which is optimum for all parties (Bhuiyan, 2016). The concept of game theory was first introduced by Zermelo (1913). His analysis focuses on two-person zero-sum games under assumption that positions are finite, players have opposite interests and perfect information, there are infinite sequence of moves and infinite number of games can be played. Zermelo's theorem supposes that a player with wining tendency will always win no matter the strategy used by the other player. Despite of these early beginnings, the theoretical concept of game theory has been initiated in the 616-page work "Theory of Games and Economic Behavior" (Neumann and Morgenstern, 1944) which gained great success and attention amongst academicians. As a result, Neumann became father of game theory. Following his work, Nash (1951) contribute to the field of non-cooperative games involving two or more players in which each has knowledge of the equilibrium strategies of the other players and there are finite sets of actions by proving that there is at least one mixed-strategy Nash equilibrium in a game following these assumptions. Nash defines this equilibrium point as an *n*-tuple or, an ordered set with *n*-elements, in which each player's mixed strategy maximizes his payoff under the assumption that the strategies of the others are kept unchanged concluding that each player's strategy is optimal opposed to those of the others. Nash equilibrium concept is applicable in situations where strategic interaction and several decision makers exist (prisoner's dilemma, matching pennies, tit-for-tat, stag hunt, battle of sexes etc.),

thus, it is used as a predictor of outcomes which depend on the decision of other players. Also, it is important to note that a player cannot predict others results of a set of choices if the player analyses those choices in isolation meaning that there must be third-party involved in order to give proper predictions. Game theory has been subject of discussion in numerous researches (Gonzaga, 2006; Da Costa et al., 2009; Myerson, 2013; Amato et al., 2015). Myerson (2013) applies game theoretic models in political institutions and further analyze Nash implementability, Muller-Satterthwaite impossibility theorem and Median Voter Theorems. Correspondingly, Yukalov and Sornette, (2011) use mathematical theory of separable Hibert spaces to examine the effect of superposition of composite prospects in order to describe variety of anomalies and fallacies in the decision-making process of real human beings. Multiple authors have used behavior decision theory as embodiment of game theory (Drechsler and Becker, 2013; Kumar and Goyal, 2015). Similarly, researchers have used game theory to understand various decision making processes in the field of finance and economics (Barberis and Huang, 2008, O'Connor et al., 2014), risk analysis and strategic management (Schmidt and Zank, 2008; Sahin et al., 2009; Krabben, 2012; Nilsson et al., 2011; McVea and Charalambu, 2014; Liu at el., 2014; Van der Amato et al., 2015). By the use of game-theoretic modelling in the market of cyber insurance, numerous authors identify the purchase of cyber-insurance as a defence strategy (Johnson et al. 2011; Pal et al. 2011; Yang and Lui 2012; Hayel and Zhu 2015; Chaisiri et al. 2015). Despite of the fact that game theory can help to design mechanisms that incentivizes the insurer, more techniques are needed to answer the questions cyber-insurance will have to improve cyber security and privacy (Cuong et al. 2017). On further note, Pal et al. (2014) suggests that risk management techniques have potential to improve cyber security with economic incentives for users, policy makers, and security software vendors. To achieve an effective cyber risk management programme insurers should include ongoing process and control improvements, incident management procedures such as response and disaster recovery, appropriate network policies and procedures, rigorous management and control of user privileges, secure configuration guidance, appropriate malware protection procedures, consistent control of removable media usage, monitoring of mobile and home working procedures, and ongoing awareness and educational initiatives for all personnel (International Association of Insurance Supervisors, 2016). The implementation of effective cyber risk management practices

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and policies will increase the awareness amongst employees to conduct business activities in a responsible and ethical manner that will potentially reduce the risk of internal cyber-attacks and data breaches.

The concept of rational choice theory

Rational choice theory (RCT) oftentimes captures social scientists' attention because of its power to explain and offer clarification of various social phenomena. The approach suggests that under given circumstances, an individual will always choose the best outcome regarding their preferences. RCT is frequently used in gaming where multiple rational players compete in teams in order to successfully fulfill the aim of reaching a result that would satisfy the interest of each member of the team. Hence, the concept of rational choice underlines multiple axioms (Osborne, 2004):

1. The individual have set of available alternatives and takes an action. *Individualism* implies that from set of given alternatives, a person creates coalescence based on self-interest which maximizes one's welfare and acts accordingly.
2. *Completeness* supposes that a_1 and a_2 are set of two alternatives, where a_1 is preferred to a_2, a_2 is preferred to a_1, or an individual is indifferent between alternative a_1 and alternative a_2. Simply put, the axiom of completeness imply that comparison can be made between all pairs of alternatives.
3. *Transitivity* is defined as follows: for any given set of alternatives (a_1, a_2, a_3), an individual prefers a_1 to a_2, and a_2 is preferred to a_3, then a_1 is necessary preferred over a_3.
4. According to *rationality*, individuals will act in ways of self-maximizing nature, or, an individual will choose the best possible outcome to a set of given alternatives that tend to bring highest utility. Here, it is important to note that there is a possibility for preferences to be altruistic, meaning that person's outcome depends on other person welfare.
5. The assumption of *perfect information* suggests that for any set of outcomes (a_1, a_2), a_1 is preferred to a_2, and in a state of perfect and complete information, an individual will choose a_1 and thus, realize best social outcome and maximize one's utility. Neoclassical economists suggest that the individual makes a choice from a set of known alternatives, he has full knowledge of all the information for each alternative, persons' preferences are given exogenously and are complete and the entity's utility function is clearly given mainly by its preferences. This assumption is oftentimes criticized by

scientists due to the fact that a person cannot predict the future and information is imperfect and incomplete as a result of the uncertainty principle and the nature of changing behavior and flexibility to adjust to situations.

Definition 1 Suppose a subset of alternatives a, where $A \subset R^n$ and $n = (option\ 1, option\ 2, option\ 3)$, and $a \in A$, for $a = (a_1, a_2, a_3, \dots, a_n)$. Consider an investor, who is faced with pair of alternatives a_1 and a_2 in a state of perfect information, where $A \subset R^n$ and $a \in A$, for $a_1 = stock\ 1, a_2 = stock\ 2$. Let, $a_1 \geq a_2, a_2 \geq a_1$ or the investor is indifferent between a_1 and a_2. Investor choses a_1 only if it's strictly preferred to a_2, or $a_1 > a_2$, in other means if, $a_1 \geq a_2$, then a_1 is at least as good as a_2 and investor is indifferent if $a_1 \sim a_2$. The definition, provides a summary of previously discussed axioms of RCT.

Social Responsibility Conduct and ethical decision-making

Ethics is the subject that examines the personal moral standards of the society (Velasquez, 2006). Business ethics can thus be understood as the study of professional practices, i.e., as the study of the content, development, management, and effectiveness of the codes of conduct designed to guide the actions of people engaged in business activity (Stanford Encyclopedia of Philosophy, 2019). But there is no unified definition for the concept of ethics, what is wrong for one individual it can be considered right for other. Despite of the early sets of principles of right and wrong behavior guiding, the complexity of business transactions in the insurance industry causes foggy ambience for tracking unethical behaviors in the workplace. Ethical behavior is of pivotal importance not only from individual perspective but also for the insurance industry as a whole. Even though, high standards for ethical business conduct are established in the insurance industry and the fact that following ethical practices help organizations develop good reputation, maintain company credibility and improve employee morale, the term of business ethics is often considered abstract for individuals who believe that rules do not apply to them. Ethical behavior can evidently increase customers' trust in the company and its agents, which is one of the major problems for the insurance industry. The fraudulent activities employees conduct negatively impact customer's perception of that company and the insurance as a whole, which further encourages customers to not get insured at all. By demonstrating

honesty, trust and integrity, a company shows that ethics is important principle in the organization. The act of being able to avoid criminal acts and illegal ethical conduct in the workplace creates strong public image, increases teamwork and productivity, which all together generate greater shareholder value for the company. A business dilemma exists when an organizational decision maker faces a choice between two or more options that will have various impacts on the organization's profitability and competitiveness; and its stakeholders. In situations of this kind, one must act out of prudence to take a better decision (Fernando, 2012). Ethics is far broader than law. It is developed by the values, beliefs and tradition of society. It provides guidelines and principles of how we ought to behave. But there is no straight line between right and wrong. In other words, what can be considered as right for one person, can be takes as wrong for other. Some situations in everyday life are not regulated with law but are considered as harmful for other's welfare and society. The issue begins when an individual does not follow the ethical rules set by society, or he internally and strongly beliefs that other people are interpreting the situation as wrong while he sees it as a right thing to do. Socially responsible companies should measure their performance with contribution to economic prosperity, environment quality and social capital, as key measurement factors. Also, it is inevitable for companies to collide traditional business activities with aggressive and far-reaching goals (Flannery, 2000). The application of game theory to ethics first appeared in 1954 in Richard Braithway's work "Theory of games as a tool for the moral philosopher". It is considered that with the help of game theory one can apply mathematics in order to understand human behavior, group social behavior, and analyze certain ethical dilemmas. For instance, Solomon (1999) argues that the rational agent in game theory is selfish and only acts in terms of maximizing his own self-interest, meaning that game theory is not appropriate discipline to integrate ethics to. On the other side, Binmore (2007) states that game theory analyzes possible outcomes of given situations and people's preferences without reflection on what these preferences ought to be. Thus, for him, game theory is ethically neutral. Another issue regarding ethical misconduct is not reporting it. Oftentimes, employees who have knowledge and full information on how their fellow workmate tricked the system or did an unethical act in his benefit, struggle to report the violation. Even though the code of ethics obligates employees to report any kind of misconduct in the workplace, in small and medium organizations is

