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Foreword

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The published articles focus on IT&C and belong to national and international researchers, professors who want to share their results of research, to share ideas, to speak about their expertise and Ph.D. students who want to improve their knowledge, to present their emerging doctoral research.

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

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

Last but not least, JISOM aims at being one of the distinguished journals in the mentioned fields.

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A PREDICTOR-BASED COMPRESSOR

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ABSTRACT

As technology evolved, more and more information is in circulation. The amount of data is in a continuously expanding phase since the first digital data storage option. For this matter, compression must be applied on, hence the predictor compression is one of the choices used nowadays. The real benefit, not only comes from compressing data for storage but from sending and receiving data over networks as well. Reducing the size of the desired data before sending will ensure the transfer will be faster and network bottlenecks are less likely to occur.

KEYWORDS: *data prediction, data compression, neural network, machine learning, prediction tree, polynomial interpolation*

INTRODUCTION

Message transfer is a widely used form of communication today. Every day more than 150 billion emails are sent over the world and more than 4 billion searches are performed over the Internet. These actions bring with them the need to store large amounts of information in a compressed form.

There is also streaming which requires real-time delivery, meaning data has to be hastily compressed, delivered and decompressed, with the smallest delay possible. To consume as few resources as possible, such as storage space or bandwidth, it is necessary to process the data in order to represent it in a reduced format (compression) but which offers the same quality of information upon decompression.

Due to storage limitation or network bandwidth, data must be compressed to store or to transfer it. In order to do so, redundant information found within data shall be removed. As a solution, a predictor is a high-speed compression algorithm. On what a predictor excels is that it is still one of the fastest algorithms for compression used today, even if the ratio obtained is not the best.

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Generally, data compression is preferred when it is rarely used, otherwise, depending on the implementation and on the data type and content, it is possible to spend more time and resources on decompressing the data in order to access the initial information. Compression algorithms are time and resources consuming. For example, streaming would require real-time delivery, meaning data has to be hastily compressed, send through whatever means of communication is used, such as the internet, radio, satellite etc., and fast decompressed at the receiver, with the smallest delay possible. Depending on various factors such as bandwidth, speed, location, storage etc., this would be, or not, preferred in order to obtain the desired result.

In our current paper, we will present various compression methods, their applicability, the data types on which the algorithms perform best, the underlying structure and functionality of each, and the obtained results after tests.

We will present some data-specific modules featuring neural network prediction, prediction trees, and numerical interpolation. Each predictor has its performance based on the data acquired at a given time. A codec module will make use of the aforementioned predictors to encode and decode data from a file.

This paper will cover the basics of prediction-based compression, the general idea as well as how it is actually working, followed by approaches for implementation and their corresponding results.

ARCHITECTURE OF APPLICATION

Given a data stream denoted DS, containing either a fixed number of bytes, namely N bytes, expressed as $D_{[0]}...D_{[N-1]}$, or an indefinitely continuous number of bytes $D_{[...]}.$ Given any DS data stream, the aim is to compress and respectively decompress it using a number of predictors for different sets of data types and to use a mean to select and alternate between the predictors in order to choose the one which best performs on the DS, thus allowing to achieve best compressing and decompressing results.

Components

A theoretical approach to this subject would be having a number of interlinked and dependent modules, each performing a single, indivisible objective, specifically: a predictor module, a codec module, a core encoding module and an after-prediction encoding module, all of which will be detailed in the following paragraphs.

Predictor Module

The predictor module has to encapsulate the total number of predictors used for attempting to make a best-guess of the next DS, looking into the current DS data history and also decide which predictor produces the best result on the given DS. Every Predictor will have to take into account a maximum number of bits and predict a given number of bits, according to its data type. Moreover, the predictor must also be able to produce as well as to receive residues for the encoding and, respectively, decoding process. The aforementioned residue represents the difference, if any, between the data anticipated by the predictor and the actual DS data. This difference can be computed by choosing from a

large variety of means and it depends on each predictor to determine, according to the DS data type, the best residue-computing mechanism, be it difference at every byte-level, integer-like difference on multi-byte representation, difference between dictionary entries in the case of dictionary-based prediction, smart heuristics etc., or a combination of the above. The purpose is to decrease the entropy of the residue, to maximize the uniformity of residue data at byte-level and to group similar symbols together, where, by entropy is denoted the randomness of the data, and the unpredictability of the entire system; the more the entropy the lesser the compression ratio will be, thus the entire system will lack performance.

Codec Module

The codec module is responsible for performing the compression and decompression of data contained in different files, by making use of the results obtained after running the predictor module over data chunks. In order to perform the compression operation, the codec module has to receive an archive name to create, if non-existent, and a file name to compress and add to the archive. Correspondingly, the decompression operation will only be executed if an archive name to decompress will be provided. A binary executable, the codec, will receive a parameter which will indicate what action to perform: adding compressed file to the archive, extracting and decompressing the content of the archive, listing the content contained by the archive, as well as metadata information, such as the date and time, the file size, compression ratio, checksums; and testing the integrity of the archive as it is of very crucial importance to create a valid, uncorrupted archive, since the compression needs to be lossless, and thus the data retrieved entirely.

Core Encoding Process Module

A good approach is to use two tables, one containing all the predictors (TP – “Table of Predictors”, index represented on NB bits for an up to 2^{NB} total predictors), and one for containing the most recently used predictors (TRUP – “Table of Recently Used Predictors”, index represented on NBRU bits for an up to 2^{NBRU} positions. TRUP will be updated at every encoding step, using a MRU-type logic, keeping in mind that the lower the index, the better the expectancy of the predictor to be used again, and the last index kept reserved for a special marker (NIT – “Not in Table) used as an “escape” to specify that a newly requested predictor, currently not in the TRUP will be loaded from the TP and the full TP index will be encoded afterward on NB bits. In the logical compressed data stream, the predictor will be followed by the residue resulted as a “difference” between the predicted value and the real data stream values.

The residue will be produced by the selected predictor. In the case of the LAST predictor, no residue value is needed. It is not necessary to code explicitly the number of bits used for every predictor, simply because a limited number of bits values will make sense and, as a result, different bits values for the same predictor may occupy different entries in TRUP and TP tables.

Example of predictors may include:

- NONE(N) – No prediction for the next N bits, the residue will be DS itself;
- LAST(N) – The prediction is exactly the last N bits encountered, the residue will be the difference;
- INT(N) – N-bit integer is expected, compute residue as a difference on N-bit numbers;
- FLOAT(N) – N-bit FP number is expected, compute residue as a difference on N-bit FP numbers;
- TEXT(N) – Text of N-bit characters is expected, predict as textual information then store the residue as N-bit difference from the prediction;

After-Prediction Encoding Module

After using a chosen prediction-based compression algorithm for encoding, to ensure all the data obtained by the previously mentioned modules is compressed it will be used a third-party powerful generic compression library, such as Zlib.

SPECIFIC PREDICTION MODULES

Neural Network Predictor

The idea behind the Neural Network Predictor approach is to use a general multi-layer perceptron neural network to create a text predictor. As input, the network receives N characters from the history and outputs M predicted characters where $M < N$. We tried various architectures for the network, most of which differed based on their number of inputs and outputs.

Firstly, we tried a simple approach, in which the characters were fed into the network as they were, without any preprocessing. It means that the network worked at byte level. A few architectures that we tried are: $64 \rightarrow 32 \rightarrow 16 \rightarrow 8$, $32 \rightarrow 16 \rightarrow 8$ or $512 \rightarrow 128 \rightarrow 32$ and so on. The numbers correspond to the size of fully-connected layers in a multi-layer perceptron architecture.

The second approach consists of processing the characters at bit level. That means each byte had to be split in its individual bits and fed into the network. For example, a network with 8-byte input will now have 64-bits input.

The networks were trained on a compilation of texts from *Wikipedia* [1] and on two books from *gutenberg.org*, *Pride and Prejudice*, and *Heart of Darkness*. *Pride and Prejudice* was used as training data while *Heart of Darkness* was used as testing data.

Prediction Tree

Prediction Tree (PT) is an algorithm designed to predict the next symbol in a sequence of symbols, by trying to match a sequence of symbols to the last N symbols from the input history. As an example, the following sequence will be considered: “streamstreamstre”. It represents a history of the last parsed symbols. A good prediction for the following character in the given sequence would be ‘a’, as the ‘a’ symbol is always preceded by ‘e’

in the data stream history. Moreover, it can be noticed that ‘a’ is always preceded by the “re” sequence and so on. The more matches are made, the clearer it is that ‘a’ should be the next character in the given sequence.

An important deficiency of this model is its limitation in terms of the number of patterns that can be learned. Even the most subtle variation within a symbol subsequence will greatly affect the prediction’s outcome, and also the prediction’s accuracy. Therefore, this algorithm does not behave very well if datasets include a high degree of noise, but the tests have shown that this algorithm can behave pretty well for various types of inputs.

The Prediction Tree is a multi-children decision tree. Each node is described by a symbol and contains references to its parent and children nodes. A sequence of symbols within the tree is represented as starting from a child of the root and continuing to any other node down in the tree. In order to build the PT, the training algorithm is fed with a set of sequences from a training dataset.

Given a sequence of symbols, the algorithm verifies whether the current node (initially the root) has a child containing the value of the first symbol of the sequence, in which case the next symbol is being processed. Otherwise, a new child of the current node is created, containing the current symbol, a child that now becomes the new current node. This process is repeated until no symbols are left in the given sequence.

Moreover, each node also contains a table of symbols to predict (prediction table) and the number of occurrences of each symbol because choosing the next symbol will be based on the symbols’ occurrence probabilities. This table of symbols will not keep the entire set of symbols which resulted from training, but only the first N symbols with the highest number of occurrences.

Given a sequence of symbols, the algorithm verifies whether the current node (initially the root) has a child containing the value of the first symbol of the sequence, in which case the current node becomes the child node described by the first symbol in the sequence and so the next symbol is being processed. Each symbol in the sequence is thus processed until there is no child of the current node containing the next symbol to be processed, from the sequence of given symbols.

Thus, if the next sequence symbol to be processed is not contained by a child of the current node, based on the prediction table of the current node, the algorithm will provide the symbol with the highest probability of occurrence, as the predicted symbol. If the current node does not contain any symbol in the table of prediction symbols, then the algorithm will go up to the parent to let it provide a prediction symbol based on its prediction table (and so on). If no parent contains any symbol in its prediction table, the root will always provide a prediction symbol (always the same symbol).

If a prediction table contains two or more symbols with the same highest probability, then the last parsed symbol will be chosen.

Polynomial Interpolation Predictor

A classic mathematical method used to predict data is polynomial interpolation or extrapolation. Polynomial interpolation is used to estimate data inside the range of two known points, while extrapolation estimates data in the future, based on previous data.

The objective of this research is to predict future data based on a data stream. Therefore, using polynomial regression is a valid technique. This method tries to construct a regression model following the general formula:

$$y_j = f(x_j) + e_j, \quad 1 \leq j \leq n,$$

where $x_j, 1 \leq j \leq n$, the index of the data or a measure of one of its traits; $y_j, 1 \leq j \leq n$, the data at point x_j ; $e_j, 1 \leq j \leq n$, the residual errors of the prediction (the difference between what the model predicted using $f(x_j)$ and what the data should be).

Adapting the formula such that the regression model is polynomial, the $f(x_j)$ function can be defined as such:

$$f(x_j) = f(x; c_0, c_1, c_2, \dots, c_d) = c_0 + c_1x + c_2x^2 + \dots + c_dx^d,$$

where: d – the degree of the polynomial and $c_k, 0 \leq k \leq d$ are constants.

Based on the previous paragraphs, the process of polynomial data prediction must fit a polynomial to the given data stream and then use that polynomial to predict the data that follows. Polynomial fitting requires the constants and degree of the polynomial to be determined. Afterward, the polynomial must be tested to check if it correctly predicts new values.

Alglib is a numerical analysis and data processing library, which was used by this project to implement the polynomial regression method. We used the library's 'polynomialfit' function to estimate a polynomial of a certain degree based on a given number of bytes of the data stream given as input. Using the resulting polynomial, *Alglib*'s 'barycentriccalc' function then predicts the next few bytes of the data stream. The index of the byte data stream represents the x variable of the polynomial and the data byte represents $y = f(x)$, the result of the polynomial.

The predictor was written in C++, using the Alglib library and its previously mentioned functions are used to fit 3rd and 4th-degree polynomials and then predict data.

CONCLUSIONS AND FUTURE WORK

As benchmark test files, we used the files from the Maximum Compression website [8]. We found 10 general files for benchmarking the performance of file compressors. We compared our results with the results of the best compression programs known at this moment: PAQ8PX and WinRK 3.1.2.

We benchmarked each predictor individually and we measured the compressed size, the compression ratio and the time it took to compress (which is not of great relevance in this context). The most relevant metric here is the compression ratio which, in the end, was at least comparable to the best solution available.

The implementation of the presented algorithms may be further refined and optimized to obtain even better results through an efficient implementation. There is still work to be done in order to create more complex predictors. For now, the presented algorithms have high potential as each has obtained good results for their given cases.

The Neural Network Predictor shows great promise as it has some improvement. The more training it is applied to it, the more improvement should be made.

Prediction Tree has a very good ratio in most cases and its results prove this.

The Polynomial data prediction is potentially useful if the data stream is mostly numerically-based.

In conclusion, the presented research is just in the beginning phase but displays promising results. There is a lot of room for improvement of the currently existing algorithms as well as for new ideas on how to approach this particular subject. For now, the presented algorithms have high potential as each has obtained good results in their use cases.

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SMART ECONOMIC DEVELOPMENT BY USING FOREIGN DIRECT INVESTMENTS – UAE CASE STUDY

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ABSTRACT

There is no novelty among businessmen that the UAE represents the country of intelligent business opportunities and solutions. In the present, the UAE is the leader in direct investment, with 14.3%, world-wide, and they intend to boost the economy by a smart developing approach. This work paper aims to show how a smart approach of financial and fiscal legislation together with innovative and performing management system can lead to rapid economic growth and spectacular social development. The research analyzed on the current situation of direct investment in the UAE, its unicity, and proposes solutions for their development in order to ensure sustainable economic growth, as the redirection of investments, from the oil and gas sector to the services sector, and research.

KEYWORDS: *Smart economic development; Foreign Direct Investments; GCC; UAE; economic growth; financial and fiscal facilities.*

1. INTRODUCTION

The economic development of almost everything around the world is changing from one day to another, taking different meanings and techniques. We are hearing about *smart investments* every day. Investment in a simple definition is the act of lending and distribution of money for an expected return or profit. Investments through financial capital infusion, lead to increase of production, increase of consumption, increase of income at private, and public sector (increasing production, sales, it leads to increasing the volume of taxes and other taxes payable to the state's budget) [1]. The research is focused on evolution of foreign direct investments in GCC, giving a special attention to UAE. During the last decade, UAE sowed a fast and incredible economic development (figure no.1). It succeed to become one of the most attractive and developed countries, despitess the geographical and natural environment. *Higher investment and public spending are likely to drive growth higher this year and the next. Particularly, infrastructure investment related to the country's preparation to host the Expo 2020 Dubai will support the outlook, buttressing the construction sector. Furthermore, recent*

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business-friendly reforms and a new investment law to be introduced in Q4 are poised to boost investor confidence and support higher FDI inflows, Focus Economics analyst said in their latest note [2].

Investments has been there for many years, when the international trade starts to develop. However, in our modern world the term investment especially financial investment has taken variable meanings ad forms. From financial and macroeconomic decisions impact, economists divide investments in two main: direct and indirect investments. Both of this forms may be foreign or domestic (local) one. One of the most types of capital flows is foreign direct investment (FDI). Companies commonly attempt to engage in FDI so they can reach additional consumers, and profit [3].



Figure 1. Dubai's transformation: 1990 versus 2018, retrieved from [4]

Stability of the financial system, the existence of a small number of taxes, and the existence of a fixed exchange rate between the AED and the US dollar [1,5] have made it possible to increase the confidentiality of foreign investors.

Nowadays, UAE is one of the best place to invest and leave, it offers an enticing business environment with a liberal lifestyle and ample business opportunities apart from the hydrocarbon sector. Foreign businesses have opportunities in various sectors including financial and trade services, tourism, entertainment, construction, manufacturing, education, and health services [6]. This research paper will show further how foreign direct investment have seen rapid growth in recent years.

2. RESEARCH METHODOLOGY

The present work paper is an exploratory research, based on investigative techniques. It is a fundamental and qualitative research which aims to present what is the situation of foreign direct investments in UAE, and what can be amendment in order to increase the volume of these specific types of investments.

3. LITERATURE REVIEW - EVOLUTION OF FOREIGN DIRECT INVESTMENTS APPROACH IN UAE

The UAE and GCC countries after the discovery of oil and the industrial evolution became strategic areas for investment, companies and countries around the globe has paid and given their attention to the importance of this area, establishing businesses and launching the very first investment in the area. The history of land in the GCC area is long and rich, but in the 1950's, a new chapter and a different chapter was opened to this region in business. In 1946 the first bank came to operate in the UAE it was HSBC Middle East Bank. The start of its operation came to life after it opened several branches in the GCC areas between 1942 and 1946 [7]. Investment in the GCC and the UAE has started with the same time the first bank become operative in the region. Banks starts to facilitate the financial flow of funds, involved themselves directly to financial investment, acting like a medium between investors and investment providers. Banks are the lenders and the financial providers, in the same time, banks are the keeper for the population's assets. Investment in the oil and gas sector since its appearance in the United Arab Emirates was huge, especially after the union in 1972. That's when all seven emirates have decided to put their hands together to develop UAE.

The investment in oil and gas has changed the desert into an industrial area, which acquired large amount of expats to immigrate to it, in all sectors: engineering, education, medical and even labors. Before the discovery of oil and gas, the gulf region including the UAE land had an active trading profile, with its strategic location as it was one of the ports for the Ancient Silk road (trade line), the line which connected the trade between the east and the west. UAE pearls were used for jewelry and traded as its exports, and importing rice and textile from the east.

Going furtherly to 1950's when the oil was discovered in the land of UAE, in 1962 the first oil export started and the transformation of the society and the country trading and investment profile started, in early 2000, when computers and telecommunication industries had their evolution, the UAE has invested largely in the development of its telecommunication and which through years has given a great revenue to its GDP, Etisalat the main telecommunication service provider in the UAE has invested in the infrastructure of UAE as well developing it to fit the needs of development in telecommunication sector.

Real Estate, one of the biggest investment field and sector in the UAE, it has performed greatly in the total country's investment. Although, in 2008 the financial crisis that affected the UAE economy was sourced by the real estate sector, other years has performed greatly and attracted a lot of foreign investment to the UAE.

With all the investment sectors mentioned above and the expansion of economy, the leadership of UAE has brought the attention about the importance for regulation in this area. Therefore, in 2007 Emirates Investment Authority was founded [8]. One year later, the Investment Authority's core team was on duty, and it has gained the financial well-being for the assets of UAE.

UAE economy is known to be young, rapid in growth and dynamic, and due to the strategic location of the UAE between the east and the west, it gained the trust for domestic and international investment. Here came the main role of Investment authority

to deliver three main goals, first to maintain financial growth of the UAE wealth for the well-being of its people. Then, be a custodian for UAE investments. In the end advise the government's policies in economic and industrial matters. Among the Gulf countries, the UAE have become the first host country for migrants around the world. Until the end of the 90's, the migration was based on the principle of a temporary expatriation for an expected wealthy return. Dubai is asserting itself as a global city where a post-oil economy is arising. Moreover, the development of industrial and business activities in the Emirate prompts the closest ones, namely Sharjah and Ajman, to offer some attractive advantages for business investments [9].

The UAE is an important producer of natural gas and oil, ranking the world's number seven in the total of proven reserves of both. Much of the UAE's improved economic performance in recent years is the result of positive measures taken to diversify its economy. The prosperity of the country and its rapid transformation into a booming economy were made possible by the revenues from oil exports. The wealth of its resources has contributed to its overall growth; in particular, an increase in oil export prices has led to improvements in the determinants of the growth rate of trade. However, oil wealth is not the only factor; macroeconomic stability and the financial development of the UAE' economy cannot be ignored [10].

Investment is one of the components of the country's macroeconomic pillars and it is reflected in its GDP. According to the Global Competitiveness Index (GCI), which measures countries according in health, education, economy and financial strength. The UAE has ranked 23 in its first year entering the top 30 countries in 2009, reaching to its highest rank in 2014 being number 12 the highest rank achieved by a Country from the Arab League [11].

The GDP of the UAE in 1980 has scored negatively 1.8, and GDP is always changing for countries, but in an overview of the GDP it has scored the lowest in 1986 with -19.3, and the highest with 23.6 in 1990, for the past 18 years only one negative figure have arisen in 2009 when the world financial crisis happened, but since then the GDP is constant growth, giving the indicator that UAE has gained stable strong trading and investment strategies to support its financial health [12].

4. TREND OF FOREIGN DIRECT INVESTMENTS IN UAE AFTER GLOBAL FINANCIAL CRISIS

UAE showed a continuous growing economy, and a fast recovery after past financial crisis (as can be seen in figure no.2). According to the International Monetary Fund, trade and investments are in a continuous growing process in all GCC countries. After Saudi Arabia, UAE register a continuous trade and foreign direct investment developments [13].

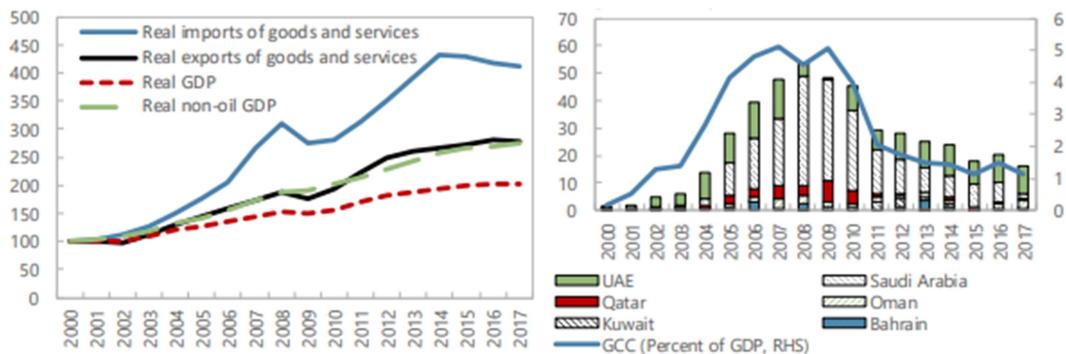


Figure 2. Trade and FDI in GCC, during 2000 – 2017, based on [13]

Since 2000, the GCC goods and services trade has grown by a real average rate of 7.5% almost double to real GDP growth, compared with the global averages of 4.8% and 3.8%, respectively. The rise in the price of oil during the period 2003-2008 led to a sharp rise in oil export earnings, which in turn led to a significant increase in imports of goods and services during that period. The financial crisis has halted this growth for only a year, largely as a result of the romance and implementation of a dual-Islamic and conventional finance system. The Islamic financial system promoted in the GCC countries based on backed investments with real assets [14, 15]. Since 2009, GCC countries have been experiencing continued economic growth, driven to a large extent by strong domestic demand and improving global conditions. On the other hand, after increasing in the early 2000s, FDI inflows into the GCC countries have steadily evolved, on average below 2% of regional GDP [13].

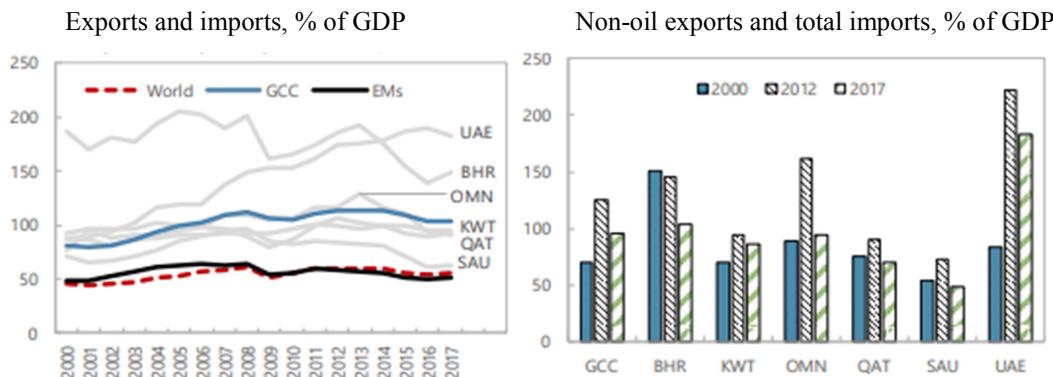


Figure 3. GCC Trade openness, during 2000 – 2017, based on [13]

The ratio between exports and imports of goods and goods and services to GDP exceeded 100% in 2017, well above the average of 50% for emerging economies (Figure no.3). This is largely due to the large hydrocarbons in the region, the most exported, and the lack of diversification of domestic production, which requires imports [13].

UAE recorded, compare with other GCC countries, the highest international trade volume (figure no.3) and higher foreign direct investments (figure no.4). The rapid development of innovative infrastructure and the promotion of smart city principles has made the UAE,

especially the emirate of Dubai, also become a strong tourist. Certain financial legislation and friendly taxation (few taxes and many free zones), as well as living conditions at risky standards, have led to increased business opportunities, increased investor inflows and international trade.



Figure 4. Foreign Direct Investments in UAE, during 2006 – 2018, based on [16]

According to the reference [16] the UAE foreign direct investment recovered very fast after financial crisis, and since 2009 the total investment has increased gradually in 2010 raising to AED 20,200 million, until it got its stability to average AED 36,100 million the past 6 years (figure no.4).

To summarize the history and the trend of investment in the UAE according to the economic activity, as mentioned before the UAE since the discovery of oil has depended on trading oil trading for many years, but the leadership in the UAE has got the consideration that oil will be gone one day and it is important to invest in other sectors to maintain a strong economy.

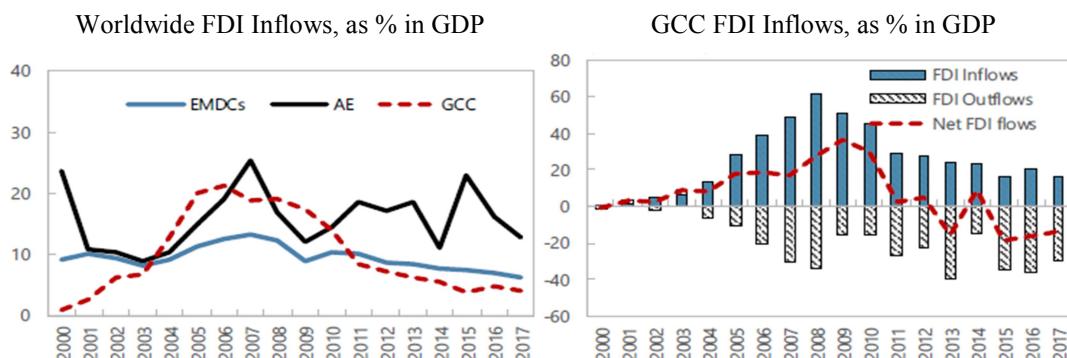


Figure 5. FDI Flows in GCC, during 2000 – 2017, based on [13]

Year after year, foreign investment laws have been improved to attract as many foreign investments as possible. The UAE has in particular created multiple free zones with substantial financial and fiscal facilities which, alongside geopolitical uncertainties and tensions in the EU as a result of the economic and financial crisis, have favored increased

investment in the Middle East region (figure no.5). The UAE has embraced a policy of open market, opening up labor gates and capital markets.

Across the world, UAE become a leader in foreign direct investments, with more than 14% (figure no.6). Dubai, especially, become a trend attraction for investors around the world, every day new business opportunities appear.

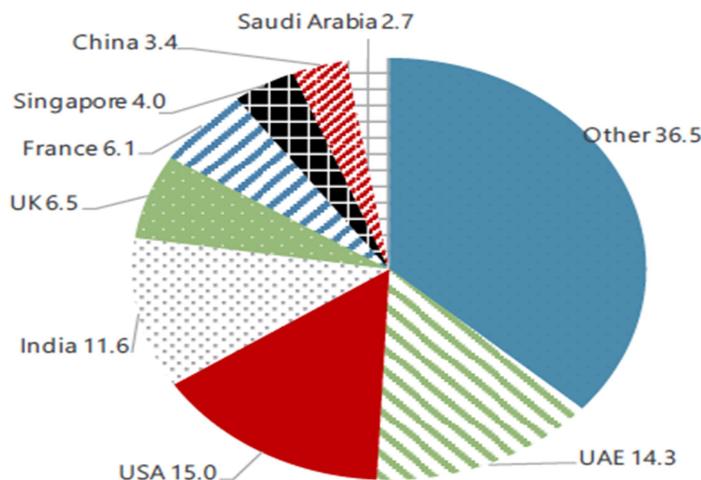


Figure 6. Cumulative FDI Flows during 2013-2017, based on [13, 16]

Insurance and financial activities has taken the major part of the UAE investment and focus, reaching in 2014 to be 50% of the total invested amount by the country, and mainly by Dubai and Abu Dhabi. After the financial and insurance activities, the wholesale and retail of motors ranked the 2nd the most foreign direct investment of the UAE, and in the 3rd place comes the real-estate activities. The major investment in the UAE are related to the main city of the country, Abu Dhabi, managed by Abu Dhabi Investment Authority as a the official investment governmental authority, and Abu Dhabi Investment Council, the largest council for investment in the UAE. In Dubai, the most popular and key truism attraction in UAE, investments are monitored by Dubai International Financial Centre, Dubai Investment Corporations are the largest institutes for investment and advisory of investment for national and foreign investment. All investments are regulated by Emirates Investment Authority.

5. 2020 AND SMART DEVELOPMENT APPROACH OF FOREIGN DIRECT INVESTMENTS IN UAE

The main type of investment in UAE used to be in oil and gas sector. Then, since the 2000's the types of investments have been diversified as the leadership of UAE has realized that in future the country cannot depend on the oil and gas only for its economy. The country has developed rapidly and since then we can see that the market expanded to be a targeted market for all types of investments worldwide [17]. The highest foreign direct investments are located in financial and insurance activities (figure no.7).

The country has gained international confidence and started to attract all types of investments. Just like any other international market the investment market in the UAE have various types of investments: stocks; bonds; mutual funds; ETF's; and, alternative investments (commodities, private equities, fund hedging, real-estate). According to the Central Bank, in the UAE there are 381 licensed banks and financial institution that are authorized to conduct financial, investment brokerage and money exchange in the UAE. The number is increasing as seen in the previous part that the investment in financial and insurance services is growing year by year [18].

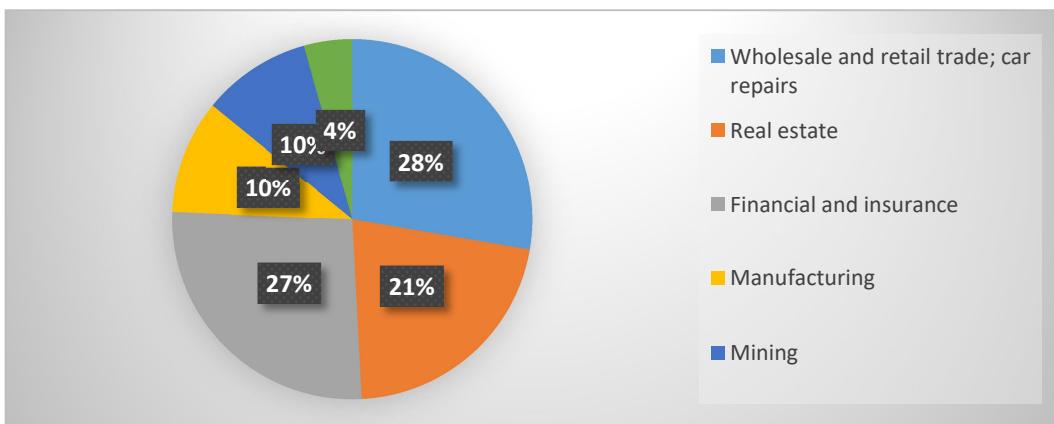


Figure 7. Main Invested Sector in UAE, during 2017-2018, based on [19]

The main financial securities exchanges operating in the UAE are Abu Dhabi Security Exchange – ADX, and Dubai financial Market – DFM. As Abu Dhabi and Dubai are the biggest and the cities that makes 50% of the total UAE market out of 7 Emirates. Both of them are member of World Federation of Exchange. DFM operates under the Sharia compliance for Islamic trading, and in 2010 it has integrated its operation to NASDAQ getting the international regulation to one of the best international exchange entities in the world giving the national investors international securities access through a single investor number but with more diversity. UAE financial market doesn't end here, as much as it's big that the UAE has these two investment exchange houses registered with WFE, there is another institution in Dubai that has a fellowship with WFE which is: Dubai Gold and Commodities Exchange – DGCX, started its trading in 2005, DGCX now a days has 267 members from all around the world ad it has its online portal for trading in dealing with Metals, currencies and hydrocarbons.

According to the Global Competitiveness Index of the World Economic Forum of 2017, UAE is among the least restrictive countries in terms of non-tariff barriers. Also, the OECD Trade Facilitation Indicator (UCITS) database classifies the UAE as a first-rate facilitator in trade facilitation. The Global Trade Fair Report, which includes 136 countries on market access, border management, infrastructure and the operating environment, points to a wide heterogeneity among GCC countries in creating a trade-friendly environment, with UAE first place [13].

The strengths of the UAE include its easy access to oil resources, low energy costs, a willingness to diversify the economy and a high purchasing power. The absence of direct

business taxation (excluding banks, oil companies and telecommunications operators) and direct income taxation, of exchange controls and of any limitations on the repatriation of capital, as well as the existence of a strong and profitable banking sector, plus a large pool of expatriate labor are the country's undeniable assets. Its main weakness is the small size of its domestic market. The UAE ranked 21st out of 190 countries in the 2018 Doing Business ranking published by the World Bank [19].

Openness to foreign business/ entry varies widely among the GCC members, with the UAE and Bahrain being the most liberal and Kuwait and Saudi Arabia the most restrictive. An important feature of foreign investment rules in the UAE has been since the emergence of legislation in the field, the participation in the company's capital, differently in free zone or mainland. Free zones represent an area where taxes, employment or trade restrictions on business do not apply in the same way as in other parts of the country. Foreign investments open in the free zones of the UAE can be 100% foreign-owned, without the mandatory participation of a local shareholder. These rules were very well settled, because foreign investments opened in mainland used to have local shareholder, local identity, and in the same time financial transfer restriction, keeping the profit inside the country, participated indirectly to the entire economic development.

In the present time, foreign investment rule, in sense of business openings has changed. Starting with 2019, increased foreign ownership of companies in the UAE is now possible. New rules [20] foreseen attraction of foreign direct investment for vital and strategic sectors. These changes in the internal regulations aim to promote and develop the country's investment environment, senior officials have reported that this will boost FDI by up to 20% across the next two years. The UAE offers lucrative opportunities for foreign investment and the strengths of the UAE include its easy access to oil resources, low energy costs, a willingness to diversify the economy and a high purchasing power. The new legislation provides the framework for the UAE Cabinet to permit foreign shareholders to own increased levels of foreign ownership (more than 49% of shares) in companies operating in certain sectors. A new public authority will be established - Foreign Direct Investment Unit – under the Ministry of Economy responsibility. The FDIU main duties are focused on proposing FDI policies, establishing a comprehensive database of investment's projects as well as licensing foreign direct investment projects and evaluating their performance.

In the same line, to increase the performance of foreign direct investment and to facilitate the soft infrastructure, the country encourage continues education and immigration of qualified human capital. Human capital is a key determinant of export performance and FDI. UAE still have tight regulation for hiring of foreign nationals in public-sector. However, higher educated investors, businessmen and employees will conduct to a higher efficiency and competitiveness. From this respect, starting with 2019, for higher educated expats working visa time limit increased.

Foreign direct investments will continue to grow in UAE, as long there is no direct taxation of corporations (apart from oil, banking and insurance sectors) or of individuals, and new implemented VAT is still 5%. In the same time, good-quality business climate and long-term political stability create a confidence to all possible foreign investors.

6. CONCLUSION

All the research above proved that good policy priorities can help inflows of FDI. Investments help the country's economy to boost rapidly, creating new jobs, productivity, consumption, and profit. In order to increase productivity and competitiveness, it is necessary to maintain and continuously improve the business climate, and reduce remaining barriers to foreign trade and investment (bureaucracy, time and costs). Ongoing reforms would be better to run in the following areas will be important: human capital development (to raise educational quality to provide knowledge and skills); legal frameworks (ensure predictability for taxation rules); and, clear rules for new entrepreneurs, start-up, SMEs.

In 2019, new foreign investments rules [20] giving more flexibility in business ownership in certain economic sectors. These changes in the internal regulations aim to promote and develop the country's investment environment, senior officials have reported that this will boost FDI by up to 20% across the next two years. The UAE offers lucrative opportunities for foreign investment and the strengths of the country include its easy access to oil resources, low energy costs, a willingness to diversify the economy and a high purchasing power, no direct taxation and low level of VAT, good-quality business climate; dynamic and diversified economy; stable banking sector; financial and political stability; and, an excellent and modern infrastructure.

UAE is one of the most opened country for foreign business. Across the world, the country become a leader in foreign direct investments, with more than 14%. Dubai, especially, become a trend attraction for investors around the world, every day new business opportunities appear. In the 2018 Doing Business Ranking published by the World Bank, ranked UAE as 21st out of 190 countries.

Promoting an stable business climate, offering an efficient infrastructure (transport, communications), using the newest technologies are some of the greatest conditions to welcome foreign direct investments, and UAE it is an example for it. Foreign direct investments, on the other hand, helped to all the above to exist and to be realized, it led to boost economic development.

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FROM BITS TO QUBITS, FROM COMPUTING TO QUANTUM COMPUTING: AN EVOLUTION ON THE VERGE OF A REVOLUTION IN THE COMPUTING LANDSCAPE

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Dana-Mihaela PETROȘANU²

ABSTRACT

The "Quantum Computing" concept has evolved to a new paradigm in the computing landscape, having the potential to strongly influence the field of computer science and all the fields that make use of information technology. In this paper, we focus first on analysing the special properties of the quantum realm, as a proper hardware implementation of a quantum computing system must take into account these properties. Afterwards, we have analyzed the main hardware components required by a quantum computer, its hardware structure, the most popular technologies for implementing quantum computers, like the trapped ion technology, the one based on superconducting circuits, as well as other emerging technologies. Our study offers important details that should be taken into account in order to complement successfully the classical computer world of bits with the enticing one of qubits.

KEYWORDS: Quantum Computing, Qubits, Trapped Ion Technology, Superconducting Quantum Circuits, Superposition, Entanglement, Wave-Particle Duality, Quantum Tunnelling

1. INTRODUCTION

The "Quantum Computing" concept has its roots in the "Quantum Mechanics" physics subdomain that specifies the way how incredibly small particles, up to the subatomic level, behave. Starting from this concept, the Quantum Computing has evolved to a new paradigm in the computing landscape. Initially, the concept was put forward in the 1980s as a mean for enhancing the computing capability required to model the way in which quantum physical systems act. Afterwards, in the next decade, the concept has drawn an increased level of interest due to the Shor's algorithm, which, if it had been put into practice using a quantum computing machine, it would have risked decrypting classified data due to the exponential computational speedup potential offered by quantum computing [1].

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However, as the development of the quantum computing machines was infeasible at the time, the whole concept was only of theoretical value. Nowadays, what was once thought to be solely a theoretical concept, evolved to become a reality in which quantum information bits (entitled "qubits") can be stored and manipulated. Both governmental and private companies alike have an increased interest in leveraging the advantages offered by the huge computational speedup potential provided by the quantum computing techniques in contrast to traditional ones [2].

One of the aspects that make the development of quantum computers attractive consists in the fact that the shrinkage of silicon transistors at the nanometer scale that has been taking place for more than 50 years according to Moore's law begins to draw to a halt, therefore arising the need for an alternate solution [3].

Nevertheless, the most important factor that accounts for boosting the interest in quantum computing is represented by the huge computational power offered by these systems and the fact that their development from both hardware and software perspectives has become a reality. Quantum computing managed to surpass the computability thesis of Church-Turing, which states that for any computing device, its power computation could increase only in a polynomial manner when compared to a "standard" computer, entitled the Turing machine [4].

During the time, hardware companies have designed and launched "classical" computing machines whose processing performance has been improving over the time using two main approaches: firstly, the operations have been accelerated through an increased processing clock frequency and secondly, through an increase in the number of operations performed during each processing clock's cycle [5].

Although the computing processing power has increased substantially after having applied the above-mentioned approaches, the overall gain has remained in accordance with the thesis of Church-Turing. Afterwards, in 1993, Bernstein and Vazirani have published in [6] a theoretical analysis stating that the extended Church-Turing thesis can be surpassed by means of quantum computing. In the following year, Peter Shor has proved in his paper that by means of quantum computing the factorization of a large number can be achieved with an exponentially computing speedup when compared to a classical computing machine [7-9]. Astonishing as the theoretical framework was, a viable hardware implementation was still lacking at the time.

The first steps for solving this issue have been made in 1995, when scientists have laid the foundations for a technology based on a trapped ion system [10] and afterwards, in 1999, for a technology employing superconducting circuits [11]. Based on the advancement of technology, over the last decades, researchers have obtained huge progress in this field, therefore becoming able to build and employ the first quantum computing systems.

While in the case of a classical computing machine the data is stored and processed as bits (having the values 0 or 1), in the case of a quantum computing machine, the basic unit of quantum information under which the data is stored and processed is represented by the quantum bits, or qubits that can have besides the values of 0 and 1, a combination of both these values in the same time, representing a "superposition" of them [12].

At a certain moment in time, the binary values of the n bits corresponding to a classical computer define a certain state for it, while in the case of a quantum computer, at a certain moment in time, a number of n qubits have the possibility to define all the classical computer's states, therefore covering an exponential increased computational volume. Nevertheless, in order to achieve this, the qubits must be quantum entangled, a non-local property that makes it possible for several qubits to be correlated at a higher level than it was previously possible in classical computing. In this purpose, in order to be able to entangle two or several qubits, a specific controlled environment and special conditions must be met [13].

During the last three decades, a lot of studies have been aiming to advance the state of knowledge in order to attain the special conditions required to build functional quantum computing systems. Nowadays, besides the most popular technologies employed in the development of quantum computing systems, namely the ones based on trapped ion systems and superconducting circuits, a wide range of other alternative approaches are being extensively tested in complex research projects in order to successfully implement qubits and achieve quantum computing [14].