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inevitable to establish close day-to-day communications with fellow coworkers and as a result, grow ***sympathy*****.** The sympathy leads to increased affinity and ***empathy*** towards the fellow coworkers which can result in decrease of the ability to report ethical misconduct or even totally surpass the obligation of reporting one. This is due to the fact that individuals express ***fear of uncertainty*** and are ***risk averse***. In other words, in small-to-medium size organizations, the ***risk of revealing the identity*** of the person who reports ethical misconduct significantly increases. In many cases, this reveal can result in ***vengeance***. Another reason for avoidance of reporting is the lack of trust that an ***appropriate disciplinary measure*** will be taken towards the unethical.

Applications of game theory for cyber security in insurance

Game theory provides a mathematical description of a social situation in which two or more individuals, or players, interact. Information concerning the rules of engagement and the payoffs may be known to all players or imperfectly known to some (Chen, 2014). For instance, the Bayesian game generalizes the notion of a strategic game to allow us to analyze any situation in which each player is imperfectly informed about some aspect of her environment relevant to her choice of action (Osborne, 2004). Meaning that, in many situations players do not have the perfect knowledge about other player preferences, valuations on the object of negotiation, firm' cost function. Even they have the knowledge, the player's interpretation can vary for different situation. Game theory gives an abstract interpretation of real-world scenarios. To identify the potential applications of game theory for cyber security in the insurance, The International Association of Insurance Supervisors (2016) recognize the following types of cyber threats and cybersecurity weaknesses to the insurance sector:

1. *Missing or Incomplete Overview of the IT-Landscape* refers to the existence of data flows between IT systems in insurance with high levels of protection and systems with lower security levels which makes the data vulnerable to cyber criminals that attempt to gain access to the secure systems.
2. The *Inadequate Control Process Regarding User Privileges* can be a result of the failure of controls within the allocation process of user rights and the failure to recognise when an account no longer needs certain system privileges. These issues are related to

the inefficient user identity management within the company which can lead to insider abuse and exposure to cyber risks.

3. *Improper Access to Superuser Accounts Direct* relates to the condition when the employee in the insurance company has been granted an access to the "superuser" accounts without sufficient controls. The major risk arises when a hacker gains access to any of the accounts held by the employees with access to the superuser account. In this case, the hacker could effectively control the entire system.
4. *Loss of Confidential Data* can occur when collected and stored personal identifiable information such as personal health information names, birthdates, social security numbers or medical identification numbers are target for attack by cyber criminals for the purpose of committing fraud and identity theft which could harm the valuable intellectual property rights of a policyholder.
5. If an insurer suffers a data breach it can easily lead to *Reputational Damage* of the company and could extend to the insurance sector as a whole and adversely affect the confidence of consumers, policyholders, investors, rating agencies, and business partners.

In that manner, useful applications of game theory can be potentially be focused on modelling real-life scenarios dominantly from the Bayesian game contexts due to the fact that in the attacker/defender games both players possess incomplete information or put simpler, the defender is uncertain about the type of his opponent (regular or malicious) which is followed by selection of strategies based on the defender's belief of the type (Liu et al. 2006). Another application of game theory in practice could be linked to covering the behavioural aspects of the games as a foundation in the software development projects to test negotiation skills (Rodrigues et al. 2013). Additionally, application of the Bayesian dynamic games can help insurers to identify cyber risks in time and develop strategies for rapid response and defence. This can provide assistance to insurers to discover best threat control methods while giving an insight of the level of confidentiality of certain core information and actions within the system are (Van der Veeken et al. 2016).

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Conclusion

This paper contributes in the understanding of various unethical behaviors, deviant and aberrant social phenomena in insurance industry. Usually, individuals who are faced with situations in which they possess knowledge of any ethical misconduct being done by their coworkers and they ought to report it to a competent authority, the circumstances become complicated. In many cases, individuals become part of the ethical misconduct. This can be explained by the concept of rational choice theory and the nature of every human being to act in maximization of his self-interest. Situations exist in which an individual gets involved in unethical practices due to restriction of expressing his own opinion in the organization or be prohibited by superiors to bring changes within the company. Oftentimes, these opinions are socially responsible and in one company's interest, but the simple act of restriction by superiors, can easily lead the individual to get involved in unlawful practices in order to gain enough power and authority and further, give his opinions a pragmatic application that will maximize not only his own interest but company's self-interest and the interest of society as a whole. Another factor of behaving unethical can be explained as influence of superiors or intimidating behavior by managers, meaning that the employee is threated or forced to conduct immoral practices. In order to motivate the employees to report fraudulent activities in the insurance industry it is important for the C-level management to take appropriate measures for sanctioning these behaviors, encourage employees to report misbehaviour and ensure them that the report will be followed by sanction measures. Another step the management should consider is the set up of a hotline that allows employees to report information anonymously, if desired and ensure that the reports will be treated confidentially. Correspondingly, it is important to create a positive work environment that nurtures loyalty between employees and the company. Similarly, one should carefully screen job applicants by thoroughly examining educational credentials, criminal records, employment history and references. Taken in consideration the novelty as well as the dynamical and rapid proliferation of innovations in the cyber security field, game theory and insurance, this subject should be a matter of an in-depth analysis and further diligent research.

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THE FUTURE OF ORGANIZATIONAL CULTURE

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ABSTRACT

Today, in the dynamic and turbulent conditions, the future of the organizational culture is of outstanding importance. In this article different definitions and trends in the ”new” organizational culture, the necessity of implementation of strategies for corporative development as well as organizational culture are explained. The highlight is on the change in the culture of the organization and its challenges, by creating the model of “culture in action”. The new future concept of organizational culture integrates some aspects of which situational consciousness is basic with special focus on the socio – psychological details in connection with interpersonal and group dynamics.

The theoretical review of the article also points out the ingredients of the organizational culture and emphasizes the corporate/collective identity which includes shared aspirations and vision for the future. The objective of this article is to underline that the organizational culture in the contemporary corporative turbulent world should not be “iceberg” but it should raise above the water. The visible part – the peak , should be the future new concept or the so called green office in which common knowledge, shared orientations towards certain issues will be implemented, group spirit of “ vibrancy” as well as active aging – experience exchange.

KEYWORDS: behavior, organizational culture, organizational climate, teamwork.

JEL CLASSIFICATION: M14

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1. INTRODUCTION

The process of acquiring competences starts with the need of certain context. In the recent years a series of studies have been made, empirical researches which emphasize the organizational culture as main/basic in building group ties in the community and creating high-quality results which will support the complete long term results in the society. The inadequate management of knowledge is risky for the future projects of the organization. Organization culture indicates one of the most complex concept in organization theory and as such is defined as system of values, believes and traditions within the framework of certain organization which are in interaction with the formal structure creating standards of behavior. The aim of the managers should be to create culture oriented towards studying, at the same time trying to avoid politics in the culture.

Considering that the culture cannot directly be manipulated, the managers should develop sophisticated repertoire of leadership skills as well as sharp sense for socio-psychological dynamics.

2. " NEW" ORGANIZATIONAL CULTURE – DEFINITION AND TRENDS

When defining the organizational culture is concerned, series of authors from around the world give different definitions for it. Martin Joan in his book "Organizational Culture" points out that the fields of organizational culture (Joanne, 2002) and her close relatives, managing the knowledge, intellectual asset, human resource and organizational studies have grown up into exponential rate of growth.

Today, more and more managers are using the language of organizational culture as well as corporative culture (Schein, 2018). On the other hand, when talking about culture, in fact, we think about several different things: from the shared principles which people claim/state that they are not familiar with; from transient trends and fashion to enduring taboos and standards; from hard rituals for acceptance in the field/scope of status symbols of power; the list is rather long.

A lot of authors point out that this intricacy is not widely accepted. Besides the four decades of studying the organizational culture, the term is being used in endless ways, most often without specific meaning. Peter Stoyko from the Canadian school of public administration notices that one particular multitude of characteristics is helpful: Culture oriented towards learning honesty, constructive debate, common consideration, respect for the past and the usual sharing of the knowledge and its preserving (Stoyko, 2009). As Fritz Maklap points out, the knowledge may be built in the working process. The ideas what is the best way to perform the things are often spread, become routine or usual working habit (Machlup, 1962). Organizational culture is the instrument with which the knowledge is transferred through the time to the working place. Workers transfer the lessons learned through oral retelling. The knowledge is personified in the common working habits(Lewin, Lippitt, White, 1939).

Organization culture, also influences the way information and knowledge are being shared end the way they are kept by other means. For example, connections of confidence created at the work place influence how much workers dare to be honest and direct. Values and standards may influence the people's readiness to contemplate about the job and to codify the lessons learned. These examples show how culture is a part of the working environment which influences the way people think and act. One of the key questions today, which are important for the organizational culture by emphasizing the behavior is, what the manager can do to sophisticate the good and to eradicate/exterminate the bad?

Different definitions about organizational culture analyze certain elements which need some time so that shared experience can be accumulated before culture comes into being in certain organization.

3. STRATEGIES FOR CORPORATIVE AND ORGANIZTIONAL CULTURE DEVELOPMENT – HONESTY CULTURE

Even in the past, and specially in the contemporary corporative world it is of upmost importance to implement strategic theories for corporative development and organizational culture (Deiss, 2020). Among the strategies for changing the organizational culture the most important are the following: indoctrination strategy,

cognitive dissonance/disharmony and strategy for changing people (Davis, 1984). These strategies may be used alternatively and simultaneously as well.

Developing strategy for change in certain organization, the influence of the organizational culture on the workers behavior, it is important to exist consciousness for the difference between what should be changed (the content) and the way the change needs to be carried out/accomplished (the process). Hence, different strategies for organizational culture change, may be put into effect only by communicating the desired changes in the attitude and the values of the workers. In reality organizational strategy becomes key factor for how much some organization is successful or not. In other words it explains how in the same working conditions some organizations accomplish better results than other. At the same time, effective strategy is inspiring and informs about the actions of the executive teams and at the same time mobilizes all resources of the organization.

It is broadly accepted that different organizations have different culture. Throughout tradition, history and structure, organizations build their culture. The culture of the organizations gives them the feeling of identity, arises questions like: who we are, why we exist, what we are doing. At the same time it is defined, through organizational legends, rituals, beliefs, meanings, values, standards and language.

Organizational culture comprises everything that was good and successful in the past. These values quite often are well accepted by the loyal members of the organization.

Among the first things the new employee learns are some of the legends in the organization – for e.g. that the manager works overtime or that he/she does not evaluate the formal education or extra credentials. The legends may stay in the organizations and become part of the established way things are done. Maybe the manager's vision about the education will only be momentary, whereas in a long term this culture may change by coming new managers in the organization.

In the course of time it is necessary organization to develop its own standards, established and expected ways of behavior as part of organizational culture.

Big number of organizational culture types have been identified by researchers, but this is an example of most widely accepted, defined by Charles Handy (Handy, 1976) and extended by Roger Harrison (Harrison,1972).

1. Culture of power is ground work for domination by one or small number of individuals in the organization. They bring key decisions for the organization. This kind of culture of power may be present in small businesses or in parts of big businesses.

2. Culture of role exists in big hierarchic organizations in which the individuals have clear roles (the ones that work), which they need to perform and are clearly specified. Individuals prefer to work in accordance with their job description. They also prefer to work to follow the rules rather than to work in a creative way.

3. On the contrary, culture of duties exists when teams are created to perform certain duty. The teams create their own culture and since they have the power to make decisions, most often they are creative.

4. Culture of personality is the most individual form of culture and it exists when the individuals are allowed to express themselves and to make decisions. Culture of individual exists only in loose organizations, for e.g. when somebody has a distance job for a company which is based on a different continent.

   Cultural changes take the organizations from one form of culture to another, most often through programfor cultural change.

4. MODEL – CULTURE OF ACTION IN THE ORGANIZATION

The guidelines for leadership, step by step and how to do it, includes practical advice for changing the organizational culture in the company, extracted from numerous articles as well as interviews made with a number of managers in companies (Murray, 2010).

1.The process of change should start with people who have different influences in the organization.

2. A way needs to be found to help the people to experience the stark reality which will bring the change.

3. A way should be found to direct the resources towards most risky activities which need few resources but make big differences.

In the article main highlight is put on: How the process of changes to be made? How culture of honesty to be created? How to create culture of action? How to increase the variety in the working position?

The managers in organization maybe have the power to change the policy in the organization by a single movement of their pen, maybe they have the opportunity to employ, to fire, to upgrade or degrade people, with very little effort. But, the most difficult job they may face is to change the culture of the organization. To make the change first they have to win the hearts and the thoughts of the employees in the organization, and it requires conviction and wiliness.

Four obstacles are being identified that the managers are facing to establish big change in the organization. The first one is cognitive – people must realize the necessity for the change of strategy or culture. The second is limited resources – unavoidable, changes in one organization demand transferring the resources from one range/branch to another. The third obstacle is motivation – still in the end the employees need to be willing to make the change. And the fourth is the policy of the institution. Professors W. Chan Kim and Renee` Mauborgne in the book `Blue Ocean Strategy` point out one of the managers who says: "In our organization you will be rejected even before you suggest something".(Kim, Mauborgne, 2004). To overcome these obstacles they suggest specific management strategy underlining that not everyone can/will change, but above all you should start with the people who have different influences in the organization. Unless the people do not manage to dedicate to the change, they should be immediately dismissed. Once they become devoted to the changes, they should be reworded publically for their achievements, so that the rest get the message. The second concept which the professors are pointing out is – instead of only talking about the necessity for change, a way to implement them needs to be found. The key aspect emphasized is that the implementation starts in the moment when people, managers and the employees themselves feel the harsh reality.

The authors of the book select one example about a commissioner who in 1990 was riding day and night in the New York subway so that he could understand why the frightened citizens called it electric drainage. Other companies have made similar attitude where the managers were rejecting the calls from the disturbed clients. The third aspect which they are describing is how to find a way to organize the resources in critical activities which need little resources but, make big changes, and stay away from the activities which need big resources but make very little influence.

One of the essential/crucial activities which is recommended is to appoint a respected employee from the company who will help the manager, who will struggle for the organization, who supports the organization and knows where it is necessary to build alliance or strategies for change. It is necessary to point out that all leaders have the risk to lose the contact with what is going on below. But, implementation of such activity may help a lot in finding solutions for the problems inside the organization.

Organizational culture change is of crucial value in the whole structure of all affected/concerned sides. Collective spirit and identity needs to be stimulated through creativity in the working position. That`s why the structure of the employees needs to be assessed. In numerous researches the results show that most often the managers usually rely on the creative abilities of small number of employees. (Dyer, 2018). Still, by analyzing the employees` needs and attitudes in a sequence of real situations and studies, it is necessary to have in mind the elements of organizational culture like shared values and principals, shared vision and aspirations, common knowledge, social regulation and collective/corporative identity (Alvesson, Berg 1992). Identifying the employees` strong sides implies how new groups to be made with different talents, i.e. employees with different levels of experience to be involved: the younger members of the team bring energy and optimism, the experienced one bring experience – active aging and experience exchange.

One of the means to create new culture of action in the organization is through building new concept which offers possibility to exchange ideas between the employees and the management. The new concept integrates few aspects among which the key one is situational consciousness with special attention to socio-psychological details connected with the interpersonal and group dynamics. Culture of action as a

model in the organization implies putting into practice positive communicational practices aiming to improve the organizational ethics and effectiveness, integration through constructive approach toward organizational culture (Driskill G. 2018). Green office or garden where employees may spend an hour weekly with a piece of paper and pen are trends which need to be part of their concept aiming to create collective identity.