One must take into account the fact that along with the new hardware architectures and implementations of quantum computing systems, new challenges arise from the fact that this new computing landscape necessitates new operations, computing algorithms, specialized software, all of these being different than the ones used in the case of classical computers.

A proper hardware implementation of a quantum computing system must take into account the special properties of the quantum realm. Therefore, this paper focuses first on analyzing these characteristics and afterwards on presenting the main hardware components required by a quantum computer, its hardware structure, the most popular technologies for implementing quantum computers, like the trapped ion technology, the one based on superconducting circuits, as well as other emerging technologies. Our developed research offers important details that should be taken into account in order to complement successfully the classical computer world of bits with the enticing one of qubits.

2. SPECIAL PROPERTIES OF THE QUANTUM REALM

The huge processing power of quantum computers results from the capacity of quantum bits to take all the binary values simultaneously but harnessing this vast amount of computational potential is a challenging task due to the special properties of the quantum realm. While some of these special properties bring considerable benefits towards quantum computing, there are others that can hinder the whole process.

One of the most accurate and extensively tested theory that comprehensibly describes our physical world is quantum mechanics. While this theory offers intuitive explanations for large-scale objects, while still very accurate also at the subatomic level, the explanations might seem counterintuitive at the first sight. At the quantum level, an object does not have a certain predefined state, the object can behave like a particle when a measurement is performed upon it and like a wave if left unmeasured, this representing a special quantum property entitled wave-particle duality [15].

The global state of a quantum system is determined by the interference of the multitude of states that the objects can simultaneously have at a quantum level, the state being mathematically described through a wave function. Actually, the system's state is often described by the sum of the different possible states of its components, multiplied by a coefficient consisting in a complex number, representing, for each state, its relative weight [16, 17]. For such a complex coefficient, by taking into consideration its trigonometric (polar) form, one can write it under the form $Ae^{i\theta} = A(\cos\theta + i \sin\theta)$, where $A > 0$ represents the module of this complex number and is denoted as the "amplitude", while θ represents the argument of the complex number, being denoted as "the phase shift". Therefore, the complex coefficient is known if the two real numbers A and θ are known.

All the constitutive components of a quantum system have wave-like properties, therefore being considered "coherent". In the case of coherence, the different states of the quantum components interact between them, either in a constructive manner or in a destructive one [1]. If a quantum system is measured at a certain moment, the system exposes only a single component, the probability of this event being equal to the squared absolute value of the corresponding coefficient, multiplied by a constant. If the quantum system is measured, from that moment on it will behave like a classical system, therefore leading to a disruption of its quantum state. This phenomenon causes a loss of information, as the wave function is collapsed, and only a single state remains. As a consequence of the measurement, the wave function associated to the quantum object corresponds only to the measured state [1, 17].

Considering a qubit, one can easily demonstrate that its quantum state could be represented by a linear superposition of two vectors, in a space endowed with a scalar product having the dimension 2. The orthonormal basis in this space consists of the vectors denoted as $|0\rangle = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ and $|1\rangle = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$. If one considers two qubits, they could be represented as a linear combination of the 2^2 elements of the base, namely the ones

denoted as $|00\rangle = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$, $|01\rangle = \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$, $|10\rangle = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$, $|11\rangle = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$. Generally, in the case of

n qubits, they could be represented by a superposition state vector in a space having the dimension 2^n [2].

Another special property of the quantum realm consists in the entanglement, a property that has the ability to exert a significant influence on quantum computing and open up a plethora of novel applications. The physical phenomenon of quantum entanglement takes place when two (or more) quantum objects are intercorrelated and therefore the state of a quantum object influences instantaneously the state(s) of the other(s) entangled quantum object(s), no matter the distance(s) between these objects [16].

Another important quantum mechanical phenomenon that plays a very important role in quantum computing is quantum tunneling that allows a subatomic particle to go through a potential barrier, which otherwise would have been impossible to achieve, if it were to obey only the physical laws of classical mechanics. An explanation of this different behavior consists in the fact that in quantum mechanics the matter is treated both as waves and particles, as we have described above, when we have presented the wave-particle duality concept [15].

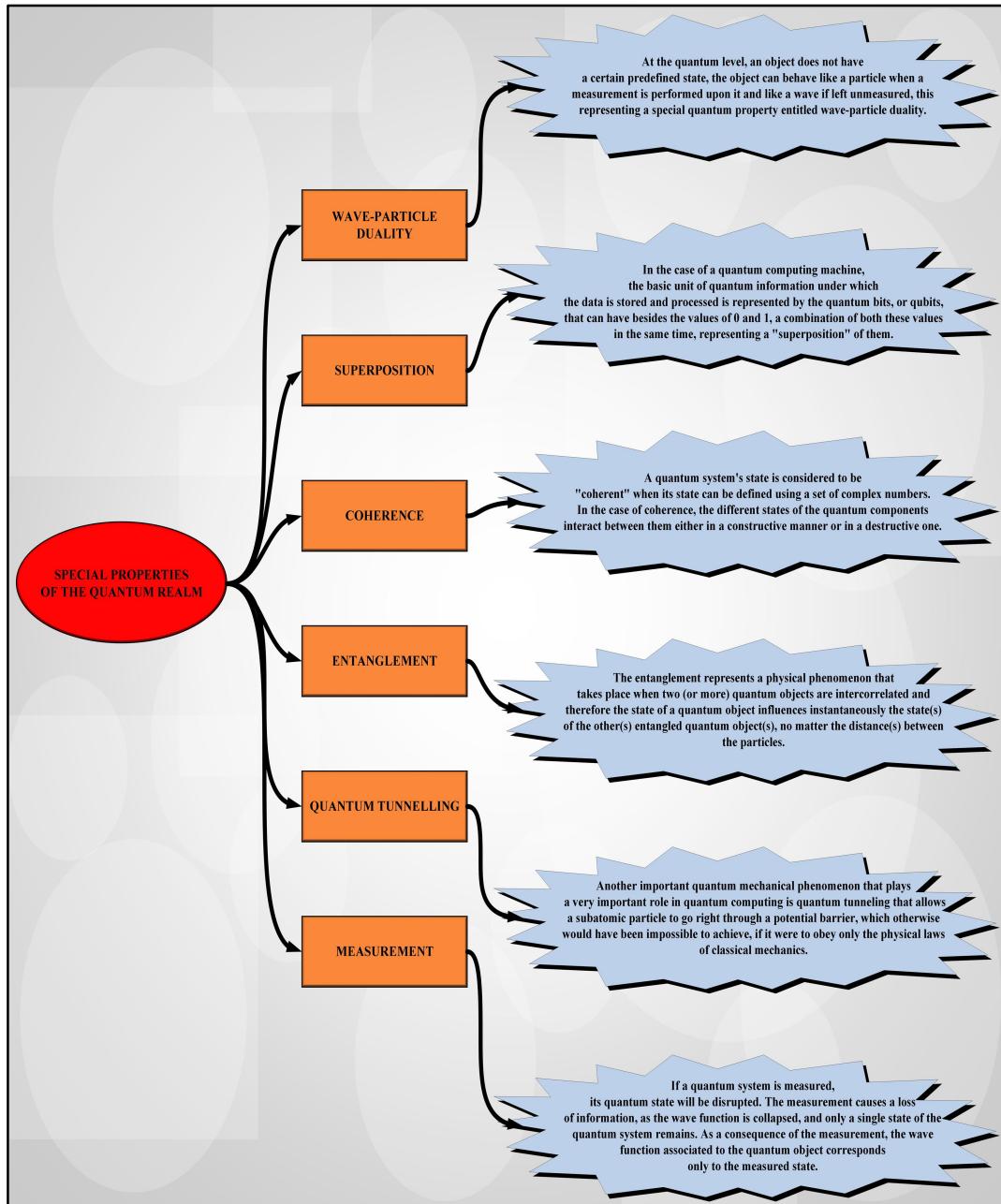


Figure 1. The main special properties of the quantum realm¹

The Schrödinger equation describes the variation of the wave function, taking into account the energy environment that acts upon a quantum system, therefore highlighting the way in which this quantum system evolves. In order to obtain the mathematical description of the environment, of the energies corresponding to all the forces acting upon

¹ The Figure has been devised using Microsoft Visio, based on the information presented in [1, 12, 15-17].

the system, one uses the Hamiltonian of the quantum system. Therefore, the control of a quantum system can be achieved by controlling its energy environment, which can be obtained by isolating the system from the external forces, and by subjecting the system to certain energy fields as to induce a specific behavior. One should note that a perfect isolation of the quantum system from the external world cannot be achieved, therefore in practice the interactions are minimized as much as possible. Over time, the quantum system is continuously influenced to a small extent by the external environment, through a process called "decoherence", process that modifies the wave function, therefore collapsing it to a certain degree [1].

Figure 1 depicts the main special properties of the quantum realm, which, when precisely controlled, have the ability to influence to a large extent the performance of a quantum computer implementation, and open up new possibilities for innovation concerning the storing, manipulation and processing of data.

In the following, we analyze a series of hardware components and existing technologies used for developing and implementing quantum computers.

3. AN OVERVIEW OF THE NECESSARY HARDWARE AND OF THE EXISTING TECHNOLOGIES USED IN THE IMPLEMENTATIONS OF QUANTUM COMPUTERS

A proper hardware architecture is vital in order to be able to program, manipulate, retrieve qubits and overall to achieve an appropriate and correct quantum computer implementation. When implementing a quantum computer at the hardware level, one must take into account the main hardware functions, a proper modularization of the equipment along with both similarities and differences between quantum and classic computer implementations. Conventional computers are an essential part in the successful implementation of a quantum computer, considering the fact that after having performed its computation, a quantum computer will have to interact with different categories of users, to store or transmit its results using classic computer networks. In order to be efficient, quantum computers need to precisely control the qubits, this being an aspect that can be properly achieved by making use of classic computing systems.

The scientific literature [1, 18, 19] identifies four abstract layers in the conceptual modelling process of quantum computers. The first layer is entitled the "quantum data plane" and it is used for storing the qubits. The second layer, called "control and measurement plane", performs the necessary operations and measurement actions upon the qubits. The third layer entitled "control processor plane" sets up the particular order of operations that need to be performed along with the necessary measurement actions for the algorithms, while the fourth abstract layer, the "host processor", consists in a classical computer that manages the interface with the different categories of personnel, the storage of data and its transmission over the networks.

In the following, we present the two most popular technologies employed in the development of quantum computing systems, namely the ones based on trapped ion systems and superconducting circuits and, afterwards, other alternative approaches that are being extensively tested in complex research projects in order to successfully implement qubits and achieve quantum computing.

By means of trapping atomic ions, based on the theoretical concepts presented by Cirac et al within [20], in 1995, Monroe et al [21] revealed the first quantum logic gate. This was the starting point in implementing the first small scale quantum processing units, making it possible to design and implement a rich variety of basic quantum computing algorithms. However, the challenges to scale up the implementations of quantum computers based on the trapped ion technology are enormous because this process implies a synergy of complex technologies like coherent electronic controllers, laser, radio frequency, vacuum, microwave [1, 22].

In the case of a quantum computer based on the trapped atomic ions technology, the qubits are represented by atomic ions contained within the quantum data plane by a mechanism that keeps them in a certain fixed location. The desired operations and measurement actions are performed upon the qubits using accurate lasers or a source of microwave electromagnetic radiation in order to alter the states of the quantum objects, namely the atomic ions. In order to reduce the velocity of the quantum objects and perform measurements upon them, one uses a laser beam, while for assessing the state of the ions one uses photon detectors [14, 23, 24]. **Figure 2** depicts an implementation of the quantum trapping atomic ions technology.

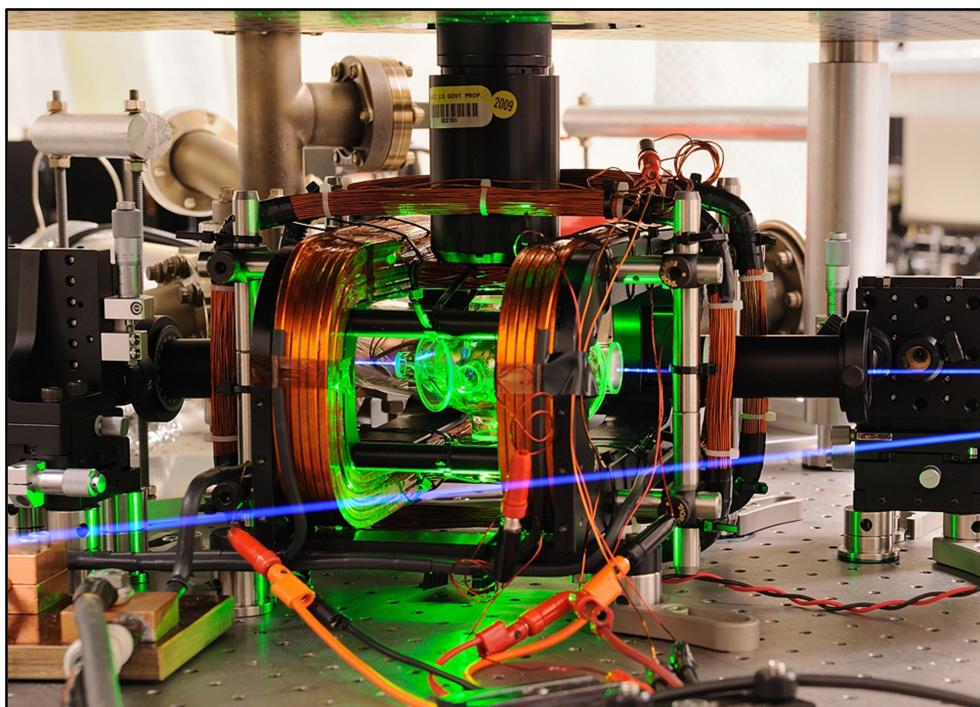


Figure 2. An implementation of the quantum trapping atomic ions technology (the image depicted in this figure is licensed under the public domain, being available for reuse)¹

¹ [https://commons.wikimedia.org/wiki/File:Microwave_Apparatus_\(6029992084\).jpg](https://commons.wikimedia.org/wiki/File:Microwave_Apparatus_(6029992084).jpg)

Another popular technology used in the development and implementation of quantum computers is based on superconducting quantum circuits. These quantum circuits have the property of emitting quantized energy when exposed to temperatures of 10^{-3} K order, being referred in the literature as "superconducting artificial atoms" [25]. In contrast to classic integrated circuits, the superconducting quantum circuits incorporate a distinctive characteristic, namely a "Josephson junction" that uses wires made of superconducting materials in order to achieve a weak connection. The common way of implementing the junction consists in using an insulator that exposes a very thin layer and is created through the Niemeyer–Dolan technique which is a specialized lithographic method that uses thin layers of film in order to achieve overlapping structures having a nanometer size [26].

Superconducting quantum circuits technology poses a series of important advantages, offering reduced decoherence and an improved scale up potential, being compatible with microwaves control circuits, operating with time scales of the nanosecond order [1]. All of these characteristics make the superconducting quantum circuits an attractive and performant technique in developing quantum computers. A superconducting quantum circuit developed by D-Wave Systems Inc. is depicted in **Figure 3**.

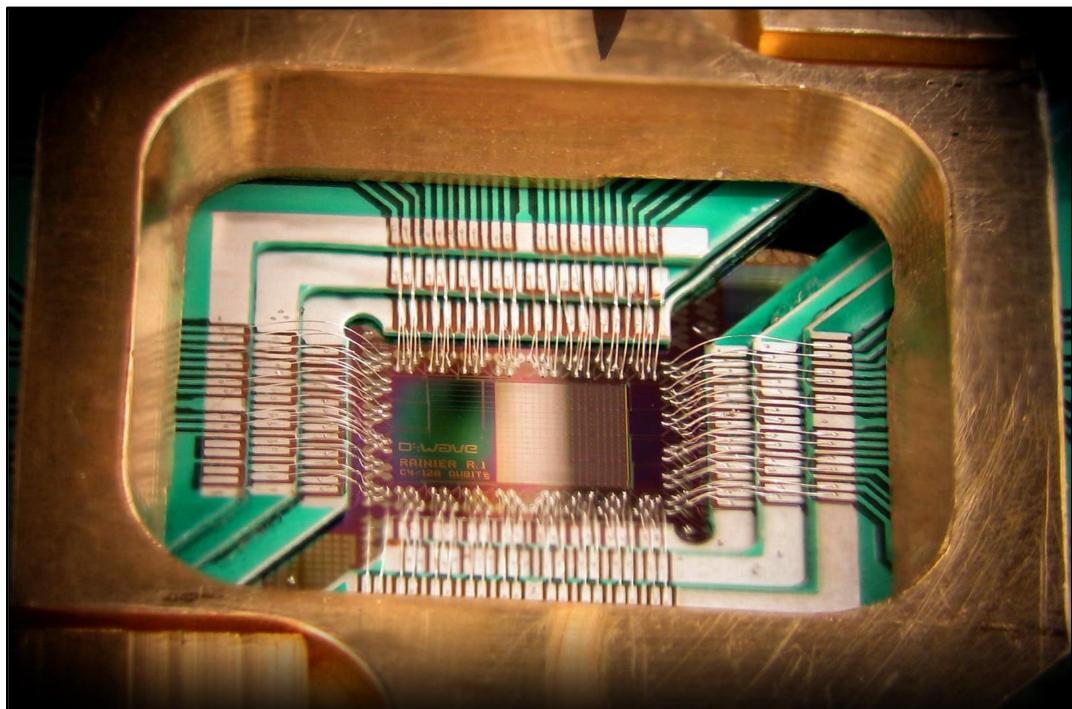


Figure 3. A superconducting quantum circuit developed by D-Wave Systems Inc.
(the image is licensed for reuse under the Creative Commons Attribution 3.0 License)¹

In order to overcome the numerous challenges regarding the scaling of quantum computers developed based on trapped ion systems and superconducting circuits, many

¹ https://commons.wikimedia.org/wiki/File:DWave_128chip.jpg

scientists focus their research activity on developing emerging technologies that leverage different approaches for developing quantum computers.

One of the alternatives that scientists investigate consists in making use of the photons' properties, especially of the fact that photons have a weak interaction between each other and also with the environment. The photons have been tested in a series of quantum experiments and the obtained results made the researchers remark that the main challenge in developing quantum computers through this approach is to obtain gates that operate on spaces of two qubits, as at the actual moment the photons offer very good results in terms of single qubit gates. In order to obtain the two-qubit gates, two alternative approaches are extensively being investigated as these have provided the most promising results.

The first approach is based on operations and measurements of a single photon, therefore creating a strong interaction, useful in implementing a probabilistic gate that operates on a space of two qubits [1]. The second alternative approach employs semiconductor crystals structures of small dimensions in order to interact with the photons. These small structures can be found in nature, case in which they are called "optically active defects", but can also be artificially created, case in which they are called "quantum dots". An important challenge that must be overcome when analyzing quantum computers based on photons is their size. Until now, the development of this type of computers has been possible only for small dimensions, as a series of factors limit the possibility to increase the dimensions of photon quantum computers: the very small wavelengths of the photons (micron-size), their very high speed (the one of the light), the direction of their movement being along a certain dimension of the optical chip. Therefore, trying to significantly increase the number of qubits (represented by the photons) proves to be a difficult task in the case of a photonic device, much more difficult than in the case of other systems, in which the qubits are located in space. Nevertheless, the evolution of this emerging technology promises efficient implementations in the near future [27].

Another technology that resembles the one of "trapping atomic ions" for obtaining qubits consists in the use and manipulation of neutral atoms by means of microwave radiation, lasers and optics. Just like in the case of the trapping atomic ions technology, the "cooling" process is achieved using laser sources. According to [1, 28], in 2018 there were implemented successfully quantum systems having 50 qubits that had a reduced space between them. By means of altering the space between the qubits, these quantum systems proved to be a successful analog implementation of quantum computers. In what concerns the error rates, according to [29], in 2018 there have been registered values as low as 3% within two-qubit quantum systems that managed to isolate properly the operations performed by nearby qubits. Since there are many similarities between the two technologies, the scaling up process faces a lot of the problems of the "trapping atomic ions" technology. However, the use of the neutral atoms technology offers the possibility of creating multidimensional arrays.

A classification of semiconductor qubits is made according to the method used to manipulate the qubits that can be achieved either by photon manipulation or by using electrical signals. Quantum dots are used in the case of semiconductor qubits that are gated by optical means in order to assure a strong coupling of the photons while in the case of semiconductor qubits manipulated via electrical signals, voltages are used upon lithographically metal gates for manipulating the qubits [1]. This quantum technology,

although being less popular than other alternatives, resembles the existing classical electronic circuits, therefore one might argue that it has a better chance in attracting considerable investments that eventually will help speed up the scaling up process of quantum computers implementation.

In order to scale up qubits that are optically gated, one needs a high degree of consistency and has to process every qubit separately at the optical level. In [30], Pla et al. state that even if the qubits that are gated electrically can be very dense, the material related problems posed not long-ago serious quality problems up to single qubits gates level. Although the high density provided by this type of quantum technology creates opportunities for integrating a lot of qubits on a single processor, complex problems arise when one has to manipulate this kind of qubits because the wiring will have to assure an isolation of the control signals as to avoid interference and crosstalk.

Another ongoing approach in developing quantum computers consists in using topological qubits within which the operations to be performed upon are safeguarded due to a microscopically incorporated topological symmetry that allows the qubit to correct the errors that may arise during the computing process [1]. If in the future this approach materializes, the computational cost associated with correcting the quantum errors will diminish considerably or even be eliminated altogether. Although this type of technology is still in its early stages, if someday one is able to implement it and prove its technical feasibility, the topological quantum computers will become an important part of the quantum computing landscape.

4. CONCLUSIONS

Quantum computing represents a field in a continuous evolution and development, a huge challenge in front of researchers and developers, having the potential to influence and revolutionize the development of a wide range of domains like the computing theory, information technology, communications and, in a general framework, regarding from the time perspective, even the evolution and progress of society itself. Therefore, each step of the quantum computers' evolution has the potential to become of paramount importance for the humanity: from bits to qubits, from computing to quantum computing, an evolution on the verge of a revolution in the computing landscape.

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THE RIGHT TO PRIVACY IN INTERNATIONAL HUMAN RIGHTS LAW

Özgür H. CINAR ^{1*}

ABSTRACT

Everyone has the right to demand respect for their privacy (private life). Hence, this right has been safeguarded in international law. However, in the digital age the boundaries of privacy have widened. Both state bodies and non-state organisations make frequent interventions. In fact, these interventions have to be carried out in line with legislation, with the permission of the authorities and in a proportional manner. In this article the historical origins, definition and scope of this right will be examined. Examples from domestic law will be presented and the approach of international bodies such as the United Nations, European Court of Human Rights and European Union mechanisms such as the Court of Justice of the European Union will be examined in detail.

KEY WORDS: *Right to privacy, private life, personal data, international human rights law, European Court of Human Rights, United Nations, European Union.*

1. INTRODUCTION

From the earliest times human beings, as a social entity have shared public spaces with other human beings, while also having a personal and private life. What is mean by the term private life is the right to privacy. Private life is the term used to define the space which people allot to themselves and into which they allow the persons they want. Private life in fact protects us against arbitrary and unjustified interventions by states and other non-state actors. The control of this space is in the hands of the individual who does not want others to intervene. [1] Human dignity lies at the root of this right, and constitutes the basis of all other human rights. What is important here is to improve a person's rights and their conditions of life, so that they may achieve their personal aims and ambitions. Within the broad scope of this right are things such as physical space, home, family life and correspondence. Hence, this sphere has been safeguarded by international law and by the laws of many countries.

Private life is a fundamental right that should be respected by everyone (state and non-state actors) everywhere. This right received recognition in international law after the Second World War. However, it is necessary to be aware that due to the complexity of this right it is linked to different areas of law, for instance: property rights, health, insurance and financial law.

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However, with technological progress in the 21st century serious restrictions on people's private life are being talked about. For instance, our movements can be monitored through the smartphones or computers we use. Data can also be gathered on individuals from search engines, social media, internet searchers and credit cards. This monitoring is in general carried out by states on security grounds.

In this article, in addition to looking briefly at the historical origins of private life, a close examination will be made of its definition and scope. Additionally, how this right is defined in national and international law will be explored and answers sought to the following questions: In private life how can the delicate balance between the gathering of personal data and security be ensured? What is meant by personal data? In what circumstances may this freedom be restricted?

2. HISTORY, DEFINITION AND SCOPE OF THE RIGHT TO PRIVACY

In fact we even come across the origins of this right in primitive communities. Where there were no dividing walls or screens abstract private areas were created by 'imaginary walls'. For instance, in the northeast of Peru the Yagua people who live in houses without dividing walls or screens will turn to the wall of the house when they want to establish a private space. When they do this they are in fact saying that they do not exist in that area. From the 5th century onwards, with the fall of the Western Roman Empire and the coming to power of tribes, people began to live in more protected houses, and privacy gained importance once again. In this context the inviolability of domicile and right to privacy were partially protected. For example, in 1361 the 'Justices of the Peace Act' foresaw the arrest of those who secretly listened in to or followed others. [2] With industrialisation in the 16th century and increasing urbanisation mechanisms were developed to protect privacy with the press having an influence. In 1710 the opening of letters in England without the permission of official authorities was prohibited. In the United States of America there were debates over respect for private life in the 19th century. International debate on this topic came about after the Second World War. Technological developments in the 21st century have made it apparent that this right needs to be protected in a more serious way. [3]

As regards the definition of private life in the literature there are serious difficulties as to its meaning and uncertainty in determining its boundaries. For instance, Arthur Miller said it was hard to define because of a tiresome vagueness and its tendency to disappear. [4] As for Julie C. Innes, she said: "we turn to the legal and philosophical literature on privacy in the hope of gaining a foothold." [5] Unfortunately, the definition of private life has not been completely outlined in international documents. For instance, in article 8 of the European Convention on Human Rights ('ECHR' and/or 'the Convention') we see there is no definition of private life. In *Niemietz v. Germany* the European Court of Human Rights (ECtHR) stated that a definition of private life was neither possible nor necessary: "The Court does not consider it possible or necessary to attempt an exhaustive definition of the notion of 'private life'. However, it would be too restrictive to limit the notion to an 'inner circle' in which the individual may live his own personal life as he chooses and to exclude therefrom entirely the outside world not encompassed within that circle. Respect for private life must also comprise to a certain degree the right to establish and develop relationships with other human beings..." [6] The Court maintained the same

stance in *Costello-Roberts v. the United Kingdom*, making reference to *Niemietz v. Germany*, reiterating that the concept of private life was not entirely suitable to be defined. [7]

However, the impossibility of a definition does not imply that this right does not exist or is unimportant. The existence of this right is important for human dignity, freedom and democracy. Hence, this right, which is necessary in a democratic society for a person's creativeness and to ensure we can establish and maintain social relations with others and also to safeguard an autonomous life and physical tranquillity, has been described as the heart of all essential freedoms. [8] According to a report written by the Special Rapporteur to the Human Rights Council in 2016:

Recognizing that the right to privacy can enable the enjoyment of other rights and the free development of an individual's personality and identity, and an individual's ability to participate in political, economic, social and cultural life, and noting with concern that violations or abuses of the right to privacy might affect the enjoyment of other human rights, including the right to freedom of expression and to hold opinions without interference, and the right to freedom of peaceful assembly and association...[9]

It is apparent how this right has been violated by state and non-state actors, particularly now with the advances made in technology. According to the United Nations (UN) Special Rapporteur in 2016 one in ten of citizens in all member states suffered human rights violations relating to their personal data. [10]

3. RIGHT TO PRIVACY IN NATIONAL LAWS

It has been pointed out that in more than 33% of UN countries, that is, more than 70 states, there is no law pertaining to private life. In more than 75% of member states there are no safeguards or remedies relating to this right of citizens not being violated by other states. [11] But in more than 120 countries this right is safeguarded by national laws. [12] Efforts are also being made in many countries to provide Data Protection Authorities (DPAs) or Regulators to protect personal data.

For instance, it has been safeguarded by the 4th Amendment of the American Constitution: “The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.” [13]

In the German Constitution although the right to privacy is not openly expressed, it is evaluated within the framework of article 1(1) relating to human dignity and article 2(1) concerning freedom of personality. In the Chinese Constitution, although the right to privacy is not mentioned, this right is associated with the physical rights mentioned in article 37, human dignity referred to in article 38 and public spaces in article 39. [14]

In the South African Constitution this right is clearly set down in article 14: “everyone has a right to privacy which includes a right not to have one's home, person or property searched, possessions seized and privacy of communications infringed.” Article 5 of the Brazilian Constitution states: “personal intimacy, private life, honour and reputation are

inviolable”; Article 10 of the Finnish Constitution states: “Everyone's private life, honour and the sanctity of the home are guaranteed.” Article 20 of the Georgian Constitution states: “Everyone's private life ... shall be inviolable”; article 20 of the Turkish Constitution states: “Everyone has the right to demand respect for his/her private and family life. Privacy of private or family life shall not be violated. [15] Article 26 of the Romanian Constitution states: “The public authorities shall respect and protect the intimate, family and private life...” [16]

Although in the Constitutions of Canada, the United Kingdom, France, Japan and India this right is not mentioned, this freedom has been tacitly accepted as a constitutional right by means of court judgments. For instance, the Indian Supreme Court in 2017 made the following judgment: “Privacy is the ultimate expression of the sanctity of the individual. It is a constitutional value which straddles across the spectrum of fundamental rights and protects for the individual a zone of choice and self-determination.” [17] The protection of private life has also been guaranteed by law in these countries. For example, in Canada a law on ‘the Protection of Personal Information and Electronic Documentation’ was enacted in 2000. A similar law was passed in Japan in 2003. [18] This right was safeguarded in the UK by article 8 of the Human Rights Act of 1998, the Wireless Telegraphy Act of 1949, the Copyright Act of 1956, the British Telecommunications Act of 1981 and the Data Protection Act of 1984. [19]

4. RIGHT TO PRIVACY IN INTERNATIONAL HUMAN RIGHTS LAW

This right is also safeguarded in international law. For instance, article 12 of the Universal Declaration of Human Rights, article 17 of the International Covenant on Civil and Political Rights, article 8 of the European Convention on Human Rights, articles 7 and 8 of the European Union (EU) Charter of Fundamental Rights, article 5 of the American Declaration of the Rights and Duties of Man and article 11 of the American Convention on Human Rights are the main international provisions of the right to privacy. All these articles answer the question as to why privacy needs to be safeguarded. However, there are no answers as regards when, how and by whom this freedom should be protected. [20] We see the answers to these questions in examples of case law or in resolutions passed on this issue.

4.1. UN Human Rights System

The UN General Assembly passed two important resolutions in 2013 and 2014 calling on member states to respect the right to privacy in their laws and policies in digital communications, and to take the necessary steps to ensure this (Resolution 68/167, December 2013; Resolution A/C.3/69/L.26/Rev.1, November 2014). In 2015 the UN Human Rights Council appointed a Special Rapporteur on the Right to Privacy. This Special Rapporteur was asked in particular to make expert analysis on a human rights law perspective and give guidance as regards the right to privacy in the face of new technological challenges. Hence, in a report published on 1 March 2019 was the following: “As I have emphasised in the past, there is much work to be done to protect the right to privacy, and a defensive posture is not sufficient. We, Member States and institutions of the United Nations, need to actively entrench privacy as a standard in a democratic society.” [21]

4.2. European Human Rights System

There are two important mechanisms in Europe. The first of these is the Council of Europe, while the second is the EU. The ECHR and the ECtHR will be examined under the heading of the Council of Europe. Under the EU heading the Global Data Protection Regulation (GDPR) and decisions of the Court of Justice of the EU (CJEU) will be examined.

4.2.1. European Convention on Human Rights

Article 8 of the ECHR states:

1. Everyone has the right to respect for his private and family life, his home and his correspondence.
2. There shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and is necessary in a democratic society in the interests of national security, public safety or the economic well-being of the country, for the prevention of disorder or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others.

As can be seen in this paragraph, this freedom also protects family life, the home and the confidentiality of correspondence in addition to individual private life. However, this is not a correct approach to only identify article 8 with the concept of private life. Personal identification, honour and reputation, personal data, physical and moral integrity and sexual life are also included in the concept of private life in judgments made by the ECtHR. As for a person's identity, this includes the name, gender identification, ethnic identity and lifestyle and image. We will look closely in particular at the principle of the confidentiality of personal data within the scope of the above. States have the negative obligation to prevent all manner of arbitrary interference in this freedom. States also have positive obligations to ensure that private parties behave in a respectful manner towards each other. [22]

In addition to the positive and negative obligations of states, since this article is a "qualified right" the state or public authorities are legally entitled to interfere with this freedom in certain limited situations. There are three stage test that must be applied for this freedom to be restricted: 1-) Any interference by the state must be in accordance with law; 2-) It must satisfy one of the legitimate aims stated in Article 8(2); 3-) It must be necessary in a democratic society. This last point is very important as the ECtHR's judges the concept of necessary according to whether there is 'pressing social need'. On this point national authorities have a margin of appreciation as regards determining whether there is 'pressing social need'. [23]

4.2.2. European Court of Human Rights' Case Law

The protection of personal data is related to the right to privacy. The Court evaluates the gathering of data on a person's private life and the holding and use of this data within the scope of Article 8. The Court stated in *S. and Marper v. the United Kingdom* that the gathering and holding of personal data, even if it is not used, constitutes a violation of Article 8. [24] The Court also takes into consideration the nature of the information gathered and held, the way it is used and possible consequences. Hence, the Court ruled in *Klass and others v. Germany* that states could not use the grounds of espionage and counter terrorism to monitor individuals as they wish. [25] It was emphasised that

interference with the rights of individuals should be subject to ‘an effective control’ and that attention should be paid to the principle of proportionality. [26]

The Court constantly refers to the Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data in its judgments. Article 2 of this Convention defines the concept of personal data thus: “any information relating to an identified or identifiable individual...”

The Court also frequently makes reference to Article 6 of this Convention: “Personal data revealing racial origin, political opinions or religious or other beliefs, as well as personal data concerning health or sexual life, may not be processed automatically unless domestic law provides appropriate safeguards. The same shall apply to personal data relating to criminal convictions.” In accordance with this article personal data is separated into two: specific data and other data.

Specific data concerns data such as ‘racial origin’, ‘political opinions or religious or other beliefs’, ‘health or sexual life’ or ‘criminal convictions’ as referred to in Article 6. However, the problem here relates to other data that is not mentioned in the article, but which may indicate a person’s identity or be sufficient to do so. In this regard the source that need to be referred to be the jurisprudence of the ECtHR. In the Court judgments a person’s profile, photographs, fingerprints, DNA profile, cell samples, information regarding health, voice, security number, home address and personal spending are all within the scope of personal data. [27] The Court also differentiates between data as to whether it is of a personal or public nature. For instance, while a person’s picture is of a personal nature, their political activities are of a public nature.

The Court points out that a person’s photographs distinguish them from others on account of their unique character. For this reason they are important as regards a person’s personal development. This matter is particularly relevant in the case of a well-known person’s photographs being publicly shared, leading to a complicated situation. For it is necessary to strike a balance between a person’s reputation, as safeguarded by Article 8, with Article 10 that protects freedom of expression. On this point the Court asks the following questions: “how well known is the person concerned and what is the subject of the report?; prior conduct of the person concerned; content, form and consequences of the publication; circumstances in which the photos were taken; and severity of the sanction imposed.” [28]

Particularly at the present time we frequently see our personal information used on search engines such as Google. This is an interesting example of conflict between Article 8 and Article 10, for while our personal information is on the internet, on the other hand there is the public’s right to information. The case of *M.L. and W.W. v. Germany* was the first case to deal with the issue of press archives on the internet featuring previously reported news (para. 90 and para. 102). In this case the Court rejected the applicants’ request for media organisations to be obliged to anonymise on-line archive material relating to their criminal trial and conviction (para. 116). In its judgment the Court stressed that Article 10 of the ECHR protects media archives, and public access to them. Nevertheless, the judgment did confirm the validity of the right to be forgotten enshrined in Article 8 being used against primary publishers in addition to search engines. Hence, it is important to distinguish this case from others in which individuals exercise their data protection rights as regards their personal information which is published on the internet and which may be

obtained through search engines (para. 91) and used for profiling purposes by third parties (para. 97). [29]

On 27 June 2017 the Grand Chamber of the Court found that in the case of *Satakunnan Markkinapörssi Oy and Satamedia Oy v. Finland* there had been no violation of the right to freedom of expression and information. [30] The case in question involved the mass collection, processing and publication of personal taxation data publicly available in Finland. The Court found there had been no violation of Article 10 based on a narrow interpretation of (public interest) journalism and a wide margin of appreciation for the domestic authorities finding. [31]

The Court found that the data that had been collected and published by newspapers, giving details of the tax affairs of many people, evidently related to their private lives, despite the fact that the general public was able to access the data, under domestic law, with certain limitations (para. 138). In such matters domestic law has to provide proper safeguards to prevent the use of personal data that could conflict with the guarantees enshrined in Article 8. It is worthy of note that the Court emphasised that Article 8 provided for the right to a form of self-determination as regards information, in that it permitted individuals to rely on their right to privacy concerning data collected, processed and disseminated en masse and in a way that the Article 8 rights of the individuals in question are ensured (para. 137, see also para. 198).

Additionally, personal information is not only monitored by means of the internet, as our movements can also be monitored in public spaces by CCTV or different technological equipment. At this juncture the question as to what will happen to footage taken by video surveillance of public places comes to mind. The Court primarily evaluates this situation within the scope of Article 8. [32] For instance, in this case a violation of Article 8 was found on account of video footage of the suicide of the applicant being shared without permission in the media. [33] In the same way, it was stated that the sharing of photographs taken of persons in custody by the police or public authorities without permission constitutes a violation of Article 8. [34] However, the sharing of photographs of a suspected terrorist was not found to be in violation of Article 8 as in this instance a state's margin of appreciation was interpreted more broadly. [35]

Moreover, the monitoring by states of communications is one of the most controversial issues of modern times. Although national governments and national authorities are granted a certain margin of appreciation when it comes to assessing the best policy in this sphere, States must carry out unlimited covert surveillance of persons within their jurisdiction. The Court has made clear that States may not use whatever measures they consider legitimate on the pretext of combatting espionage and terrorism; instead, there must be adequate and effective measures adopted to prevent abuse under whatever system of surveillance is utilised. [36] Covert surveillance of citizens is only tolerable when it is absolutely necessary to safeguard democratic institutions. [37] All such measures must be based on concrete and sufficient grounds and be proportionate to the legitimate purpose set forth. [38]

The Court has also included the collection of DNA samples within the scope of the right to privacy. The gathering and holding of cellular material, and the determination and retention of DNA profiles extracted from this material, was found to be an interference with the right to respect for privacy enshrined in Article 8 para. 1 of the ECHR. [39] This

ban does not necessarily include the taking and holding of DNA profiles of convicted criminals for future use in criminal proceedings that may arise. [40] As referred to above, such interference is a violation of Article 8 unless it is considered to be ‘in accordance with the law’, and can be justified under paragraph 2 of Article 8 as trying to achieve one of the legitimate aims listed, and as being ‘necessary in a democratic society’ in order to achieve the aim or aims in question. [41]

In summary, the ECtHR, by broadening the scope of Article 8, is making clear that this freedom is not unlimited. However, bearing in mind the negative and positive obligations of states as regards restricting this right, it is necessary to carefully implement the three stage test we mentioned above. Otherwise, there will be a risk of violating the principle of proportionality and consequently violating Article 8.

4.3. European Union Legal System

Apart from the ECtHR, another important mechanism in Europe is the EU. Article 7 of the EU Charter was constructed on Article 8(1) of the ECHR: “Everyone has the right to respect for his or her private and family life, home and communications.” However, Article 8 of the Charter for the first time included ‘personal data’ for the first time in international documents, guaranteeing its protection:

1. Everyone has the right to the protection of personal data concerning him or her. 2. Such data must be processed fairly for specified purposes and on the basis of the consent of the person concerned or some other legitimate basis laid down by law. Everyone has the right of access to data which has been collected concerning him or her, and the right to have it rectified. 3. Compliance with these rules shall be subject to control by an independent authority.

The EU Charter is not a statement of fundamental rights and privileges with a universal scope. Article 51 of the Charter states that it only applies to EU institutions and Member States when they are engaged in the implementation of EU Law. Thus, the Charter has an aim to guide the implementation and interpretation of EU Law, including the GDPR. [42]

In *Digital Rights Ireland and Seitlinger and Others* the CJEU stated: ‘The retention of data for the purpose of possible access to them by the competent national authorities, as provided for by Directive 2006/24, directly and specifically affects private life and, consequently, the rights guaranteed by Art. 7 of the Charter.’ [43] The CJEU found that holding private data violated Art. 7 of the Charter, and that national authorities having access to such data constituted a ‘further interference with that fundamental right’, referring to ECtHR case law. [44]

The CJEU held in *Google v Spain* that Google is responsible for the processing of the personal data in which it engages, as a data controller established in the EU, and is responsible for this data which appears on web pages published by third parties. Hence, Google has a responsibility to respect EU data protection laws (Arts 7 and 8 of the Charter) and also to comply with requests to remove links to certain personal data, under certain circumstances (the right to be forgotten). [45] In *A, B, C v Staatssecretaris van Veiligheid en Justitie* the national court asked the CJEU whether EU law imposed any restrictions as regards the verification of the sexual orientation of asylum applicants. According to the CJEU, Member States have the right to examine the truth of applicants’

statements regarding his/her sexual orientation. [46] However, the methods used to evaluate the credibility of these statements by national authorities must respect the right to respect for private and family life and other *fundamental rights*. [47]

In summary, the CJEU hands down similar judgments to the ECtHR. However, the EU has gone one step further by accepting the Global Data Protection Regulation (GDPR) 2016/679 and the Data Protection Directive for law enforcement and police area in April 2016. At this time the GDPR is the broadest provision in the world concerning data protection in the digital era. [48]

Article 1 of the GDPR is as follows: “[Regulation] protects fundamental rights and freedoms of natural persons and in particular their right to the protection of personal data.” The Impact Assessment of the European Commission noted that, “individuals are often neither aware nor in control of what happens to their personal data and therefore fail to exercise their rights effectively.” [49] Hence, the GDPR emphasises autonomy and consent while also attaching equal importance to the duties of data controllers, without seeing whether data subjects have acted to enforce those duties. [50]

The EU also established a body called the European Data Protection Supervisor (EDPS) to deal with data protection in 2004. The role of the EDPS is one of independent adviser to EU institutions concerning all matters relating to the processing of personal data, including security initiatives and new data-exchange tools for law enforcement agencies. The EDPS has published many Opinions on initiatives designed to broaden information-sharing for the purpose of law enforcement inside the EU, including the Entry/Exit System and EU PNR - and also beyond Europe, examples being the Umbrella Agreement with the US and PNR agreements with non-EU countries. [51]

In summary, EU rules on the right to privacy in particular present the greatest source for us, as it has provided a very strong mechanism to protect personal data. The GDPR is not only implemented in organisations or institutions founded in the EU, but also in bodies founded outside the EU that are legal entities within the EU. In addition to providing new rights to individuals in the digital environment, new detailed obligations have been introduced for companies and organisations. In this regard it is important not to overlook the fact that the EDPS and CJEU have effective mechanisms.