The focus should be towards encouragement of innovation with culture of equality, flexible timetables as well as interdisciplinary project teams. Office where tenability is established which informs, connects and supports the employees to act maintainable. The newly established situation opens possibility to work from home and in the way employees feel greater confidence from the organization itself.

5. CHALLENGES OF ORGANIZATIONAL CULTURE – PROCESS OF CHANGES

Overcoming the challenges in organizational culture influence the creation and adapting to a new process of changes. The picture becomes even more complicated when we look forward to what the future can bring. Socio - economic changes together with the variable/inconsistent standards in the working position most probably will initiate aggravating the manages` access to the knowledge of the organizational culture. The society becomes more and more ethno – cultural and intellectually diverse (Pauleen, Wu, Dexter, 2007). The population also shows little respect for authors of any kind. There is possibility to overemphasize the tendency of the younger generations to be less conformist and more individualistic: each generation considers itself as more rebellious than the previous one. The organizational culture plays a big role in socialization of the young employees/workers in the working power, today as well as in the foreseeable/ predictable future.

The way of forming policies based on aims and exponents which is established with the Goals of Tenable Development should enable and change the culture of making decisions and management (UN, 2020).

Still, organizational culture has to be more adaptable with individual variations and less dependent on the forced forms of conformism. For a long period of time people

identified themselves through their organizations, i.e. certain individual would see himself as "someone from Commercial Bank " or lifelong civil servant.

Today the probability is stronger people to change the employers several times during their career, but also to have more than one career in the course of their working life. They see their career as part of their personal identity, but they don`t develop the same personal identification with the organization. The high rate of employees` change and the low loyalty toward the organization as well, are reasons for fewer steady organizational cultures. That`s why it is more difficult for the organizations to develop coherent corporate identities (Mason, 2007). As the companies become more and more multinational, the cultures of the organizational affiliates most often acquire quite different character because of the intertwined influences on the local and national cultures. This is a common source of organizational structures in the time when more cultures are intertwined together to create something different. Even by spreading international business standards and way of behavior, local and national cultures will continue to influence the values, attitudes and behavior of the people. The traditional knowledge established in the local national cultures may also be useful for the members of a bigger organization, in that way intertwined transferable influence exists (Pauleen, Wu, Dexter, 2007).

6. CONCLUDING REMARKS

In the course of the coming period the development of the culture which supports studying should enable creating safe space where people may talk openly, to contemplate about what they are doing, and to act authentically. Still, influential leader plays a significant role providing psychological security and modeling the behavior expected from others. This includes cultivation of attentiveness, respect for the past, use of clear language and constructive skepticism. It also implies battle against political – cultural dynamics of the cleavage which eats away the integrity of the organizational culture. These are not quick decisions, but a long-term efforts. This article and its theoretical framework offers original impact towards the future of organizational culture and it is of upmost importance employers in every organization to integrate elements of organizational culture, especially to support the inclusiveness in relation

to difference, intending the employees to realize the bond between the ethics and the culture as part for achieving personal and professional growth.

The future steps of the organizational culture include new trend and role of the employees who need to develop higher intercultural awareness and to be bearers/holders of a steady nucleus in the organization. It is necessary the managers to focus on coherent collective/corporate identity, to acquire situational awareness and to actively accept the cultural signals. Policy creators should offer advantages of the intellectual differences and to give impulse for common wellbeing.

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DIGITAL TRANSFORMATION OF LEARNING PROCESS DUE TO COVID-19 CRISIS IN THE REPUBLIC OF NORTH MACEDONIA

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ABSTRACT

The paper focuses on ICT-enabled education and advanced Learning Management Systems (LMS) through introducing the concept of gamification on improving the learning processes of students in Higher Educational Institutions (HEIs) in the Republic of North Macedonia, which has become a requirement due to the measures related to the COVID-19 crisis. The main goal of the research is to examine the practical implications of gamified systems on improving student motivation and engagement in distant learning processes. The research indicates that HEIs can benefit by implementing gamification in their higher educational processes, especially prevalent when LMS are involved. In line with other research on the field, the paper brings new data and conclusions applicable for the country of interest, as well as the more expanded Balkan region. As the research focuses on primary data through case study and questionnaires, it moves forward the discussion on implementing gamification systems in the learning processes for students at a tertiary level, with significant improvement to student motivation, habits and participation in class even on a short term-basis. Data and analysis from the research enable new evidence and conclusions in the role of gamification in modern LMS.

KEYWORDS: Gamification, learning management systems, Distance learning, motivation, COVID-19

JEL CLASSIFICATION: I22, I23

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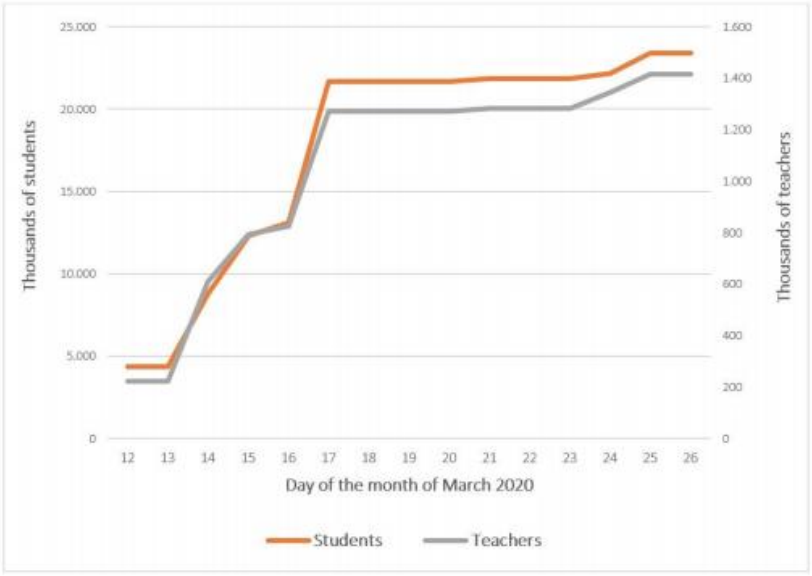
INTRODUCTION

The concepts of distance learning have gained traction with the recent changes due to the COVID-19 pandemic, forcing HEIs (Higher Educational Institution) to change traditional classes with the utilization of IT and Internet technologies and transform them into virtual classes. Latest numbers state that courses are already done mostly in a virtual working environment in the fall semester of the academic 2020/21, with this trend expected to continue throughout the next summer semester, as well as increased percentage of students with full-time employment, due to the flexibility that this system can offer (Athanvale, 2020). UNESCO (2020) predicts that the current crisis will leave a mark on higher education both on the short-term and the long-term, affecting both students and teaching staff. Students face uncertainty over many activities, which can be summarized in two broad categories: learning and evaluation processes. On the other hand, HEIs and teaching staff have to quickly adapt to the new situation, ensuring that both learning and evaluation processes can be transformed into a virtual environment, while maintaining the same level of quality when compared to the traditional methods.

Graph 1. Number of students and teaching staff affected by COVID-19



Source: COVID-19 and higher education: Today and tomorrow Impact analysis, policy responses and recommendations (UNESCO, 2020)

Graph 1 indicates the enormous impact of the current COVID-19 crises on higher education across the world. In a span of several days in March 2020, millions of students and teaching staff had their activities paused due to government regulations

and lockdowns, with most of them continuing activities in a virtual learning environment. These measures are expected to last on a long-term basis, so as each solution has to be rolled out to students as soon as possible, there are concerns with the quality of the implementation and student feedback.

The paper focuses on the first category, which encompasses the transformation of student learning process from traditional into digital form. The student learning process involves three broad elements which are examined in the paper (Gogus, 2008):

- In-class activities
- Out of class activities
- Material for studying

METHODOLOGY

To research the main topic in detail, a combination of secondary and primary research methods is utilized. Literature review represents the main method for obtaining theoretical and background data through books, scientific papers and articles on connected topics. Primary research is done through implementing a case study method on two North Macedonian HEIs with students from second, third and fourth year of studies, selected to participate in the study. A total of 32 students were selected to participate in the study, which lasted for a time period of 2 weeks, which included extensive usage of the gamified application "Habitica[1]" and a period of evaluation through a research questionnaire. This entails establishing a baseline for current level of motivation for students before utilized a gamified system, as well as evaluating the level of improvement in aspects for motivation through a research questionnaire. The research questionnaire contains 15 questions mostly from the closed nature, which was distributed to the students after the completion of the case study period of utilizing the gamified application. Since there were no further restrictions on demographic characteristics or type of studies, students were selected at random, with the questionnaire being sent to them in a digital form, through the digital platform Google Forms. Results are analyzed focusing on several key points regarding improvement of learning processes and educational systems. The research was implemented from 01.02.2020 through 21.04.2020.