5. CONCLUSION

It is impossible to define the concept of private life and to set forth exactly what it is. Within this freedom there is not only private life, but also freedom of ideas, expression, religion and conscience in social life. Although it is exceedingly difficult to define the concept of private life and draw its boundaries, this does not mean this right does not exist. This right is one of the most fundamental human rights and is important in the safeguarding of human dignity and autonomy. This right is the right of a person to live their private life without unwanted intrusion. Hence, this freedom protects us against arbitrary and unjustified interference by both state and non-state actors. In this context it is part of a state’s negative and positive obligations to develop and implement effective mechanisms to protect this freedom of individuals. These obligations have been clearly set down both in international law and in the domestic law of many countries.

Of course, this right is not unlimited. However, interference in this right must be based on legal grounds and have permission and in accordance with the principle of proportionality. It can be particularly difficult to determine boundaries in the digital world. For this reason UN, ECtHR and EU mechanisms have introduced provisions (e.g. GDPR) recently in order to ensure that people do not suffer arbitrary and unjustified interference in this right. However, when we consider that more than 70 UN member states have still no legal provisions safeguarding this right, it is important that both these countries and international bodies take action as soon as possible.

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FRACTALS – A SMART FINANCIAL TOOL TO ASSESS BUSINESS MANAGEMENT DECISIONS

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ABSTRACT

The research aims to identify the existence and connections between financial decision, financial performance and fractals patterns. The investigation starts to examine if there is the possibility to verify a repeating pattern for future events to be foreseen. Mathematics is a logical base of our entire life, and fractals are of it. A fractal appear as a geometric object that repeats itself in the same structure on different scales and/or timings, showing reduplicate patterns. Fractals are everywhere around us. Fractal patterns can be easily linked with financial markets or any economic events. Price movement in the market are very complex and appears to be randomly. The financial economists believed that this complexity is built up from self-similar patterns of trader behavior. That means that the whole structure is not random but follows a model that can be measured – fractals. A multidimensional analysis of financial data provides a clear picture of decision makers at company level or at macroeconomic level. Economic data are very useful and they can be classified according to different decision maker criteria and taking into consideration accordingly. However for a better performance of economic and financial forecasts, predictions and the impact of any decisions throughout the economy, we argue that fractals pattern are more than helpful be taken into account.

KEYWORDS: fractals; financial decisions; intelligent management decisions; smart forecasting.

1. INTRODUCTION

This research purposes to study if there is the possibility to verify a repeating pattern for future events to be foreseen. In particular, based on the Mandelbrot's studies, [1] taken up and applied by the economist Taleb [2], it has been possible to hypothesize the occurrence

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of improbable events, which may have a devastating impact. The Authors focused on the comparison between the original fractal approach and the Gaussian one, based on the so-called *Gaussian bell*. The latter excludes the possibility of considering some events simply because they are unlikely, regardless of the effects they might produce.

A fractal is a geometric object that repeats itself in the same structure on different scales and/or timings, showing repeating patterns. It does not change its appearance even if it is viewed with a magnifying glass. Objects with such behavior could appear as artificial constructions, although they are frequent in nature such as: the arrangement of the branches of a tree, the shape of a cauliflower, the surface of the clouds, the path of a river, the structure of the galaxies, the shape of lightning (figure no.1).



Figure 1. Examples of fractals shapes

Furthermore, since its Mandelbrot's discover, fractals are becoming a powerful new mathematical language, thanks to which it is possible to describe natural phenomena and solve the real natural problems that had once been set aside. The Mandelbrot's crucial aim it was to find a comprehensive way to explain the chaos. This modern mathematics makes use of the information technology (Mandelbrot used to work at IBM for decades). To understand the importance of fractal pattern, it is necessary to take a step back in time. Galileo Galilei, one of the greatest scientists of all time, believed that mathematics was an indispensable discipline for interpreting natural phenomena and for representing the forms of nature. However, our daily experience leads us to believe that the most familiar geometric figures (lines, circles, regular polygons) are exception in the nature. This is precisely the Mandelbrot's objection [3], which introduced the fractals in 1975 as new geometric figures more efficient to represent the complexity of nature. The term *fractal*, which he invented, it comes from the Latin word *fractus* (broken, fractionated). Fractals are geometric figures that may seem irregular because they cannot be traced back to the classical figures of Euclidean geometry. They are in fact strange figures, very jagged, grainy, sometimes ramified and intricate, with tentacles or protuberances, just like most of the figures in nature.

A fractal is a geometric object with internal homothetic, which it repeats his shape in its same form on different scales. Enlarging any part, it is possible to obtain a similar figure to the original. It is therefore called *fractal geometry*, the Non-Euclidean geometry that studies these structures, recurrent for example in the engineering design of networks, in Brownian motion and in galaxies. This feature is also known as *self-similarity*. Benoit Mandelbrot invented the term *fractal* in 1975 and described like *imagine of a figure, a leaf for example, which reproduces itself to infinity, always the same shape but always*

smaller. In this way the fractal can be used in the description of real natural events or objects. Moreover, the fundamental characteristic of the fractal figures is *self-similarity*: if the details are observed on different scales, it is always possible to notice a certain resemblance to the original fractal. Fractal geometry comes to identify these configurations, to analyze and manipulate them and can be used, not only as a tool for analysis and synthesis, but also as a forecast. The rules of the fractals are precise, so the result is predictable. This contrasts with traditional science which instead consider the irregular aspects of nature and non-similar events such as chaos theory [4]. The chaos theory is considered like a drop of water that expands into the sea, or cardiac fibrillations, or even computer errors and price fluctuations.

The Mandelbrot's set (figure no.2) is one of the most popular fractals, also known outside the mathematical field due to the suggestive multicolored images that have been disclosed. It is the set of complex numbers – c – that shows a limited sequence defined by:

$$\begin{cases} z_0 = 0 \\ z_{n+1} = z_n^2 + c \end{cases}$$

Despite the simplicity of the definition, the function has a complex shape whose contour is a fractal. It is possible to view and draw it only by using a computer.

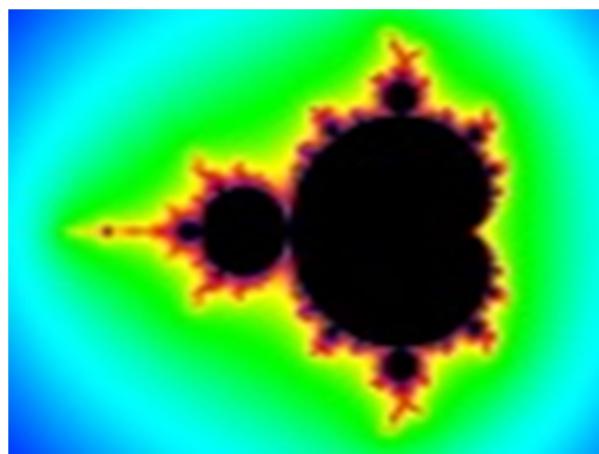


Figure 2. The Mandelbrot's Set

2. RESEARCH METHODOLOGY

This research is proposed to be a qualitative exploratory research, because the aim of the paper is to deepen the already advanced researches made by [1] and Taleb [2], focusing on the theory of finance and linking it to the business management. The research started from the obvious existence of fractals in everything that surrounds us and wishes to show and confirm that patterns exist in economic life and may help, even may become an important tool for financial decision makers. Fractals can let financial experts to be aware or prepared for periods of cyclical recession.

3. LITERATURE REVIEW

3.1. Different approach: Fractal versus Gaussian bell

Now become understandable that fractals have always been there, part of our day-to-day life, just waiting to be discovered. At the beginning of the twentieth century, some mathematicians had created very strange curves and figures that subverted the rules of classical geometry violating the characteristics of harmony considered natural for objects in the scientific field. This is a case of *Koch's snowflake* (a line which links all corners – figure no.3); *Peano-Hilbert curves* (a line that unfolds a labyrinth which it covers a square – figure no.4); pitted figures, like the *Cantor's set* (figure no.5); or the *Sierpinski's carpet* (Figure no. 6). At that time, these structures were considered as monsters to be relegated in a sort of museum of horrors or to be exhibited only in an equestrian circus.

Thanks to Mandelbrot, the *mathematical monsters*, previously set aside, were finally considered, assuming a new role of ancestors of modern fractal figures. Fractals were therefore born by recovering pre-existing separate pieces, but conceived in limited and distinct contexts. The mathematicians were surprised and pleased to discover that their pathological figures had become the key to the complexity chased for so long. In the last twenty years, fractal models have been investigated, acquiring the role of the key structure in financial modeling. Mathematic in all sectors is constantly growing: from natural sciences to economics and social sciences, from physiology to technology, advanced logistics and their field of application.

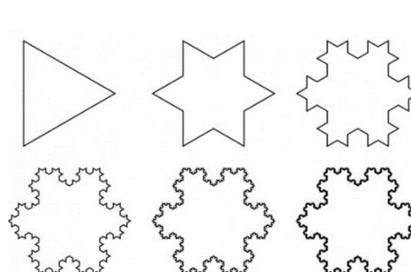


Figure 3. Koch's Snowflake

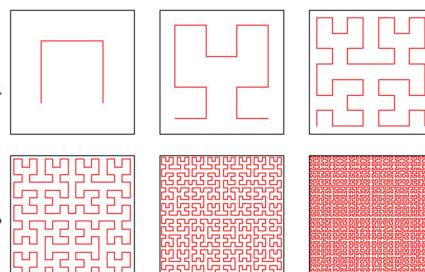


Figure 4. Peano-Hilbert curves

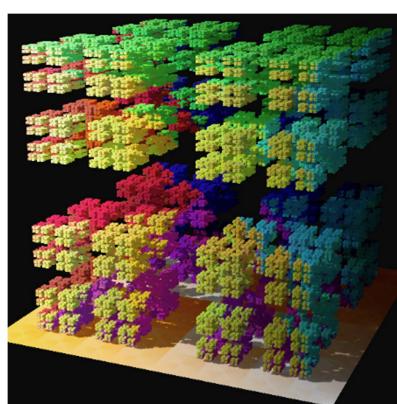


Figure 5. 3D Cantor's set

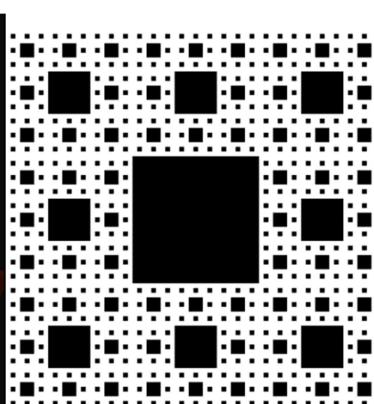


Figure 6. Sierpinski's carpet

The fractals theory is also closely linked to the chaos theory. Thanks to the captivating graphic representation that can be obtained with the help of a computer, fractals have also acquired a space in the art world. Therefore, fractal painting and music were born. Beyond their apparently very complex figures, secret of extreme simplicity is hidden. This is perhaps the most surprising aspect of the whole fractal theory.

Karl Friedrich Gauss' mathematic formulas and everything that is behind the mathematician is known to a few of us, however its general meaning and usefulness is known to many. *Gaussian curve* is a curve with a classic bell shape that has a maximum around the average of the measured values and can be more or less narrow depending on the dispersion of the values around the average. The dispersion is measured with the standard deviation: practically one of the properties of the Gaussian is that 68% of the measurements differs from the average less than the standard deviation and that 95% less than two standard deviations. Therefore, the greater the standard deviation, the more the Gaussian it is *open* and there is the possibility that the average (the highest point) is not representative of many cases.

Also in the case of the Gaussian bell curve (Figure no.7) the area subtended by the curve is 1 because the sum of the probabilities of all the values gives 1, which is the certainty. The Gauss's theory is also known as the theory of rationality. Indeed, the events that are found on the highest peak of the curve represent those with the highest frequency (and then with the highest probability), while the events with lower probability, closer to the asymptotes, according to this theory are considered negligible, only because of the fact they are rare, regardless of their importance in terms of damage they can produce.

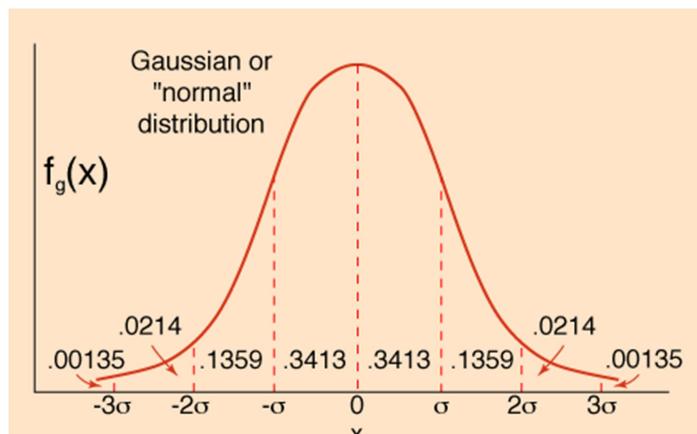


Figure 7. Gaussian Bell – Normal Distribution

3.2. Fractals and Scaling in Finance

With fractals the rules are precise and the result is predictable. This contrasts with traditional science which instead includes the irregular aspects of nature and non-similar events such as chaos theory. It is chaos theory a drop of water that expands into the sea, or cardiac fibrillations, or even computer errors and price fluctuations.

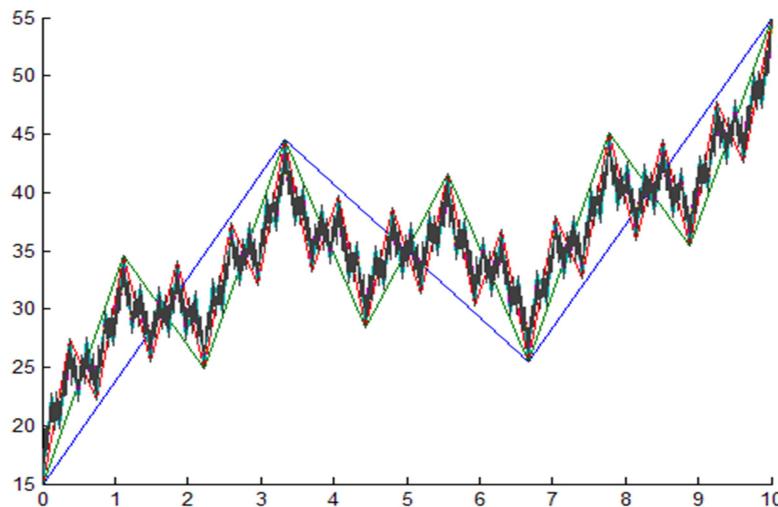


Figure 8. Fractal stock price simulation

Nevertheless, sometimes reality overcomes that the chaos theory exists, in the sense that the unpredictable is realized. This is the collapse of the stock exchange in 1929, or the unfortunate financial events of August 1998, and financial crisis from 2008. According to the standard models, studied by the traditional economy, the sequence of these events was so unlikely as to be impossible. Technically it was called *erratic value*, that is, very far from the normal expected value in the financial world. Yet it happened. This, according to the fractals, means that the traditional economy may have error. Studying of financial markets risk, using fractal theory applicators, it can be offered a new tool to perform better quantitative control and take a better qualitative financial management and investment decisions. The goal is therefore to study the risk, even if Mandelbrot himself admits that nothing can be predicted accurately. It is true that observing the behavior of those who play on the financial market there is something illogical. We observe the stock exchange phenomenon: prices are very variable, movements have an irregular trend (figure no.8). Those who bet on these tendencies to accumulate wealth, they usually put us back because the changes are valued without order: prices increase then without warning, this tendency is interrupted and the opposite trend can even be established (figure no.9).

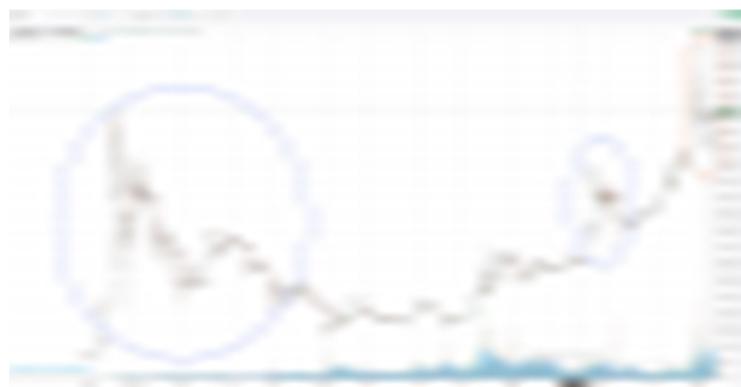


Figure 9. Fractal Pattern of bitcoin price

On financial markets, the reality overcomes the chaos theory in the sense that the unpredictable is realized as for example the collapse of the stock exchange in 1929 or the unfortunate financial events of August 1998. According to the standard models, that is the models studied by the economy traditional, the sequence of these events was so unlikely as to be impossible. Technically it was called *erratic value*, that is, very far from the normal expected value in the stock world. Yet it happened. This, according to the fractals, means that the traditional economy is in error. Financial markets are risky, everyone knows, but a thorough study of risk, according to fractal theory applicators, can offer a new understanding and one can hope to have quantitative control. The goal is therefore to study the risk, even if Mandelbrot himself admits that nothing can be predicted accurately. It is true that observing the behavior of those who play on the stock market there is something illogical. We observe the stock exchange phenomenon: prices are very variable, movements have an irregular trend. Those who bet on these tendencies to amass wealth, they usually put us back because the changes are valued as without order: prices increase then without warning, this tendency is interrupted and the opposite trend can even be established.

The fractal indicator is based on a simple pricing model that is often found in financial markets. A fractal is a given geometric model that is repeated along all time frames. From this concept was created the fractal indicator. The indicator generates potential turning points on the chart. That shows that the price could move higher and a fractal signal shows the signal that the price might decrease. Bearish fractals are marked by an up arrow and the bullish fractals are shows with an arrow (figure no.10).



Figure 10. Scenarios' tree for financial decision making

The financier Bill Williams has developed the fractal indicator it and can be used in all markets and in all time periods [5]. When there is a low point with two bars or candles a bullish fractal occurs. Moreover when there is a high point a downward fractal occurs. When the arrow is located above or below the center, there is no possibility that a trader can enter the world also if the model is five bars. If someone is exchanged fractal signals, the voice would be the right price of the third bar after the arrow, moreover fractals are frequently used, and sometimes they can be very inaccurate entry points. Fractals can be very inaccurate entry points because they are frequently used. Williams is the one that has fundament a new indicator, the *Aligator*, among the classical known indicators of the financial stock exchange market. This is an indicator of the combined approach of the

direction of travel assessment and filtering market periods of trends absence. The Alligator takes into account the combined analysis of three lines of balance (jaw, teeth and lips). Its interpretation is made as follows: in periods of consolidation, the lines are braided together (sleeping alligator), the more this process lasts, the stronger is this movement of the price (becomes more hungry alligator). Along the trend development, the alligator opens its jaws and follows its prey, the price. As it is more than enough, he squeezes its jaws and falls asleep again [6].

Traders always look for new strategies in their market analysis in order to gain an advantage. A fractal pattern is a model repeated that shows the same configuration throughout the structure, on different scales. Outside, in nature we may see many fractals pattern such us the twigs linked to the tree or snowflakes, these reinforce the properties of being self-similar. No matter how complex is the whole situation, the fractal patterns are recursive since it is built from many repetitions of the same process. If you look at a small section of the pattern, they are self-similar, there is no difference to a much larger section of the pattern, or even the whole.

Fractal patterns can be easily linked with financial markets. Price movement in the market are very complex and appears to be randomly. The financial trader and analyst Bill Williams [5] believes that this complexity is built up from self-similar patterns of trader behavior. That means that the whole structure is not random but follows a model that can be fathom. Williams believes that the structure of the Elliott Wave is actually fractals. The Elliott *Motive Wave* is the first half of the idealized Elliott Wave pattern [7]. It always advances in the direction of the trend of one larger degree and it is subdivided into five smaller waves (Figures no.11). If trades are the results of a behavioral fractal, Williams reasoned, then the aggregate comportment also follows a fractal pattern [7]. That means that the behavioral fractal model gives a way to the traders to potentially profit from the market.

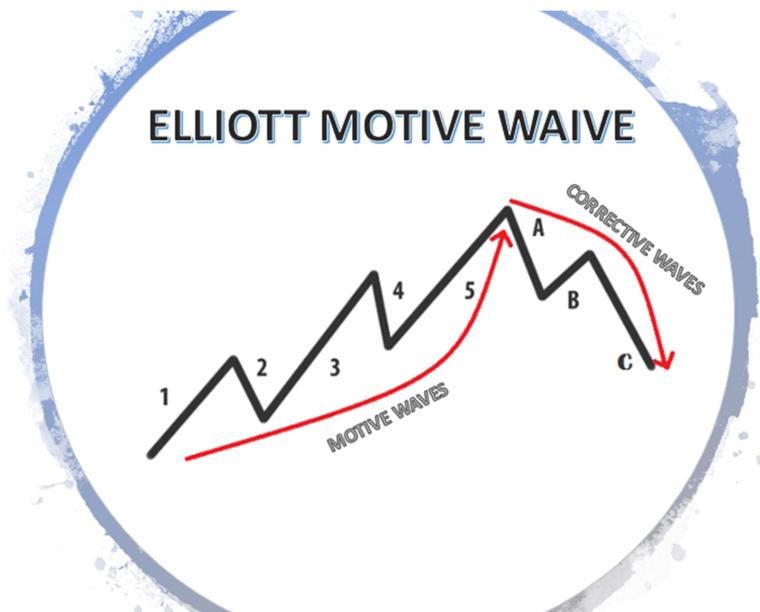


Figure 11. Elliott Motive Waive

4. FINDINGS AND CONCLUSIONS

The Authors tried to reduce the scale of observation and detect the phenomenon by applying the vision of fractal finance. The irregular tendencies of the stock exchange are grouped by size: the large variations arrive in rapid succession followed by sequences of small variations. The behavior of the stock exchange is therefore a fractal structure. In the same way it is possible to proceed with the description of the *bubbles* of the investments, that is the abnormal expansion of a value. The bubbles, however calamitous they may seem, are very common in the general market indices (for example the Dow Jones) and in the individual activities [8]. Despite this, traditional economic models consider the bubbles of aberrations, of irrational deviations of the norm, caused for example by an avid speculator. Why it is not considered as a combined result of so many discontinuities? Or again, why does traditional finance presuppose that the financial system is a linear and continuous machine even if it admits the existence of bubbles?

An example can help: based on the standard model of finance (the price bell curve) the probability of ruin is equal to 1 in ten billion billions, that is more likely to be hit by a meteorite that will go bankrupt in a financial market. But if prices have wild variations (it happened for the price of cotton but also with oil) the probability of ruin increases dramatically.

The most famous and most general pricing model of the options was developed at the beginning of the seventies by Fisher Black and Myron Scholes [9]. Originally this model was developed to price European-style financial options (type of option that cannot be reimbursed before their maturity). Starting from that first early version it has contributed and influenced all subsequent pricing models. An important contribution to the development of the model of Black and Scholes undoubtedly goes to Merton who, on the basis of the 1973 version, made changes and improvements [10]. According to their binomial model, the basic hypothesis is the possibility of creating a portfolio equivalent to the option, consisting partly of units of the underlying and partly of risk-free bonds. The main difference with respect to the binomial model is that in this case the hypothesis foresees that the yields are distributed among infinite states of nature according to a normal Gaussian distribution. The Black and Scholes model represents the limit in the continuum of the binomial model, which is discrete (figure no.12).

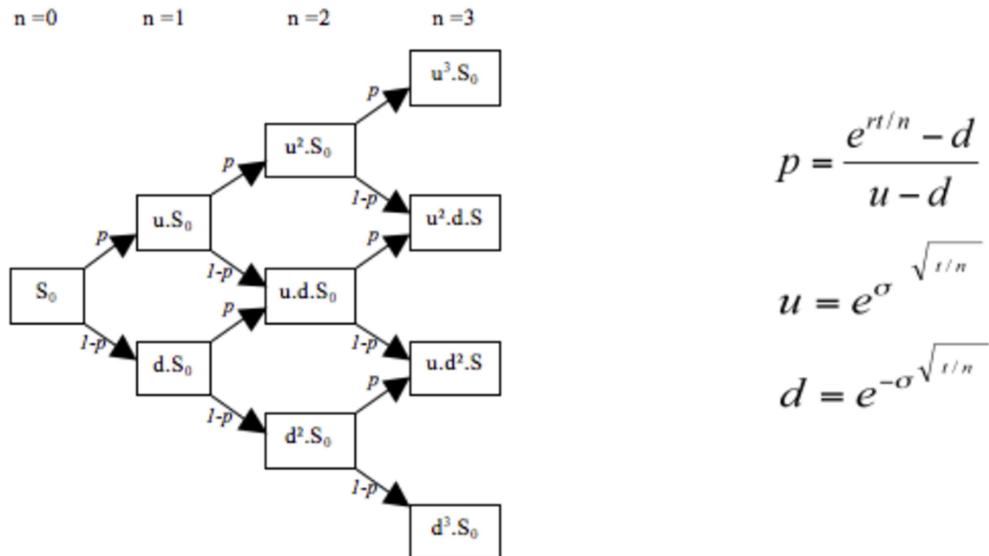


Figure 12. Binomial option pricing model. Decision tree approximation.

The intention and suggestion of the Authors is to apply an innovation to the Black and Scholes method, basing the analysis of the pricing of the real options no longer on the normal distribution, but on a fractal approach. According to authors' opinion, this method, despitely all evidence, definitively can be the one which represents all possible states of nature and all scenarios, without neglecting any event, not even those that are unlikely to be happened.

Since decision-making strategies should be based on the most detailed analysis possible of all scenarios, the normal distribution therefore appears to be a limit rather than a foundation, as it excludes unlikely events. Moreover, it has been shown that the most improbable events are the most dangerous, or the one that represent the most important opportunities, therefore they are not negligible.

Future research will be able to focus on quantitative and econometric analysis, with the support of computing power and computer design, and able to discover and test complexity and the perfectly realistic algorithms.

In essence, with the implementation of the model suggested in this paper, it will be possible to replace the probability percentages assigned (currently by normal distribution) to each branch of the Black and Scholes construction, with more detail through the fractal approach.

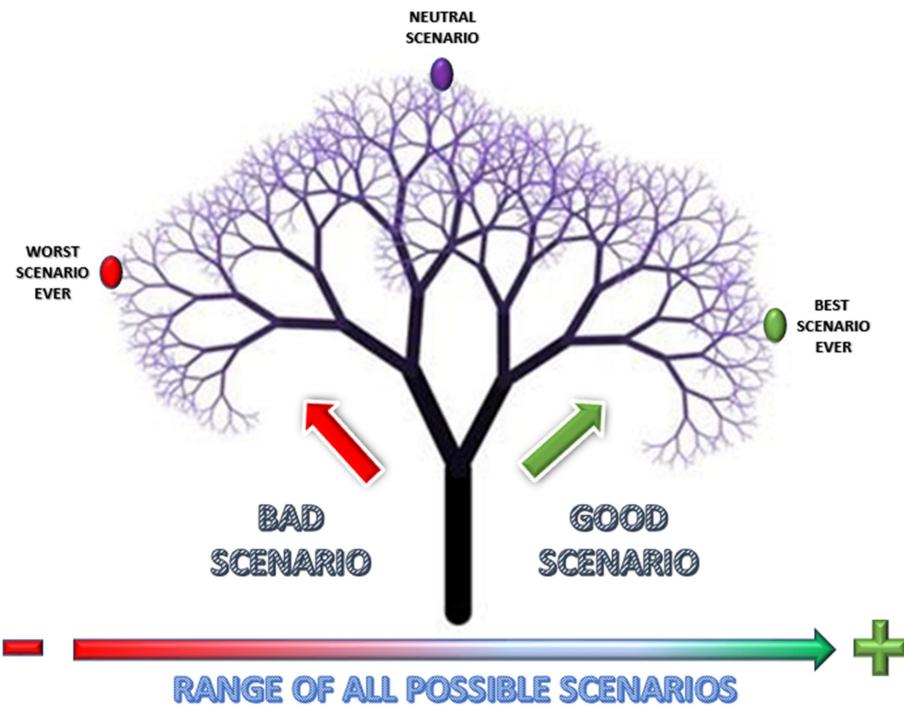


Figure 13: Scenarios' tree for financial decision making

Financial performance of foreign exchange markets or performance of foreign investments [11] is a constant issue of the present normal or turmoil economic, however it is insufficiently explored, without taking into consideration all aspects, like fractals patterns. The analysis of the economic and financial performances is a frequently debated matter in the economic media from the last decades, covering a very large spectrum, comprising various meanings and tendencies which will continuously capture the interest of the economists, the accountants and the IT specialists [12]. However, the present research comes to emphasize that fractals patterns can predict a certain economic trend for each type of transaction or economic behaviour, under the circumstances of the action of the same type of external factors [13].

A multidimensional analysis of financial data provides a clear picture of decision makers at company level or at macroeconomic level. Economic data are very useful and they can be classified according to different decision maker criteria and taking into consideration accordingly. The research showed and natural life confirm that patterns exist in economic life too. These patterns may help, even may become an important tool for financial decision makers. However, for a better performance of economic and financial forecasts, predictions and the impact of decisions throughout the economy, we argue that fractals pattern are more than helpful be taken into account, fractals can let financial experts to be aware or prepared for periods of cyclical recession and take better and less risky business decisions.

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COMBINING TESSERACT AND ASPRISE RESULTS TO IMPROVE OCR TEXT DETECTION ACCURACY

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ABSTRACT

We live in a highly technologized era, where a great number of physical documents have started or must be digitized in order to make them accessible anywhere, for a great number of people. Optical Character Recognition (OCR) is one of the techniques which are widely used in order to recognize characters from specific images obtained after scanning. Different types of systems have been developed in order to perform Optical Character Recognition for various types of documents, but the task is not easy, as documents differ not in terms of content, but have also in formats, fonts, age or deterioration. After reviewing the existing systems, the paper at hand proposes one which uses two well-known OCR engines and a voting principle based on weights. There are also analyzed the results of our combined technique, as opposed to each individual approach of the two chosen engines.

KEYWORDS: *text recognition accuracy, OCR, Tesseract, Asprise, text detection*

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INTRODUCTION

In the past years, a great number of written documents have been digitized, using scanners or different types of specific methods. The need for creating a system that can translate given data, such as pictures, to editable written documents, has appeared. The technology created for this task is Optical Character Recognition (OCR).

The problem with OCR engines is that a specific one may be good at recognizing only a specific type of scanned documents with certain characteristics - deterioration, paper quality, fonts and so on, and not always with 100% accuracy.

The focus of the presented research is set on how several types of OCR engines can be applied to a dataset of input scanned documents to yield the best result. In the next sections, we will analyze the potential result of each system and based on their performance on a specific document type, a voting algorithm will be employed in which the best engine has more weight in the overall decision process. We will start by giving details about the used systems and all possible alternatives. We will further present our system and analyze its workflow. Finally, we will present the results after the images were processed through our system.

USED SYSTEMS AND RELATED WORK

At the core of this paper is situated the OCR technology, which is the artificially reading process, in which image data from documents or natural scenes containing written messages is converted into text data [1].

Modern OCR engines are powerful because they provide the above-mentioned functionality without the need for developing the code further. The first OCR engines had to be trained on huge amounts of data to recognize characters or fonts and they were not always reliable because of the diversity and level of degradation that was present in specific datasets (skewed or blurred pictures, containing special characters, etc.). Some of the most widely used OCR engines, systems, models examples include:

- Ocropus [2] - or Ocropy, OCR engine based on LSTM;
- Ocrad [3] - The GNU OCR;
- SwiftOCR [4] - a fast and simple OCR library written in Swift;
- Attention-OCR [5] – a model for extraction of texts in real-world scenes;
- Tesseract [6] – mature OCR engine, including both NN and LSTM text recognition approaches;
- Asprise [7] - used as an OCR and barcode recognition SDK with high performance;
- Abby Finereader [8] – high-performance OCR and Layout detection engine

In this paper, we focused on the last two OCR engines described above, Tesseract and Asprise, and combined them to obtain better results. Each engine outputs a confidence level to measure if the detection process produces valid results.

Tesseract

Tesseract is a Google-developed OCR project, from 2006 [6]. It evolved a lot during the years, starting from a simple NN-based text reader, without any support for layout analysis, into a fully-featured system, which recognizes common layouts and offers both NN and LSTM recognition support. The later versions of Tesseract support different output formats, including hOCR with layout and formatting information [9], or may even be integrated with frontends such as Ocropus [10]. Even though initially designed to work for the English language and languages that read from left to right, Tesseract has been eventually trained to process different scripts, text orientations and reading orders [11].

Tesseract has no GUI and is run from the command-line interface, but several attempts to create one exist, such as OCRFeeder [12].

Despite having a lot of technical advancements, Tesseract has also several shortcomings, especially when we are taking into account input image page defects like:

- Invalid scanning resolution which results in less than 20 pixels font size;
- Artificially introduced skew, in the image acquisition process;
- Suboptimal image binarization due to changes in brightness across large areas, without significant edges;
- Extra-border surrounding the useful page data.

Asprise

The second system which we will describe is Asprise, a commercial OCR engine which has numerous abilities, including reading barcodes. It also possesses a number of features like:

- Solid text recognition, with quality that may be traded for speed;
- Multi-threading support and GPU acceleration, ensuring optimal use of the computing system resources;
- Multiple output formats.

SYSTEM WORKFLOW

After the analysis of Tesseract and Asprise, a new system is proposed, which uses both OCR engines and a voting mechanism based on weights to obtain the best output possible. Input files are processed through a series of steps, which can be observed in Figure 1. They are executed as follows:

- The system receives the input file and sends it to each OCR engine;
- Each OCR generates an output file with a certain confidence level - for each word in the case of Tesseract and for each row for Asprise (to make the data relevant we assigned the same confidence value to each word of the line), as seen in Figure 2);
- The system uses a reference test document in which all the correct words are manually inputted. The results from the system and manual set are compared in order to calculate the overall document correctness;
- Using the overall correctness of each output document, the system assigns a weight to each engine;
- The system combines the results based on the above-given weight.

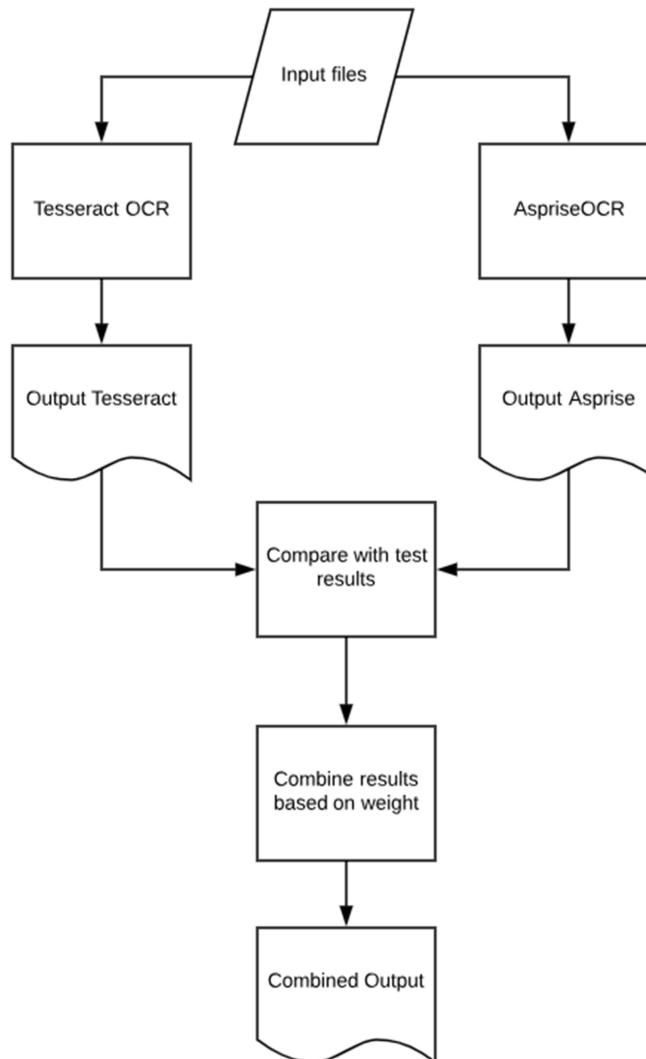


Figure 1. Steps of processing input files in the proposed system

```

[[("ENGLISH", 80), ("ROMAN.", 80)], [("@hque", 69), ('tandem', 69), ('abutére', 69),
('Catilina', 69), ('patientia', 69)], [{"nofh'a?", 77}, ('uamdiu', 77), ('nos', 77),
('etiam', 77), ('furor', 77), ('ifce', 77), ('tuus', 77), ('eludct?', 77)], [{"quem', 73}, ('a',
73), ('fincm', 73), ('fefe', 73), ('efienata', 73), ('jaé'tabit', 73), ('audacia?', 73)],
[("nihilnc", 79), ('tc', 79), ('nofiumum', 79), ('praefidium', 79), ('palatii', 79), ('nihil',
79)], [{"urbis', 82}, ('vigiliae', 82), ('nihil', 82), ('timor', 82), ('populi', 82), ('nihil',
82), ('confou', 82)], [{"us', 76}, ('bonorum', 76), ('omnium.', 76), ('nihil', 76), ('hic',
76), ('munitifl'unus', 76)], [{"ABCDEFGHIJKLMNPQRSTUVWXYZ', 57}]]
```



```

[[("ENGLISH", 78), ("ROMAN.", 83)], [{"ufque', 52}, ('tandem', 83), ('abutére', 78),
('Catjina', 65), ('patientia', 76)], [{"nofh'a?", 74}, ('quamdiu', 79), ('nos', 83),
('ctiam', 78), ('furor', 76), ('ifce', 70), ('tuus', 86), ('eludet?', 72)], [{"quem', 84},
('ad', 88), ('finern', 87), ('fefe', 76), ('effreinta', 76), ('jaéfabit', 64), ('audacia?', 81)],
[("nihilne", 82), ('tr', 74), ('noé'curnum', 66), ('praefidium', 76), ('palatii', 82),
('nihil', 85)], [{"urbis', 85}, ('vigilia', 62), ('nihil', 86), ('timor', 83), ('populi', 82),
('nihil', 80), ('confou', 73)], [{"fus', 71}, ('bonorum', 80), ('omnium.', 82), ('nihil',
76), ('hic', 85), ('munitiflimus', 80)], [{"ABCDEFGHIJKLMNPQRSTUVWXYZ', 53}]]
```

Figure 2. The output generated by Asprise (left) and generated by Tesseract (right)

RESULTS

After receiving the input file, each OCR has created its own visual interpretation of the text based on the confidence level.



Figure 3. The main scenario input test image

The input file is represented by Figure 3, whilst the output OCR texts color-bordered using the specific engine confidence in Figure 4.



Figure 4. The visual output generated: Tesseract (top) and Asprise (bottom)

The following step was the analysis of the output files of each engine as seen in Figure 5 and their comparison to the test output in order to determinate and set the weight.

```
ENGLISH ROMAN.|(hgque tandem abutere, Catilina, patientia|nof'h'a? uamdiu nos etiam furor if'ce tuus eludct?|quem a fincm  
fefe efienata jaetabit audacia?|nihilne tc nofiumum praefidium palatii, nihil|urbis vigiliae, nihil timor populi, nihil  
confou-|{us bonorum omnium, nihil hic munitifl'unus|ABCDEFGHIJKLMNPQRSTUVWXYZ  
ENGLISH ROMAN.|@ufque tandem abutere, Catilina, patientia|nof'h'a? quamdiu nos ctiam furor if'ce tuus eludet?|quem ad finern  
fefe effremta jaetabit audacia?|nihilne tr: noe'curnum praefidium palatii, nihil|urbis vigilia, nihil timor populi, nihil  
confou-|fus bonorum omnium, nihil hic munitifl'mus|ABCDEFGHIJKLMNPQRSTUVWXYZ
```

Figure 5. The output generated by Asprise (top) and by Tesseract (bottom)

In the last step, we combined the documents based on their given weights and obtained the final output which can be seen in Figure 6.

ENGLISH ROMAN. |@ufque tandem abutére, Catilina, patientia nofh'a? quamdiu nos etiam furor if'ce tuus eludet? quem a fincm fefe effremta jaéfabit audacia? nihilne tc nofium praefidium palati, nihil urbis vigiliae, nihil timor populi, nihil confou- |{us bonorum omnium, nihil hic munitifimus| ABCDEFGHIJKLMNOPQRSTUVWXYZ

Figure 6. Results after combining the results (red Tesseract and blue Asprise)

A series of experiments were performed in order to assess the most appropriate weights. In figures 7 and 8 are identified some results based on the confidence level of each OCR engine. The intensity of the color gives the confidence level: green represents high confidence, red means low confidence.



Figure 7. The blurred scenario input test image

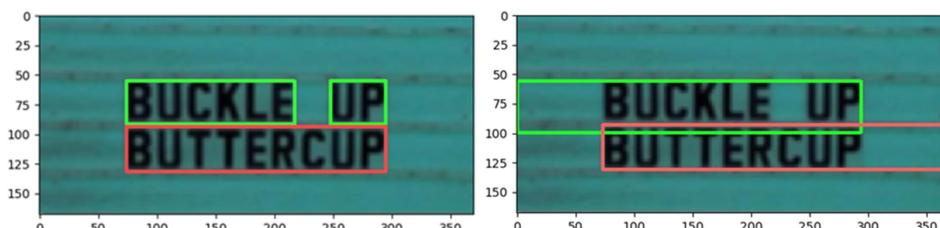


Figure 8. Output Tesseract (left) and Aspire (right)

After analyzing more situations, it is noticed that for any level of image blur, but especially for an intense one, Asprise tends to perform better than Tesseract. One good example is presented in Figure 9.

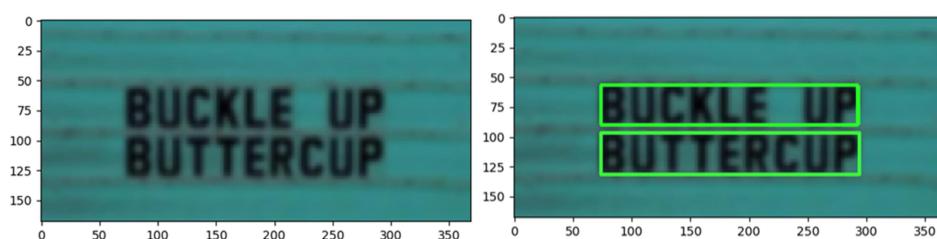


Figure 9. Output Tesseract (left) and Aspire (right)

CONCLUSIONS

When the results of several OCR engines were compared, it can be observed that each one of them has its own shortcomings when dealing with the degradation of the input files. In order to minimize the possible erroneous results given by the low-quality files which most engines will encounter, we decided to create a weight-based voting mechanism which analyzes both results and generate an output based on the confidences of the individual results.

The proposed approach improved the probability of creating a correct result by combining the individual engines' results into a single output, thus resulting in a higher detection accuracy than the individual output files.

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TAX EVASION _ INFORMATION SYSTEM AND BLOCKCHAIN

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ABSTRACT

This research paper is about to analyze tax evasion mechanism and how this risk can be managed by using digital system and Blockchain. A possible solution of immediate and easy application could be to streamline the tax assessment system by setting a predetermined and very low rate (at most 10%) linked to gross revenues rather than net income. The application of system proposed with this paper would allow to obtain various benefits that would be added to the almost complete elimination of the phenomenon of tax evasion, such as simplification of tax obligations, reducing the costs of consulting for companies; possibility of carrying out a concrete and immediate tax planning; the elimination of the discretionary nature of the determination and attribution of costs violating the principle of economic competence to bend it to fiscal requirements; or, greater positive collaboration between institutions and companies.

KEYWORDS: Tax evasion; Tax fraud; Accounting information systems; Digital system; Blockchain

1. INTRODUCTION

Today, in all the countries in the world, in order to raise the funds necessary to finance their public expenditure, to create public goods and services, governments imposed different types of taxes on economic activities, including income from earnings or consumption of good and services, also on properties [1]. Therefore, in the present time, in many countries, taxation become one of the main sources of the public revenue and, in the same time, one of the main fiscal tool used by the government to stimulate or to control the economic growth and particular economic sectors. Moreover, tax revenue present higher sustainability and efficiency in getting state's revenue than reliance on public borrowing. The Organization for Economic Cooperation and Development defines tax as *compulsory unrequited payments to general government*.

With time, tax policy has a very important place within macroeconomic country's policies and it is part of public finance policy [2]. In most of the countries, tax policy represents a set of measures and actions related to the role of tax revenue, the way they are settled and how they are used as a tool to help and stimulate economic growth, in the most efficient way. In some countries, tax policy has, on one hand, the role in helping those individuals

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and businesses, which face income trouble, and, on the other hand, this policy helps to reduce the differences between poor and rich people. In other words, tax policy plays a very important role in both microeconomic and macroeconomic life [3]. Tax policy consists of a set of government decisions, which follows economic activity influencing social mobility using public revenues and expenditures. Tax policy is a key component of economic policy, which, through taxation, financial system aims to influence the aggregate economic activity. It includes all measures relating to the amount and perceptions/use taxes in an economy. Tax policy can leave its mark, influencing the unfolding economic and financial processes and default on the evolution of the society. Nevertheless, in turn, it is conditioned by the economic environment, through a series of factors, among which stand out: the economy, the relationship between public sector and private citizen's income level etc. On one hand, tax policy is in interdependent relationships with tax policy, monetary policy, currency policy, price policy, employment policy and financial policy of the country. On the other hand, tax policy has objectives and instruments of its own manifestation. By tax policy, the state can influence many economic developments (demand for goods, income, etc.). Transactions of this nature are mediated by the public expenditures and investments, with the purpose of determining renewed growth.

The public financial resources are formed mainly from taxes, fees, and contributions. Therefore, the collection of tax liability has a primordial importance. The increasing number of taxes and fees which form the tax liability, together with the increasing of the coverage area of taxable base, it may lead to tax pressure, which it can be hard to bear by individuals and business, in the same matter. From tax pressure to tax fraud it is just a matter of time. Almost all the time, tax pressure has stimulated ingenuity to avoid, finding effective subterfuges, determined either by practical work or by ambiguous or inaccurate legal regulations in tax legislation. When it comes to money, there is a taxpayer's psychology to pay only what he can. Taxation touches one of the most important interests of individuals and business: money, profit and well-being. Often, human nature tends to place particular interest before the general interest. Therefore, some may consider tax a damage rather than a legitimate contribution to the public spending. Today, some people may consider that tax fraud it is more a skill test, and not a dishonest behavior [4]. In plus, nowadays all economic activities are facing a new type of challenge: artificial intelligence and Fintech. The present paper aims to show how the artificial intelligence is coming to help to reduce the human error (done with or without conscience).

2. LITERATURE REVIEW

The research has revealed that, from the very incipient state's form, when people were set up in groups of families or clans, tribes around a temple, there was a use for a contribution with a certain amount of money from their earnings (and not from assets). The temple was the first place where people prayed, and it was used also as the judgment room and the jury for the members of these groups or clans. As with the years, the number of group members grew, the divergences appeared, and along with them the borders between them, and states starts to be in place officially, end to end with their own pecuniary mandatory contributions to the functioning of the state. The earliest known tax records,

dating from approximately six thousand years B.C., are in the form of clay tablets found in the ancient city-state of Lagash in modern day Iraq [5]. The early taxation appears also in ancient Greeks, Egyptians and Romans, Chinese and English society. The taxation threshold has always been raised by economics, and practice exceeded it every time. Therefore, it can be said that the existence of maximum taxation threshold it is very difficult to settle. The maximum taxation pressure varies depending on the economic and social consequences of each country. The level of taxation pressure is given by financial and fiscal policy promoted through economic and financial leverage – taxes and fees - but also by the instability of the financial, fiscal and tax system. Permanent changes in tax rates and the development of new and new taxes have led to the diversification of forms of taxation pressure and the appearance of its certain limits. Types of taxation pressure limitations: *psychological and political limits* (imposed by reaction of taxpayers – they can have a severe resistance to the growth of mandatory taxation – which can appear in a form of tax evasion, fraud, reduction of production activities, protests or strikes); *economic limits* (compulsory taxation it may have the effect of defying the desire to work, or reduction the entrepreneurship spirit); *compensation associated with taxation pressure* (it is a positive aspect – taxpayer will benefit later on public expenditures – improved infrastructure, health and education sector...) [6].

The increasing number of taxes and fees which form the tax liability, together with the increasing of the coverage area of taxable base, it may lead to tax pressure, which it can be hard to bear by individuals and business, in the same matter. From tax pressure to tax fraud it is just a matter of time. Almost all the time, tax pressure has stimulated ingenuity to avoid, finding effective subterfuges, determined either by practical work or by ambiguous or inaccurate legal regulations in tax legislation. When it comes to money, there is a taxpayer's psychology to pay only what he can. Taxation touches one of the most important interests of individuals and business: money, profit and well-being. Tax evasion it is *wholly or partly avoidance from the payment of taxes, fees and other amounts owed to state budgets by individuals and businesses* [6].

Depending on the way in which fraud is committed, tax evasion can be classified as [6]: legal tax evasion; fraudulent tax evasion (illegal fraud); customs evasion; masked tax evasion; short-term fraud; phoenix syndrome - or long-term, premeditated tax fraud; multiple companies syndrome; insignificant manipulations; underground tax economy, and tax haven. These forms of tax evasion are encountered, to a varying extent, in most countries of the world.

Tax fraud and tax avoidance are recognized as a serious problem. Artificial Intelligence through its new technology Blockchain can be used to dominate tax fraud. Furthermore, with the permissioned Blockchain, different parties/roles can be given different data views, restricting access to data to some. Triple-entry account systems through Blockchain it can be programmed to follow accounting standards and regulations automatically using smart contracts, and could even automate tax filings through continuous updates [4].

The digital revolution is changing the way of living, working and communicating. The transformation, that takes place within the telecommunications industry, it has a great impact on the surrounding world with the emergence and continued improvement of digital technologies [7]. Artificial Intelligence is one of them. It is a recent technological

breakthrough, which, combined with industrial technology, it helps overcoming many human errors, exceeding human performance in different areas. IT programs are becoming more accurate, detecting and scaling objects better than human performance [4].

The most valuable derivative of digitization is the rich pool of gathered data, which is growing very fast. Advanced computing capability has paved the way for *big data* analytics [4]. Social media, mobile, analytics and cloud (SMAC) and application programme interface (API) technologies have allowed different data streams to *talk* to each other in a highly efficient manner. This has led to the integration of multiple services into a single platform, thus creating a plethora of cases for digital financial services – fueling the *app economy* [8].

To remain competitive and achieve longevity in the market, financial services has to keep up with digital transformation. The survival of financial institutions is connected with the adoption of innovation, and embracing digital changes, to improve the efficiency and the performance within the organization [9]. Digital transformation and new technology adoption have changed the way of doing business and channels [10] that offer any financial products and services are more intuitive and trustworthy. *Digital* systems are becoming more and more used, representing a much faster, cheaper and safer way when it comes to financial transactions. Contemporaneous economists defined digitalization as *the realignment of, or new investment in, advanced technology and business models to more effectively engage digital customers at every touchpoint in the customer experience lifecycle* [11]. Blockchain is another newest technology, which enable businesses to generate their required reporting information directly from their financial data. The technology Blockchain was introduced a decade ago, after financial crisis of 2008 [12], and there is still a long way to be accepted and adopted by everyone. Blockchain can be described as the chronological record of block transactions.

3. RESEARCH METHODOLOGY

The present work paper is an exploratory research, based on investigative techniques. It is a fundamental and qualitative research, which aims to present how tax fraud can be avoid using artificial intelligence, respectively Blockchain technology. Authors of the paper want to present how through implementation of new technologies, human errors are avoided and tax evasion can be reduced.

4. RESEARCH ANALYZE AND DISCUSSION

A tax evader is a person who reduces or minimizes their tax liability by illegal methods, he is usually a socially dangerous person, believed to be engaged in criminal activities. Tax evasion consists in the non-payment, tax avoidance consists in a less payment of taxes, directly as a natural person or indirectly through a legal person. The exercise of a business for which the payment of taxes is not made is not a crime, unless it is also illegal activity (trafficking in drugs, exploitation of prostitution, smuggling ...). Surely an illegal activity (as prohibited and not officially exercisable) is a source of evasion, if it is possible to consider that the Government can claim a right on illegal and immoral activities. A person could however hide the profits obtained from the exercise of a perfectly legal activity (for example simply by not issuing the fiscal receipt/invoice).

Tax evasion and tax avoidance are currently extremely rooted and widespread. The diffusion, probably, is due to the intrinsic characteristics of the type of crime, which provide different psychological alibis to the offenders.

- being an omitted crime (linked to the non-declaration of income or tax-exempt assets), it is usually subconsciously considered less serious than an direct crime;
- the complexity of the tax system determines the need to turn to burdensome external consultants. Since the tax legislation is subject to constant updates, there is a need of extreme care and expertise, continuous training, software investments, which the entrepreneur has no way to conduct independently, having to focus mainly on the management of his business. The entrepreneur considers dangerous what is not directly controllable.
- tax obligations are usually added to additional mandatory obligations such as health, trade, security & privacy, considered sterile from the point of view of profit. The entrepreneur is encouraged to consider execrable what is directly unproductive;
- the low perceived level of services provided by the State and the widespread dissatisfaction with the management of the Government, induces individuals to consider the payment of taxes as a waste,
- when the tax rate is high, the feeling of unjust withdrawal is accentuated, even more if it exceeds half of the income produced. A civic duty, although reinforced by mandatory rules and a system of sanctions, if considered unjust, is hardly respected;
- the widespread diffusion of the phenomenon leads to an emulative effect, difficult to eradicate, and is configured as "self-fulfilling prophecy". The failure to declare certain income is considered natural, because of common application. In identifying the psychological profile of the tax evader it can be considered encouraged by the social effect rather than affected by a pathology.

The judges are often criticized because of their excessive indulgence. Moreover, it is difficult to observe how the judges are necessarily linked to an order that in itself is very benevolent. The choice of the level of "benevolence" is controversial because it lends itself to a broad subjectivity. The applied statistics can however help to better explain the roots of the problem. It must be considered that when issuing a sentence, the judge could incur two types of errors: acquitting a guilty person or condemning an innocent person. Type I errors happen when we reject a true null hypothesis; Type II errors happen when we fail to reject a false null hypothesis (see figure no.1).

HYPOTHESIS	refuse H0	refuse H1
H0: innocent	WRONG DECISION TYPE 1: an innocent is condemned	RIGHT DECISION: an innocent is acquitted
H1: guilty	RIGHT DECISION: a guilty is condemned	WRONG DECISION TYPE 2: a guilty is acquitted

Figure 1. Hypothesis

When a decision is made, it is not known whether an error of the first or second type has been committed. However, it is possible to control the likelihood of an incorrect decision for both types of inference. In an ideal world the two types of errors should never occur,

but mistakes are made in reality. Currently the judges make decisions trying to minimize the error of the first type (condemnation of an innocent). Paradoxically, however, to totally annul the possibility of condemning an innocent one should absolve all the defendants. Given that the errors of the two types are inversely proportional, it seems obvious that it becomes difficult to reach a guilty verdict, unless there is a willingness to increase the possibility of condemning an innocent person. In essence, the acquittal of perpetrators is in a certain way the price to pay in order not to risk to condemn the innocent. The tradeoff is difficult to solve and the work of the judges is anything but easy. In fact, there is no universally acceptable balance in the choice of risk of error to run.

Blockchain technology allows for timely examination of potential errors or fraud within accounting entries (e.g., duplicate payments), as well as automation of transaction verification using data from business partners. Moreover, smart contracts encoded with accounting and business rules could enable efficient control of the recording process [13]. Blockchain technology continues to grow and is being used in more and more business sectors, accounting has been identified as an area that could greatly benefit the distributed registry and other features of the blockchain. The main benefits discussed include: reducing the risk of error (especially human error); low risk of fraud (blockchain is very difficult to penetrate and manipulate); system automation, huge cost savings (by increasing the efficiency and decreasing in errors), increased reliability in financial reports, and reduced workflow.

Nowadays many economists and accountants are saying that *at the end of the road, fully automated audits can be real* [14]. Triple-entry accounting (figure no.2) is an extension of the double-entry system that has been in use since the 16th century [15].

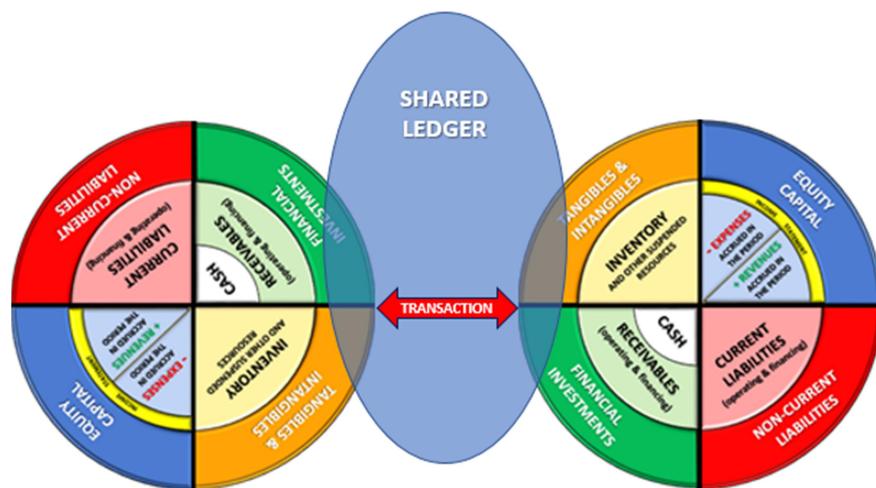


Figure 2. Triple-entry bookkeeping

Double-entry transaction set up jointly by three parties as a payer, a payee and a payee issuer, as is usually done by banks and their customers. The payer sends units of the beneficiary's money (for example, a check) and the issuer (the bank) is responsible for checking and signing the transaction, for transferring the money and issuing a receipt for both the payer and the payee to update their books. This model offers too much

centralized power to the issuer, which would be strong candidate for internal fraud. In order to reduce the issuer's ability to commit fraud, triple-entry accounting through blockchain brings countless advantage that the three parties involved are guaranteed exactly the same information and no party can enter unauthorized information [16]

The basis for triple entries is a unique, cryptographically safe record, called *receipt*, the full probative proof of proof is provided by the digital signatures of the author, the payer and the accepting issuer, making sure that no party can successfully pass unauthorized transaction is valid. This reduces the problem of accounting with that of its presence or other type of receipt, which would be guaranteed by dividing the copies between all parties involved (figure no.3).

The new blockchain technology, rules and data layers are already implemented in many activities, and the triple-entry with blockchain could be implemented successfully within accounting system. This comes with balance checks, asset levels and inter-organizational confirmations of debts and accounts receivables and would be integrated into the automatic use of smart contracts [13].

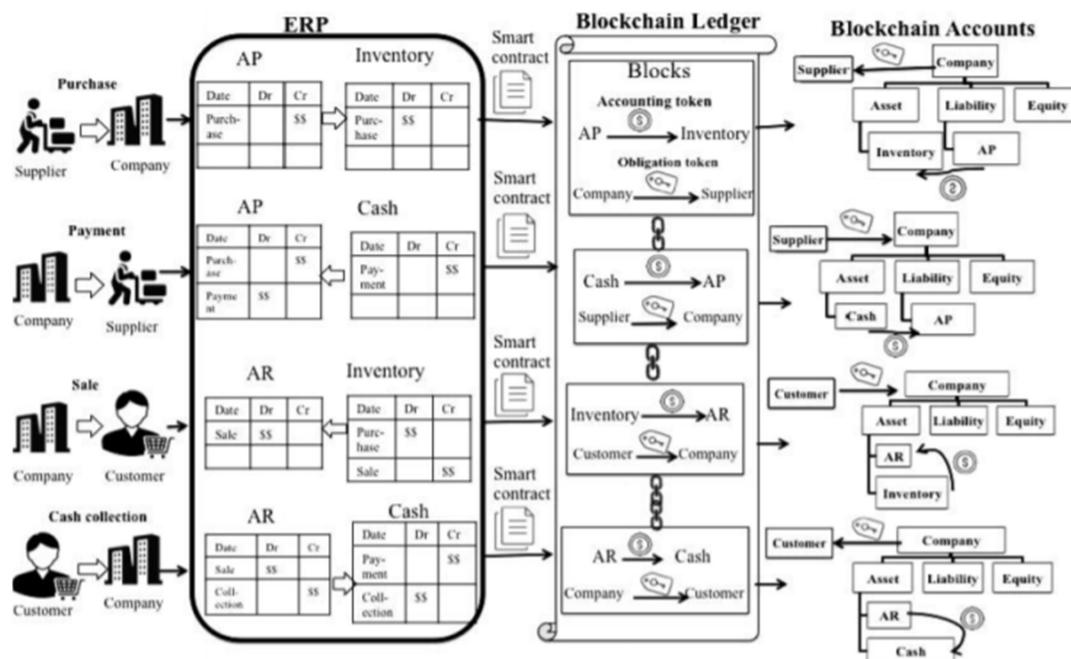


Figure 3. Triple-entry accounting system through block technology, [13]

Furthermore, with the permissioned blockchain, different parties / roles can be given different data views, restricting access to data to some. Triple-entry account systems through blockchain it can be programmed to follow accounting standards and regulations automatically using smart contracts, and could even automate tax filings through continuous updates.

5. FINDINGS AND CONCLUSION

The aim of this research paper is to suggest a new tax system, based on actual technologies, useful to avoid tax evasion and frauds. By focusing and limiting attention to tax evasion generated by economic activities, and therefore on corporate income, it is possible to formulate the following considerations:

The added value generated by an economic activity must be distributed proportionally among the subjects that contributed to producing it. The stakeholders can include members, employees, suppliers and creditors. The state can be considered like any private provider if we take into account that the tax claim is based on the supply (implicitly requested and in any case the company benefits) of the infrastructural capital that requires remuneration: roads, communications, social justice, legal order, contractual protection, security, health, regulation, public lighting;

The determination of the tax base, in most cases, in quite all international tax systems, takes place in a rather complex manner, as the difference between revenues and deductible costs (net tax income).

The key technical elements that are considered are most likely to affect the spread of the crime of tax evasion are: complexity in determining net income, in particular for the criteria of deductibility and the application of tax credits; self-tax-declaration mechanism that can be randomly verified only afterwards, in which tax payers are exposed to the temptation to declare a lower taxable income in order to obtain immediate benefit, with the possibility of remaining unpunished in the case in which the controls are not directed to their activity; and, high tax burden, which accentuates the will to obtain benefits in the case of impunity.

A possible solution of immediate and easy application could be to streamline the tax assessment system by: setting a predetermined and very low rate (at most 10%) linked to gross revenues rather than net income, (therefore regardless of the costs incurred), at most differentiating the rates compared to different industries (in order to facilitate some industries and to manage the country's production policy); obligation to issue electronic invoices only; obligation to make payments exclusively with traceable instruments (credit transfers, electronic payments, elimination of cash money); withholding tax (at the fixed rate indicated above) by the banks on behalf of the Government.

The application of this system would allow to obtain various benefits that would be added to the almost complete elimination of the phenomenon of tax evasion:

- simplification of tax obligations, reducing the costs of consulting for companies;
- possibility of carrying out a concrete and immediate tax planning;
- the elimination of the discretionary nature of the determination and attribution of costs violating the principle of economic competence to bend it to fiscal requirements;
- greater positive collaboration by companies which would consider rates below 10% fair and acceptable. The sustainability of the provision would be unquestionable because the actual tax revenue could even increase thanks to the recovery of the tax now still evaded;

- the possibility to pay corporate taxes on a monthly basis, but linking the tax withholding of the invoices issued. The Government would also obtain constant cash flow and would also be able to obtain enormous benefits from the point of view of monitoring production and GDP;
- the companies, in calculating the mark up could easily take into account the cost related to taxes. They could also avoid incurring unnecessary costs for the sole purpose of reducing the tax burden, but focusing exclusively on business efficiency;
- the reduction of uncollectible tax credits by the State, which could in real time verify the non-payment and inhibit the activity of defaulting companies. Basically, the mechanism of self-declaration (income tax return) tested on a sample (source of temptation to escape) would be eliminated. The automated systems, based on electronic invoices issued in a centralized system, as well as thanks to the withholding tax applied in the payments, would verify instantly in the following month the payment of the taxes due. By placing lenders solidly responsible for the payment of taxes.

In conclusion, the phenomenon of tax evasion, which currently constitutes a widespread practice, socially considered sometimes even acceptable when the tax burden is exaggerated and the services offered by the Government are perceived as not adequate, with the use of technology and a reduction of opportunities of temptation could be greatly reduced, if not nearly eliminated.

In the reiteration and diffusion of the crime, rather than a predisposition of the unfaithful taxpayer, an inadequacy of the system is recovered, which allows a plausible improbability due to the low incisiveness of the controls (for quantity and quality) and subsequently, in the case of assessment, a high level of indulgence. In the accounting industry, Blockchain comes to help the companies to write their transactions directly into a joint bookkeeping, creating an interlocking system of enduring accounting records. Double entry accounting has been used for a very long time now. Triple entry accounting adds a level of clarity and honesty to bookkeeping that double-entry accounting cannot offer [17].

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ANALYSIS ON EDUCATIONAL RESULTS USING COLLABORATIVE AND COMPETITIVE APPROACHES

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ABSTRACT

As long as courses exist, there will also be a way of applying the notions learned from them. They come in various forms, such as laboratories, workshops, and homework. There is a long discussion involving different strategies that a professor can use to boost the results of their students. The purpose of this paper is to outline, assess and present the best strategies to follow to maximize students' growth while also taking into consideration the personal experiences of the above-mentioned authors.

KEYWORDS: collaborative approach, competitive approach, learning skills

1. INTRODUCTION

The concept of grading has existed for a very long time in the education system. The first recorded grading comes from the then President of Yale University, Ezra Stiles, in 1785 when he said that “*after examining 58 Seniors, recorded in his diary that there were Twenty Optimi, sixteen second Optimi, twelve Inferiores(Boni), ten Pejores.*” [1].

Every student knows that in order to promote the course they need good grades. Grades decide whether or not students have accumulated and processed the knowledge taught during a course, and approximate, with a given degree, the growth of the student. However, grades do not always reflect the knowledge of a student. This has contributed to the feeling that teaching methods need to be innovated and improved. The teaching methods that are chosen have a great impact on students.

“*Collaborative learning is a reacculturative process that helps students become members of the knowledge communities whose common property of knowledge is different from the common property knowledge communities they already belong to.*”, according to

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Bruffe[2]. By collaborating, students can learn to work as a team, to share ideas with one another, to contradict one another and present their points of view. They also come in contact with different mindsets and learn about the hardships that come with working in a group. Ultimately, the goal is to raise a sentiment of accomplishment at the sight of the end results of their work.

In the competitive approach, students are often given a task and they are put to compete against one another. Achieving the goal of one of the student means the failure of the rest of the students. This way, they feel like they want to do better than their peers and they struggle to obtain the best result. Often a reward is set for the best result, thus rewarding the efforts of the students.

The authors of this article follow to ascertain if and how collaborative and competitive approaches changed and will change students' growth and turn them into fully fledged engineers.

2. PREVIOUS WORK

Up until now, various studies have shown that both approaches have positive effects on students' growth.

As presented in "*Effects of Competitive E-Learning Tools on Higher Education Students*" [3], where The Quest System was tested out and students were graded by their fast response to challenges that came from both teachers and students, the growth rate increased drastically. This experiment shows that a competitive environment can lead to unexpected results, such as the ones presented in Table 1 and Figure 1. The T-Test shows whether the means of two groups are statistically different from each other. When the scaling factor of T-Test is under 0.001, the results are significantly different.

Table 1: GROUP COMPARISON—STUDENTS' ACADEMIC OUTCOMES AND PARTICIPATION IN QUEST. Taken from [3]

	QUEST group 126 students		Control group 74 students		T-Test
	M	SD	M	SD	
Final grade	2.7	1.9968	1.58	0.7343	<0.001*
* Results are significantly different at $p < 0.001$ (T-Test) * M = mean (the average) * SD = standard deviation * P = scaling factor of T-Test					

The results shown in Figure 1 emphasize the fact that the students that took high scores in the Quest System, did not score as well in the final examination. Thus, the second hypothesis of the study did not hold.

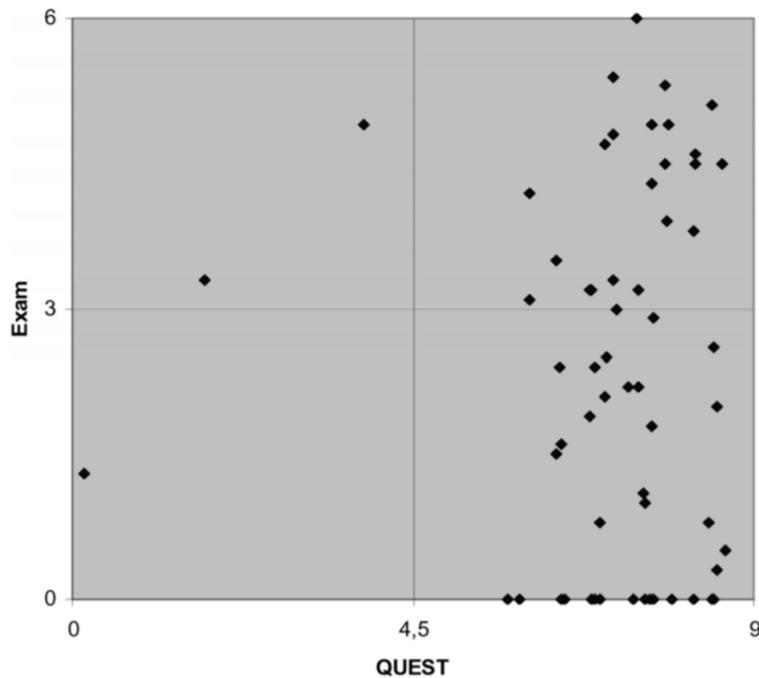


Figure 1. Grid of exam-QUEST scores. Taken from [3]

Two other studies, “*Active Learning: Cooperation in the College Classroom*” [7], and “*Cooperative Learning Returns to College: What Evidence is There That it Works?*”[8] compare the efficiency of the collaborative and competitive approaches on different plans.

The authors looked at 168 studies between 1924 and 1997 and compiled a table of improvements by learning outcome. Table 2 suggests that by using collaborative teaching instead of a competitive one, each category presented sees an improvement rate between 6% and 83%.

Table 2. Collaborative vs. competitive learning: Reported effect size of the improvement in different learning outcomes. Taken from [9]

Reference	Learning Outcome	Effect Size (%)
Johnson, Johnson and Smith [7]	Improved academic achievement	67
	Improved quality of interpersonal interactions	82
	Improved self-esteem	83
	Improved perceptions of greater social support	67

Reference	Learning Outcome	Effect Size (%)
Johnson, Johnson and Smith [8]	Improved academic achievement	49
	Improved liking among students	68
	Improved perceptions of greater social support	6
	Improved self-esteem	47

Both of the studies presented above show how competitive and collaborative approaches can affect students' growth and the way they have been used.

3. PROPOSED APPROACH

The aim is to analyze how these approaches had an impact on the grades of the students while outlining the differences between them. This study is based on data from the generation of students who started the Faculty of Computer Science and Automatic Control at the POLITEHNICA University of Bucharest in the year of 2015 and who are expected to finish their bachelor's degree in the year of 2019. The study regards the following courses in different years of study: "Algorithms Design" that took place in 2016 – 2017, during the second year of university, "Microprocessors Design" between 2017 - 2018 during the third year and "Software Project Management" that started in 2018 and finished in early 2019, as part of the fourth and final year of university. In regards to the consistency of the examined students, the batch of 500 students for the "Algorithms Design" course is reduced to 400 for the "Microprocessors Design" and then to 130 because of the structure of the faculty and the students that left.

It should be noted that there are many types of students and there is also a formed hierarchy based on the level of academic preparation. Taking this into consideration, these aspects will be observed using the proposed approaches.

On the one hand, there is the collaborative approach where students were to work with others in teams in order to achieve a goal. On the other hand, there is the competitive approach where students were to compete against one another using their ingenuity. Lastly, there is the mixed approach where the combination of the aforementioned two will be considered. This approach involved students working in teams in a competitive manner.

Regarding the collaborative approach, it was started from the premise that the students would embrace the idea, considering that it would mean sharing the work, the planning and the grade without any consequence. Forming teams would also reduce the pressure of working alone that some might be affected by when working on a task at hand. In the end, this premise turned out to be true and it will be analyzed why.

Considering the competitive approach, most situations that involved this approach implied students learning extra information regarding a subject in order to be able to compete at the highest level of knowledge against their peers. The initial premise was that in these cases, most students might feel discouraged to compete, being aware of the fact that the number of potential winners was very low compared to the total number of students (out of the 400 participating students, only the first 15 places were winners). That implies that some students would believe that their supplementary work would lead to nothing and, because of that, they would feel intimidated by other students whom they perceived as being too competitive. However, that did not happen, making it interesting to analyze the reasons why.

Being aware of the two approaches that we mentioned, it was believed that by combining them the negative aspects would even out while the positive ones would additively stack, creating a new mixed approach. Having that in mind, for the mixed part we tried to outline how this approach stood out compared to the other two.

As with any project, during its lifetime, teachers could point out some advantages and disadvantages regarding the growth of the students. It is important to take these into account when considering which approach to adopt.

The results of the study will be presented after the description in detail of every part.

4. COLLABORATIVE PART

In 2018, during the “Software Project Management” course, students were organized into teams of 6 persons and were given a project, that being to create a 2D card game. The teams were formed randomly so it was mandatory for the students to collaborate in order to obtain a good grade in the assignment. Their goal was not only to finish the project but to also go through every step of the development cycle that happens in the industry, inside a team. Firstly, the students had to establish the specifications and the design for their software, then they would choose the most fitting technology, plan the development and assign tasks to each member of the team. In order to help the students with project monitoring and planning, they were encouraged to use the Git version control. At the end of the assignment, the teams presented a demo of the game in front of the other students and the teaching assistant and received questions and feedback.

The main advantage of the collaborative approach was that the students could learn from each other and improve their technical skills. In order to implement the game, teams had to choose different software products even if they were aware of the fact that not all members of the team were familiar with them. These students had the chance to learn something new and improve their skills while being guided by their colleagues. This experience also enhanced the team working skills of the students. When a team member submitted a component of the project they were working on to the version control repository, they would receive feedback about the readability of the code, its performance or even unnoticed bugs from their team, proving that communication and listening are crucial in a team. This aspect led to the development of a cleaner and more refined final product. Finally, the project was able to put the students in a position where they had to deal with different opinions and reach a common ground in order to obtain a good grade.

Another advantage of this approach is that the students had the chance to simulate the project management and development that happen in the IT industry today. They could experience what happens in each individual team that belongs to a company, from debating ideas and technology, planning and assigning tasks to testing and presenting their product. This undoubtedly gave the students a better understanding of the importance of teamwork in software development and prepared them for a future career.

One disadvantage is that one does not get to try to work on each part of the project. The authors of this paper believe that it is important to get to work, at least once, on each part, mainly because of the fact that if one knows how others want to approach a subject, they can more easily adapt to the styles of others.

5. COMPETITIVE PART

In 2017, during the “Microprocessors Design” course, the teachers decided that in order to stimulate the students to improve, they need to promote the competitive spirit. Those who would follow the idea would be rewarded for their effort with something that should motivate them, such as bonus points to the final grade. Having that in mind, they created a competitive science fair named “PM Fair”, in which students would present their projects created during the semester.

The projects aimed to allow the students to learn not only about embedded programming but also about hardware management. Each student had to choose what they were going to build for their project and had to implement the most attractive one. The 5 most interesting ones received special bonuses as well as a significant increase to their final grade. Despite the fact that the competition was very tense and challenging, most of the students still tried to push their limits in order to win the competition. This is exactly the opposite of what was believed in the beginning. This is due to the fact that the teachers made the “PM fair” and working on the projects to be interesting and the fact that the promised awards were consistent enough.

One main advantage was that every student tried their best, each to a different degree, to innovate as much as they could. While the best students saw it as an opportunity to learn more about what they like, the ones that clearly had a passion for hardware outdone themselves. This aspect encouraged some students to keep trying and build something everyone would be amazed of.

On the other hand, a clear disadvantage of this approach is that it hinders any development of team spirit and social friendliness. As it is important to be on a high level of education, it is also important to aspire to grow as a human being. Students stopped sharing interesting knowledge between them in order to prevent the competition from benefiting from the information they worked hard to obtain.

Even if the expectations were set since before the launch of the project, there were some unexpected results that brought good news. The grading teachers were fascinated by the work of their students.

6. MIXED PART

When considering both the collaborative approach and the competitive approach, it is important to be aware of both their advantages and disadvantages. The “Algorithms design” course tried to combine them during the year 2017. The organizers of the course proposed a whole semester project that involved working in teams to create a bot for the game “Halite”. The game features a board of locations with production values that create pieces and each bot controls 1 location at the start. The purpose of the bots is to win the game as fast as they are able to. The first stage of the project evaluated the bots created by students against a set of predefined bots created by the course team which were not very efficient. The purpose of this part was to give the students an example of the competition to start with and to encourage them to participate. The second stage of the project had a ranking system and ranked the students by evaluating the performance of their bots against each other. The teams of students would then receive points based on the rank of their bot.

The mixed approach taken in this course brought advantages from both the collaborative and competitive approaches.

Firstly, just like in the “PM Fair” competition described above, every student participated. While the best-graded students wanted to stay at the top and get the most points, the lower graded ones wanted to get more points in order to raise their grades. This desire not only motivated the students to participate but also showed them that teamwork was entirely necessary since they could not get many points if they would not collaborate with their team. Thus, the students had no choice but to use and improve their team working skills to create synergy with the other members.

Secondly, the competition was a great way of making the students understand the notions presented in the course. This is true because the bots had to use the most efficient algorithms possible in order to yield the best winning time, and the most suitable environment to understand them are obviously the course and laboratory activities. Furthermore, the students would then deepen their knowledge by comparing the alternatives and trying to reach a common point of view inside the team.

Unfortunately, because of the early stages of students’ knowledge and the difficulty of their project, the results were not the ones that were expected.

7. STUDY RESULTS

The results of the students in the above-mentioned projects where analyzed by the score they obtained on a 1 to 10 scale. The grades were given by different professors and laboratory assistants and they can be affected by subjectivism.

The results were surprising. With a high grade of 8.56 in the collaborative approach project and 8.49 in the competitive project, the mixed part only provided a grade of 6.33. The causes of this low average grade could be the difficulty of the assignment, the first experience of working in a group and competing at the same time, and the inexperience of the students that took part in the study at that time.

Other indicators such as standard deviation show how well distributed were the results of the study. It should be noted that the mixed part has the highest standard deviation which means the evaluation was done more correctly than in the other approaches. Details about each approach are presented in Table 3.

Skewness shows the asymmetry of a Gaussian distribution. 0 skew means normally distributed, thus the negative values show that more high grades were given than low grades.

Kurtosis shows if the peak of the Gaussian distribution is sharp or round. In the competitive part, we can observe a sharp spike at the grade of 10.

Table 3. Results category”; * SPM = Software Project Management; * MD = Microprocessors Design; * AD = Algorithms Design

	Collaborative (SPM*) 130 students	Competitive (MD*) 400 students	Mixed (AD*) 500 students
Average grade	8.56	8.49	6.33
Standard deviation	1.087	1.842	2.078
Kurtosis	-0.888	1.497	-0.703
Skewness	-0.098	-1.342	-0.390

Figure 2 presents the distribution of grades among students and how they were influenced by the 3 methods presented above. The figure does not present the number of students per grade, but the distribution of them.

In the collaborative part, there were many grades higher than 6 with a maximum of 40 students obtaining a grade of 9. The notes are well distributed in the array of 6 to 10, thus showing stability and suggesting that everyone has deepened their knowledge on the subject of the course.

With the competitive approach, there was a spike of students who earned maximum grade of 10, but there were many that scored low. The talented students that were passionate about the competition obtained the maximum grade, while the ones that were neglectful of it had low grades.

Regarding the mixed approach, many students scored 8 but fewer scored higher than that. In fact, most of the students scored lower than 8 and a spike around grade 3 is visible. This shows that not everyone was prepared for this kind of approach.

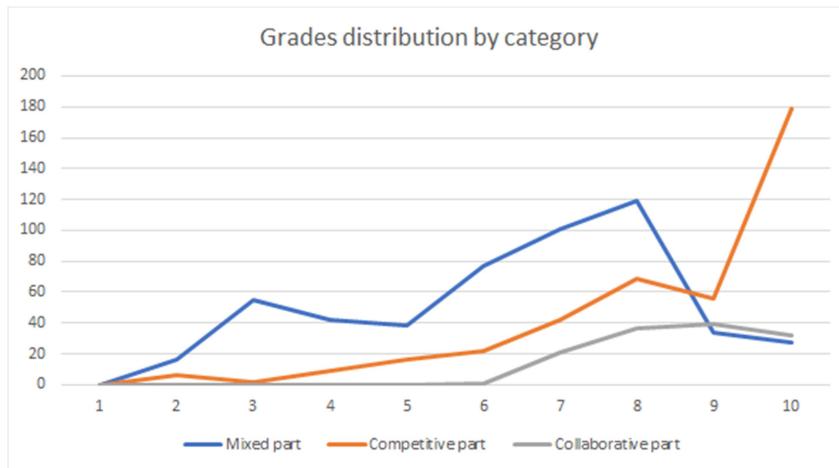


Figure 2. Distribution of grades by category

8. CONCLUSION

In this article, an analysis of the competitive, collaborative and mixed approaches was conducted, by considering the courses which the authors attended. The advantages of collaborative and competitive approaches were illustrated by using the projects from the “Software Project Management”, “Microprocessors Design” and “Algorithms Design” courses that took place during the authors’ four years of college.

In conclusion, the use of competitive and collaborative approaches benefits both professors and students. The students had the opportunity to experience new methods and to learn more than only one way to approach a project, while professors had the chance to study how their approach had results on this particular batch of students in order to improve their expertise as educators.

While each one of the proposed methods has its own particularities, one could not say which is superior. Diversity is what we should try to achieve, as this study shows, when there is more than one way of approaching the students’ response to challenges, unexpected results appear.

9. FUTURE WORK

Internships and University group projects

With internship programs, companies give students a role in the team and evaluate them based on their performance. Generally, companies adopt a collaborative strategy, each member having a very specific role in the team (developer, tester, manager, designer, etc.).

We believe that universities should use group projects to give students an understanding regarding why such a strategy is important, why people have these different roles and to prepare them for real life situations by making them experience something similar.

A group project managed by a real company might also give students insight into the life of an actual engineer.

Introducing these methodologies in laboratories and courses

Courses are mostly activities where the theoretical work is presented, and the dialogue should be between the teacher and their students. During laboratories, on the other hand, students must use the principles and methods they acquired in order to find solutions to problems. We believe that this is the best environment to teach them how to work in a team and how to find a common solution and prepare them for real-life experiences.

The competitive approach could also be applied here to make students work harder to obtain the most points, but we believe that it would also be very stressful.

Remove studies' causes for non-relevant data

Remaking this study by using the same batch, in the same year and course. This should eliminate all the causes that have affected the mixed part of this study.

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GENERAL PSF RETRIEVAL AND IMAGE DEBLURRING USING THE CEPSTRAL DOMAIN

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Costin-Anton BOIANGIU²

ABSTRACT

This work proposes a new approach for processing blurred images and retrieving their PSF. The proposed technique works in the cepstral domain, but unlike existing cepstral domain methods, that are only able to recover close to rectilinear kernels, any type of kernel can be reconstructed.

Aside from the base algorithm, filters aimed at correcting the results are also implemented. Numerous other improvements are mentioned, basing the explanations on already implemented methods.

Results are offered for an artificially convolved image with a large kernel, a naturally blurred image having a large kernel and a naturally blurred image having a small kernel. This method offers good results on all of them.

KEYWORDS: *single image deblurring, deblurring survey, cepstrum analysis, PSF retrieval.*

1. INTRODUCTION

The motivation behind this paper was to implement a blind deblurring method that relies only on natural assumptions: the PSF is present on the entire image (limiting the approach to uniform motion blur) and the image contains sufficient non-repetitive information (a small pattern that is present all over the image could be mistaken for the kernel).