[1] https://habitica.com/static/home

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LITERATURE REVIEW

To successfully transform student learning processes with IT and Internet technologies, all three elements have to be taken into account during the implementation. The system and encompassing technologies that facilitate the provision of courses in a virtual environment (over long-distance) are termed as "Learning Management Systems" or LMS in short (Turnbull et al., 2019). Another definition of LMS is a web-based software platform that can create a virtual learning environment, automate the administration, organization, delivery, reporting and provide support for educational content and learning outcomes.

LMS can provide several advantages for students (Iqbal & Qureshi, 2011):

- Single point of availability for all courses and course related information
- Option to get regular feedback from teaching staff
- Possibility for interactive learning with various tasks and exercises directly on the LMS
- Convenient tracking of progress in a course
- Ease of use through various devices equipped with access to the Internet
- Location independence and opportunity to follow classes online and participate in all activities without any physical presence

However, the implementation of an LMS does not automatically guarantee the transformation of traditional class and learning activities in the virtual environment. Despite the technical nature of an LMS, HEIs must allocate time and resources in the organization of activities and supporting teaching staff to fully exploit the potential benefits and ensure the best possible implementation. In many cases, LMS implementations tend to be course-centric rather than student-centric, which tailors the activity across courses inequality and leaving students to adapt to each course differently based on the teacher's preferences. Not utilizing a holistic approach in LMS and virtual learning implementation can result in limited student motivation and ability to participate in activities.

Student motivation represents a significant psychological concept in education, since it directly drives and strengthens the students' ability to learn and improve in their academic performance. SDT (Self-determination theory) is a theory of human

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motivation that researches different types of motivation, with specific focus on autonomous motivation, controlled motivation and motivation as predictors of performance (Odanga, 2017).. The main goal of SDT is to determine how people can be motivated or demotivated due to different factors surrounding them. Motivation is a construct that explains goal-directed behavioural force to face severe and challenging circumstances characterized by initiation, direction, intensity, persistence, and quality of behaviour (Alsawaier, 2017). Student motivation has been in focus throughout the past, but with the virtual learning environment, new technologies introduce different complexities which usually results in reduced motivation in most cases. Furthermore, limited face-to-face contact with students results in difficulty to assess student (de)motivation for teaching staff, making it even harder to react in these types of situations. Students self-motivation is of prominence important when designing and implementing LMS and preparing to tackle learning in a virtual environment, for HEIs of all countries and educational areas.

When analyzing motivation, in can be divided in two main categories (Kiselicki & Josimovski, 2019):

- Intrinsic motivation, which is also referred to as student self-motivation in this case, which comes from the internal motivators/factors. This type of motivation is harder to achieve, but tends to be much more effective and last longer
- Extrinsic motivation, which comes from external factors imposed by the environment, in this case the teaching staff, parents etc. This type of motivation is easy to achieve, but is usually very short-term and with limited impact.

Throughout the past years, a new concept for increasing intrinsic motivation has been extensively researched by the authors of this paper, which has found to produce promising results in various working environments, especially when introduced in a virtual working environment. The concept of gamification can be defined as utilizing game theory, mechanics and certain elements of game design in an environment outside of (video) games, with the end goal being to motivate people to achieve their goals (Detering, 2011). Gamification as a system is starting to gain traction through various implementations in different sectors, though most of the

implementations so far have been focused in the business world. Companies utilize gamification systems to intensify customers' and employees' interest in a specific brand, leading to increased engagement and levels of satisfaction. Gamification can appear in many different forms, such as loyalty programs, hidden tokens, virtual avatars, competitions, game prizes and etc (Van Der Boer, 2013). Usage of gamification and game mechanics can boost learning skills by 40%, leading to higher level of commitment and task completion (Kiryakova et al., 2014). Student motivation is core in improving the student learning experience, which is difficult to monitor and managed remotely in an LMS. By introducing gamified systems and processes, students are engaged in an automated system that constantly guides them in their activities regardless of their location (Lopes et al., 2015).

Models for gamification can be implemented in the educational sector through a system of elements, mechanisms and rewards encompassing four different steps (Aparicio, 2012):

1.**Identification of the main tasks** - the classroom tasks that needs to be gamified

2.**Identification of transversal objectives** - other objectives besides the main objective that would be interesting and attractive for students to perform the activity

3.**Selection of gamification mechanisms** - depending on the main goal, related to the elements of intrinsic motivation

4.**Analysis and control** - through tests with specific metrics, questionnaires, or evaluation of experts on gamified processes and mechanisms applied, in order to compare the results before and after implementing gamification in activities.

RESULTS AND DISCUSSION

To assess the impact of gamification and gamified application on student motivation and view toward learning, a primary research was carried in a time period of 80 days. During this period, selected students were required to install and daily use the gamified platform Habitica, over the period of 1 to 2 weeks (based on preferences). Habitica can be described as a platform to improve real-life habits by gamifying all the tasks and habits[2]. Following the usage of Habitica, students were given a questionnaire,

[2] https://habitica.com/static/features

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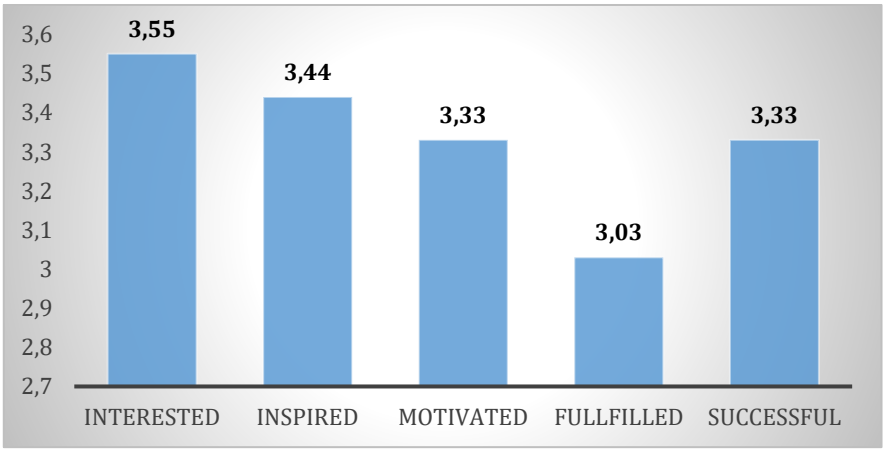
which was structured of 14 closed question and 1 open-ended question. Students were part of either private or public HEIs functioning on the territory of the Republic of North Macedonia. In the period of 01.02.2020 through 21.04.2020, a total of 27 students completed the given assignments and successfully completed the questionnaire, with 5 other students not being able to either finish using the platform or to deliver a filled questionnaire. The questionnaire in its original form is contained in the annex of the paper.

Most of the students are between the age groups of 20-22 (44,4%) and 18-20 (40,7%), followed by 22-25 (11,1%) and 30+ (3,7%). Gender distribution remains almost equal, with 51,9% of the participants being male and 48,1% of the participants being female. Demographic classification concludes with the type of studies that participants are enrolled with, where social sciences dominate with 74,1%, followed by applied sciences with 18,5%, as well as natural and humanistic sciences, both with 3,7%.