The method is based on properties of the cepstrum domain, described in the chapters to come. Other recent advances on the problem at hand are presented in [35][37].

This paper concludes the work done during the 2 years of master studies at the faculty of Automatics and Computers from the “Politehnica” University of Bucharest by the author of [36] and provides a new method for reconstructing the alteration kernel from a corrupted image during the phase of blind image deblurring, thus continuing the work presented in [38].

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2. PROPOSED METHOD

2.1. Cepstrum domain

The cepstrum was firstly defined in 1963 by Bogert et al. as:

$$\text{power_cepstrum} = \left| \text{Fourier}^{-1} \left\{ \log |\text{Fourier}\{f(t)\}|^2 \right\} \right|^2$$

Or in a more intuitive form:

$$\text{Fourier}^{-1} \rightarrow \text{abs} \rightarrow \log \rightarrow \text{Fourier}^{-1}$$

The domain of application was human speech, which naturally doesn't emit clean sinusoids that can be visualized on a Fourier transform as a clear spike. The vocal chords vibrate not only at a single defined frequency but also generate harmonics (consonant higher frequencies). Inside the vocal tract, some harmonics are amplified and other diminished. If the frontier analysis is to be applied directly to thin signal one would have to choose from the multitude of spikes present at every moment at different frequencies making even the simplest of sounds hard to interpret. These echoes, or harmonics, form a wave-like (sinc) shape in the frequency domain. By applying logarithm and taking the Fourier transform again the waves end up in a single spot. Thus, all the harmonics generate a single impulse on the cepstral graph.

The idea that started research in the PSF estimation of a blurred image in the cepstral domain was that inherently the cepstrum transforms the multiplication from the frequency domain into a summation in the quefrency (cepstral; reversal of letters from 'frequency') domain. This is because applying logarithm on the multiplication gives the sum of logarithms.

$$\text{Fourier}^{-1} \{ \log(F(v)G(v)) \}(t) = \text{Fourier}^{-1} \{ \log(F(v)) \}(t) + \text{Fourier}^{-1} \{ \log(G(v)) \}(t)$$

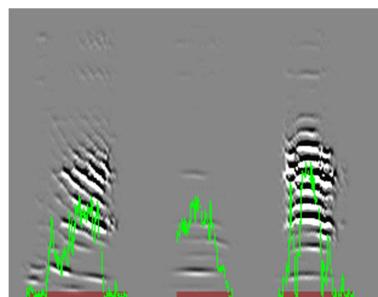


Figure 1. Short time Fourier transform contains many harmonics while the Cepstrum gathers all the harmonics in a single spot.

2.2. Power cepstrum observation

After the initial definition, multiple types of cepstrum were developed and found application in other kinds of signal analysis:

- The power considers as input the amplitude of the first Fourier transform
- The real cepstrum receives as input the real part of the Fourier transform

- The complex cepstrum considers the entire output data of the first transform, thus it is fully reversible to the original signal

In our problem, the convolution signal is present on the entire image surface, thus it would be useless to try to find information in the phase of the Fourier transform. Having this in mind and establishing that the phase is forever lost in the computation, the signal must be reconstructed from the remaining elements: the amplitude of the frequencies. This is the first observation.

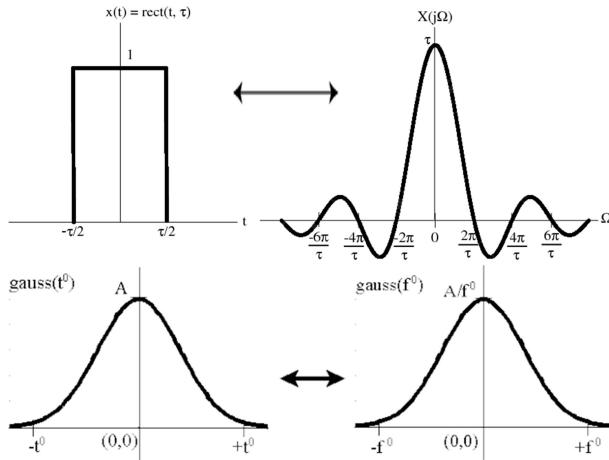


Figure 2. Reversible functions in the Fourier transform.

The second refers to the shapes of the kernels and some important shapes for the Fourier transform: Any motion blur kernel can be created from a filiform shape (movement of the camera) and a Gaussian (defocus). These two functions remain the same after two consecutive Fourier transforms. That is why a slightly modified cepstrum is used: instead of calculating the inverse of the Fourier in the second step, the direct Fourier transform will be applied again.

The importance of this observation is that the shape of the motion blur kernel (which split into the rows of columns is a square convolved with a Gaussian) is preserved in the Cepstrum transform. So this is the theory behind the geometrical cepstrum methods. What wasn't taken into account was the fact that the phase was lost, the recovered signal being a combination of transformed original kernels.

2.3. Baseline method for PSF reconstruction

Based on the observations made earlier, after applying the Power Cepstrum transform, the result is an image that has the shape of the general image but no phase.

The fact that the image is random, from the point of view of the phase, but the kernel is present on the entire surface, this means that the kernel's characteristics will be at most N times stronger than the latent (clear) image's characteristics, because it is present in all N pixels of the image and in the Cepstrum domain it will be over-imposed on the same pixels. This means that the shape of the kernel with the phase lost would be strongly evident.



Figure 3. Left to right: the blur kernel; Cepstrum of a blurred image; autocorrelation of the kernel

In (Figure 3, center) the image is mapped almost randomly over the entire surface of the Cepstrum, but a stronger shape steps out of the picture, which resembles the actual PSF. At closer inspection of the kernel autocorrelation, it is evident that it is the same shape, and this is the second observation. Thus, the problems remaining are those of filtering the Cepstrum and resolving the de-autocorrelation.

2.4. De-autocorrelation

The autocorrelation represents the process of correlation of a signal with itself. It would seem a straightforward problem of finding a signal from the autocorrelation, as the autocorrelation is the multiplication with the complex conjugate in the frequency domain:

$$R_f(T) = \text{Fourier}^{-1}(F(t) \cdot \bar{F}(t))$$

In this situation, the phase becomes 0 so this is the same problem. There is an infinite number of functions that autocorrelated generate the same signal!

In conclusion, our problem becomes that of offering enough extra information in order to limit the number of possible functions. The multiple projection method [26] is used for achieving this objective.

2.5. The multiple projection method

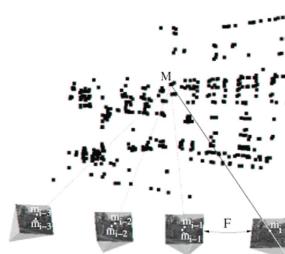


Figure 4. Projection of 2D images on 3D space. Image from [34]

The basic idea is this: the input is an image that lost its phase in the frequency domain but must satisfy some constraints in the spatial domain and the amplitude in the frequency domain is known. This is the same problem as generating a 3D image from multiple 2D images.

So the base algorithm is this:

1. Take the estimated autocorrelation
2. Compute the Fourier Transform
3. Satisfy the constraints in the Fourier transform (the amplitude should be the initial image)
4. Calculate the Inverse Fourier transform
5. Satisfy the constraints in the spatial domain (ex: the image should be real, positive, less than 255)
6. Go back to step 1 with the new image

Figure 5. How to generate a phase that respects both spatial and frequency constraints.

When a change is made in the spatial domain, a phase is generated and the amplitude is distorted. Going back to the frequency domain and changing the amplitude, the spatial image is distorted. Iteratively the image will get to the point of satisfying both conditions.

The problem is to find enough restrictions in order to limit the infinite number of functions that autocorrelated generate the observed signal.

The constraints used in the program include: the image must be real, positive, have values smaller than 255, centered in a square the dimension of the estimated kernel; all of these with an epsilon tolerance, directly proportional to the level of noise in the estimated autocorrelation. The tolerance is needed because with the noise the exact restrictions cannot be met.

2.6 Filtration techniques

As observed in (Figure 3, center), the deduced kernel has a very small signal to noise ratio rendering it impossible to use the already too unstable projection method.

2.6.1 Multiple patches

By instinct, we are tempted to use only the patches of the image in which the PSF is evident.

In order to find the best patches, an estimated PSF is correlated with the image, thus generating high-intensity spots where the PSF is the most evident.

In the frequency domain, the correlation is the multiplication with the conjugate, as seen earlier. The problem is that a light part of the image ends up being white on the correlation result, distorting the data.

The normalized cross-correlation removes the image's influence:

$$NCC = \frac{1}{n} \sum_{x,y} \frac{(F(x,y) - \bar{F})(K(x,y) - \bar{K})}{\sigma_F \sigma_T}$$

Where n is the number of pixels in the kernel and image, F is the sub-image under the kernel and K the kernel, σ the standard deviation and \bar{F} , \bar{K} the means. In other words, for every over imposing of the kernel on the image, calculate the standard deviations of the kernel and region from the image; their means; subtract the means from

the regions and divide by the deviations and normalize by the number of pixels. Put the result in the current pixel.

As the correlation has great complexity, it cannot be used directly. The implementation idea comes from Industrial Light and Magic: [27]. The mean and the deviations of the image are calculated by a progressive sum and the actual correlation is done in the frequency domain.

As all colors have the same movement applied, 3 times more data can be used by combining the colors along with the best image patches.

The selection algorithm works by choosing the most intense points from the cross-correlation, in order, but doesn't choose overlapping windows in order not to influence an object in the image multiple times.

The combination of the patches is done using the difference between them. The PSF's characteristics must be present in all of the images because only the best patches were selected. So the more different an image is the less influence it will have in the combination because it means that it contains more image information than more kernel information.

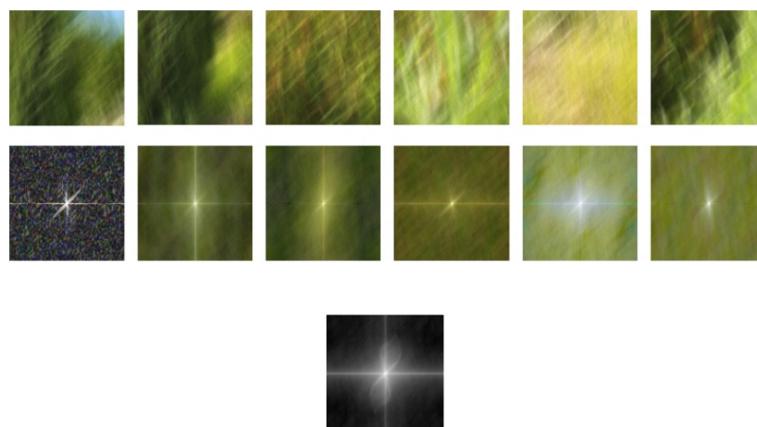


Figure 6. Selected patches from a blurred image, their cepstrum and the combination result.

2.6.2 Margins removal

Another problem that is evident is the cross in the middle. It is generated by the abrupt margins of the patches. A solution could be to blur the margins, but this would just generate another type of artifact because it would be present on every patch.

The idea used here is to apply logarithm on the image in order to get the lines uniform (because a square generates a sinc in the frequency domain. Applying logarithm to a sinc generates a more uniform function, thus the edges will have almost equal intensities from the center to the margins), and delete the margins from the entire cepstrum. Deleting is done by actually removing the values from the margins from the entire cepstrum patch. This implies that the estimation of the kernel must be 2px larger than the kernel itself.

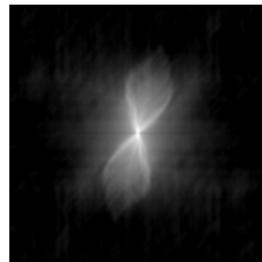


Figure 7. Autocorrelation with margins removed.

2.6.3 Noise removal

The last step is removing the remaining noise. Because it isn't a frequency dependent noise, but rather random, it can't be done in Fourier space. That is noise removal will be done using the spatial domain.

Noise reduction starts with computing the Laplace pyramid. Noise only regions are deduced by automatically selecting the most uniform patch from the image. All the frequencies present in the Laplace pyramid that are smaller than those deduced in the uniform region will be removed.

In order to increase the influence of filiform kernels, a derivative of the input image can be applied before inserting it in the application.

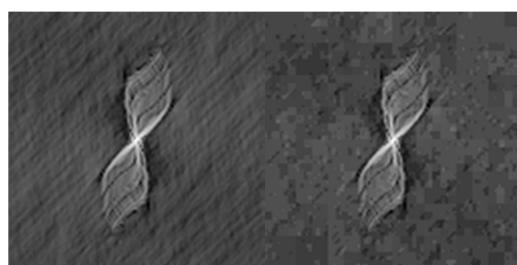


Figure 8. From left to right: kernel from derivation image; filtered kernel using Laplace pyramid.

Now the kernel's autocorrelation is highly evident and De-autocorrelation can begin.

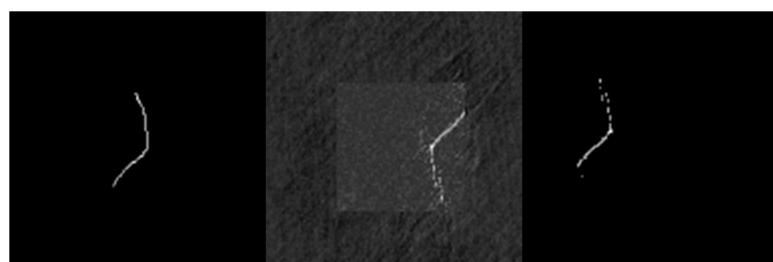


Figure 9. From left to right: actual kernel; deduced kernel; filtered and rotated kernel

Because the autocorrelation is symmetrical, the deduced kernel can possibly have reversed Orientation.

Finally, by means of inverse filtering, with the obtained kernel on the input image, the clear image is restored.

3. RESULTS

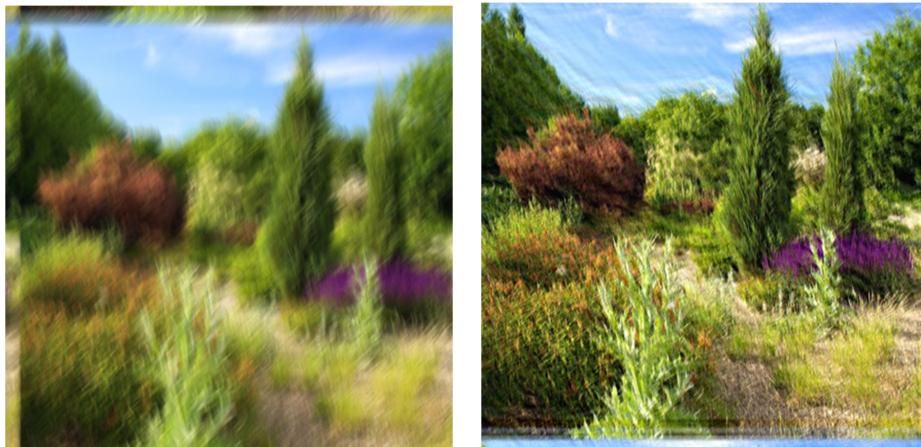


Figure 10. Automatic blind deblurring of an artificially blurred image.

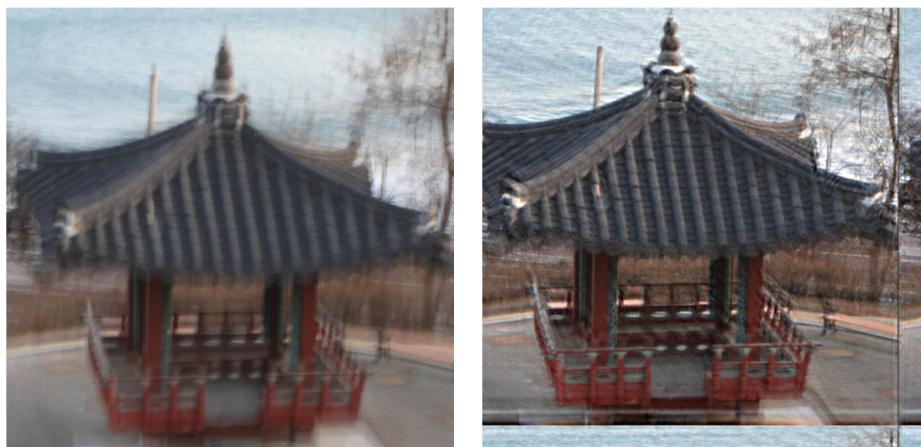


Figure 11. Automatically blind deblurring of a naturally blurred image

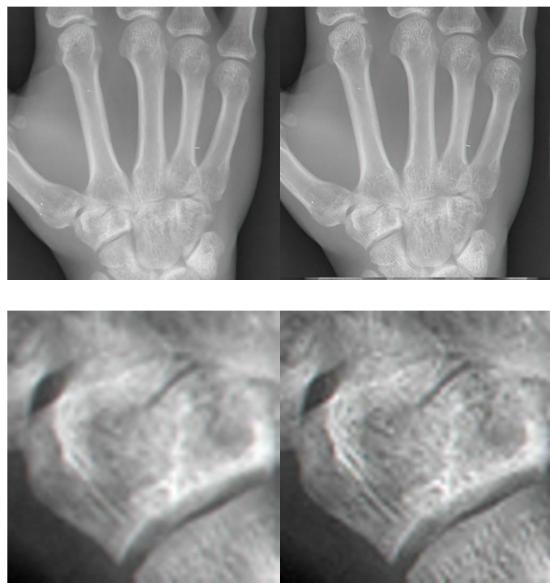


Figure 12. Automatically blind deblurring of a real X-ray (pre-filtered of noise).
Bottom 2x zoom and normalization.

4. CONCLUSIONS

The presented method is a new approach for estimating the Point Spread Function of an image corrupted by convolution, a method that doesn't rely on opaque assumptions to generate the result. It is based on the work presented in detail in [36]. The different and lite assumptions made in this approach make it useful in combining the results with results from other existing approaches in voting-like systems [29][30][31] in order to obtain a better output than any individual one.

The method proves to be robust for strong motion blur and can also be used to correct small defocus aberrations. What was presented is only the base algorithm, with minor deduction improvements. As future work, all the correction steps mentioned in the related work chapter can be applied, along with some improvements in the existing implementation:

- Remove the waves by generating a gradient border around the image by utilizing the algorithm presented in the ringing artifact removal
- Use one of the better multiple projection algorithms, as this is the simplest and has the possibility to fall in a local minimum
- Add support for non-uniform motion deblurring by splitting the image into layers and selecting patches from the current layer
- Add a preprocessing phase for eliminating noise and superimposing it on the result (in order not to lose the look and feel of the image or details that were wrongly classified as noise)
- Add gamma correction and outliers handling

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THE PLACE AND THE ROLE OF THE FINANCIAL ACCOUNTING AND AUDIT IN PREVENTING AND FIGHTING MONEY LAUNDERING

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ABSTRACT

One of the major issues of concern to the international community in general and European states, in particular, is the notions of "legal commercial transactions - good faith - licit money versus money laundering - illicit financial resources", all viewed from the perspective of preconditioning and determining the conditions which require the adoption of strategies and general rules - applicable, so that the principles of democratic values, human rights and respect for the cultures and civilizations of the planet are defended and recognized. With regard to the prevention and combating of money laundering, the social character of the company's accounting is manifested in the sense of participation of the professional accountants in the efforts to ensure the public order and the national security.

KEYWORDS: *financial accounting, financial audit, money laundering, users of financial information, financial and accounting information.*

1. INTRODUCTION

Globalization has become a word of the day, bringing together the nations of the world, perhaps realizing the greatest interconnection at states level from the beginning of the era of commerce and information, basically transforming the world into a single city. Between multiple forms of crime, both as a stand-alone offense in some legislations, but also as a form of disguise of proceeds from other crimes, the money-laundering offense is by far the one that generates, the so-called money-laundering phenomenon. In recent years, this phenomenon has gained a global dimension, and it is also linked to the financing of terrorism as a support factor for terrorist groups. Money laundering is a crime, which means it is the result of organized crime efforts. As regards to the prevention and combating of money laundering, the social character of the company's accounting is manifested in the sense of participation of the professional accountants in the efforts to ensure the public order and the national security, and their specific obligations are laid down in legislation on the prevention and sanctioning of money laundering as well as the establishment of measures to prevent and combat terrorism financing, with subsequent amendments and additions.

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2. FINANCIAL ACCOUNTING AND AUDITORS- GENERAL OBLIGATIONS WHEN MONEY LAUNDERING IS CONCERNED

If the relationship between the company's administrators and its owners it is mainly about management, it is no less true that at international level accounting must now meet the needs of a diverse range of users, with its increasingly social character. External users of accounting information are represented by those who finance the enterprise, its trading partners, the social partners, the public power and other external users¹.

Regarding the prevention and combating of money laundering, the social character of the enterprises accounting, manifests in the sense that professional accountants combine their efforts to ensure the public order and the national security, and their specific obligations are laid down in the Law 656/2002 for the prevention and sanctioning of money laundering and for the establishment of measures to prevent and combat terrorism financing, with subsequent amendments and completions.

The external users of the accounting information in this situation are the authorities of the State with competences in the field, namely the Romanian Financial Intelligence Unit (National Office for Preventing and Combating Money Laundering) and, in case of a criminal investigation, the law enforcement bodies.

At European level, accountants were introduced as Non-Financial Entities and Liberal Professions (abbreviated ENFPL) with reporting obligations, from December 4th, 2001, with the adoption in Brussels of the European Parliament and Council Directive no. 97/2001 / EC amending Council Directive 91/309 / EEC on the prevention of the use of the financial system for the purpose of money laundering, known as the Second European Money Laundering Directive.

The second European Directive is a particularly relevant benchmark for this research, since it explicitly defines accounting entities as reporting entities. This point highlights once again the actuality of the topic addressed in the present research, since at European level these obligations have only been accountable to accountants since 2001, and practice and literature are relatively limited.

Alongside the European Directive, the Revised FATF Recommendations also foresaw the expansion of obligations on the prevention and combating of money laundering and on non-financial professions. This necessity resulted because the practice in the field (reflected in the reports on money laundering typologies performed by the FATF and other specialized international organizations as well as in the activity reports of the National Financial Intelligence Units) indicated the frequent involvement of these categories in complex money laundering circuits, while pointing out that a number of financial information is only accessible to these categories, which makes them a valuable resource in the fight against money laundering and terrorist financing.

On the other hand, this necessity resulted from the evolution of the internal rules of some FATF Member States, as well as from the rules of international law.

¹ L. Feleagă, N. Feleagă, Contabilitatea financiară - O abordare europeană și internațională, Publishing House Economică, 2007, pp. 40, 41

The category of non-financial professionals (referred to in the literature as **gatekeepers**) includes a range of different activities and professions not only from the point of view of the legal regulation that governs their activity and the code of conduct, but also from the perspective of the risk of being involved in financial crimes and money laundering.

The glossary attached to the Revised FATF Recommendations specifies that the "*designated businesses and professions*" category includes: casinos (including internet casinos), real estate agencies, precious metal traders, precious stones merchants, lawyers, notaries, other legal professions, accountants etc.

In the case of accountants, it is stated that the rules refer to independent practitioners, partners in accounting firms and employees of companies specialized in the provision of specialized services. It does not refer to accountants employed by companies operating in other areas of activity, nor to accountants working in government agencies.

A particularly important document in defining and explaining the legal obligations binding to accountants in the field of money laundering and money laundering is the FATF Guideline on the Application of Risk Measures, issued in 2008.

The obligations of accountants as reporting entity are found in the Romanian legislation in Law 656/2002, with subsequent amendments and completions. From this perspective, accountants have similar obligations to all the other reporting entities mentioned in art. 10 of the said law. However, there are a number of peculiarities that originated in international documents (FATF Recommendations) and which are reflected as such in the Romanian Law.

Common obligations¹:

- Obligation to report unfulfilled operations suspected of having the purpose of money laundering or terrorist financing to the National Anti-Money Laundering Office (National Office for the Prevention and Control of Money Laundering) - art. 5 paragraph (1) of Law 656/2002, as subsequently amended and supplemented;
- The obligation to report cash operations above the threshold of EUR 15,000 equivalent in any currency - art. 5 paragraph (7) of the Law 656/2002, as subsequently amended and supplemented;
- The obligation to report external transfers above the limit of EUR 15,000 equivalent in any currency - art. 5 paragraph (8) of Law 656/2002, as subsequently amended and supplemented;
- Obligation to Report Suspicious Transactions Art. 6 paragraph (1) - (3) of Law 656/2002, as subsequently amended and supplemented;
- Obligation to provide ONPCSB information upon request - Art. 7 par. (1) - (3) of Law 656/2002, as subsequently amended and supplemented;
- The obligation to apply the measures of knowing the clients and keeping records of art. 13-19 of Law 656/2002, as subsequently amended and supplemented.

¹ Parlour, R., The new FATF forty recommendations, Financial Regulation International, Vol.15. No.5. June 2012, pp. 10-13

Particularities provided by the law and applicable to gatekeepers:

- auditors, natural and legal persons providing tax or accounting advice are not required to report to the Office the information they receive or obtain from one of their clients when determining its legal status or defending or representing it in judicial proceedings or in connection with them, including advising on the opening of court proceedings, according to the law, whether or not that information has been received or obtained before, during or after the conclusion of the proceedings. Article 5 (9) of Law 656/2002, as amended and supplemented;
- in the case of auditors, natural and legal persons providing tax or accounting advice, reporting is made to persons designated by the governing bodies of the liberal professions, who are required to send them to the Office within 3 days of reception. The information shall be forwarded to the Office unaltered. Article 5 paragraph (11) of Law 656/2002, as amended and supplemented;
- in the case of accountants, part of the obligations stipulated by law are attributed to the management (and representation) structures of the profession, according to art. 10 lit. e) and f) of Law 656/2002, as subsequently amended and supplemented. Thus, these structures (CECCAR) will designate one or more persons responsible for the application of the said law, the names of which will be communicated to the Office, specifying the nature and limits of the responsibilities entrusted, and will establish appropriate policies and procedures for knowledge of accounting, reporting, keeping of secondary or operative records, internal control, risk assessment and management, compliance management and communication, to prevent suspicious operations of money laundering or terrorist financing by ensuring appropriate training for employees.

Thus, we can observe a fundamental difference in the compliance of accountants (alongside other professions mentioned by law) with other rapporteurs, in that the obligations to designate a person with law enforcement responsibilities, to establish a set of rules and procedures for customer knowledge and risk management of AML / CFT, as well as professional training of its own staff, do not belong to each accounting consulting cabinet, but to the structures of representation of the profession. This is absolutely natural because the vast majority of the accounting consultancy offices are extremely small (2-3 persons) and they do not have the necessary resources to implement an effective risk management system.

In the case of Romania, the structure of representing the profession with obligations under Law 656/2002 is the Body of Expert and Authorized Accountants of Romania.

At CECCAR level, persons with responsibilities in the enforcement of the AML / CFT Law and cooperate with ONPCSB are designated by order of the President of the Corps. Also, the Presidents of the subsidiaries designates by decision, one or more of the members of the subsidiary to be responsible for the enforcement of the legal provisions on the prevention and combating of money laundering. At CECCAR level, the designated persons will mainly follow¹:

¹ Guide to Preventing and Combating Money Laundering for Professional Accountants - Revised 2nd Edition - CECCAR Publishing House, Bucharest, 2007, pp. 2

- to ensure the activity of accountants in accordance with Romanian legislation, body rules and international regulations in the field;
- to centralize information on operations or transactions that fall under the law;
- to keep a relationship with ONPCSB;
- to be concerned about raising the professional level of staff by organizing training sessions.

Thus, in the context of the special situation in relation to the AML / CFT Law of the accountants, as well as the relative novelty of their inclusion among the reporting entities, this paper aims to explain these regulations and to propose an efficient and pertinent system of applying the legal provisions in the field, which on the one hand ensure the fulfillment of the compliance requirements and on the other hand, to not impede the current activity of the professional accountants.

At the international level and at the highest level of competence, the risk of money laundering (involuntary) of professional accountants are highlighted in the FATF¹ documents, which consider that some of the functions performed by accountants could be of great help to a potential launderer of money.

In terms of tax and financial advice, large-value offenders can post to people who are interested in minimizing their tax debts or placing their assets in different jurisdictions (some offshore) to avoid future payment obligations to the State budget. In fact, behind a seemingly justified interest in legal minimization of taxes, one can hide the attempt to outsource unlawfully obtained money and clear the money trail².

Creating companies or other complex legal arrangements (trusts, company chains associated with other companies to lose track of individuals acting from the shadow) can also present a number of vulnerabilities in the sense that these structures could be used for hiding or disguising the links between the outcome of the offense (money) and the offender. They can also serve to conceal the true owner of the companies (and in the case of the assets, the wealth they hold), in the conditions in which a long chain of companies is involved in the association relations, and the beneficial person can be successfully camouflaged behind an entity incorporated into an offshore³.

The sale and purchase of real estate, a phenomenon specific to Romania in recent years, may serve either to justify the transfer of illegal funds (the placement phase) or may represent the final investment of the proceeds of the offense (after having undergone the laundering process) in the integration phase. Real estate transactions have been frequently used in money laundering schemes in Romania and not only because of the extremely fluctuating nature of prices in recent years. Thus, amounts of money resulting from illicit activities could be either hidden or justified (depending on the moment of interest).

Making financial transactions by accountants on behalf of their clients (cash deposits or cash withdrawals from corporate bank accounts, foreign exchange operations, issue or

¹ FATF Guideline Based on Risk Criteria for the Occupational Accounting Published in 2008 – <http://www.fatf-gafi.org/data/oecd/19/4041091859.pdf>

² Cochrane P., Safe bet, the risk in online gambling, Money Laundering Bulletin, No. 212 April 2014, pp. 16-18

³ Bassi U., The hidden economy, 2013, STEP Journal, Vol. 21. No. 8, October 2013, pp. 64-65

receipt of checks, securities sale / purchase, international fund transfers etc.) undoubtedly constitutes a risk of money laundering when the client or another person controlling it has this intention.

By addressing in concrete terms the legal obligations provided by the Romanian law relating to the money-laundering profession, they can be classified into three categories¹:

- Obligations relating to the **recognition of the risk of money laundering / financing terrorism**;
- Obligations relating to **customer knowledge and record keeping**;
- **Reporting** obligations
 - Automatic, based on a value benchmark;
 - Based on anomaly indexes (without value limit);
 - As a response to a direct request from UIF.

3. THE IMPORTANCE OF FINANCIAL-ACCOUNTING AUDIT IN IDENTIFYING CRIMINAL ACTIVITIES IN THE ECONOMIC FIELD

According to literature², „audit is the process by legally empowered individuals or legal entities called auditors that analyze and evaluate professionally information about a particular entity, using specific techniques and procedures to obtain evidence called audit evidence, on the basis of which it draws up the audit report and a responsible and independent opinion”.

This implies the use of assessment criteria resulting from legal regulations or good practice that is unanimously recognized in the field in which the audited entity performs.

The audit process is conducted on the basis of national or international standards, the auditors being persons who acquire this quality under the conditions strictly regulated by the legislation in force.

3.1. Objectives of financial-accounting audit and evidence collection techniques

The accounting information system, due to its functions, is the main source of information for the financial and accounting audit and at the same time it is one of its main objectives.

Regardless of the methods, means and techniques used for data processing, the audit has *the task of pursuing two target groups*³:

1. the reality, sincerity and integrity of the information provided by the economic record;

¹ Melinescu I., Talianu I., Investigațiile financiare în domeniul spălării banilor, Publishing House Imprimeria Națională, 2004

² M. Boulescu, Fundamentele auditului, Publishing House Didactică și Pedagogică, Bucharest, 2000, pp. 11-12

³ Munteanu V. (coord.), Control și audit finanțiar la întreprinderi și instituții publice, Publishing House Universul Juridic, Bucharest, 2015

2. the legality, necessity and economy of the recorded economic and financial operations as well as the integrity of the patrimony of the economic operator or of the respective public institution;

By following these two target groups, the financial accounting audit may be confronted with the following situations¹:

- (a) *documents and records are properly drawn up, kept up to date and comply with the requirements of legal regulations and the decisions of boards of directors and comprise only real, accurate and exact transactions;*
- (b) *the irregularities found in the preparation, circulation and processing of documents and in the keeping of the accounting registers are only of a formal nature, such as: the documents contain inaccurate corrections, the records are not kept up to date, correspondence between the accounts is not observed, the correspondence between the operative records, analytical accounting and synthetic accounting is not insured etc.*
- (c) *the irregularities found in the organization and management of the accounting determines, favors or masks the cases of bad management, tax evasion, subterfuge, distortion of results etc.*

Documentary verification identifies the nature of the deficiencies (form or substance) and measures are taken to prevent and eliminate them and / or to punish the culprits, as the case may be.

In order to express its opinion on the assurance of fairness through financial statements, the auditor is required to ensure that the following criteria and objectives have been met:

The criterion of completeness and integrity of records (completeness)

This criterion requires that all transactions occurring in an enterprise be reflected in appropriate supporting documents and be recorded in the accounts without omission and without some of them being accounted for multiple times.

Criterion of recordings.

All the information contained in the annual accounts must be justifiable and verifiable. Then, all patrimonial items reflected in the accounting must be consistent with those identified physically by inventory or other processes (third-party confirmations, laboratory tests, etc.). Revenues and expenses as well as the assets and liabilities presented in the annual accounts must be real and concern the enterprise.

The criterion of correct bookkeeping and correct presentation through annual accounts implies respecting the principle of exercise independence. As a result, operations must be recorded in the appropriate periods, and through the regularization work, the correct delimitation over the period of expenditure and revenue management is ensured by: provisioning, reversal of provisions, distribution of price differences over expenses and inventories, exchange rate differences related to foreign currency denominated assets,

¹ Feleagă L., Feleagă N., Contabilitatea financiară - O abordare europeană și internațională, Publishing House Economică, 2007

translation differences related to foreign currency receivables and payables, prepaid expenses and revenues recorded in the balance sheet etc.¹.

A fair assessment makes all property items and all economic and financial operations evaluated in accordance with the accounting rules and principles. Also, all the calculations underlying the records in the accounting must be correct.

All economic and financial operations should be recorded in the appropriate accounts with respect to the correspondence between the accounts established by the rules for the implementation of the chart of accounts. Failure to comply with these correspondences may help to mask fraud, unlawful compensation, distortion of balance sheet items or indicators such as: assets, stocks, expenses, results of the year, tax obligations, turnover etc.

3.2. Risks, fraud and possible errors, specific to financial accounting audit

The specialized literature reveals that the amount of audit evidence required to prove compliance with a given assessment criterion is always commensurate with the risk that the auditor would give an opinion on compliance with the criterion, but in reality there is a strong departure from (deletion) to that criterion, which will be covered by the importance for users of the audit report. The risk in question is called **global audit risk**.

Therefore, the audit cannot provide absolute certainty, but it is necessary to limit to a low and acceptable level the overall audit risk, the auditor's ability to formulate an inaccurate opinion or conclusion in an audit report. In this regard, it will be taken into account that in its turn the opinion of the audit will be inaccurate and misleading to its user².

Since it is not practical to recover all operations in a set of financial statements, the auditor must accept a certain level of overall audit risk.

NOTE: Given the users' expectations of financial statements made by public bodies, particularly with regard to legality and regularity, only very low levels of overall audit risk are used and recommended, about 1-2%.

Components of audit risk

a) *The inherent or essential risk is*, in general, the risk of material misstatement (meaningful) or of erroneous independent statements. Inherent risk in fact amounts to the possibility that a balance of an account or a category of financial operations may contain erroneous information that could be individually significant or when it is aggregated with erroneous information from other balances or financial transactions as a result of the absence of effective internal controls. The inherent risk depends on the nature of the entity

¹ Olteanu I., Bistriceanu G., Evaziunea fiscală. Metode și tehnici de combatere a evaziunii fiscale, Publishing House ASE, Bucharest, 2005

² An audit report misleads if: the report mistakenly states that there was a non-compliance with the evaluation criteria. For example, it is stated that financial statements are misleading when, in reality, this is not the case or it is stated that the entity's management has not made every effort to achieve the objectives; when, in reality, the objectives have been achieved; it is omitted by report the indication of the limits of the scope of the audit and that it may influence the interpretation of the results

under audit, the work it carries out, and the susceptibility of activity-related errors. In order to estimate the inherent risk, the auditor performs an assessment of the environment (context) in which the entity operates and an assessment of the characteristics of the aspect audited.

b) *The control risk* is the risk that the accounting and control systems of the audited entity do not prevent or detect in a timely manner a misstatement or an affirmation that could materialize either individually or together with errors in other balances; or categories of operations.

Fraud and error in financial auditing

The audit should take into account the potential impact of a possible fraud on financial information and consider amendments to the audit plan and the use of additional audit procedures.

The auditor should distinguish between alleged fraud and proven fraud. An *alleged fraud* is considered to be those circumstances that suggest fraudulent action and that come to the attention of the auditor during an audit. This approach reinforces the principle that only the tribunal or equivalent jurisdiction is empowered to decide whether a particular action or operation is a *proven fraud*. The use of additional procedures gives the possibility to confirm or refute suspicion of fraud. Sometimes, however, this refutation or confirmation cannot be achieved and the possible impact of this uncertainty on the financial statements (information) must be considered.

4. CASE STUDY: RUNNING AN EXTERNAL AUDIT TO DETECT FINANCIAL FRAUD IN PUBLIC PROCUREMENT

In this subchapter we will present the way in which an audit action is carried out on the detection of financial fraud in the field of public procurement. The exemplary institution is a Food Safety Direction (DSA). The exemplified individuals are hypothetical.

Intermediate inspection report to DSA

I, the undersigned R.B., acting as financial auditor in the Romanian Court of Accounts, the Chamber of Accounts of "X" County, under Law no. 94/1992, modified and completed by Law no. 263/2010 and Delegation no., I have audited the execution account and the balance sheet for year N at the Food Safety Office (DSA).

On the same occasion I checked some issues included in the DSA, under the signature of the Executive Director, - dr.vet. N.F., registered at our institution under no., as well as in the address no. of the National Control Authority, submitted to the Court of Accounts of Romania and registered under no.

Mainly, through the above-mentioned addresses, a verification is required to take into account the objective of the control "Regularity of Public Procurement", regarding the endowment of the institution with laboratory equipment during the period N – (N+1)

Our control took into account those benchmarks worth more than 25,000 u.m., which were the subject of acquisitions made by DSA in the respective financial years.

During the audited period executive management was provided by:

- ✓ executive manager;
- ✓ Economic Deputy Executive Director;

DSA is a specialized public institution with legal personality, subordinated to ANSA, financed by state budget allocations and extra budgetary incomes, according to Government Ordinance no. 42/2004 regarding the organization of the sanitary-veterinary and food safety activity, with the subsequent modifications and completions, approved by Law no. 215/2004, as subsequently amended and supplemented. The DSVSA Executive Director is a tertiary authorizing officer for budget appropriations.

As a result of the inspection, there were found facts that caused damages, irregularities and financial deviations for which there are indications that they were committed in violation of the law. The commission of these facts led to the provision to several private companies of amounts coming from the budget of the institution in the context of carrying out non-compliant tendering procedures.

Thus:

1. The audited institution did not prepare the annual procurement program to be carried out during the budget year.

According to the provisions of art. 3 of the Government Decision no. 925/2006 approving the implementing rules for the provisions regarding the awarding of public procurement contracts in the Government Emergency Ordinance no. 34/2006 on the award of public procurement contracts, public works concession contracts and service concession contracts, as subsequently amended and supplemented, according to which:

Instead of the above-mentioned document, laboratory equipment required by LSVS was submitted for inspection, based on the requests submitted by each section. We note that neither the "Fundamental Notes on the necessity and the opportunity to make the expenditures assimilated to investments" have been elaborated, which leads to the impossibility of checking the compliance with the provisions of Law no. 270 of October 15, 2013 for amending and completing the Law no. 500/2002 on public finance art. 43 par. (1).

Therefore, the person charged with the exercise of the preventive financial control within the unit is obliged to check - when submitting the public procurement contract to the preventive financial control - whether the public procurement is foreseen in the Annual Procurement Program, according to the provisions of MFP Order no. 923 / 11.07.2014 - for the approval of the General Methodological Norms regarding the exercise of the preventive financial control and of the Specific Code of professional norms for the persons performing the own preventive financial control activity, could not fully fulfill its specific tasks.

Although the internal audit staff highlighted this issue in the periodic reports, the institution's authorizing officer did not order the elaboration of a procedure for the preparation of the annual public procurement program in accordance with the provisions of GEO no. 34/2006 on public procurement, as subsequently amended and supplemented, and Government Decision no. 925/2006 approving the implementing rules for the

provisions regarding the awarding of public procurement contracts in the Government Emergency Ordinance no. 34/2006 on the award of public procurement contracts, public works concession contracts and services concession contracts, as subsequently amended and supplemented.

Also, the provisions of MFP Order no. 923 / 11.07.2014 - for the approval of the General Methodological Norms on the Exercise of Preventive Financial Control and the Specific Code of Professional Norms for the Persons Performing the Activity of Own Preventive Financial Control ("Documents on Operations Affecting Public Funds and / or Public Heritage will be accompanied by the opinions of the specialized departments, the substantiation notes, the documents and / or supporting documents and, where appropriate, a "Proposal for an Expense" and / or an "Individual / Global Commitment" of Annex 1 and of Annex 2 respectively to the Methodological Norms approved by the Order of the Minister of Public Finance No 1792/2002 as amended by OMFP 547/2009") were neglected.

The production of the deviation we were referring to was possible because the DSA Executive Director and the Deputy Executive Director during the period to which we refer did not take into account the provisions of Law no. 500/2002 art. 22 par. (2), as amended by Law no. 270/2013 on public finances, as subsequently amended and supplemented, according to which:

Creditors are responsible for:

- a) hiring, liquidation and authorization of expenditures within the limits of commitment credits and budget credits allocated and approved according to the provisions of art. 21;
- b) achieving revenue;
- c) engaging and using expenditure within the limits of commitment appropriations and budget appropriations on the basis of sound financial management;
- d) the integrity of the assets entrusted to the institution they lead;
- e) organizing and keeping up-to-date accounting and timely presentation of the financial statements on the status of the patrimony managed, and the execution of the budget;
- f) organizing the monitoring system for the public procurement program and the program of public investment works;
- g) organizing program listings, including related indicators;
- h) organizing and updating property records as required by law.

2. Division of public procurement contracts to avoid the application of open or restricted bidding procedures.

There are two public procurement contracts, namely contract no. for the acquisition of two units of an automatic colony counting unit worth 900,974 u.m. and contract no. for the acquisition of two units of data monitoring and processing system, amounting to 1,552,065 u.m., both contracts closed with the same supplier

Through its technical and constructive nature, the two devices (the automatic colony count and the data monitoring and processing system) do not work separately but only together and they dependent on each other.