Graph 2. Student view towards classes



Source: Own research

Graph 2 pertains towards students' motivation during classes with physical presence. Due to the extensive focus of gamification toward intrinsic motivators, student self-motivation is crucial to provide a baseline before the implementation of the gamified platform. The answers were based on a 5-point Likert scale, with 1 being the lowest and 5 being the highest grade. General levels of satisfaction are above average (a menial 2,5), but fail to break the 4,0 barriers. During physical classes, students score the highest in interest with 3,55 (out of 5), followed by being inspired

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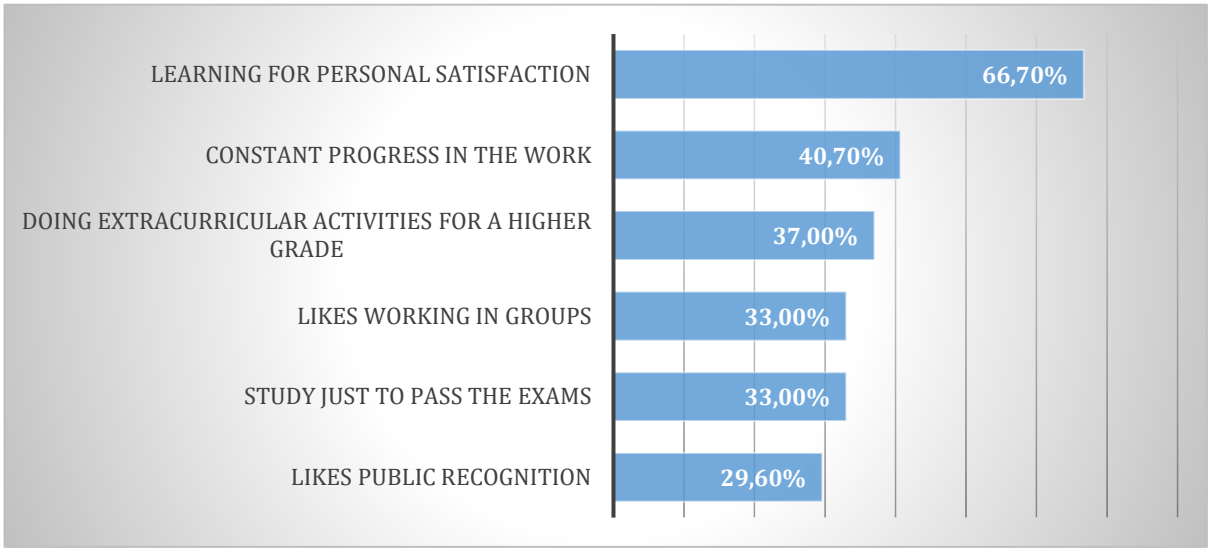
with 3,44 (out of five). These are above average levels which can certainly be improved through implementing gamification processes.

Graph 3. Student motivation for participating more in certain classes



Source: Own research

Breaking down the specific reasons for student participation in classes in Graph 3, the most prominent reason is “getting personal satisfaction” with 66,70%, followed by “seeing progress” with 40,70% and “doing extracurricular activities for a higher grade” with 37%. Student valuing personal satisfaction as a key component in motivation for studying and participating in class activities is in line with the intrinsic motivators which are targeted through gamification models. Additional data is gathered to discover the most frequent reasons for doing school activities. Students rate the highest “improving personal skills and knowledge” with 70,4%, “getting extra points/higher grade” with 59,3% and “getting public recognition with 29,6%. This also demonstrates that there could be definitive potential in implementing models for gamification to increase student motivation and participation in virtual classes.

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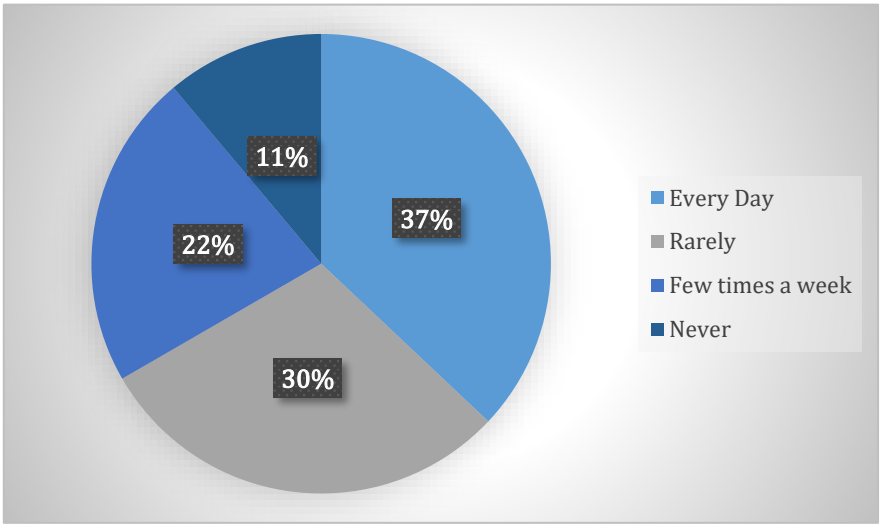
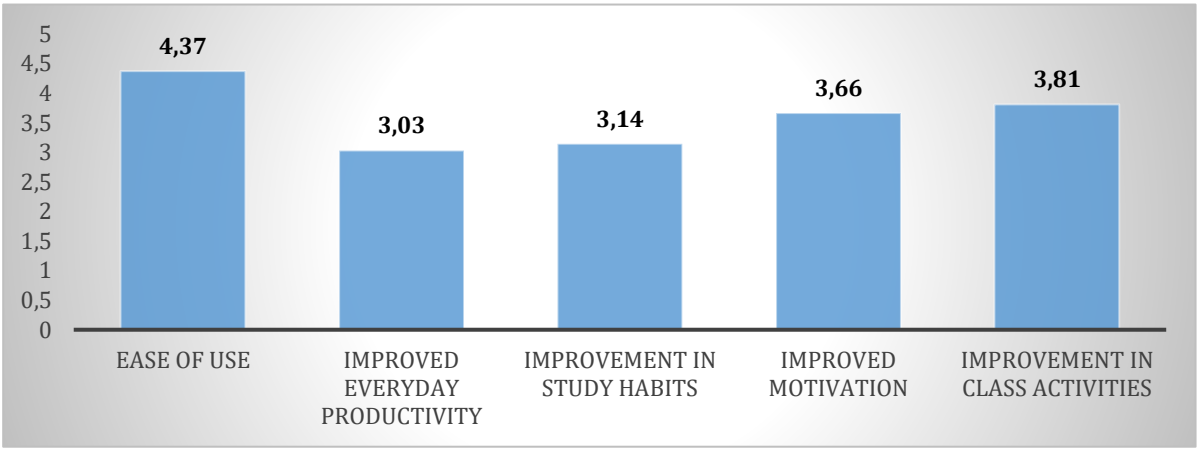
Graph 4. Frequency of playing mobile/video games



Source: Own research

The last qualifying question is how often students play mobile or video games, represented in graph 4. Most of the students (37%) play video games or mobile games on a daily basis, while only the smallest percent (11%) have never played. Since gamification utilizes mechanics often found in video games, exposure to games on a regular basis can significantly shorten the learning curve and adaptation to gamified platforms and applications.

Graph 5. Student view towards classes



Source: Own research

Graph 5 analyzes the student views after a period of one to two weeks of actively using the application as part of at least one subject in class. Since the situation with the COVID-19 pandemic, part of the study was conducted with combined classes (physical presence plus online activities in February 2020 and part of March 2020), while the other part in March/April 2020 was entirely conducted utilizing online classes and

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work. The situation can give us a better insight into the usefulness of this type of platform during both combined and online classes. After extensive daily use, students were asked to evaluate five relevant aspects of the application. The first evaluated aspect is the ease of use, which has scored very high on the Likert scale, with 4,37 (out of five). Across the other four aspects, which are related to different areas of student activities, we have above average grades (over 2,5) in two of them, including Improvement in study habits (3,14) and improvement in everyday productivity (3,03), as well as high grades (over 3,5) relating to improvement in class activities (3,81) and improved motivation (3,66).

CONCLUDING REMARKS

Current implementation of LMS focuses on content delivery, while student and teacher feedback and ease of use is limited, which can lead to poor implementation and dissatisfaction in the end. Conducted primary and secondary research shows that models for gamification can have significant impact if implemented properly into LMS and classroom activities:

- Current level of satisfaction from physical classes is above average (around 3,0 on a Likert scale), but the digital transformation of classes can result in loss of motivation and participation in learning activities
- Gamification focuses on the intrinsic motivation, which is more difficult to achieve, but also longer lasting than extrinsic motivation. Various case studies show that gamification can yield positive results, from higher attendance, higher engagement rates and ultimately higher average grades for the students.
- Different student generations (ranging from 18 to 30 years) have been regularly exposed to video games or mobile games at least a few times a week (67%), which is an indicator that they have already been exposed to certain mechanics of gamification, which are directly lifted from said games. This enables easier integration into the gamified platform and an advanced starting point when compared to older generations.
- Through an extensive case study and analysis, initial results demonstrate that students are relying on intrinsic motivators, which include learning for

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personal satisfaction and seeing constant progress in the work done, which is a precursor for susceptance to gamified systems. As gamification targets intrinsic motivators which are in line with current student motivations, we predict a greater chance of success than in other implementations.

- The study clearly demonstrates the benefits of introducing a gamified system to students, which has resulted in above average improvements in class activities, student motivation, everyday productivity and study habits. All four analyzed indicators have shown improvement, even in the relatively short period of implementation ranging from one to two weeks.

This research can be further expanded by including students from several different Balkan countries, as we believe that there could be significant cultural differences, resulting in potentially different results. Additionally, the research focused on a short-term implementation without direct integration in the LMS, which leaves the potential to evaluate integration on a deeper level throughout a whole semester in a single or multiple subjects.

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ANNEX I – Research questionnnaire

Анкета за гејмификација во датабази и образование

Почитувани студенти, ви благодариме за учество во овој прашалник, која е дел од истражувањето користење на бази на податоци и гејмификација. Вашите одговори се од огромно значење, но учеството е доброволно и може да се откажете од прашалникот во секој момент.

Одговорите на прашањата се целосно заштитени и доверливи, при што ќе бидат кодирани и прикажани како вкупни статистики, а не како посебни индивидуални податоци.

Ви благодариме однапред за соработката и одвоеното време.

* Required

Возраст *

- ◯ 18-20
- ◯ 20-22
- ◯ 22-25
- ◯ 25-30
- ◯ 30+

Пол *

- ◯ Машки
- ◯ Женски
- ◯ Не би сакал/а да специфицирам

Вид на студии *

Одберете поле на студирање според факултетот на кој сте запишани

- ◯ Општествени науки
- ◯ Природно-математички науки
- ◯ Технички/применети науки
- ◯ Хуманистички науки

Додека сум на факултет/предавање се чувствувам: *

Оценете ги изјавите од 1 (најниско) до 5 (највисоко)

	1	2	3	4	5
Заинтересиран/а	◯	◯	◯	◯	◯
Инспириран/а	◯	◯	◯	◯	◯
Мотивиран/а	◯	◯	◯	◯	◯
Исполнет/а	◯	◯	◯	◯	◯
Успешен/на	◯	◯	◯	◯	◯

Одберете со кои изјави се согласувате за вашето студирање? *

- ☐ Студирањето и учењето ми дава лична сатисфакција
- ☐ Целта ми е да ги положам предметите со најмалку вложен напор
- ☐ Сакам да гледам постојан напредок во задачите ги правам
- ☐ Сакам да работам во група за време на часовите и надвор од нив
- ☐ Сакам да добијам јавно признание за мојот труд
- ☐ Правам дополнителни активности за повисока оценка

Одберете причини заради кои ги извршувате обврските со факултет? *

Под обврски се сметаат присуство и активност на час, домашни задачи, работа во групи на час, решавање задачи итн...

- ☐ Постои можност да добијам награда/поени за извршување на задачата
- ☐ Постои можност да добијам пофалба од професорот за време на часот
- ☐ Постојат негативни последици (казни) доколку не ја завршам задачата
- ☐ Бидејќи сите останати студенти ја прават задачата
- ☐ Бидејќи ќе ги подобрам моите вештини и способности
- ☐ Не ги извршувам

Колку често играте мобилни игри или видео игри? *

Под терминот „мобилни игри" се сметаат игри за вашите паметни телефони

- ◯ Секој ден
- ◯ Неколку пати неделно
- ◯ Ретко
- ◯ Никогаш

Дали успеавте успешно да ја инсталирате апликацијата Habitica? *

- ◯ Да
- ◯ Не

Колку лесно ги внесовте вашите податоци во базата на апликацијата? *

	1	2	3	4	5	
Најтешко	◯	◯	◯	◯	◯	Најлесно

Со кој степен апликацијата влијаеше врз зголемување на вашата секојдневна продуктивност? *

	1	2	3	4	5	
Најниско	◯	◯	◯	◯	◯	Највисоко

Со кој степен апликацијата влијаеше врз зголемување на вашите секојдневни навики? *

	1	2	3	4	5	
Најниско	◯	◯	◯	◯	◯	Највисоко

До кој степен постоењето на виртуелни аватари и виртуелни награди влијаеше врз вашата мотивација? *

	1	2	3	4	5	
Најниско	◯	◯	◯	◯	◯	Највисоко

До кој степен би можела да се користи гејмификација за извршување на вашите активности на факултет? *

	1	2	3	4	5	
Најниско	◯	◯	◯	◯	◯	Највисоко

До кој степен гејмификацијата може да послужи кај студентските вработувања? *

	1	2	3	4	5	
Најниско	◯	◯	◯	◯	◯	Највисоко

Дополнителни коментари:
наведете дополнителни коментари кои не се опфатени во прашањата

Your answer

Submit

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THE PROCESS OF REALIZATION AND TESTING OF E-ELECTIONS

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ABSTRACT

Electronic democracy (abbreviated e-democracy) is one stage in the historical development of democracy in societies. Other terms that have been used, or are still used in parallel, are teledemocracy, digital democracy, cyber democracy, virtual democracy, Internet democracy, and sometimes electronic republic. E-democracy implies the use of new ICTs in the service of democracy i.e. to strengthen democracy, democratic institutions and democratic processes. The name itself of electronic voting indicates the use of certain electronic devices and data processing during the vote process. The broadest definition of e-voting would include those voting who are using at least one electronic device or procedure. This paper describes how e-voting should be realized and how it should be tested in order to be successfully implemented.

KEYWORDS: ICT, e-democracy, e-voting, e-election, testing, EVS.
JEL CLASSIFICATION: C88, L86, L88.

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1. INTRODUCTION

Election process increasingly depends on ICT systems, and when the (un)certain frontier gets crossed, it becomes e-voting. It is medium complexity socio-technology system. Technical subsystem of e-voting is a process which transforms its' inputs into certain outputs. Social subsystem represents interpersonal relations established between the employees in the e-voting organization. Due to the interdependence from and to other social components, holistic, integrated and detailed plan is needed for implementation of this kind of system. This plan includes adoption of the type of system for e-election, development and introduction of e-election, system implementation and testing, and finally monitoring of established e-voting system.

Realization of e-elections can be reflected through mode of realization of multiware (hardware, software, orgware), realization of physical installations and through other activities, like procedures in e-elections. Together with realization comes the final solution testing, and this topic is discussed in a separate section.

Voting procedure in e-elections usually consists of two steps. First step is the registration of voters and the second step is the act of voting. These two steps are in a special technical way separated in order to provide secrecy of the vote and the anonymity of voters. The main problem that remains is connecting the steps and keep these goals, which will be addressed later in this paper.

In the case of e-voting at the fixed locations, appearance and functionality of these places could be predefined by law and bylaws. Sometimes the full deployment of all physical locations is defined (examples in some Arabic countries), sometimes it is defined by religious regulation (like Feng Shui in some Far East countries), somewhere only parts of polling stations are defined strictly and in detail (western countries with voting machines), and finally, in some cases, list of guidelines are given for the organization and decoration of voting places (e.g. country flag should be positioned strictly...).

If the voting machine should be positioned at the fixed (or eventually at the mobile) polling station, then this machine should have architecture of few simple layers. Generic and abstracted model for the purpose of realization illustration of e-voting with voting machines follows:

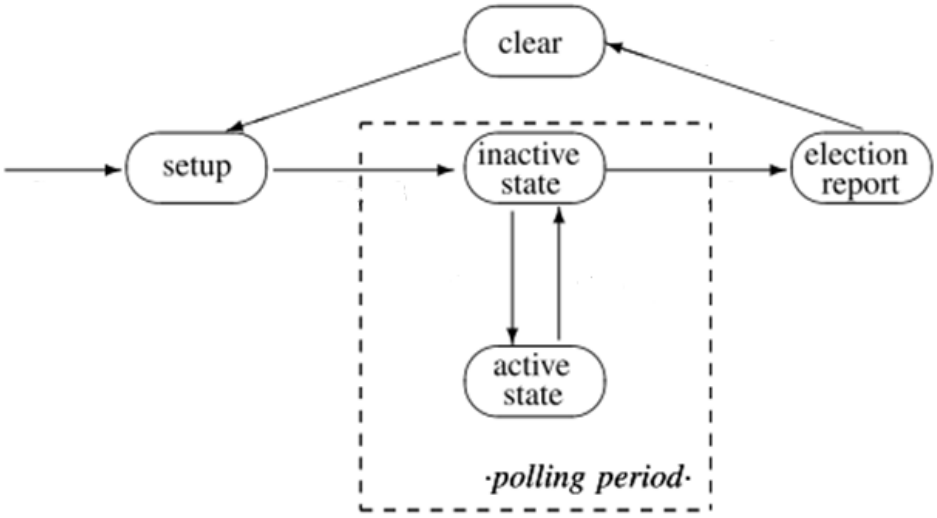
- user interface which receives voters inputs and eventually has output for option listing and confirmation,

- votes storage for the votes of all voters that have used this machine for voting and

- Tabulator that collects votes from all voting machines from one polling station and calculates the total result of voting.