However, the CEO of the DSA and the Deputy CEO, who were in office during the period to which we refer, have signed the above-mentioned contracts (which we enclose as photocopies).

3. Making payments in installments and / or in full before receiving the machines / equipment.

Payments have been made in installments and / or in full prior to the reception of the machines / equipment in the facility, making available to economic agents (future suppliers) sums of the institution's budget resources for periods ranging from one month to 12 months.

The non-realized benefits, calculated by us until the date of receipt of the received documents, are 159.842 u.m.

Please note that there is no legal / contractual basis for these payments. To this it is added that in some cases, the holding of the auction precedes the opening of the financing. However, the DSVSA Executive Director and Deputy Executive Director, who were in office during the period to which we refer, have validated the operations in question.

4. Failure to comply with Government Emergency Ordinance no. 34/2006, with the subsequent amendments and completions and of the Government Decision no. 925/2006 approving the implementing rules for the provisions regarding the awarding of public procurement contracts in the Government Emergency Ordinance no. 34/2006 on the awarding of public procurement contracts, public works concession contracts and service concession contracts, with the subsequent modifications and completions - regarding the purchase of Intranet system implementation services / Management program / Web page setup ", accepting the extra procedural offer SC "Z" SA Bucharest, sent to the DSVSA Executive Director via ANSA Bucharest (Higher Body).

The three invoices issued subsequently by the relevant provider and paid by DSA totals 160.650 lei.

In addition to the fact that this illegal acquisition method did not allow the choice of an optimal price / quality offer, the decision to invest in this type of equipment did not take into account the basic criteria regarding utility, economy, efficiency and the effectiveness of the operation as such. For example, the financial management program has never been used after its implementation.

5. Failure to comply with legal requirements for documents recorded in accounting

For some procurement cases, we note the lack of visas, approvals and other legal signatures for supporting documents requested by OMFP no. 1792/2002 modified and completed by OMFP 547/2009. We also found payments that were accepted and registered in accounting in violation of OMFP provisions no. 1792/2002, with the

subsequent modifications and completions for the approval of the Methodological Norms regarding the hiring, liquidation, authorization and payment of the expenses of the public institutions and the provisions of the OMFP no. 923 / 11.07.2014, amended and completed, for the approval of the General Methodological Norms regarding the exercise of preventive financial control.

The provisions of art. 52 par. (5) of the Law no. 500/2002 on public finances, as subsequently amended and supplemented, which stipulates that: "The payment instruments must be accompanied by the payment order authorized by the credit officer, to which are attached the documents regarding the quantitative and qualitative reception of the goods / services / works, as appropriate, in accordance with the provisions of the legal commitments entered into, certifying the payment amounts, were violated".

The payment instruments shall be signed by the accounting officer and the head of the financial-accounting department, in compliance with the provisions of art. 14 of the Law no. 500/2002 on public finances, as subsequently amended and supplemented, stating:

- "(1) Budget expenditures have a precise and limited destination and are determined by the authorizations contained in specific laws and annual budget laws.
- (2) No expenditure may be entered in the budgets provided for in art. 1 par. (2), nor engaged or made out of these budgets, unless there is a legal basis for that expense.
- (3) No public spending can be engaged, ordained, and paid if it is not approved by law and has no budgetary provisions".

The financial accounting department recorded in the accounts the entry of the fixed asset on the basis of the initial partial invoice (which was subsequently canceled) and of the NIR - the receipt and differences note, and not according to the minutes of receipt and the tax invoice based on the legal commitment.

Payments of intangible assets suppliers were made without having at that time the documents stating the goods delivered (fiscal code 14-4-10 / A or invoice code 14-4-10 / A and the receipt code 14-2-5).

To the violated legal regulations, indicated above, the provisions of the Accounting Act that has not been observed by the deputy executive director. G.B. - in function during the period to which we refer, to whom the most obligations deriving from its application (Law 82/1991), updated by GEO no. 37/2011 and Law 187/2012, are added.

This Audit Report was written today in three copies, and was registered under no. to DSA. By signing it, it is recognized the return of the documents made available to the auditing body.

Financial auditor,

Executive manager,

B. Proposals to capitalize the audit performed at DSA

NOTE ON THE VALUATION OF THE FINDINGS - FOLLOWING THE DSA AUDIT CONTROL (financial exercises N – N+1)

I, the undersigned R.B, having the function of financial auditor, conducted the auditing of the execution account and the balance sheet for year N at the Food Safety Office from 14 to 30 September 2017.

As our institution has been notified several times about the perpetrating illegal activities regarding the investment activity in this institution, we carried out audits focused on the audit objective "Regularity of public procurement", regarding the endowment of the institution with laboratory equipment, during the period N – N+1.

Our control has taken into account those benchmarks worth more than 25,000 u.m, which were the subject of the purchases made by DSVSA in the respective financial years. As a result of the control, there were found facts that caused damages, irregularities and financial deviations for which there are indications that they were committed in violation of the law.

Committing these acts led to the provision of several private companies (headquartered in Bucharest) of amounts due from the institution's budget performance of irregular bidding procedures and financial accounting regulatory framework abuse.

Thus:

1. The institution that was controlled did not elaborate the annual public procurement program and recourse to the splitting of public procurement contracts to avoid open or restricted bidding procedures;
2. Payments were made in installments and / or in full before (up to 12 months) by the reception of the machines / equipment (unrealized benefits, which totals 9,842 lei and are attributable to the authorizing officer);
3. The provisions of the Emergency Ordinance no. 34/2006 on the granting public procurement contracts, public works concession contracts and services concession contracts, with subsequent amendments and completions - regarding the purchase of services "Intranet system implementation / Managing program / Configuration of web page"
4. The legal conditions (derived from the application of Law 82/1991 on Accounting and Law 500/2002 on Public Finances, both with subsequent amendments and completions) regarding the documents recorded in the accounting, including their non-compliance with the CFP visa, have not been complied with;
5. The existence of inconsistencies between the data included in the documents on the acquisition of fixed assets in the institution's patrimony.

Because, one of this infringements of financial accounting legislation:

1. Was observed during previous verifications and
2. Have been the basis for favoring several private companies that have been given financial means in advance;

Then:

- The contravention sanctions applied by us in the past did not have the expected effect
- Payments (on costly laboratory equipment) mainly targeted the same trading companies with headquarters in Bucharest, which participated in most of the selection procedures organized by the DSA in years N and N + 1
- No steps have been taken to remedy the situation,

We suggest:

1. Reporting to criminal investigating bodies to decide on the extension of the investigation, including the people in the supplying companies, and establishing possible criminal liability, with some indications of committing acts of abuse in the service to the detriment of the public interest by the Executive Director of DSA, Executive Director - and the deputy executive director
2. Disposition of the current DSA's management of the measure of verification and calculation of any unused benefits for all situations where amounts of money have been made available in advance to suppliers, up to the prescription period, by selecting for control only those transactions that are over 25 000 u.m.

We are of the opinion that the transmission of documents to the bodies responsible for verifying certain issues at the level of the companies issuing the invoices indicated in the annexes - because we don't have the legal competence - is not an efficient measure, the previous request being solved only with the finding of invoices to suppliers and tax obligations.

Therefore, in order to ascertain the level of the commercial margins, favored by the unfair tender procedures for deliveries to the DSA, and confirmation of the abusive provision of (in advance, without legal contracts, etc.) amounts coming from the public budget, we consider it more appropriate to issue the acts drawn up in the course of this action to the police authorities responsible for investigating and combating financial fraud.

NOTE was completed on, in one copy, and underlies the initiation of criminal prosecution, the persons responsible for causing the damage referred to in the above report.

Financial auditor,

5. CONCLUSIONS

The money laundering process takes place through institutions and legal procedures that have been set up to address market needs that are very different from those sought by those who recycle fraudulent amounts. The confidentiality of bank transactions does not serve to ensure a citizen's right to privacy but to escape the investigation of dubious funds that individuals hold. The advantages of free international capital flow are not used to increase the efficiency and effectiveness of fair trade operations but to transfer large sums of money from states or areas with strict banking supervision to more permissive or less prepared places to detect and counteract fraudulent activities. Money laundering, by corrupting the normal use of some institutions, tends to contaminate the system as a whole, using abnormal instruments to serve market relations.

Transition economies have to take rigorous measures to combat crime, specific premises that produce dirty money: tax evasion, bank fraud, corruption, fraudulent privatizations,

smuggling, various financial deceitfulness. At the same time, specific measures are also required to combat the placement of sums resulting from these crimes, thus money laundering.

When dealing with money laundering in relation to company accounting, obviously the **relevance and credibility** of the accounting information reflected in the financial statements is deeply affected. Accounting creativity can be caused by gaps in accounting rules, or sometimes professional accountants are focused on some subjective professional judgment even by the provisions of accounting rules. However, when accounting information is knowingly directed towards objectives contrary to lawful commercial practice, we are dealing with dramatic manipulation of information beyond the limits permitted by law. In this case, in the context of national anti-money laundering and anti-money laundering legislation, the role of an independent, good-faith accountant is to identify anomalies and to raise suspicions that would lead to the detection and punishment of accounting practices that facilitate money laundering.

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SMILE-O-METER: A PILOT PROJECT TO MONITOR A PATIENT'S EMOTIONAL CHANGES THROUGH AN ON-LINE THERAPY SESSION

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ABSTRACT

Smile-O-Meter is a pilot project that aims to track and analyze how a patient's emotional state changes throughout an online therapy session using a webcam. The main goal of the project is to see if a patient's mood has improved over time and this is performed by analyzing the frames of the webcam's video stream, with the help of facial recognition and emotion detection algorithms, coupled with a deep learning technique. The current approach aims to detect five different emotions. Results have shown that some emotions have a high detection rate (happiness, surprise), while others tend to be wrongly interpreted (sadness, disgust).

KEYWORDS: *emotion recognition, facial recognition, online therapy, convolutional network*

1. INTRODUCTION

Psychologists and counselors are using the technology to make their daily tasks easier, mostly outside the therapy sessions. But because humans use emotions to convey messages [1], psychologists are starting to use the technology during the therapy sessions, the main reason being that patients are not always sincere. Also, psychologists might miss some features and expressions that may appear during the session. They may be recording the sessions, even go

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through them after to see if they notice something new in a patient's mood evolution or they can even provide online counseling or telepsychology, "the provision of psychological services using telecommunication technologies" [2]. Telepsychology has been practiced for a while now and comes in different forms: by phone, text messages, emails or webcams [3]. Monitoring a patient through these types of online sessions can be an automated process, by detecting, tracking and monitoring her/his emotions. The presented project is not an attempt at replacing the psychologist but rather is intended as an indication tool that can be used in order to improve the sessions. It is capable of giving punctual information, but it is more useful when providing statistics regarding the patient's mood and tracking the evolution in time.

The first part of this paper presents some of the previous studies carried in this field. In the next part, the paper covers information about the technologies that were used during the implementation, after which information about the implementation itself is presented. The last part of the paper presents the results that were obtained using the presented application.

2. RELATED WORK

AU	Description	Facial muscle	Example image
1	Inner Brow Raiser	<i>Frontalis, pars medialis</i>	
2	Outer Brow Raiser	<i>Frontalis, pars lateralis</i>	
4	Brow Lowerer	<i>Corrugator supercilii, Depressor supercilii</i>	
5	Upper Lid Raiser	<i>Levator palpebrae superioris</i>	
6	Cheek Raiser	<i>Orbicularis oculi, pars orbitalis</i>	
7	Lid Tightener	<i>Orbicularis oculi, pars palpebralis</i>	
9	Nose Wrinkler	<i>Levator labii superioris alaqueae nasi</i>	
10	Upper Lip Raiser	<i>Levator labii superioris</i>	

Figure 1. Example of Action units from the FACS system (Source [15])

Affectiva is a company that has made improvements to the field of emotion detection, their main focus being using this technology for market research. *Affectiva*'s emotion detection solution measure 7 emotions: anger, contempt, disgust, fear, joy, sadness and surprise. The way this software works is presented in their official paper [13] which puts emphasis on the methodology that the team used to select the data training sets and perhaps, more importantly, on the "Efficient Non-Linear Kernel Approximation" [14] and "Active Learning Algorithm" [16] that seem to be the key to the software's accuracy. The specific actions and signals that *Affectiva* searches for in a picture are AU02 (outer eyebrow raise), AU04 (eyebrow lower) and smiles. *Affectiva*'s plans for the future include extending the search for more face markers and further improving the already accurate algorithm.

Imotions and *Emotient* are two other companies that have united in the purpose of creating a fully-developed solution software for recognizing emotions based on face movements and postures. They thrive to detect the same 7 emotions as the people at *Affectiva*, but also adding another two "advanced" emotions: confusion and frustration. Besides this, the program also extracts an overall feeling of a subject with positive, negative and neutral streams. This result was possible due to using *FACS* (Facial Action Coding System) [14], [15] which is a system for defining various human facial movements, based on facial regions of interest. There are 64 "Action Units", each with a name, the muscle groups involved in obtaining that facial expression starting from a neutral, relaxed face and a picture showing that facial expression, as it can be seen in Figure 1.

Using this system to detect emotions is not something entirely new. The breakthrough comes from the fact that it is now used to categorize emotions automatically, whereas in the past actual doctors and scientists that were familiar with *FACS* studied images by hand to retrieve emotions.

In the not-so-distant future, *Imotions* and *Emotient* plan to combine the software that they created with Stimuli, Facial Expressions, EEG (electroencephalography), GSR (galvanic skin response) and more in order to achieve the best accuracy possible in.

3. USED TECHNOLOGIES

Earlier methods for detecting facial features were based on extracting manually the features of interest from the image. These features were usually a collection of points mapped on a face and corresponded to facial areas that determine expressions. In general, these areas are mouth, eyes, nose, eyebrows and face contour. Although some of these methods had some success, they were based on heuristics and new mappings and rules had to be implemented for each new expression. Taking this into consideration, deep learning is a better alternative for approaching this task. Firstly, by using deep convolutional networks, the relevant features that have to be extracted are learned and not manually extracted. This means, that the model can extract the features that matter, even though some of these may seem esoteric. Secondly, the same model (maybe with a few changes in hyperparameters) can be used to detect new emotions, however, needing a dataset with labeled pictures of people experiencing the wanted facial emotions.

Convolutional networks are a better choice than fully connected networks for a couple of reasons. Since in images the localization and the neighborhood of every pixel are very relevant, two pixels that are outside each other's vicinity do not contain relevant information regarding each other, so instead of connecting each pixel in the input to each neuron in the first layer, it is better to use convolutional connections. A second reason is that convolutional networks are much faster, thanks to fewer connections and shared weights.

Amongst the most popular open-source deep learning frameworks is *Tensorflow* [4], which will be used for the purpose of this project as well. *Tensorflow* has been developed by *Google Brain Team*, the first version being released in February 2017. The API is available in multiple programming languages, such as Python, C++, Java and Go.

To train the network, labeled images are needed. They will be used by the neural network to learn to differentiate between the desired classes of emotions. After the training is done and the model provides the desired performance, the model can be saved and loaded when the project is run. The training of the model is time-consuming, taking hours, maybe days, depending on the sizes of the dataset and the neural network. However, the trained model can classify images very fast. Depending on the size of the neural network and the available hardware, the response time may vary between a few milliseconds to a few seconds. This is enough for real-time detection of emotions during sessions with a psychologist.

4. CONVOLUTIONAL NEURAL NETWORKS

The main layers in a convolutional neural network are convolutional layers, in which every neuron is connected to a window of neurons in the previous layer, as it can be seen in Figure 2. This allows the network to extract features automatically, the layers acting like a multitude of filters that are applied to the input. Initially, the filters are randomly initialized, but during training they should converge to the desired values.

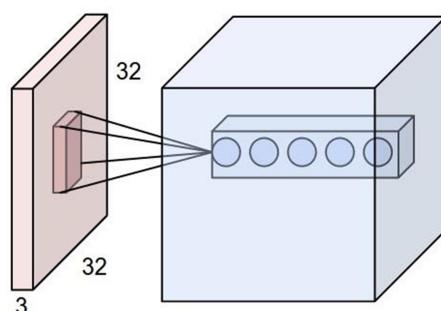


Figure 2. Example of how neurons are connected in a convolutional layer (Source [18])

Usually, convolutional layers induce a certain depth to the information. This means that the depth of the layer is equal with the number of filter types that will be learned, as it can be seen in Figure 3.

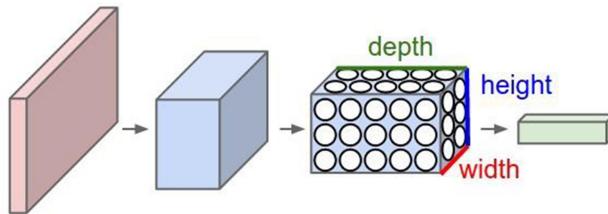


Figure 3. Example of how information changes shape through a convolutional layer (Source [18])

Pooling is usually applied after a convolutional layer in order to reduce information size and to offer more invariability to rotations, translations, and small variation in features. There are multiple ways to apply pooling, but the most common is max-pooling which chooses the biggest value in a 2×2 window of pixels and sends it forward, as it can be seen in Figure 4.

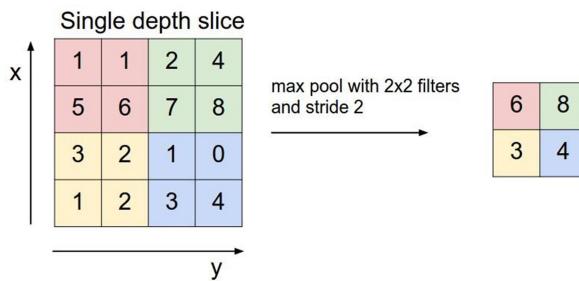


Figure 4. Example of max pooling (Source [18])

The first layers will learn basic features such as edges, regions, when the latter layers will learn complex features such as facial parts, faces, emotions etc. Figure 5 exemplifies this process.

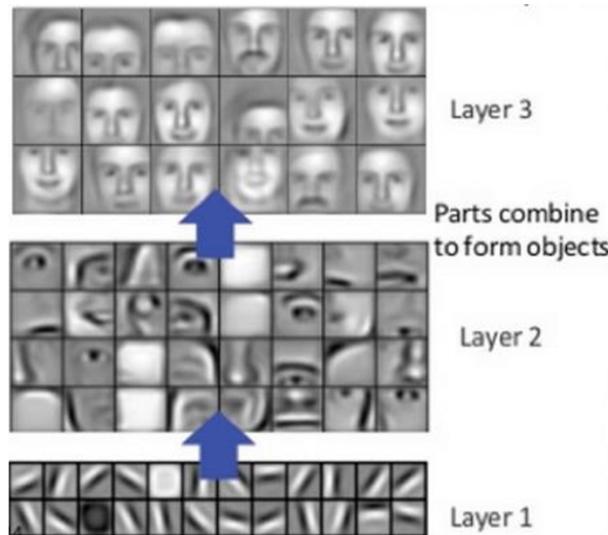


Figure 5. Examples of the features learned by different layers (Source [19])

5. IMPLEMENTATION DETAILS

When the application is first run, the neural network will be initialized with a file which contains the configuration of the trained network. Afterward, the network will only be used for interrogations. The application allows input from a specific folder or from a video stream (webcam). The output can be saved on the hard disk (used for manual labeling) or the application can directly output an emotion classification. In both situations, the user has to choose a sampling period at which the images are extracted. In the situation of having an online stream, the sampling will be done based on time, whereas if the input is from a specific folder (offline), the sampling will be done by establishing a specific frame-rate.

In the current state of the project, the sampling of the video stream from a webcam is being done every t seconds, by setting up a timer that calls the method responsible with the interrogation of the video stream, thus obtaining each frame. This is an important step because by eliminating redundant data, the load of the network decreases as well. Each frame will be processed and sent over to the neural network to be analyzed for emotions.

As an alternative to sampling a video stream, a file system watchdog was implemented. This will monitor a specific directory for new files and changes to existing files as well. When a new image or video file is created, it waits for it to be fully written on the disk. This is done by inspecting the file size until 2 consecutive results are equal. If the file is an image, then the specific image is loaded and it is being preprocessed in order to be fed to the neural network. Otherwise, if the file is a video, the watchdog extracts frames at each second of the video and creates images with them in the same input folder so they can be processed as a new image would be.

5.1. Emotion detection

The emotion recognition step is done using convolutional networks. These networks “can accurately interpret semantic information available in faces in an automated manner without hand-designing of features descriptors” [5] and they are capable of learning different characteristics from an image, by feeding them with matrices of pixel values for each image, with minimum preprocessing. They also considerably reduce the computational cost [6] due to the fact that they are not fully-connected networks and weight sharing. Usually, convolutional neural networks contain mainly convolutional layers, coupled with pooling. In a convolutional layer, each neuron is connected to a windows of neurons from the previous layer and all neurons share the same convolutional weights. This way, a lot fewer connections are needed compared to fully connected layers. Also, in images, pixels are relevant only to a limited vicinity, not to the whole image, which makes convolutional connections very useful. The pooling helps as well, reducing the size of data while keeping the essence of the information and giving the images invariance to rotation and distortions.

In the early stages, this algorithm was supposed to detect 7 emotions. Due to the lack of relevant dataset “fear” has been removed from the classes. Also, due to the high similarity with every other class, the “neutral” class was also removed. The currently used algorithm detects 5 emotions: disgust, sadness, anger, surprise, and happiness.

5.2. Preprocessing

Preprocessing each frame is important to increase the quality and the response speed of the neural network. The preprocessing step involves applying face detection and extraction algorithm on each frame (Figure 6), followed by a resizing of the image to a 128x128 dimension if a face has been detected, and, finally, converting the image into a grayscale one (Figure 7).



Figure 6. Example of an image before the preprocessing step. (Source: [7])

Also, the images are randomly flipped left-right, rotated and blurred. This is done as a way of giving images invariance to various transforms. This also helps with generalizing the information found in the dataset.

The face extraction step is done using trained Haar cascades classifiers [8]. The image is first converted to gray-scale, after which the algorithm marks the coordinates of a detected face (front or profile). The images containing faces will be scaled to a given dimension by using a Lanczos4 interpolation [9].



Figure 7. Example of a cropped, gray-scale photo obtained from the original photo.

The face detection and extraction steps are necessary because of several problems encountered when no face extraction algorithms were applied and the results were incorrect because of the background of the image being mostly constant in the training dataset, while in reality, the background can vary a lot.

Another preprocessing step involves reformatting the data to the correct input format for the neural network: converting integers' values [0, 255] to floats [0.0, 1.0] and modifying the matrix which contains the 2D data to a 3D one by wrapping each value in an array with only one element. This can be achieved easily using numpy, by creating a new axis to a numpy array. The network uses tensors in order to move data inside. Although an image maps visually to a 2D tensor, it is actually a 3D tensor, where the third dimension is the number of color channels. Only after this can the data be used to interrogate the network.

5.3. Network response

After the analysis of the input data, the network will provide a dictionary, which consists of each possible emotion with its associated probability. These probabilities will sum up to 1.0. The emotion with the highest probability will be considered as the detected emotion.

```
{  
    "time stamp": "2018-01-29 21:08:18",  
    "emotions": {  
        "anger": "0.0000",  
        "sadness": "0.0000",  
        "happiness": "1.0000",  
        "surprise": "0.0000",  
        "disgust": "0.0000"  
    },  
    "id": "pixels-photo-713312"  
}
```

Figure 8. Example of network response.

For the alternative implementation that is using a watchdog, the results are being written to disk as a JSON file, as shown in Figure 8. The file name will be the image id, which is the original image file name. The file will contain the id of an image, which may be needed for future functionalities, the timestamp at which the file was written and the probability for each emotion.

6. RESULTS

For testing purposes, we have used Cohn-Kanade dataset [10], [11]. The complete dataset consists of 593 sequences gathered from 123 subjects. All sequences begin from the neutral face and end on the peak expression. There are only 327 from the 593 sequences that display emotion sequences, with 8 different emotions available: neutral, anger, contempt, disgust, fear, happiness, sadness and surprise.

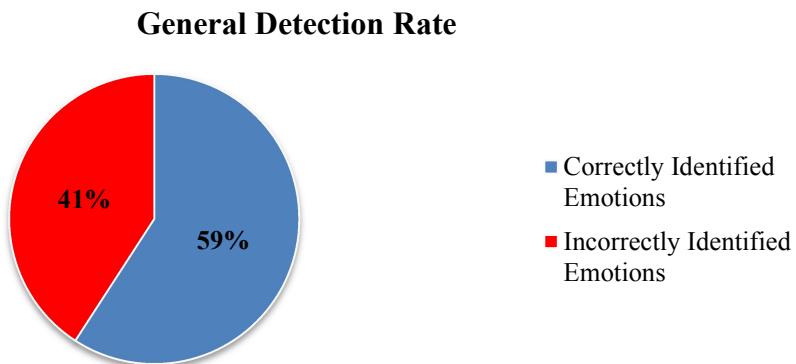


Figure 9. The general emotion detection rate of the algorithm.

As previously mentioned, the current implementation detects only 5 emotions out of the 8 available in the dataset: anger, disgust, sadness, surprise, and happiness. Each image from the set has been labeled with the appropriate emotion that needs to be detected. Out of the 327 images, only 284 contain an emotion that can be detected by the algorithm and out of the 284 images, 168 were correctly identified emotions, the algorithm having a ~59% success rate, as it can be seen in Figure 9.

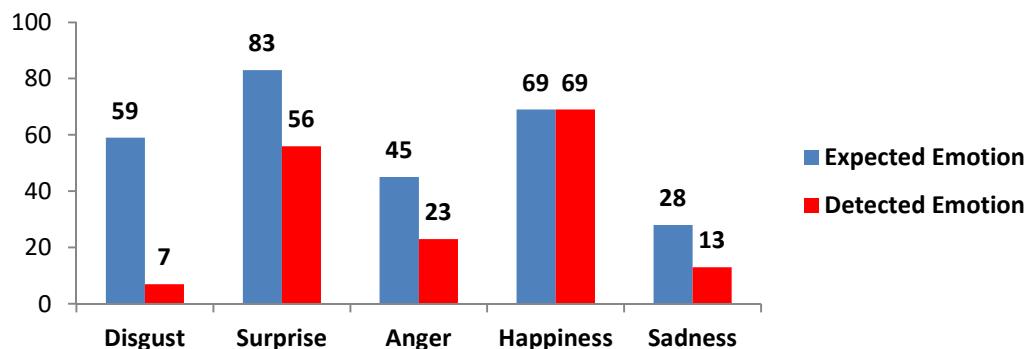


Figure 10. Number of correctly identified emotions for each image provided

Each emotion has a different detection rate, as it is shown in Figure 10. The highest detection rate was found for *happiness*, where 100% of the images were correctly identified and the lowest emotion detection rate was for *disgust*, where only 11.86% of the images were correctly identified. In between were *sadness*, *anger*, and *surprise* with a 46.43%, 51.11% and 67.47% detection rate, respectively.

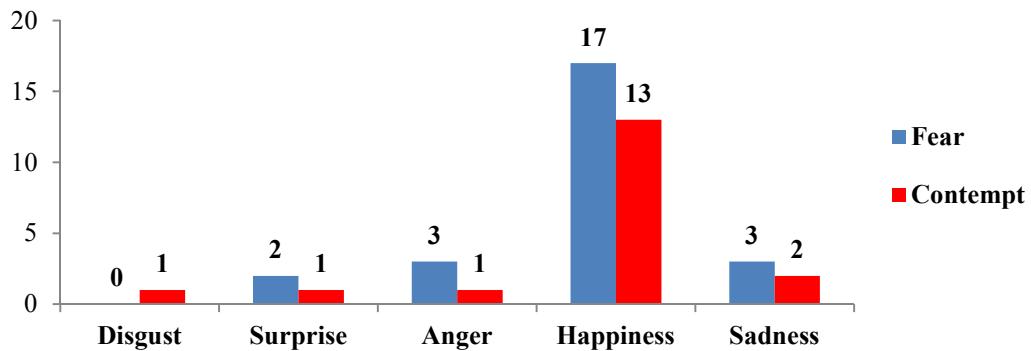


Figure 11. Incorrect detection of unavailable emotions

As previously stated, the dataset contains images with emotions that the current implementation cannot detect. Two of these emotions are *fear* and *contempt*. It has been noticed that both of them are generally interpreted as *happiness*, 68% of the time for *fear* and 72% of the time for *contempt* (Figure 11).

Aside from *happiness*, none of the other available emotions have a perfect detection rate. In Table 1 there are shown the complete results from the dataset. In general, when it is not correctly detected, each emotion is interpreted as *happiness*.

Table 1. Table of complete results for each image.

	Output				
	Disgust	Surprise	Anger	Happiness	Sadness
Input	Disgust	Surprise	Anger	Happiness	Sadness
Disgust	7	1	15	30	6
Surprise	1	56	6	17	3
Anger	3	0	23	14	5
Happiness	0	0	0	69	0
Sadness	2	1	2	10	13
Fear	0	2	3	17	3
Contempt	1	1	1	13	2

7. CONCLUSION

The approach presented in this pilot project will be integrated on an online platform and used by a team of doctors from a municipal hospital in Bucharest during the therapy sessions conducted there. Future work may include monitoring the results by a certified therapist, improving the neural network by continuously feeding it with data from the

therapy sessions and creating an UI to easily monitor the emotional changes throughout a session. The idea here is that, if willing, the therapist could “approve” or “disapprove” with the results of the software for a specific image or frames by entering his/her choice in the UI and so the neural network will learn from this good/bad review and evolve while being used. There will also be further experiments with different type of topologies for the neural network. Besides this, a bolder plan for the future is to add emotion detection based on the gestures of subjects. This could be achieved by adding another neural network that would be trained with different postures that signify specific emotions. Then the results would be combined with the emotions detected from the facial movement so that a more accurate final result could be obtained.

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A STUDY ON USING WATERFALL AND AGILE METHODS IN SOFTWARE PROJECT MANAGEMENT

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ABSTRACT

There are many project management methodologies which one can choose from when starting a new project. The purpose of this article is to analyze the most known methodologies, Agile and Waterfall, in order to determine which is the most suitable for a software project.

We propose a practical study by analyzing the results of a survey designed to capture the experience of developers with the aforementioned methodologies. We will focus on the Scrum and Kanban Agile methods and Waterfall to analyze the findings of the study.

Given the results of the study, we concluded that there is no silver bullet solution when it comes to choosing the methodology for a project, as numerous factors need to be accounted for. Waterfall will be a better solution for small projects that have well-defined requirements that will not change, while Agile is preferred when continuous delivery and feedback are important, requirements are not well defined and time to market is more important than releasing a full feature version.

KEYWORDS: Agile, Scrum, Kanban, Waterfall, Project Management

INTRODUCTION

Kanban [1] was first introduced as a scheduling method for assembly lines in Toyota factories. It was developed to improve the workflow and to maintain a high level of production. Despite its modest roots, it was quickly acknowledged worldwide as an efficient way to “organize” projects. Kanban was transformed into an abstract concept that could be applied to different sectors and industries, thanks to its efficiency.

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Kanban is composed of five key stages: *visualizing the workflow, limiting work-in-progress, managing the workflow, making each and every step unambiguous* and ultimately *evolving as one single and precise mechanism*.

The aim of Kanban is to remove any “bottlenecks” from a streamlined process and to maximize efficiency and collaborative teamwork across the whole team. This goal has led to the creation of the Kanban board, which holds 4 different sets that should describe any task affiliated to the current project:

- **Ideas** – these are tasks that are still in a state of ambiguity and there are multiple discussions between members whether the task or feature should be implemented or not (“is it too time-consuming?”, “is it profitable?”, “what are the pros and the cons?”)
- **To do** – these tasks have passed the first stage and it is clear that they should be implemented. The assignment of the task remains the only problem to solve. Kanban tries to improve the workflow by assigning tasks such that there are no “blocked” members, which could refer to either waiting for another person to finish their share of the work or to having too many “to do” tasks simultaneous
- **In progress** – the task has been assigned and is actively being developed by a member of the team
- **Done** – the task has been completed and there is no more work to be done regarding this particular feature

Kanban still imposes “a tricky part” of defining when a task is considered to be done. It is natural that with so many fields and different types of projects, tasks can get quite diverse, which could mean potential problems in knowing when a task is done. This needs to be discussed thoroughly in the “idea” stage, to set clear and unambiguous goals, which can objectively be reviewed at the end.

The Waterfall model [2][3] is the first applied software development strategy, resembling the designs that were used in other industries. This strategy allows for a project to be split into multiple fixed phases, with each phase requiring the analysis and work from the previous phase:

- **Requirements** – analyzing business needs and extensive documentation of all features
- **Design** – choosing all required technology and planning the full software infrastructure and interaction
- **Coding** – solving all problems, optimizing solutions and implementing each component described in the **requirements** phase, using the diagrams and blueprints from the **design** phase
- **Testing** – extensive testing of all implemented features and components and solving any occurring issues
- **Operations** – deployment to a production environment

The Waterfall model assumes that once the initial requirements are set and every goal has been cleared of any ambiguities, there is an unobstructed road which the development team will follow towards finishing the project. However, in most real-life cases, this is not true, as customers can change their opinion towards different features, in which case

some, if not all, the phases will have to be re-evaluated. This attracts additional costs and time spent on different parts of the project, which in turn could lower customer satisfaction. This is the most obvious flaw of the Waterfall model, but it does not mean, this strategy should never be applied.

For example, when working on small projects with fixed deadlines, budget, and scope, the Waterfall model could help a team organize better, as every member would have extensive documentation from the beginning and the experience and knowledge lost if a member leaves the project is minimized. Time can be distributed optimally since every phase has a fixed period of time allocated, but in the eventuality that one task is late, all tasks will be late.

In the end, the product will have better cohesion since the design has been completed from the first phase and everything has been taken into account. This makes for an easier streamlined process for the team, in exchange for any flexibility regarding future changes and additions.

Scrum [1][4] is a framework for developing complex projects and organizing work, based on a set of values (courage, focus, commitment, respect, openness), principles and practices which provide a foundation for all members. The Scrum framework offers great flexibility and versatility when facing changing constraints, whether financial or technologically and its key for success is always targeting the highest-priority tasks, each of these going through a process of 7 steps: **requirement elaboration, design, development, comprehensive testing, integration, documentation, and approval**.

The core of the Scrum framework is composed of 3 roles, 3 artifacts, and 5 events.

Scrum Roles:

- product owner - is responsible for deciding which features should be implemented and in what order. The product owner will maintain communication with all other members and is responsible for the solution that is being developed.
- development team - the members from the development team are traditional software developers which focus on multiple domains (architect, tester, developer, UI/UX). The development team will be self-organized and will decide how they should proceed in order to achieve the goals set by the product owner in the most efficient way possible.
- scrum master - is a leader that helps the rest of the members understand and correctly apply the Scrum framework. The scrum master should not be confused with a project manager, as they cannot exert any control over what the development decides, but the scrum master can help by protecting the team from outside interference.

Scrum Artifacts:

- product backlog - a prioritized list of items that need to be solved. The backlog can contain more than simple tasks or features, such as changes to existing components, “bugs” or errors that need to be fixed, infrastructure improvements and so on.
- sprint backlog - a prioritized list of items that should be solved during the respective sprint (it is essentially a product backlog, but much more lightweight,

- since the items should be addressed during a relatively small amount of time, opposite of the product backlog which could represent work for several months)
- increment - a collection of the product backlog items that were solved in a sprint.

Events:

- Sprint - when using a scrum framework, work is performed in iterations that are time-boxed, and are almost never longer than 30 days. The sprints have the same time duration and are dedicated to implementing one feature without any distractions or goal-altering interventions.
- Sprint planning - represents a meeting for creating the sprint backlog and fixing the goals for the current sprint, while also clearing any ambiguities. The product owner and the development team agree on the sprint goal, and, taking said goal into account, the development team will order the sprint backlog accordingly.
- Daily scrum - represents a daily meeting, usually lasting no longer than 15 minutes, and occurring at the same time every day, which is not focused on problem-solving, but on what was accomplished since the last daily scrum and what needs to be prioritized for the respective day. It has the role to synchronize the work between team members and for management to be updated on the status of the project.
- Sprint retrospective - the essence of the sprint retrospective is to objectively look at what was accomplished, and to discuss what went accordingly and what did not, with the goal of figuring what can be improved for feature sprints. By the end of the Sprint Retrospective, the Scrum Team will identify improvements that should be implemented during the next Sprint, a process which proves the adaptability of the Scrum framework

PREVIOUS WORK

We have many theories and evaluations of different proposed models for software development [5][6], each having strengths and weaknesses. These strategies and frameworks are continuously updated spawning new hybrid models or improvements, such as the Sashimi model, developed by Peter DeGrace. The Sashimi model is a modified version of the waterfall model, with the key feature that development phases can be overlapped. The idea the model is based on is identifying errors early on during the development phase. This adds an iterative feature to the model for better flexibility and minimization of “bugs” and errors overall. The time between the detection of an error and the actual solution to that error is reduced, ultimately reducing the time spent during the testing phase and producing higher quality software.

Another important feature of the Sashimi model is treating the documentation as a unified entity, instead of exchanging documentation between different teams responsible for different phases, which leads to a better cohesion and a reduced volume of documentation. This model also has its own weaknesses such as unclear key development milestones, the difficulty of synchronizing team members and increased difficulty in monitoring individual activities.

PROPOSED APPROACH

In this research, a comparison will be made between the four most popular methodologies, while also trying to find the preferences of students and entry-level developers. As it was described in the Introduction of the document, we will compare two Agile subsets (Scrum and Kanban) and then the general modern Agile style with the classical Waterfall.

Scrum vs Kanban

Even if both methodologies are Agile types, they are different in regards to how strict a project has to be done. Kanban will allow teams and their members organize more freely. From this point of view, the following differences will be considered during the research:

- setting up roles in a team is not a requirement
- meetings are not restricted by time-boxed iterations (e.g. sprints)
- the board will be continuously updated and stories can be added anytime if they fit into the current workflow
- any member or team can be the owner of the board
- estimates for tasks are not needed(e.g. time, user points)

There are also a number of similarities that must be taken into account:

- both methodologies must be tested before a team can decide what approach to adopt
- focused on fast delivering functionalities
- both will discuss frequently with the customer in order to obtain feedback as soon as possible (being transparent with their work)

Choosing one of these methodologies will be a team decision, based on their style and on the type of project.

Agile vs Waterfall

Considering the aforementioned characteristics of Scrum and Kanban, we can identify their similarity, being just two different Agile ways to manage a project. A method considered much stricter than Agile is Waterfall. Comparing Waterfall with the previous methodologies will result in a number of clear differences. The Waterfall methodology is characterized by:

- having a structured process, each step of the project development has to be completed sequentially
- completed steps cannot be modified
- the project will begin with defined requirements that will not suffer any changes during the project development

Agile and Waterfall are completely different methodologies and their only common goal is to deliver a high-quality product.

Developers opinion

In order to study the preferences of students and junior developer, a form was created and distributed. The form answers will reflect what methodology fits for each candidate,

based on their previous experiences (*as stated before, choosing a methodology should be a team decision based on their needs*).

In order to determine the experience of the candidate, they will be asked them to state how many years of experience they have. The main interest is in the first category (less than 2 years), as it will show how students and junior developers interact with the chosen methodologies.

After determining how much work experience they have, they will specify what methodologies they used and how they interacted with it. If the candidate used a methodology, a set of questions will be given to evaluating how they worked with it. The following metrics are of interest to the research:

- **The number of people involved in the project** – an estimate of the number of persons involved in the project, used in studying how fit the methodology was for teams with a small or a big number of members.
- **Duration of the project** - the duration of the project, used to determine how each methodology fit for long and short term projects
- **Project completion** –whether the project they worked on has been completed or not. This metric can measure the efficiency of each methodology for the given project.
- **Project success** –an estimate on how successful the project was, used to determine if the chosen methodology fit for the requirements and the resources of the project.
- **Personal satisfaction** – how satisfied the participants were with the chosen methodology. This metric was used in order to determine which approach is preferred by students and junior developers. In the end, the candidates were asked for pros and cons of using said methodology on their project.

STUDY RESULTS

The form was sent to 32 candidates in order to examine their experience with the presented methodologies. A set of questions was chosen in order to evaluate in what circumstances the candidates used Scrum, Kanban, and Waterfall.

The research focused on students who are at the beginning of their career in software development. Most of our candidates were chosen based on their experience (< 2 years). The main reason for targeting this category is to gather relevant data from young developers attending their first internship (or internships) and finding their favorite project management methodology.

The majority of the participants had less than 2 years of working experience, consisting mainly of students and junior developers, representing 84.4% of the candidates. The results regarding the working experience of the participants can be visualized in *Figure 1*.

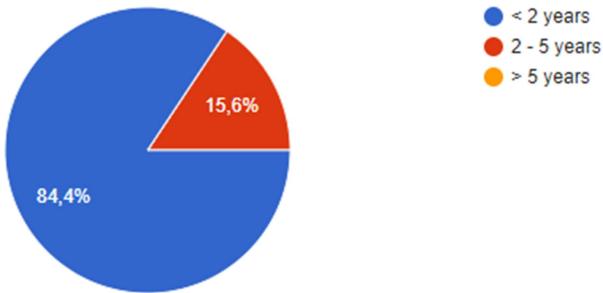


Figure 1. Years of experience

The most popular methodology used by the candidates was Scrum, with 62.5% of them using Scrum at least once. 28.1% of them used Waterfall and only 25% used Kanban. The number of people who have encountered each methodology can be seen in *Figure 2*.

By asking the candidates the size of their teams for the chosen project, it was discovered that the numbers were between 2 and 15. While most Scrum teams had 4, 5 or 7 members, the Kanban teams usually had 5. Waterfall projects had even smaller teams, of 3 or 4 people. The number of members for each team, reported by our candidates, can be seen in *Figures 3, 4, 5*.