Graph 1. shows the automat with the voting machine final state.

Graph 1. States that voting machine can have



Source: (Volkamer, 2009)

When creating e-elections system from scratch, IT engineers have the option to choose if the core system software and data will be placed on client or server network endpoints. If the server side is chosen, then voters could easily be deprived of privacy without their knowledge. Nowadays, network endpoints could be moved to clients because today exist client computers with relatively decent hardware, with at least minimal required CPU and memory characteristics. For example, new Android mobile phones have gigahertz of CPU power and gigabytes of operational memory with modified Linux operational systems. In this case software system could store more information on client side and in that way improve the voter's control over their own data.

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2. LITERATURE OVERVIEW

There are many aspects from which e-voting can be viewed. The following is an incomplete list of topics addressed by researchers in this field of research. At the end of the paragraph, our contribution to the subject area will be given.

General development in field of e-voting topics and their significant impact on social science network can be view in (Krimmer, Volkamer, Duenas-Cid, 2019).

The most common papers are describing the e-voting scheme (EVS), which traditionally include: a) mixnets, b) bulletin boards, c) blind signatures, d) homomorphic encryptions, e) zero knowledge proofs, f) secret sharing, g) visual cryptography. Brief review can find in (Mursi, Assassa, Abdelhafez, Samra, 2013).

Other articles, also numerous, deal with special characteristic related to electronic voting. In that context, relevant characteristic is usability described in, for example, in (Acemyan, Kortum, Byrne, Wallach, 2014), (Kulyk, Volkamer, 2018) and (Wang, Mondal, Chan, 2017). Second relevant characteristic named verifiability: (Kusters, Truderung, Vogt, 2012) and (Cortier, Galindo, Küsters, Mueller, Truderung, 2016).

The success of blockchain technologies such as well-known cryptocurrency Bitcoin has shifted to the field of e-voting recently, so we have papers on this intersection topic, such as (Zhang, Wang, Xiong, 2019) and (Kshetri, Voas, 2018) (Liu, Wang, 2017).

This paper concentrates on examining how to test EVS in order to their finally realization meets the requirements set on project start. Methodological approaches such as standards, methodologies and frameworks related to testing new and/or finished EVS implementations have been identified and reviewed in next paragraphs. Here is the list:

- Voluntary Voting Systems Guidelines 2.0 (2020);
- Applied Pi Calculus (2016);
- Open Source Security Testing Methodology (2010);
- Technical Guide to Information Security Testing and Assessment (2008);
- Information Systems Security Assessment Framework (2006).

The main contribution of this paper is to emphasize the importance of the testing process and elements of e-elections and EVS itself, which has not been seen in other publications.

3. E-ELECTIONS TESTING

System is tested in order to check the conformity of implemented system and its' specification. Software system testing examines the behavior of system in unpredicted circumstances, i.e. checks if the system responds correctly to unexpected inputs. First phase of testing is definitely made by the e-voting system producer and then the results are published or sent to stakeholders (internal tests are required and understood).

Testing procedure could be formal or informal by nature. Formal testing procedure follows the pre-specified procedure structure, while informal procedure could have highly anarchic and unpredictable development. Formal procedure could be expressed by (a) standards, recommendations and guidelines and (b) methodologies of testing. The former is organizing testing process through the list of best techniques from the testing practices, general recommendations and concise operation instructions. Methodologies have greater generality, as well as precision with more structured testing organization. First, the domain system is described by abstract model, then the testing procedure model is described and finally procedures are given for realization of specific parts of testing with the more details.

Regarding standards, recommendations and guidelines for e-elections systems, their testing and certification is done by independent laboratories that are mainly state-owned. System testing brings security and trust to all the stakeholders within e-election process: ministers, government officials, election organizers, associations and most importantly the citizens – voters. In the year 2002 in the United States document "Help America Vote Act" (HAVA) orders the foundation for Election Assistance Commission (EAC) that has a mandate to accredit laboratories for testing and certification of equipment for e-elections (Smith, 2013). Set of criteria, Voluntary Voting System Guidelines (VVSG) is used for testing of e-elections systems. It is interesting that these criteria do not imply property of "software independence", by which undiscovered changes or errors in software must not lead undiscovered changes or errors in the election process itself. (VVSG, 2020) (VST&CPM, 2011)

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Manual for e-elections in European Union states that the tests conducted by independent laboratories should contain the following types of testing (Blanchet, 2016):

- Testing for acceptance of complete solution that includes acceptance testing of built-in functionality in software solution for e-elections.
- Performance testing and execution speed testing of software and hardware.
- Stress testing which examines durability of system in extreme conditions.
- Acceptance testing of the e-voting system user interface.
- Controlled testing conditions are required for increasing the trust and for securing the correct system functionality.
- Programming code overview as a systematical check of a source programming code.

First formal methodology that this paper states is TGISTA – Technical Guide to Information Security Testing and Assessment from 2008. It is heir of the first generally widespread methodology for network security testing and has the following four steps (Scarfone, Souppaya, Cody, Orenbaugh, 2008):

1. planning (system is analyzed in order to find the appropriate target)
2. discovery (tester searches through the system in order to find the specific vulnerability)
3. attack (tester confirms that system could be attacked through discovered vulnerability) and
4. reporting (all findings are documented and presented).

Second methodology is ISSAF – Information Systems Security Assessment Framework, developed by OISS.org in the year 2006. It is a penetration methodology for networks, computer and information systems. Action fields are described in detail and there are three (ISSAF, 2006):

1. Planning and preparation, where the testing tools are planned and prepared, contract is drawn up and the legal protection is gained, testing team is assigned, as well as deadlines, requirements and structure of the final report.

2. Assessment, fundamental area of the methodology, that consists of nine phases: (1) information collection, (2) network mapping, (3) finding vulnerabilities, (4) penetrating the system, (5) gaining access and increased privileges, (6) further data

collection, (7) controlling the remote sites, (8) securing the gained access and (9) covering the tracks.

3. Reporting, storing and cleaning of used and destroyed things.

Third formal methodology for testing is OSSTMM - Open Source Security Testing Methodology Manual from the year 2010. This methodology is considered as inevitable for every tester or a testing team. Main field of testing by this methodology is divided in three channels: COMSEC (communications security), PHYSSEC (physical security) and SPECSEC (spectrum security) (OSCTMM, 2010). Purpose of the channels is the communication between the assets, where asset means anything that has the smallest value for the owner. Three main channels are always divided into five sub channels:

- Human channel that includes all the human objects in the observed system.
- Material channel that contains communication and demands material path or energy.
- Wireless channel that contains all the electronic communication and signals that occupy electro-magnetic spectrum.
- Data channel where data are sent and received over dedicated communication lines.
- Telecommunication channel that contains all the telecommunication networks over the shared network infrastructure.

Next to the formal methodologies for testing there are also informal procedures. The most known are those used by hackers – so called “black hat” testing. According to this methodology testing consists of four steps in order to collapse or occupy certain system:

1. Discovery of security flaws in observed systems
2. Acquiring the detailed information about security flaws, with the list of system vulnerabilities that could be practically used.
3. Estimation of which vulnerability is the most profitable by own criteria
4. Exploiting is made by known and improvised means and procedures.

This way a hacker attacks through only one entrance, one vulnerability, while e-voting system testing has to cover all the possible vulnerabilities.

Another variant exists, called the “white hat” testing, where all the support for testing conduction similar to the original “method” is delivered by software and

hardware producers for the e-voting system. Testers are getting network diagrams of the system, list of operational systems used and hardware components on which it is executed, versions and settings for network devices (routers etc.), database systems settings, installed protocols and open ports, executable and source code of the software, site structure etc. Testing technique could be passive and active. Passive testing is actually collecting and listening of network traffic, for what are used network analyzers like NMAP. This mode is executed without any special data packets for network examination. However, with active mode, by penetration testing, this data could be acquired in a quicker manner.

CONCLUSION

From all the above we see the importance of e-elements as constituents and/or contiguous entities for the implementation of e-democratic social system. So far it is not clear whether it will lead to revolutionary changes or improvements of existing democratic organization. Nevertheless, we think it is only a matter time when they will start new processes.

For a deeper analysis it is necessary to examine the area at the intersection of these e-elements, such as e-elections. Thus, it should describe the organization of e-elections, abstract and detailed views of the organization, selection of the type and system for e-elections (framework), the procedure of introducing and implementing e-elections, then how to monitor the e-elections implementation to obtain a trust (e-trust) etc.

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