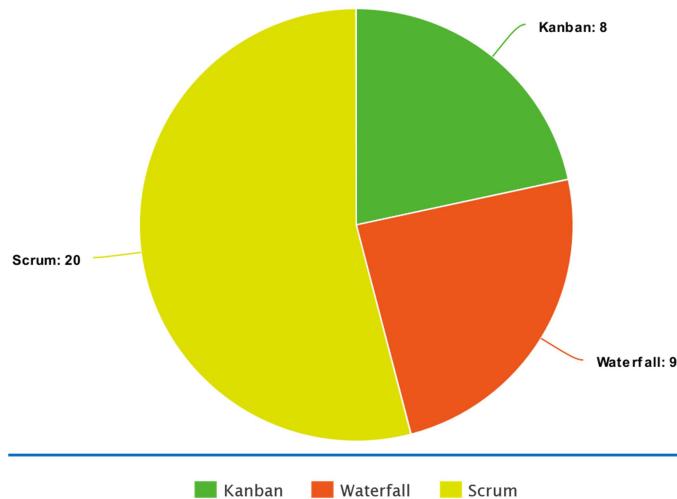


Figure 2. Number of candidates for each methodology

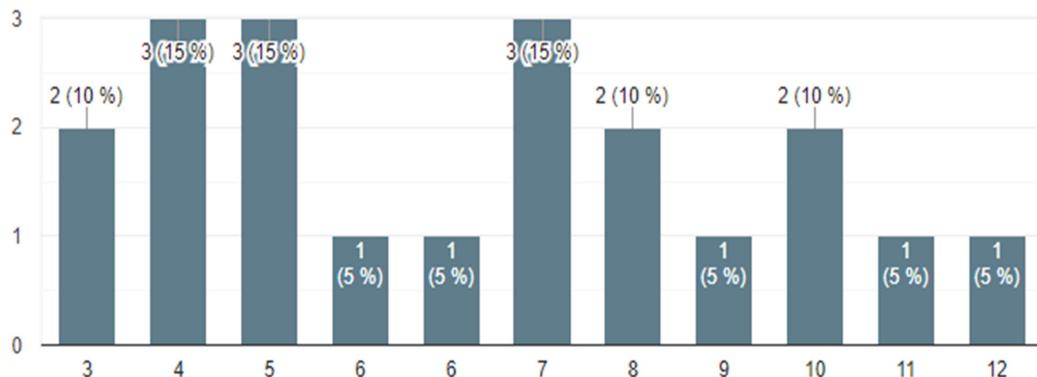


Figure 3. Number of team members for Scrum teams

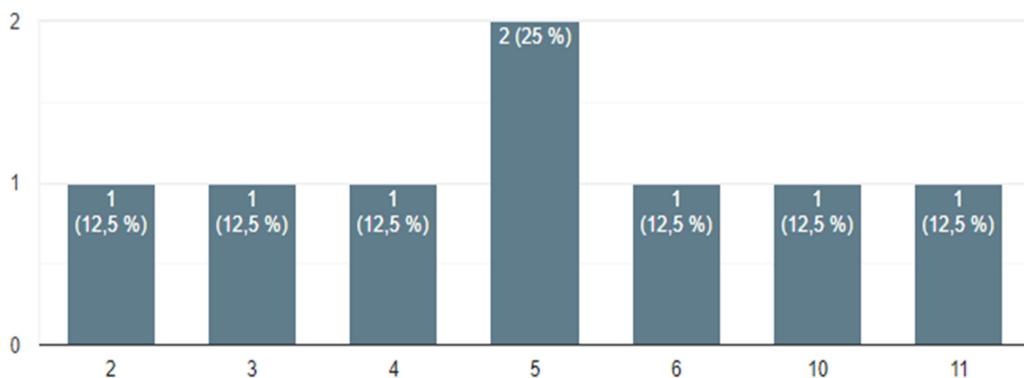


Figure 4. Number of team members for Kanban teams

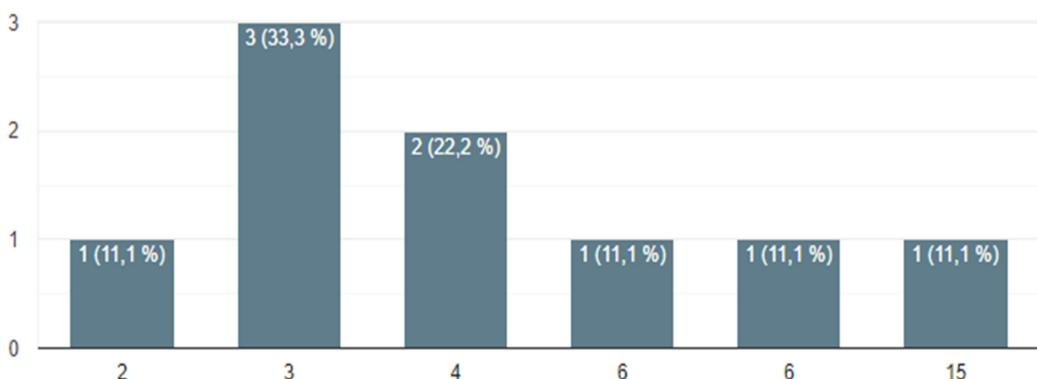


Figure 5. Number of team members for Waterfall teams.

Most of the candidates participated in short term projects, lasting less than 6 months. Waterfall presented the shortest duration, with 88.9% of candidates stating that the

duration of their project was less than 6 months. Kanban was used for projects with variable length, from less than 6 months to more than 1 year (*Figure 6*).

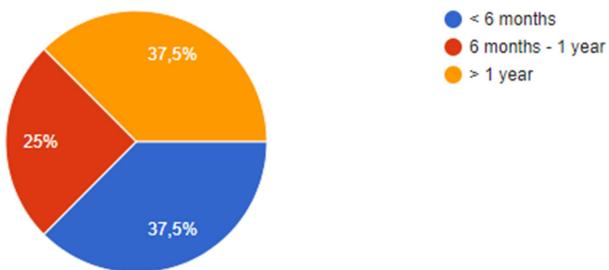


Figure 6. Kanban projects duration

The majority of the Scrum projects were short term projects as well, with 70% of the respondents affirming their project lasted less than 6 months (*Figure 7*).

All of the projects that used Waterfall were finished. Similarly, 95% of the ones that used Scrum has been finished. A high percentage of projects that used Kanban were abandoned, as seen in *Figure 8*.

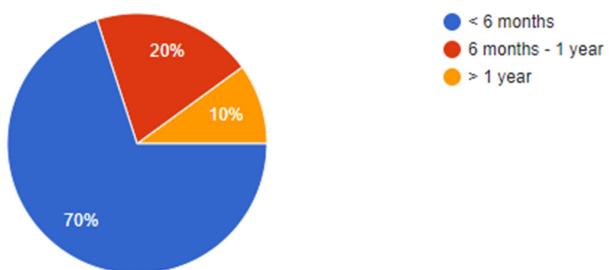


Figure 7. Scrum projects duration

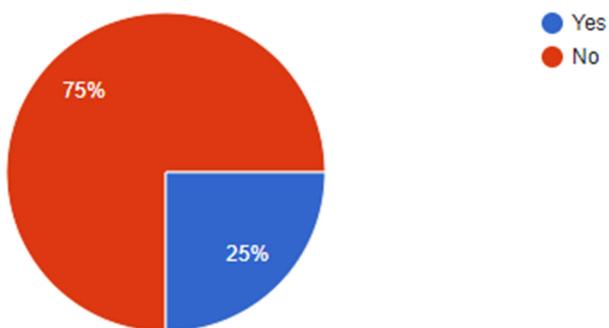


Figure 8. Finished Kanban projects

Candidates considered that Scrum delivered the most successful projects, with 50% of them classifying the success of the projects as 4 and 5 on a scale from 1 to 5. Kanban results are close to the previous ones, with 50% voting for 5 and 37% for 4. Most of the Waterfall users estimated the success of the project as a 4, with 55% of the votes. A discrepancy can be seen between the number of abandoned Kanban projects and the

success of them. The possible explanation for this is that most candidates used Kanban for projects designed to be experiments.

While the big majority of Scrum and Kanban users gave a score of 4 and 5 (90% and 87.5%, respectively), Waterfall has an average of 77% votes for 4 or 5. However, most of the votes were scores of 4. Overall, all candidates enjoyed using each methodology.

Respondents that used Scrum reported that they were highly motivated during the development and liked the fact that they were in good synchronization with the rest of the team. However, some of them did not enjoy the high number of meetings and the fact that they induced a routine.

Kanban users enjoyed the simplicity and flexibility of the methodology while reporting issues with task prioritization and the amount of time they spent updating the cards.

Waterfall users enjoyed the Plan-Driven Development that this methodology encourages and the strict requirements imposed from the beginning but had issues measuring progress.

CONCLUSIONS

Following the results of the study, it can be concluded that each methodology has its strengths and weaknesses. As such, there is no solution for all types of projects. Various factors like the number of people in the team, how inclined to changes the requirements are or the duration of the project should be considered.

Therefore, it was observed that the majority of projects that used Waterfall are small projects, having teams of less than ten people and a duration of fewer than 6 months.

In the results of the study, it can be seen that the most popular methodology is Agile, using Scrum. Scrum reported as well the best overall satisfaction in terms of how much they enjoyed using the methodology.

In conclusion, the methodology chosen depends on each team and has to be picked specifically for that project, as no approach can satisfy all needs. The tendency is that Waterfall is used mostly by small teams for a small project that have well-defined requirements, while Agile is more flexible and preferred when continuous feedback is important.

FUTURE WORK

Considering the small number of candidates in the research, we will try to obtain more answers in a future form. The new form will cover more metrics that can be processed. New questions will be added, choosing them after an analysis of the current data. New research should focus on differences between junior and senior developers, correlating the methodologies with the candidate generation.

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ACCOUNTING DIMENSIONS IN TOURISM AND PUBLIC SECTOR

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ABSTRACT

The sector of services is one of the broadest sectors in the modern economy, being constantly subject to the transformation of globalization, and tourism and public sector as integral parts of the sector, have a rather socio-economic impact on the development of a nation. In order to be able to identify rigorously the role of tourism and public alimentation in the national economy it is appreciated that it imprints on several plans such as: economic, social, cultural and political, the structure of the entities and the cultures of different countries. The accounting of the entities in tourism and public alimentation must be independent and capable of providing a complete picture of assets, equity and debt, and the management has a high contribution to valuing service activities.

KEYWORDS: *tourism, public alimentation, economic entity, social accounting, financial decision, performance.*

JEL CODE: M41

1. INTRODUCTION

The article's approach deals with issues related to the accounting of the entities in tourism and public alimentation sector. Over the course of the paper the legislative and normative framework for organizing the accounting of the entities in tourism and public alimentation sector, the architecture and the particularities of the financial-accounting information system, the harmonization and normalization in accounting, the financial reporting and the external communication and the possibilities of capitalizing on the information provided by the accounting management and cost calculation for efficient management of entities, are highlighted.

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2. ACCOUNTING FOR ENTITIES IN TOURISM AND PUBLIC ALIMENTATION SECTOR - COMPONENT OF ACCOUNTING FOR REPORTING ENTITIES

The entities in tourism and public alimentation sector do, like other entities, cash or credit transactions as well as other economic and financial transactions called events of the transaction, such as: sale of goods or services (delivery / purchase), buying / purchase of goods or services, where both revenue and expenses contribute to the creation of the result; which, for practical reasons, is treated as an element that can influence the capital, in the sense that the increase in expenditures diminishes the result, thus, implicitly, also the equity, and the increase in revenues determines the increase of the result, therefore, of the equity.

All of these transactions are recorded in supporting documents and registered in the accounting system through accounts, with multiple functionalities: as assets, debts, equity, income, expense and result, that are found in financial statements as the balance sheet. After repealing Order no. 3055/2009, starting with 01.01.2015, according to OMFP no. 1802/2014 for the approval of the Accounting Regulations on the individual annual financial statements and the consolidated annual financial statements, the place and the role of the balance sheet as „*synthetic accounting document disclosing the assets, liabilities and equity of the entity at the end of the financial year, as well as in the other situations provided by law*”, was taken by „the annual financial statements made up of the balance sheet, the profit and loss account, the statement of changes in equity, the cash flow statement; accounting policies and explanatory notes to the annual financial statements”¹. In this context, entities in the tertiary sector operating on this segment of public service provision, like tourism entities, need a dual appreciation from the consumer: from a quantity and quality point of view.

Reporting to a legislative and regulatory framework for organizational accounting of entities in general, implies focusing on strict adherence to rules that are about to regulate accounting activity. In this respect, from January 2015, it can be specified that the legal basis for the approval of the Accounting Regulations for the individual annual financial statements and the consolidated annual financial statements is given by **Order No.1802 of December 29, 2014**, which repealed, one by one:

- a) O.M.F.P. no. 3.055/2009 for the approval of Accounting Regulations compliant with European directives;
- b) O.M.F.P. no. 2.239/2011 to approve the Simplified Accounting System.

One of the representative changes to accounting regulations through O.M.F.P. no.1802 / 2014, consists in the adoption of new size criteria for those legal entities that apply the new accounting regulations.

According to these criteria, the entities are classified into three categories according to which the annual financial statements will be prepared, having different components, such

¹ ***OMFP No. 1802/2014 for the approval of the Accounting Regulations on Individual Annual Financial Statements and Consolidated Annual Financial Statements published in the Official Gazette of Romania No. 963 / 30.12.2014 of 29 December 2014, Section 21 General Provisions

as: „*micro entities, small entities, medium and large entities*”.,, *The annual financial statements drawn up by each of the three categories of entities (micro-entities / small entities / medium and large entities) must provide a true and fair view of the assets, equity, liabilities, financial position and profit or loss of the entity. If the applying the provisions of the accounting regulations approved by O.M.F.P. no. 1802/1414 is not sufficient to provide a true and fair view of the assets, liabilities, financial position and profit or loss of the entity, additional information is required in the explanatory notes to the financial statements to meet that requirement*”.

3. ARCHITECTURE AND PARTICULARITIES OF THE FINANCIAL AND ACCOUNTING INFORMATION SYSTEM OF ENTITIES IN TOURISM AND PUBLIC ALIMENTATION SECTOR

Every day, we commonly use the word *information* without which there can be no professional communication or development.

Representative and current, the definition given by the lawmaker to the accounting in the updated Accounting Law no. 82/1991, by the vast content and particularities which it contains, can be considered as the starting point for establishing the infrastructure of the financial-accounting informational system.

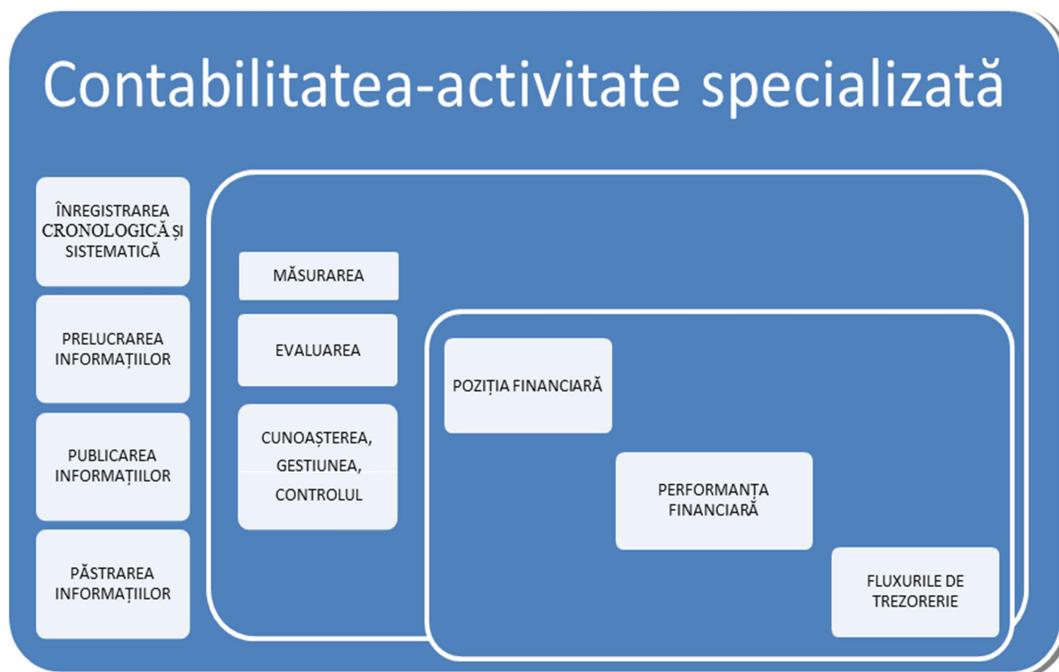


Figure 1. The definition of accounting - a starting point for establishing the infrastructure of the financial-accounting informational system.

(Source: own design after the accounting definition according to the updated Accounting Law no. 82/1991)

The financial and accounting information used by the entities in tourism and public alimentation sector presents the following characteristics:

- They have a regulatory character because they are used permanently when an economic activity is to be corrected;
- They are predominantly pro-active because they reflect in real time the processes and economic phenomena, for example, the development of purchasing;
- they are analytical because they carry out a thorough characterization of the activity carried out in the sector of tourism and public alimentation;
- they support economic development;

The financial-accounting information system is given by all the financial and accounting information available to an entity to measure performance.

Like the other information systems, the financial-accounting system is based on three components: **data** and / or information inputs, **processing** of sorting, organizing, mathematical-statistical calculations and **outputs** with outputs / purposes, illustrated in the figure below:

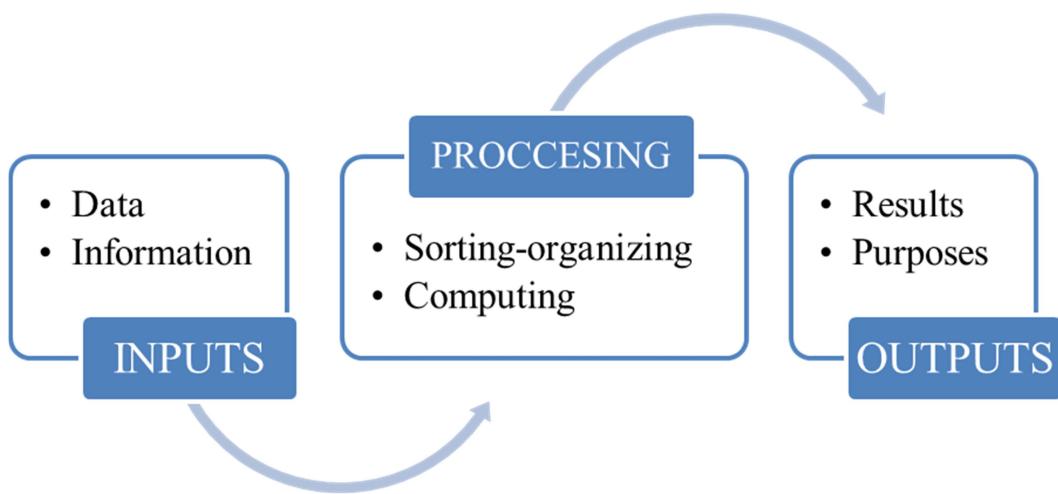


Figure 2. Components of the financial-accounting information system

(Source: own design)

As an activity sector of the national economy, tourism and public alimentation is represented by all services and goods, which are found in other sectors, ensuring the connection between suppliers and tourists by invoicing the services they require.

The palette of activities of entities in the tourism and public alimentation sector is a very diverse one, consisting mainly of *service provision* (PS), which can be grouped into primary service (PSP) and secondary services (P.S.S.) as follows:

P.S.P.1.- provision of services related to domestic tourism, organized by tourism agencies;

P.S.P.2.- provision of services related to the tourist accommodation activity, including accommodation / hotel activity, by hotels, motels, inns, tourist villas, cottages;

P.S.P.3.- provision of services consisting in the transport of persons by their own means of transport;

P.S.P.4.- provision of services relating to the production of confectionery and pastry-making laboratories and food production including, among other things: bakery products and those resulting from the processing of meat;

P.S.S.1.- provision of complementary services offered to tourists, which include postal services, hairdressing, laundry, cleaning, spa and treatment¹;

P.S.S.2.- the activity of selling the goods at the retail price specific to public alimentation.

The particularities of the financial-accounting informational system, directly influence the organization of accounting, as follows: all the services rendered to the tourist at a place, accommodation, meal, transport, treatment, visits, form the "touristic product"².

The achievement of the touristic product from the accounting point of view is important in highlighting the revenues and expenditures by activity, by types of tourist services, offering the possibility of their determination and analysis. The services provided to the tourist form the touristic activity which is entrusted to a travel agent who is responsible for its realization in terms of efficiency. In this sense, the travel agent operates with various values, such as money, travel tickets, checks, for which he becomes a debtor. When the values received are justified, it ceases to be the debtor and, at the same time, ends the touristic action. Based on the supporting documents retained during the trip, the travel agent will record the expenses after the end of the touristic action. In the practice of tourism services, such actions are numerous, so it is necessary to track the expenditures on each side using the technical-operative records.

4. FINANCIAL REPORTING AND EXTERNAL COMMUNICATION, INFORMATIONAL VALENCES OF FINANCIAL REPORTS PREPARED BY ENTITIES IN TOURISM AND PUBLIC ALIMENTATION SECTOR

Over the last twenty years, the synthetic accounting documents of reporting entities have undergone a number of important changes in form, structure, content, and quality.

In order for the accounting information to be available to users it is necessary to observe the qualitative characteristics provided by the financial statements, as it can be seen in the table below:

¹ Minciu.,R., Economia turismului, Publishing House Uranus,Bucharest, 2000, p.215

²Stăncioiu, A-F, Dicționarul de terminologie turistică, Parafrarea definiției produsului turistic, Publishing House Economică Bucharest, 1999, p.161

Table 1 - The qualitative characteristics of the information provided by the financial statements and their meaning

Qualitative characteristics of information provided by financial statements	Their meaning in short
Understanding	How easy it is to understand
Relevance	Significance Major
Credibility	Not risky Sincere
Neutrality of information	Objective
Prudence	Cautious
Completeness	Reasonable According to standards
Comparability	Measurable

(Source: own design, after IFRS)

In order to compare the qualitative characteristics of the financial information according to the current regulations contained in the OMFP no.1802 / 2014, with the above, table 2) was made, in order to demonstrate the mix between the Romanian legislation and the European standards.

Table 2 - Qualitative characteristics of financial information

Qualitative characteristics of financial information	Their meaning in short
Relevance	Usefulness when making decisions
Exact representation	Complete and reasonable
Comparability	Consistency in establishing similarities and / differences
Verifiable	Information Utility Amplifier
Opportunity	Information Utility Amplifier
Understanding	Ease of understanding financial information

(Source: own design, after section 2.3 regarding the qualitative characteristics of financial information, set by OMFP no.1802/2014)

If the qualitative characteristics of the information provided by the financial statements are not met, financial imbalances may occur, high costs and limitations that lead to the loss of relevance of the information, for example.

From the analysis of many financial statements specific to entities in tourism and public alimentation sector, it was found that:

- ✓ the accounting information needs to be made available to decision-makers who, while respecting the principle of transparency of information, publish their financial statements;
- ✓ financial reports and, implicitly, accounting in Romania are carried out and reported in Romanian and in local currency (lei);
- ✓ transactions denominated in foreign currency are recorded in accounting, both in national currency and in foreign currency.

Economic entities and, implicitly, all legal entities must apply accounting rules according to European directives, and professionally prepared financial statements are able to provide the necessary information regarding:

- the financial status of the entity;
- its performance;
- cash flow.

In this context, it is mandatory to make the annual financial statements:

- a) the balance sheet;
- b) Profit and loss account;
- c) the statements regarding changes in equity;
- d) the cash flow statement;
- e) accounting policies¹ and explanatory notes, relevant for each economic entity as users.

In accordance with the provisions of Article 1 paragraph (2) of the Annex containing the accounting regulations for the individual annual financial statements and the consolidated annual financial statements of *O.M.F.P no. 1802/2014 for the approval of the Accounting Regulations on the individual annual financial statements and the consolidated annual financial statements*, these "partially transpose the provisions of Directive 2013/34 / EU of the European Parliament and of the Council on the annual financial statements, consolidated financial statements and related reporting of certain types of undertakings, amending Directive 2006/43 / EC of the European Parliament and of the Council; repealing Council Directives 78/660 / EEC and 83/349 / EEC, published in the Official Journal of the European Union no. L 182 of 29 June 2013."², because as of January 1, 2015 Romanian simplified accounting system was replaced by the European system of simplified financial reporting.

Usually, the individual financial statements at the end of the year, of tourism and public alimentation companies, are reported at the end of the previous year and the end of the current year; they are comprised of 29 notes prepared under IFRS, as they have been endorsed by the European Union, separately for each situation, as follows:

- ,, Overall result³
- ,, Statement of financial position⁴
- ,, Statement of changes in equity⁵
- ,, The cash flow statement⁶
- ,, Notes to the annual individual financial statements.⁷

¹ International Financial Reporting Standards (IFRS) 2015, International Financial Reporting Standards Board (IASB), CECCAR translation, - 2 volumes, Bucharest, 2015, Part A

²***OMFP No. 1802/2014 for the approval of the Accounting Regulations on the individual annual financial statements and the consolidated annual financial statements published in the Official Gazette, No. 963 / 30.12.2014

³ Statement of comprehensive income, Part One of the Financial Statements for the year ended

⁴ Statement of Financial Position, Part Two of the Financial Statements for the Financial Year Ended

⁵ Statement of Changes in Equity, Part Three of the Financial Statements for the Financial Year Ended

⁶Statement of Cash Flows Part Four of the Financial Statements for the Financial Year Ended

⁷Notes to the individual financial statements, the last part of the financial statements for the financial year ended

Thus, in the notes to the individual financial statements, large entities in tourism and alimentation can produce and synthesize accounting policies. In this context, the most commonly used IASs and IFRSs are presented in Table 3, along with the changes made to the accounting policies contained in "Note 2 - Significant Accounting Policies".

Table 3 - Presentation of IAS / IFRS and implicit changes to accounting policies

Symbol IAS/ IFRS	Name IAS/IFRS	Implicit changes to accounting policies
IAS 1	Presenting financial statements	Structure, content of financial statements and mandatory posts
IAS 2	Stocks	Definition of accounting treatment applicable to stocks in the historical cost system: valuation (first entered - first out, weighted average cost and net realizable value) and permissible cost perimeter
IAS 7	Statements of cash flow	Analysis of Treasury variations, categorized in three categories: operating flows, investment flows, financing flows
IAS 12	Income tax	Defining the accounting treatment of taxes on the result
IAS 16	Tangible assets	Accounting for assets, determination of their accounting value and principles for accounting for depreciation
IAS 18	Income	The Principles of Accounting for Income from Ordinary Activities (fair value principle, revenue sharing principle, service advancement percentage, asset exchange, etc.)
IAS 23	Borrowing costs	The definition of the accounting treatment of borrowing costs: the notion of qualifying asset, the arrangements for incorporating the cost of borrowing into the value of the qualifying assets
IAS 39	Financial Instruments: Recognition and Measurement, except for certain provisions relating to hedge accounting	Recognition and measurement principles for financial assets and liabilities, defining derivative financial instruments
IFRS 5	Fixed assets held for sale and discontinued operations	Defining an asset for trading and abandoning business, assessing these items
IFRS 13	Valuation at fair value	Defining the fair value, setting a framework for measuring fair value in a single IFRS, imposing fair value information disclosure

(Source: own design)

5. POSSIBILITIES FOR CAPITALIZING ON THE INFORMATION PROVIDED BY MANAGEMENT ACCOUNTING AND COSTING FOR EFFICIENT MANAGEMENT OF ENTITIES IN THE TOURISM AND PUBLIC ALIMENTATION SECTOR

In the literature, the phrase "*management accounting*"¹ is similar to the wider concept of managerial accounting because managers, because of their interest in business, are the first category of users who benefit from accounting.

It is used by accountants the term *internal accounting*, when referring to internal / analytical production process control (a term that has been taken from French accounting to express real cost knowledge) / exploitation (which refers to the costs incurred the current consumption of the factors of production: capital, nature, labor, information), none of these terms being wrong due to the fact that the professional accountants know best the specifics of the activity and the needs of each individual entity.

It is clear from the provisions of Article 1, paragraphs (1) and (6) of the updated Law no.82 / 1991, that there is a regulated relationship between the financial accounting and the management accounting - according to which "the patrimonial units must organize management accounting "as appropriate."²

Knowing the particularities of the management accounting, which are related to the specifics of the entities in tourism and public alimentation, the methods of calculating the costs and the applied information system, can present the objectives of the management accounting in the realization of the income and expenditure budgets by type of activities, like in figure no.3:

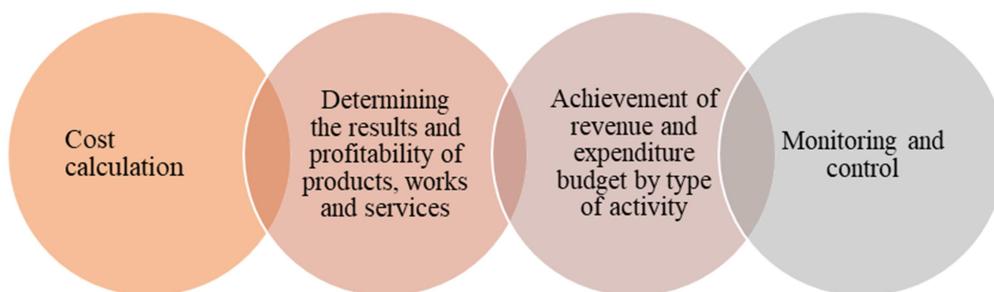


Figure 3. The objectives of management accounting

(Source: own design)

In other words, depending on the calculation of the cost of a product or service, its profitability can be determined by using the revenue and expenditure budgets by types of activities on the basis of, which one can monitor and control the whole financial and economic activity of the tourism and public alimentation entity.

¹Bouquin, H., Comptabilite de gestion, Publishing House Sirey, 1993, p.30

²*** Accounting Law no.82 / 1991, updated in Article 1. (1) and.(6)

In Article 1 paragraph (6) of the Accounting Law, 82/1991 updated in 2017, it is stated that "The persons mentioned in paragraph (1) - (4) of Article 1 of Accounting Law no.82 / 1991 shall organize and manage, as the case may be, the management accounting according to the regulations elaborated in this respect "without these regulations being specified in the text of the law.

Since the scope of management accounting is circumscribed by the way of recording operations relating to the collection and distribution of expenditure by destination, activity, section, production phase / production batch, production settlement, and calculation of the cost of production of the products manufactured goods, manufactured works and services, including production in progress, so the cost of production will be calculated with the help of analytical accounting , which, according to the accounting regulations harmonized with the 4th Directive of C.E.E.¹ and International Accounting Standards is determined by adding to the cost of acquisition of the raw materials and consumables used costs of the entity that are directly attributable to the production of that good.

Therefore, the cost of production is the total expenditure incurred by an entity in obtaining and disposing of its production over a given management period, just as the cost calculation is given by all the mathematical operations used to determine the cost of the entire activity, and also per unit of product , accomplished work and provided service, under the technical and organizational conditions of the economic entity².

Financial and management accounting reflects the direct costs represented by the cost of raw materials, cost of electricity and fuel, wages and contributions of direct productive staff, and indirect costs related to occasional consumption, such as maintenance and operating costs.

More precisely, the sum of all direct (Ch.d) and indirect costs(Ch.i) results in the cost of production(Cp) and then the full cost of production (CCp) can be determined as: **Cost of production (Cp) + General Administration Expenditures (Cga) + Expenditure on sales (C.d)**.

$$\text{Ch.d} + \text{Ch.i} = \text{C.p}; \quad \text{and} \quad \text{C.C.p} = \text{C.p} + \text{C.g.a.} + \text{C.d}$$

In order to show the independence of management accounting from financial accounting it is justified the fact that it is not by accident that the law maker has two ways to highlight consumption:

- in financial accounting, consumption is reflected in the 6th class expenditure accounts in correspondence with the 3rd class stocks in the plan of accounts;
- in the accounting of management, the accounts that help register costs of production and the calculation of costs, are included in the 9th grade of the plan of accounts and are called "accounts of management"³, these being in correspondence between each other, by taking over the operating expenses from

¹ ***Directiva a IV-a a Comunității Economice Europene

²Epuran M., Băbăiță V., Grosu C., Contabilitate și control de gestiune, Publishing House Economică, Bucharest, 1999, p.172

³*** Account Plan, updated 2016, prepared in accordance with OMFP no.1802 / 2014

the financial accounts (recorded by their nature), in order to register them according to their destination for the purpose of tracking and controlling the manufactured output, the production in progress, respectively the establishment of the differences of the actual and anticipated costs.

It is considered appropriate to credit the idea that since the application of the dualist accounting system to date, virtually everything that comes within the scope of accounting of management, leads to credibility and progress (see table 4 below):

Table 4. The evolution of accounting of management

The evolution of accounting of management in Romania was determined by:	The performance of the accounting of management at international level is due to:	Calculation of costs in tourism and public alimentation – methods
- Quality of the information of management accounting from this standardized and non-monetary area (expressed in natural standard: meters, kilograms, etc.)	-The implementation of the Fourth European Directive adopted in 1978, which refers to the rules of evaluation, the format of the published financial statements, the basic principle adopted, that of the true image of the patrimony	-Calculation of costs in tourism and public alimentation can be done by the Direct Costing method, the simplified version which determines the unitary cost of production and the absolutely necessary indicators for the decision making for the short-term management.
- Establishing the correct calculation of the cost of production including production under execution, according to the chosen calculation method	- Elaboration of the mainland inspirational accounting system by the Superior Council of the French Accounting Expert Order	- Using a Cost-Profit-Volume analysis leads to the cost evolution based on the relationship between cost, production volume and profit.
- How to manage accounting of management	- Applying International Accounts Norms / Normalization	-IAS 2/ IFRS 12.
- The particularities of the management system of internal accounts	- The Anglo-Saxon model, where financial statements represent the true image of the patrimony	
- Concerns of professional accountants and field-specific legislation	- Successful application of the Just in Time costing calculation method, since the 1960s. According to this method, only what is sold and exactly on time must be produced	
- The appearance of the Accounting Law no. 82/1991 and its Implementing Regulation approved by H.G. No. 704/1993. - Founding of C.E.C.A.R in 1994	- Working tools used: 1.I.A.S. – International Accounting Standards issued between 1973 and 2001 by the International Accounting Standards Committee (IASC); 2.,I.F.R.S.– International Financial Reporting Standards,	

	used in many countries of the world, including in the Member States of the European Union. Approximately 100 states require or allow the use of IFRS or have a policy of convergence towards them”; 3.I.S.A.– International Standards on Auditing.	
- Management accounting system has been provided since the publication of Order no. 1826/2003 and continues		
- Assistance and expertise of some U.E. member countries (France, Belgium, UK)		

(Source: own design of the authors study mentioned above)

For the efficient management of the entities in tourism and public alimentation sector it is necessary to know how to calculate the costs related to these service activities.

Thus, when calculating the cost, it starts from the price of resources of any kind used, which is paid by the person who bears the cost to obtain and maintain the quality of the services / products from tourism and public alimentation.

It is commendable the managers' concern about cost reductions and, implicitly, the efficiency of the activity, because resources have to be rationalized, identified, reorganized or eliminated, those centers that have a negative influence on the fixed costs compared to the variable ones, but also on the general expenses, which are often considered expenditures of the services support, in relation to direct costs.

In Romanian law it is mandatory to keep the accounting of management, but few are the decision-makers who apply it with good results in tourism and public alimentation sector, and many economic entities do not apply it. In our opinion, the calculation of the costs of tourism and public alimentation products and services can be made advantageous by applying the Direct-Costing Method, called *variable costing method*¹, which provides information to the production process about the relationship between the cost of production , its volume and the benefits generated, allowing easy control of the profitability of the products obtained.

Because it is known from practice that there is a large volume of data recording and processing in the analytical accounting of the entities in tourism and public alimentation, it is considered necessary to implement the Direct-Costing Method using computer programs, although there is a belief that only one method can completely solve both the problem of planning and tracking costs. The basis of the method is the principle of

¹ Călin, O., Man M., Nedelcu M.V., Contabilitate managerială, Publishing House Didactică și pedagogică, Bucharest, 2008, p.150

separating production and selling expenses into variable and fixed expenses, and when calculating the unit cost per product, only variable costs are taken into consideration.

Even if fixed costs are known and calculated, they diminish the entity's gross financial result because they are considered as expenses of the period, the purpose of the method is to cover the fixed costs of the large volume of sales of the period.

The realization of the optimization of the price - cost - volume correlation, related to the manufactured output, is expressed by the relation (1) below, in order to determine the economic - financial results.

If it is deducted from the sales revenue, from the turnover, the variable expenses are the gross contribution, considered as the preliminary financial result from which the fixed expenses are incurred.

$$(1) \quad \text{Financial result} = C.A - \text{Variable expenses} - \text{Fixed expenses}$$

$$C.A - \text{Variable expenses} = \text{Gross contribution} / \text{Preliminary financial result},$$

where:

C.A = turnover;

In the calculation of the cost of the product, the variable cost is taken into account in relation to the production volume, such as raw materials and direct materials, direct labor and variable indirect costs, and the administrative costs of the staff, the depreciation of fixed assets, with insurance premiums that "are the expression of a time function"¹.

Outstanding authors who have approached the **Direct-Costing Method** in Management accounting, have shown that it differs significantly from other costing methods by "tracking the causal link between products and costs"² without ensuring the establishment of some responsibilities regarding the level reached by fixed expenses, while allowing a detailed analysis of production costs in order to make the entire activity of the entity more efficient.

From the literature studied, it is obvious that the main interest of the **Direct Costing Method** is the possibility of developing the activity on the basis of the information obtained through its continuous use, because the fixed expenses can be easily controlled and due to their predictability, it can be determined the way of coverage based on variable cost margins.

Foreign literature also deals with the hypotheses and the results of this method, which can be exploited in order to develop management models aimed at the profitability of the enterprise in the short term³, also in view of the difficulties encountered both in theory and in practice in distinguishing fixed expenses and variable ones.

In tourism and public alimentation sector, the share of fixed costs in the entity's total expenditure can be determined using the **Direct-Costing Method** by "identifying within

¹Tabără, N., Briciu, S. Actualități și perspective în contabilitate și control de gestiune, Publishing House TipoMoldova, Iași, 2012, p.104

² Cucui, I., Horga, V., Radu, M. Contabilitate de gestiune, Publishing House Niculescu, Bucharest, 2003, p.178

³ Boutat, A., Capraro, J.-M., Comptabilité analytique de gestion, PPUR, Lausanne, 2008, p.109

the fixed costs of that specific part that may be affected or distributed by product"¹, because wage costs are not always fixed, they depend on the current socio-political environment , they are changing, they are difficult to allocate, they depend on the volume of activity, on the evaluation of the employee's performance and on the receipts.

Using the **Direct-Costing Method**, the unit cost can be calculated according to the **relation (2)**: as the ratio between the variable costs and the quantity of products obtained:

$$(2) \quad C_u = \frac{CV}{Q}$$

where:

C_u = unit cost;

CV = total variable expenses;

Q = quantity of products obtained.

It will be tried, according to the bibliographic sources, to summarize the ability of the **Direct-Costing Method** to determine the correlation between fixed and variable costs, production, sales and profit, using the following indicators:

- the equilibrium point;
- coverage factor;
- the dynamic safety index;
- safety interval ².

Starting from the author's explanations in the paper: "Their costs and importance in controlling the company's management"³ the indicator:

- **the equilibrium point** represents the volume of activity in which the income obtained from the sale of production and total costs are in equilibrium, resulting in a null result, it is arrived at by calculating the relation (3) shown below:

In line with Professor I. Cucui's approach, which shows that any increase in sales volume above this level brings benefits, and a reduction in sales below this point produces losses, the formula of output at the point of equilibrium:

$$(3) \quad Q_{pe} = \frac{CF}{P_{vu}} - C_u, \quad \text{where:}$$

Q_{pe} = production volume at the equilibrium point;

P_{vu} = unit sales price;

C_u = unit cost;

CF = fixed expenses.

The processing of economic information resulting from the definition of the equilibrium point, highlights two other indices:

¹ Niculescu, M., Diagnostic global strategic, vol.1, Publishing House Economică,Bucharest,2003, p.258

²Zaharciuc, E., Contabilitate de gestiune și control de gestiune, Publishing House Pro Universitaria, Bucharest, 2009, p.126

³ Cucui, I., Costurile și importanța lor în controlul gestiunii firmei, Publishing House Arves, Craiova, 2008, p.160

- *The safety interval*, calculated according to the relationship (4), reflects how much sales can decrease in order for the economic entity to reach the equilibrium point and can be determined as the difference between turnover and critical turnover.

$$(4) \quad I_s = CA - Cac \quad \text{where:}$$

CA = turnover;

Cac = critical turnover.

- *The Dynamic Safety Index*, calculated according to the relationship (5), is the indicator that determines how much the turnover decreases so that the economic entity can reach the equilibrium point, representing the ratio between the safety interval and the total turnover.

$$(5) \quad I_d = \frac{I_s}{CA} \quad \text{where:}$$

I_s = safety interval;

CA = total turnover. In order to determine the percentage of the turnover needed to cover costs and obtain profit, another indicator is determined:

- *The coverage factor*, which represents the ratio between the variable cost margin and the total turnover, according to the relationship below:

$$(6) \quad F_a = \frac{C_v}{CA} \quad \text{where:}$$

C_v = variable cost margin; and CA = total turnover

In order to make optimal decisions regarding production, selling and obtaining profitability, the Direct Costing Method has seen a number of improvements:

- variable and fixed costs are separated and analyzed on the main economic processes;
- the separation of fixed costs from variable ones, due to variable costs that evolve in proportion to the increase in production volume and fixed costs that decrease;
- determining the gross contribution to profit, organizational levels and the inclusion of standards and spending budgets.

Based on these improvements to the method, several variants of the *Direct-Costing Method* were processed, a simpler and more comprehensive and another evolved one, based on standards and spending budgets. As it was natural, because the work of the professional accountant focuses on ways to make economic and financial activity more efficient, Figure 4 presents the advantages of the *Direct-Costing Method*:

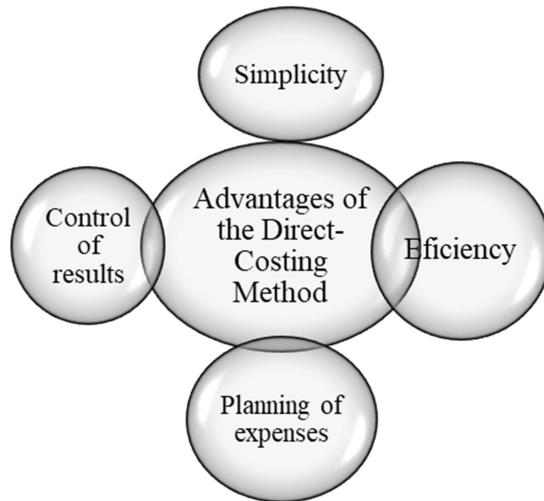


Figure 4. Advantages of the Direct-Costing Method

(Source: own design after Călin, O., Cărstea, Gh., in the paper: *Contabilitate de gestiune și calculația costurilor*, Publishing House Atlas Press, Bucharest, 2003, p.424)

Of course, all these extremely useful benefits without which the cost per product unit cannot be calculated on the basis of variable costs and gross contribution to profit, the *Direct-Costing Method* provides information to both entrepreneurs and professional accountants on the policy organization production, implicitly in the planning of total and fixed variable expenses, and systematic control of the results of the activity.

Direct-costing as a costing method allows for short-term analysis when the tourism and public alimentation entity is not in a position to change its production capacity level = planning expenses.

The calculation is simplified because only indirect variable costs are allocated = simplicity in obtaining the necessary information quickly.

Direct-Costing allows a better fit in the budgeted spending per product and service = planned control and highlights the most cost-effective products = expected results that drive the entity to economic efficiency.

6. CONCLUSIONS

This article brings to the attention of the reader the tourism and public alimentation sector, both as an economic and social manifestation of sustainable development and as part of the application of accounting. The repetition of tourism and public alimentation operations does not take into consideration accounting cycles, as they create unique difficulties in predicting revenue and operating costs, such as variable costs, such as cost of sales and labor costs that require single planning budget.

Measuring the increase of the relevance of financial and accounting information to the entities in the tourism and public alimentation sector through budgets, is another important subchapter for this research, because through their elaboration, the budgets plan

the achievement of the indicators needed to achieve the foreseen objectives, the results, without which a company cannot have a present and future.

Management control mediates and ensures increased economic efficiency and increased performance in entities in tourism and public alimentation sector. It is very important the way you determine the calculation of the fiscal accounting result and the production of accounting reports, with the help of the software so that the entity does not record delays and fines.

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- [10] *** Accounting Law no.82 / 1991, updated.

THE HERMENEUTICS OF THE “EMMA!...” OR “PAPER HAS A GREAT FUTURE” ADVERTISEMENT

Alexandra MĂRGINEAN^{1*}

ABSTRACT

The focus of this paper is the “Emma!...” advertisement, considered particularly rich as far as the meanings conveyed, especially since it paradoxically lacks verbal communication between characters. The author’s endeavor is to delineate the plethora of signifying elements and their intended significations, touching upon aspects of psychology, marketing and communication. After a brief description of the advertisement and its underlying assumptions, we look at the reasons for empathizing and rallying with the perspective of the female character, Emma. This discussion bears on topics such as: the role of art therapy, of the tactility and tangibility of experience, the connotations of the physical objects that she uses, deemed as obsolete or vintage (authenticity, heritage, refinement etc.). The attention falling on the stereotypes foregrounded by the situation goes to show that there is a complex dynamic within which these are juggled, meant to further illustrate a critique of modern society and its postulations regarding the use of technology and human communication. In the hermeneutics of the ad, we resort to aspects from different theories of communication: the relevance of minding circularity, the appropriateness of the structuralist three-fold approach to the sign for interpretation, the transactional role analysis, and non-verbal and paralanguage considerations.

KEYWORDS: *technology, books, advertisement, stereotypes, psychology, marketing, communication*

1. INTRODUCTION

This analysis focuses on the “Emma!...” or “Paper has a great future” advertisement, which I consider interesting and expressive for a number of aspects. The main reason why it triggered my dedicated, scholarly attention, and which determined me to write a study on it was that, surprisingly, a lot can be said about and inferred from this commercial despite its considerably synthetic nature (only thirty-eight seconds), and in spite of the fact that verbal communication between the characters featured in it is virtually absent – if we do not take into account the six times the man pronounces his wife’s name, on different tonalities.

The paper is divided into sections. The first two after the introduction deal with the psychology behind the making of the advertisement and its targeted effects, tracking,

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firstly, the affective responses and dynamics that take place in the viewer, and, secondly, the reasons for siding with the female character. Then, we take a look at the meanings behind the six pronunciations of Emma's name by her husband, pinpointing the attitudes behind them. Section five presents the stereotypes associated with the protagonists, the way these are destroyed and reinterpreted as a result of the unexpected outcome of events, resorting, in all this, to some elements present in various theories of communication, as well as filtering what is happening through the lens of transactional role analysis. The paper ends with the overall conclusions.

Before going into the demonstration *per se*, we need to throw a quick glance at the actual advertisement, to describe what happens in it. While the woman is drawing with her small son, using colored pencils and paper, the husband comes in and takes away the sheet from the child, extending a tablet instead, and demonstrating with his finger on the screen how one can draw on it, and thus that it can replace the other objects. The second scene shows him heading for the fridge, where a great number of post-its are stuck on the door. As he points to them disapprovingly, he shows his wife the tablet, on the screen of which an image with post-its can be seen. In the third act, as she is cuddled on the couch in the evening solving Sudoku, he thrusts the tablet, where a Sudoku game in progress is displayed, under her nose. The next setting shows Emma seated at a desk, printing something, while the husband opens the door to the room and shows again his discontentment. Finally, while in bed next to each other, the two spouses read, her – a book, and him – out of his tablet, grinning suggestively at her as if trying to point out her funny choice. In all the contexts shown, he is always pronouncing her name as he notices her actions or in order to draw her attention, as a form of address, and every time in a different manner. The very last fragment of the video shows him on the toilet seat about to grab some hygienic paper, when he notices that it has finished. He cries out to his wife – pronouncing her name one last time – and he promptly receives her answer: she slides the tablet, which is now displaying a big picture of a hygienic paper roll, under the bathroom stall door to him, while the message “Paper has a great future” appears on our television screen.

2. PSYCHOLOGY – THE BENEFITS OF TRIGGERING AFFECTIVE RESPONSES

The ad baffles the viewer's expectations, as it initially appears to be promoting a new model of a tablet. At the beginning, we are rendered this impression and are made curious about the device because of the prominence with which it appears, and due to the insistence of the husband on emphasizing that it eases all sorts of interactions, eliminating the need for (the handling of) other objects. However, our predictive horizon is confounded as we realize that the ad is actually for hygienic paper. The puzzlement of the viewer's expectations is already a manipulative marketing strategy. Let us further follow the process and the dynamic of the receiver's feelings and thoughts, and psychology behind it, as it occurs.

Our attention is bound to be caught by the introduction of a theme that preoccupies the modern-day consumer, as it represents an ability continuously required from him/her by society. (S)he is reminded of this necessity extremely often in both televised advertising and in everyday life – so often, in fact, that it puts a certain amount of pressure on

him/her: it is the crucial importance of being up-to-date with modernity and all the products that it puts forth in general, especially in what regards technology and expertise in using (advanced) technological devices and gadgets, in particular.

The ever-presence of global telecommunications implicitly relies on updated devices and services that can supply the new software and offer the physical support needed for worldwide communication to take place. Statistics show that, among the ads that Romanians are most interested in seeing on YouTube, those for smart electronic devices and internet providers rank first. The globalization tendency comes from the western world – America and Western Europe, and smaller and Eastern European countries have felt the necessity to align to the trend. In a top ten of the most popular commercials viewed in Romania during the first quarter of 2017, YouTube Romania Adds Leaderboard shows us that seven advertisements are about technology and device performance [1]. The first three positions are occupied by, in the actual order: a commercial for the Samsung Galaxy S8 smartphone, followed by two ads for seasonal offers for products from Orange Romania, whereas the others bearing on the field of technology relevantly refer to two episodes from the “Boost My PC” series, an educational announcement on robotics made by Vodafone featuring a series of celebrities like entertainers and journalists, as well as the unboxing of a particular smartphone accompanied by a review [2]. These preferences show the Romanians’ awareness of the need to learn about, acquire and become users of new technology.

This global tendency does not come without stress and strain. Machine is bound to evolve faster than the average human’s ability to handle it adroitly. From this point of view, even the consumers who feel most comfortable handling new technology may at times become insecure about their adaptability and skills as users of gadgets, which may, moreover, remain obsolete or insufficient in tandem with the most recent advancements. In other words, as times are constantly changing at a head-spinning speed, it becomes increasingly difficult, even for the adapted consumer, to keep the pace with innovation, which results in a subdued but ever-present fear of falling behind. It is thus this fear and the pushing of this more or less unconscious button or soft/sore spot that guarantees catching the viewer’s attention in the commercial under analysis. Putting forth the theme of the need to keep up with the times (and activating, implicitly, the underlying fear that one cannot, or may not, at some point, be able to do it) is, first and foremost, a success recipe for drawing attention. It is only after this occurs, that we realize that the ad is about something entirely different than smart devices and last-minute technology; all the same, the purpose of the buzz topic, of getting our focus, has been served. The use of this fear of the public continues throughout the advertisement, until the very end of it.

The final sentence displayed on the screen, that “Paper has a great future”, together with the ending of the video convey the message that the consumer can relax, as this is not yet another ad that intends to make him/her feel guilty or incapacitated because (s)he is not fully synchronized with technology, as so many do nowadays, excluding and marginalizing technologically ignorant people, precisely by depicting individuals from categories that are not normally included among the usual users of advanced devices successfully handling such gadgets (the elderly, people from rural areas etc.). Moreover, numerous ads introduce the notion that technology has not only reached the categories that are less likely to be interested in it and converted them into users, but it has also

penetrated to and works in the most improbable spaces (on mountain tops, at sheepfolds, in chalets at high altitudes, in the countryside etc.) By rendering this message about paper, together with the humor triggered as soon as the actual intended meaning of the ad is revealed, the video under analysis manages to gain the viewer's liking and benevolence as a result of the psychological release of tension provoked with the help of the two elements in question. A disposition of favorability and goodwill has been subconsciously created, or induced, in him/her. The viewer has become far more open, willing and inclined to like the product that is being advertised, especially since it is something as banal, ordinary and thus non-threatening as hygienic paper. The viewer's attention is being piqued, then (s)he is threatened, scolded, patted on the back in reassurance, then allowed to laugh and unwind – in this order – in an emotional rollercoaster. Let us see the purpose of this rollercoaster of emotions.

Studies on the role of emotional response in consumer behavior have shown that, on the one hand, videos are “successful affect manipulations” and, on the other, that “some video manipulations can enhance more than one specific affective state at the same time”, the targeted effect of producing an affective response being a “better consolidation of memory traces under high emotional arousal” [3]. In other words, when emotions are involved (the more or the stronger, the better), what the potential consumer sees will stick to her/his mind, which increases the chances of subsequent purchase of the product being advertised because it will have prominence over others in the person’s memory. Isen notices that research has shown that “negative affect appeared to reduce false memory” (i.e. it increases the capacity to accurately memorize details) [4] and, although it may not be the best strategy to put consumers into a negative state to the purpose of making them remember your product thoroughly in order to buy it later [5], this idea offers a rationale for the use of negativity-enhancing stimuli in the commercial.

In the end of the “Emma!...” ad, humor has the role of appeasing the potential stress associated with the idea of the insufficient technological adroitness of the viewer, as, besides realizing that this ad is not the type of ad that requires him/her to be adapted from this point of view, (s)he has the opportunity to make fun of his/her own flaws or shortcomings in this respect in a safe context. Also, what the commercial ultimately does is turn the tables on the technologically competent – punishing the punisher/abuser. Humor comes therefore from a double source – the unexpectedness of the type of ad we are dealing with, and the way in which it makes fun of the arrogant mocker (husband) by putting him in difficulty based on his own haughtiness and assumptions (which get invalidated). The quality that humor has, of bringing about relaxation or “relief” – an observation made by Freud as early as his “Relief Theory” [6] – and thus the possibility of a lighter approach to difficult or stressful situations, here also functions as an element that establishes openness towards the product that is actually being advertised, thus constituting a component of the marketing strategy. In the emotional rollercoaster that we have mentioned above, we may wonder why there is a choice to end on a positive note. Positive emotions have been considered to broaden attention, to favor “a global focus” [7] or wider perspective, as well as flexibility, as the viewers “conceptualize and integrate more material and see it in more different ways” [8]. Hence, the consumers in positive emotionality “think more broadly about brands” and are more likely to accept “brand extensions” [9]. There is even a “Dopamine Hypothesis”, which postulates the “positive affect’s facilitative effect on thinking processes” such as “working memory, attentional

flexibility”, monitoring etc. because of the effect of dopamine release in the frontal brain areas [10]. The judgment passed on the products tends to be more favorable, biased in the sense of highlighting their qualities and overlooking the flaws: “Objects are typically evaluated more favorably when the evaluator is in a good mood than when the evaluator is in a bad mood” [11]. The introduction of “playful peripheral, secondary material” on the background of a stressful state has been recognized as an effective focalizer [12]. So, one explanation for the humorous turn in expectations would be this one. There may also be another, which does not eliminate the one we have just mentioned, but may come as a corollary, thus increasing marketing effectiveness. It may be that the ad is intentionally trying to make the viewer feel worse before making him/her feel better, as, in this way, the positive affect resulting from the emergence from a stressful state of anxiety is greater and more significant than the one that would be obtained as a result of merely stimulating him/her out of a neutral state. This is because the relief that is thus experienced heightens and intensifies the pleasure or satisfaction felt afterwards, because the contrast between states is greater and because it contains a type of survival reassurance. We now have a more accurate picture of the rationale of the emotional rollercoaster.

One last point needs to be made here, in what regards affect, its influence on consumer behavior and the way in which it is used in the ad under analysis, before moving on. In order to make this point, we need to understand two realities. Firstly, that affect can be categorized, besides into the broad classes of positive and negative, as: “integral”, in which case the emotional response is directly connected with the object of decision-making; “incidental”, i.e. “unconnected to the object to be evaluated” and, thirdly, “task-related”, meaning that affect is related to the “task or process of making judgments and decisions” [13]. Secondly, we have to take into account that “affect is often seen as having information value—an idea known as the ‘affect-as-information’ hypothesis” [14], and “in the course of evaluating objects, people are often inclined to inspect how they feel about these objects—a process known as the ‘how-do-I-feel-about-it?’ heuristic” [15]. If, for a regular consumer, the topic of choosing one type of hygienic paper over another may not seem crucial, a priority, or arise strong preferences on its own, the marketing ruse of capturing the viewer’s focus to it indirectly, by pressing more stressful buttons – such as the necessity of being in tune with technology – may turn out extremely useful. This is definitely, also, a case of incidental affect, performed through a clever recontextualization of the concept of paper into a perspective in which it is made to stand in contrast with (excessive) technologization and the abuses that it performs on the individual directly and indirectly, which is a buzz topic that is more likely to incite strong emotional response. In this latter context, paper stands for tradition, comfortableness, warmth, undemanding, simple contexts and realities, and relaxation. In this way, paper that opposes stressful technology is associated with positive feelings, which then get transferred to hygienic paper as well, as a result of “assimilation effects” [16]. Under the effects of the affect-as-information hypothesis, the consumer will translate to and project on the hygienic paper all the emotional charge felt previously in relation to paper in the other context. The humor deriving from the comical *recontextualization*, which starts by placing the viewer in a totally different area of the conceptual field of the notion of paper, adds to the positive affect accompanying this notion.

The play upon the consumer’s fears and potential guilt, then the sudden lifting of the burden of these off his/her shoulders goes a long way towards acquiring the viewer’s

attention and benevolence, and strikes points for the popularity of the product, transforming the viewer into a potential buyer. Hence, the advantages of producing affective responses, as well as the exact way in which this reality was capitalized upon in the “Emma!...” commercial have been analyzed in this section.

3. PSYCHOLOGY – SIDING WITH EMMA AND EMPATHIZING WITH HER PERSPECTIVE

The fear of failing to rise to the expectation of being a skilled user of technology, as well as the husband’s indirectly arrogant and insensitive behavior make us side, from the beginning, with the female character in the video, Emma. However, since we understand the need to be in tune with technology usage, we initially tend to comprehend and empathize with the man’s perspective. Thus, it can be considered here that the “focalizer”, namely the character whose point of view we are encouraged to adopt [17] is him. We are supposed to side with the husband, and we tend to believe that this is expected of us, especially as we are manipulated into thinking that this is a commercial for tablets, but we incline, nevertheless, towards Emma, because of our underlying fear and because of the husband’s aloofness and lack of empathy. Hence, it is, in part, out of a mirroring fear and frustration with the forever-advancing technology, as well as a tendency to reject the male character’s obnoxiousness verging on a passive-aggressively abusive attitude that we rally with her. Perhaps it is also out of a subconscious resistance to novelty present in any human being, to various degrees, that we do that.

Nevertheless, there are other, more diversified reasons why Emma’s perspective is more popular with us. At the beginning, she is presented while drawing with her young boy. Even if we are not familiar with the importance and usefulness of drawing and/or painting, we perceive the husband as an upsetting element of the harmony that has been created between mother and child while engaged in this creative and educational activity. But let us understand more thoroughly the exact importance of drawing/painting that we have mentioned here. Firstly, these are part of the concept of art therapy [18] or art making, defined and recognized as “psychotherapy” and thus acquiring all the texture and seriousness entailed by such a concept. If we look only very briefly at some areas of application of art therapy, it is used as a remedy in neurodegenerative diseases, with results in curbing the rhythms of deterioration of neural paths, boosting mood, improving motor, communication and social skills, providing a sense of belonging and accomplishment, the satisfaction of self-expression, not to mention “alleviating the burden on caregivers” [19]. Besides assisting impaired adults in this way, it has been proven, with countless studies, that art therapy also offers support with children, not only when it comes to physically, emotionally or mentally challenged ones (suffering from autism, trauma, abuse, hyperactive or with attention deficits), but also in the development of healthy children due to the help that it provides with acquiring motor and cognitive skills; youngsters learn to create images of their inner thoughts and experiences (and thus have a balanced, normal psychic life); artistic activities lay the foundations for self-esteem, or boost the IQ from an early age etc., not to mention that they constitute a useful tool in diagnosing the developmental stages in children [20]. But even if we do not know or do not think of all these aspects when we see the mother drawing with her son, we at least perceive the activity they are involved in as one of bonding, and can appreciate it as

creativity-enhancing and therefore healthy for the psychology of the child. This much we know. Consequently, the husband who brings the tablet in the picture not only interferes with them, having a disruptive intervention, but also deprives the child of the above-mentioned benefits accompanying this activity, not to mention going against the popular belief that children's interaction with gadgets should be limited instead of encouraged.

If we have just stated that the man deprives the child of the advantages offered by drawing if he wants to make them use the gadget, the observation that we need to make at this point is the distinction between drawing with paper and pencils and drawing on the tablet, by merely using one's finger to trace lines. Let us see why tablet drawing is not the same. Firstly, the experience of using colored pencils and paper is a superior one because it involves tactile interaction with more objects, of various shapes and textures, which enhances motor skills. Then, this manipulation of various objects is, in its tangibility, more empowering. The child sees that his actual movement and object handling produce something that is also tangible in the real world. Thirdly, the child is healthily induced, subconsciously, the idea that the creation of something requires (complex) work and effort, which avoids granting him a too facile, false and dangerous sense of empowerment. Hence, the tablet experience is poorer in these respects.

The element of the pleasure derived from tactility and tangibility is part of the other activities that Emma is involved in throughout the commercial. She uses post-its on the fridge, solves Sudoku from a paper magazine, prints the information she wants to read instead of merely reading it from the computer screen, and reads an actual book instead of its electronic version. Every time, her husband is trying to make her give up the physical objects that she is using in the respective activities, and replace them with the versatile tablet, trying very hard to show and convince her that all can be performed with the wondrous electronic device, implying that the effort would be smaller as well, and that the tablet is, additionally, a more economical version of doing those things, since all the other objects can be discarded once the tablet is adopted.

Let us see the advantages and connotations that the activities enumerated above bring, if they are performed in their traditional manner, using the various objects that they involve, instead of only the tablet. As physical reminders placed on the refrigerator – one of the most visible places in the house – the post-its are a common practice. People have found a way to give the necessity to remember things, which can be a little stressful at times, a pleasant form with the post-its. This is so given the ludic element involved in both their actual appearance and their usability. Since they come in various shapes and colors, post-its are mood boosters due to the way they look. When important things are written on them and then placed in high-visibility places, it is as if the adult is playing a game with himself/herself. The post-it is a message usually addressed to oneself (i.e. in which the adult is thus sometimes both the sender and the receiver), which psychologically puts him/her under the impression that (s)he is in control of his/her life and has already successfully approached handling the task that the post-it reminds him/her of. The post-it is like a message in a bottle which reunites two versions of the self – an older one, from the past, who believed about oneself that (s)he can do the assignment, and the present-time one, functioning in this way as a reassurance for and proof of the survival and resilience of the individual despite being faced with potentially stressful experiences. If it is not merely an outer form of intrapersonal communication [21], it can be a form of

communication with a different receiver as well. The message to remember doing something may address another individual than the writer of the post-it, in which the element of the ludic acquires new playful aspects. On the one hand, the action of leaving a message like this connotes a previously-established and existing collaboration, partnership and intimacy or mutual reliability between the sender and the receiver, thus representing and indicating (the existence of) the relationship itself, being reassuring from this point of view as well. It metonymically is the relationship, i.e. proof of not being alone in the world. Furthermore, the post-it usually includes humorous elements and elements of surprise, such as emoticons, funny lines etc. The fact that it is frequently placed on the fridge does not only have something to do with visibility. The refrigerator is the space where food supplies are kept, and therefore connotes not only the assurance of survival, the satisfaction of a basic need, the pleasure of palatability, or the togetherness involved in preparing meals with someone else, but also the domestic sphere and *shelter* from anything that has the potential of bringing about anxiety. By associating a “to-do” item, i.e. a potentially worrying element, with the sphere that connotes physical and psychological shelter, i.e. one’s home, the potency of the disquieting aspect is reduced, and gets contained and associated with a space of individual empowerment, being given a more “digestible” or “palatable” form, which is the sender’s choice, and within his/her control – namely, the post-it. The post-it becomes an object connoting playfulness, fun, reassurance (in a number of ways), and a communication enhancer.

While playing Sudoku on paper, the person uses, besides the paper magazine, a pencil and an eraser, in case they recalculate, change their mind and need to make corrections. The tactile and dynamic experience is more complex and superior to just making these adjustments by tapping a screen and buttons. The same happens while printing information on paper and while reading a book, the pages of which need to be turned, and the feel of which while holding is always specific to the format of that respective book, not to mention the smell or color, or cover and page textures which diversify the experience in comparison with the use of a tablet for it. As far as reading is concerned, the experience on paper has been demonstrated to yield better reading comprehension and retention, as the “fixity” of the text supports the quicker and more thorough mental reconstruction of information by resort to the spatial representation of details and immediate access to the entire text, not to mention the help provided by the “*visual ergonomics*” [22].

We need to see, however, if there is any other aspect (besides the ones that we have already mentioned) that makes the use of a variety of objects instead of just one – the tablet – a superior experience in all the cases above. In other words, what else is there to be gained by performing those activities traditionally? If we think about the materials that the person has contact with while handling the old-fashioned objects (the magazine, pencils, books), these come down to (mostly): paper (of a variety of textures, forms and colors), wood, rubber, graphite and clay (for the pencil lead). Out of these, the prominence is held by paper and, ultimately, wood. These materials are all natural – in opposition to, and in comparison with plastic or metal, out of which the tablet is made. Hence, we could say that, by being natural, the materials used for the outdated objects, along with the objects themselves evoke the notion of vintage, as well as those of authenticity and originality. These three concepts go together, as they all point to one another, also having as connotation the idea of something being old and, because of that,

more valuable, as time and endurance in time add value. Baudrillard has pointed out this relation, between antiques and the various features that we have just mentioned, in a more complex argumentation in *The System of Objects* [23]. In terms of feelings, all three notions are linked with nostalgia, and, somewhat implicitly, loss – so, presence and absence of something valued and dear. By entailing the classical, vintage also brings along the connotation of refinement. All these aspects are positive and deemed as sending to “plus value”, which the potential consumer may be interested in getting associated with, in building his/her image of self or in representing oneself to others. By possessing (and using) objects with authenticity, originality, refinement and value inherent in them, the consumer acquires these features himself/herself, as a transferable halo. We can say that these are some of the buttons that also get pushed in the viewer of the “Emma!...” commercial.

4. PARALANGUAGE AND NON-VERBAL CONSIDERATIONS

In this section we will focus on two aspects. Firstly, we will have a look at the paralanguage used by the husband in his six pronunciations of his wife’s name, analyzing the meanings behind them, i.e. providing an actual sentence or phrase that the name essentially substitutes in the respective contexts. Thus, we will have a set of unpronounced – but conveyed and intended – utterances. Secondly, we will also analyze the non-verbal communication of the couple, which reveals their attitudes, thoughts and communication.

A definition of paralanguage would be the manner in which the message is transmitted, i.e. the momentary characteristics of one’s voice, including its speed, tone, pitch, volume, the use of breaks, interjections etc. [24]. The first time the man calls her name the intonation is descending, and the word is prolonged, which suggest disappointment and perhaps a bit of sadness, also implied by his serious face and a tilt of the head that points to him being reproachful. After he takes the paper away from the child, he shows them the tablet and, while drawing with his finger on it, he supports this activity with a smile and a movement of the hand laterally, palm upwards, as if saying: “See how easy it is?”. His overall attitude is one of didacticism, as he is in a teaching mode. His tone sends to a self-imposed patience, the type that a teacher would have with pupils (perhaps even pupils who are not the quickest in grasping the notions that they are being taught), or that a parent would adopt upon having to do with stubborn children. The tone and the gestures also make us think that it is definitely not the first time that the couple have approached the subject of using a tablet more in their activities, as a certain controlled restlessness detaches itself from the man’s overall attitude.

In the second sequence, as he makes for the fridge, the tone on which he articulates his wife’s name is changed: it is deeper, harsher, the pronunciation is shorter, which show annoyance and coldness. His mimicry sends the same signals, as he turns his head to us (to the right, for him), looking at his wife askance and critically, his lips pursed in irritation. His hand initially points to the fridge, palm up and fingers stretched, as if saying “What’s this?!”, then points with one finger to the tablet that he raises with the other hand, a gesture also accompanied, to give it more force, by a nod of the head while additionally raising the eyebrows, the message clearly being: “This is what you need, ok?!?”.

In the third interaction, when he slips the tablet with a Sudoku game under Emma's nose while she is seated on the couch, his tone is more musical, as if he sings her name instead of merely uttering it, also clearly marking a break between the two syllables, the "e" being longer and more stressed, while the final "a" is exaggeratedly prolonged in an ascending intonation. This manner of saying Emma's name is playful, but at the same time the border between this playfulness and mockery is blurred, the overall perception of the pronunciation being that he is ridiculing her a little (or, rather, a little more).

When he enters the room where she is seated at the computer, a page is just coming out of the printer, and, as he is witnessing this, he calls her name on a clearly disappointed tone, again tilting his head, frowning a bit, his lips parted as if saying "Not again?!?". His facial expression has no element of aggressiveness this time, being the least imposing from all hypostases. It is the one time when he is completely non-belligerent and unprovocative, just sad, not seeming to understand why she keeps insisting on using paper. The last scene of them together shows the couple reading in bed, using – Emma, a book and him, the tablet. As she turns the page, the husband looks at Emma's gesture, but not at her – which shows that he has given up trying to communicate with her and determine her to change her ways. While he is looking, he has a superior smile on his face, conveying the "It can't be helped" message, while his tone seems to be saying "She's something else!".

While in the restroom on the toilet stool, as he realizes that he is out of hygienic paper, the ascending intonation on which he calls out to his wife, rather shortly, and with the final "a" stretched out on two notes, the second higher than the first, shows uncomfortableness, the desire to hurry and quickly resolve the situation that he is being faced with, and a little panic and distress. The pairing sentence could be "Come quickly, please!", but said on a tone that is rather authoritative than suppliant or pleading. It is as if he expects her to immediately solve the problem for him. We also notice less embarrassment than we might presume natural, or one that is masked by urgency and practicality or matter-of-factness.

It is worth considering now Emma's non-verbal messages, taking into account her facial expressions and body movements, as these speak volumes. Despite the fact that she does not make a sound throughout the whole commercial, we can talk about a clear progression of her feelings and clear-cut attitudes coming out of the woman's obvious acting skills and expressivity. At the drawing table, at the beginning, she looks up at her husband in surprise, and this is more or less everything that she communicates at this point. During the fridge scene, when he is much more abrasive, she looks at him with squinty eyes, obviously upset by his attitude, then down, blinking a few times rapidly, which points to an indecisiveness whether to address him or not, and we see her decide to let the matter slide – this time. As he shows his wife the tablet Sudoku, we only see the upper half of her face, as the rest is covered by the device, and the signals that we can interpret come solely from her eyes, which is, nevertheless enough, as we see her lowering her eyelids in a meaningful way which points to the fact that her patience may be coming to an end, and that she is trying to refrain herself from bursting out in anger. This contained anger is nevertheless more visible in the printer scene, when she ostentatiously takes the sheet of paper out of the machine, pulling it instead of just lifting it, while she is fixing her husband with her eyes, as if in a warning to let her be, as she is ready for confrontation and will not back away from it this time if he does not leave her alone. In the bedroom scene, her mimicry tells us that she has reached a point where she takes responsibility for

the fact that she is intentionally not using the tablet (nor will she in the future), and that she is now not afraid to admit to it openly. If we have a look at the progress of her affect, we realize that she has passed from a hesitant attitude to owning her choices, in the end becoming combative and mocking, like her husband has been towards her. The potpourri of her emotions has included surprise, a bit of embarrassment, hurt, tentativeness, irritation, anger, arrogance, and mockery.

If we resort to theory on non-verbal communication, and to the functions of this silent communication stipulated by theoreticians such as Hybels, Weaver and DeVito, we could say that, in the case of the male character, it mainly *emphasizes* and *completes* his paralanguage messages, whereas, in Emma's case, it *substitutes* or *replaces* the verbal communication that is non-existent with her [25]. Regarding the substitution that we are referring to in the case of the female character, we notice that the silent cues are more than enough to compensate for the absence of the verbal elements and to convey a clear message, demonstrating and justifying once more the high percentage and prominence taken by the non-verbal in the act of communication in Albert Mehrabian's equation – 93% [26]. The husband uses primarily “illustrators”, which emphasize his paralanguage, and “regulators”, which involve the whole body and send more complex messages [27], whereas with Emma facial expressions (especially eye language) are important.

5. ADVANCING STEREOTYPES

In the first part of the commercial, what we appear to be offered as the topic of the video – the necessity and advantages of befriending technology – plays upon certain stereotypical polarities embodied by the two characters. Referring to representations of otherness, or “social representations”, Georgiu differentiates between “prejudices, stereotypes, clichés and simplified categorizations” (my translations) [28]. The features that we are about to discuss in connection with the two characters in the commercial can be considered to represent, simultaneously, prejudices – i.e. evaluations made previous to the “communication experience” [29] – clichés or commonplaces, and stereotypes. Firstly, starting from the assumption that the rationale of technological advancement is, besides making life easier, mainly to improve communication, the man could be considered to embody the epitome of the technology-synchronized individual, enjoying thus all the communication opportunities one can think of in modern age and which derive from this *technological literacy*. He opposes the technologically illiterate (or insufficiently literate) person, one who suffers from the lack thereof. The second stereotype derives from the characters' genders, which are, of course, far from being accidental in what regards the categories that they are made to represent. Emma's husband mirrors the stereotype of the rational, *active*, *inventive*, *future-oriented* man, opposed to his wife's stereotype, i.e. the sentimental, passive, nostalgic woman. In connection with this second, old-as-time stereotype, we can add at least two other, related ones, whose most prominent component for achieving difference is still gender opposition. Hence, thirdly, we have the stereotypical pair of the technologically *adroit man, who is good with his hands*, versus the technologically inconvenienced or challenged, clumsy woman. Last but not least, unfortunately, we have the underlying assumption (also functioning as yet another stereotypical content) of the *intelligent*, smart man (almost as smart as the smart device that he is successfully handling) versus the less intelligent woman. If, initially, sense and

sensibility seem to pertain to the man, and lack of depth, and emotionality, to the woman, the end of the ad circumvents all these stereotypes.

The second part of the video reveals Emma as a subtle, playful, ironic (even sarcastic) and now technologically adapted and integrated individual, who proves to her husband that she has finally taken in his pestering advice, and “weaponized” it (metaphorically speaking) against him. This turn against the husband using his own assumptions and world view does not only prove her adaptability and cleverness, but also helps her make a few valuable points of her own.

She shows, for one, that respect for communication is not proven in abstract, in the absence of a real exchange, merely by being preoccupied with the means to promote it while in fact forgetting about the message itself and how to be inside, or *be actively involved* in the act and the encoding and decoding that it presupposes, minding the context, striving to be accurate, balancing elements to negotiate meanings etc. In the husband’s case, the “how” of communication takes precedence over the “what” of it, in the proverbial battle between form and essence, and illustrating the equally proverbial danger of the (preoccupation with the) former taking precedence over the latter.

Taking this idea into account, in the ad there is a play upon who is really open to and good at communication and who is not. Our bet is initially the husband, as the quality of being a good communicator gets associated with an interest in cutting-edge gadgets, because nowadays the spree for technological advancement is motivated in discourse with a desire to enhance communication worldwide, sometimes even abusively so, rather than recognizing that it is merely offered as a pretext to mask, for instance, financial interests (especially beyond a certain limit, where communication at its best is already ensured anyway). Consequently, the husband is presented as the one in tune with change and wanting to open his wife’s eyes on the world out there, of infinite possibilities when it comes to communicating, while her passivity and disinterest in the tablet can be mistaken for a disinterest in communication, and falsely be considered to point to poor communication skills. Manipulation here consists, therefore, in superposing or overlapping two interpretations, and abusively suggesting that one entails the other: being avoidant of gadgets, unwilling to use them, or/and incompetent in this respect is equated with want of skill in communication, or being reluctant to communicate. The overlap of the attributes mentioned above is an intention to present an inductive argument as a deductive one, i.e. to suggest that Emma’s incompetence when it comes to communication is a certainty because she refuses to use a tablet, instead of a mere probability/possibility. An inductive argument shows that a conclusion is likely, but not definite: “Inductive logic investigates the process of drawing *probable* (likely, plausible) *though fallible* conclusions from premises.” [30], as opposed to deductive arguments, in which the conclusion is a logical necessity [31].

The outcome of the situation described in the video, however, teaches the husband a lesson. One of the meanings contained in this lesson is the importance of context in communication. The most significant aspect added and highlighted by the theories of communication that have followed, chronologically, to the Shannon and Weaver linear or mathematical model, has been circularity, or feedback, or minding the variables of the context [32]. Onwards, the further development brought by the cybernetic model, structuralism, interpretative sociologies etc. relied heavily on this awareness during the

act [33]. The husband does not mind the elements that create a context in all the situations in which Emma appears: drawing with the child, the recreational activities that involve various objects, the use of post-its etc. By not minding the context, the husband limits (or would limit, if permitted) the experiences in question. Although the alignment with the modern requirement of being a competent user of technology seems to recommend the man as the best communicator in theory, he is found lacking in practice.

Emma appears to be a versatile semiotician, instead of an ignorant (which is the picture that her husband is painting her in), since she plays with the components of the sign, as announced by Saussure and then developed by others further. When she brings her husband the tablet with the image of toilet paper instead of the actual object, she in fact shows him how significant the difference between the signifier, or “sound-image”, the signified, or “concept”, and thirdly, the referent or item, or “thing”, can be [34]. Instead of extending the physical reality required for, she gives him an image of it as a substitute, in order to demonstrate to him why image and palpable object are not always interchangeable – a notion which he failed to grasp otherwise. She finds a context and a way to transmit this idea to her husband, being an educator in her turn, but a much more effective one than him.

The ending may be interpreted, first and foremost, as a critique of excessive use (and thus, perhaps, abuse) of technology in general. It begs the question if this modern technologization does not come with its downsides. One of these may be that the loss of face-to-face encounters, when mediated ones are possible through the intermediary of a screen, causes people to lose depth and subtlety while communicating, and brings about a reduced capacity to pick up hints and interpret details from the context. This ability may be impaired by the impersonality of long-distance exchanges.

On a personal note, Emma’s reproach to her husband is his insensitivity to her individuality, needs and preferences, accompanied, obviously, even by a hint of superiority. If this superiority or arrogance is not misogyny from his part, it is definitely an embodiment of the Parent state in Eric Berne’s transactional analysis, i.e. a state that takes into account the parental mode and principles that the person has been exposed or used to, whose mannerisms the person has internalized, and which binds one to try and impose these on someone else as a persecutor and/or become (over)protective [35]. What is disturbing about the husband’s behavior is that he triggers a transactional stimulus of the Parent-Child type, presuming to teach his wife as if she were an ignorant kid, instead of the Adult-Adult, from equal groundings, as he should, in relation with her [36]. Since the wife probably naturally expects to be approached as an adult, she is offended by the patronizing tone, and this incongruence bars communication. As a countermeasure to this last manifest feature of her husband’s, the finale allows Emma to take her revenge for having been placed in the child state and role, instead of treated as an adult whose choices are respected and valued. In order to reestablish communication, though, one of them needs to change his or her state, in order to match the partner’s, so as to obtain a complementary transactional response [37]. Therefore, from within the child role, Emma interpellates her husband, fully assuming the part of a rebel child, prone to playing practical jokes and pranks, and slips the tablet to him instead of hygienic paper. Her revenge is more effective while acting from within the role system that he has set up for them, rather than protesting against it, because she shows him that she can beat him at his

own game, and because she has the element of surprise on her part, while rebelling would have been a predictable reaction.

The way her complex response and witticism is condensed in a synthetic, one-gesture, silent feedback makes it all the more effective and hilarious. If we take into account their gender and the stereotypical presumption of male rational superiority, her act can be a statement against this gender bias. We may therefore read it in a feminist key as well, among others. In her gesture, Emma transmits to her husband, without words, all the above-mentioned aspects, which makes her an excellent and intelligent communicator.

6. CONCLUSIONS

We may consider “Emma!...” or “Paper has a great future” a successful ad, both in terms of being an effective marketing tool, for all the reasons we have seen above, and from the perspective of the pleasurableness derived by the potential consumer in watching it, as it is humorous, entertaining and, I dare say, detaches itself by being satisfyingly intelligent.

The paper was particularly interested in the psychology of the ad. It has thoroughly analyzed how the triggering of affective responses, consisting in both positive and negative emotions, increases attention, flexibility and memory of the product, ultimately leading to purchase and therefore constituting an efficient marketing tool. We have also tracked the ways in which manipulation is in place as well, as the commercial resorts to a buzz topic present in the mind of every global citizen of the modern times, in order to draw attention, then to an emotional rollercoaster, and, finally, to the bafflement of the viewer’s expectations through the recontextualization of the notion of paper by taking it to a new area of its conceptual field using humor (the presence of which is itself strategic). It was extremely interesting to follow the actual psychological dynamic of the viewer in order to see the reasons why (s)he rallies with the female character. Also, the paralanguage considerations, along with the non-verbal clues given by both characters have shown how these can speak more and louder than words. In the end, we started from the stereotypes proposed by the commercial initially, and studied how these are challenged and even reversed, making room for more subtle approaches.

We should not overlook, especially in conjunction with this revisit of biased perceptions, the didactic stance of the advertisement. Its value is all the greater as this layer is not obvious or ostensible, but subtle and delicately hinted at, which makes it more effective and well received. We are taught that stereotypical thinking is not/should not be part of this century, that context is of paramount importance, that gadget literacy makes neither the best communication, nor the most versatile communicator, and that apparently-obsolete objects have their own worth. The situation also warns us against falling into a sort of autism of communication, in which we become so obsessed with perfecting our skills when it comes to the means that ensure the communicative act, that we run the risk of falling short of performing the actual communication. We also learn, if we pay enough attention, that the representation of an object, or person, and the object or person themselves are not interchangeable. As a corollary, there are certain aspects that make unmediated communication and interaction with objects and people invaluable and irreplaceable. This is a truth that we need to heed in an age in which face-to-face

communication is increasingly considered as outdated, a mentality which might one day make us, as human beings, along with our presence and reactions, unfashionable as well.

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A VIEW OF ICT IN EUROPE

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ABSTRACT

ICT (Information and Communication Technology) represent the one of the most important features of a developed country. Through the characteristics that can describe the development level for a country are: the access to technology, the use of internet for shopping, the individual's skills regarding ICT and the reasons for not using technology. This research take into account the most 22 relevant indicators for 2017 regarding ICT and use data mining techniques like: principal components analysis and Gaussian mixture models for classification along with statistics techniques for identifying the normal distribution and the number of optimal clusters, in order to group European countries in several classes of ICT development. The results show that Romania is still behind the rest of European countries in embracing the modern technology and its utilities.

KEYWORDS: clustering, *ICT in Europe, GMM, PCA*

JEL CLASSIFICATION: C38, L86

1. INTRODUCTION AND LITERATURE REVIEW

The ICT (Information and Communication Technology) incidence for a country is one of the most relevant indicators for a general development level of that country. The higher the incidence of modern technology is the higher is the level of development and the quality of life. Internet and computers are made for ease the life in general and taking decisions in particular.

In 2015, Savulescu obtained similar results as in this research regarding the development of north countries for ICT usage and the low development level for south-eastern countries (for example Romania, Bulgaria, Greece). The author underlines "the efforts of the European Union in view to reduce the digital divide in Europe and create a genuine internal digital market" (Savulescu, 2015). On the other side, Kleibrink et.all (2015) analyzed 97 regions from 9 Western Europe countries, 29 of the regions "having a dedicated ICT strategy". The authors findings suggest that "having a dedicated ICT strategy has not had a clear effect on performance in terms of Internet and broadband

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access" (Kleibrink et.all, 2015). In 2018, Becker et.all used k-means to study Central European countries from ICT usage point of view. Their findings were that "Slovenia and Austria were leaders in Central Europe in 2017, and the worst-performing country was Poland, preceded by Hungary" (Becker, et.all, 2018).

The second section presents the methodologies used for having an overview of European countries from ICT point of view, the third section shows the dataset used and results, while the last section is about conclusions, discussions and further research.

2. THE METHODOLOGIES

The principal components analysis (PCA) is one of the most used techniques for reducing the dimension of a dataset. The big amount of data is stored in many variables that are essential for describing and modeling an issue, like the development of ICT in Europe. Also, the correlations between variables that represent the same fact have a big influence for the outcome of a model. PCA reduces the number of variables by creating new variables using a maximization problem. These new variables (PC) are not correlated, so the redundant information is reduced significantly, these take about 80%-90% of information from initial variables and their number is significantly reduced compared with the number of variables.

The new variables (PC) were tested for normality. Shapiro-Wilk test of normality have the null hypothesis that the selected sample come from a population that have a normal distribution. A value for p-value lower than 0.05 (the chosen alpha value), the null hypothesis is rejected and the distribution is considered not-normal. Another way to test from the visual point of view, that a variable have normal distribution is to generate a normal distributed sample with mean and standard deviation equal with the tested sample and represent graphically the probability density function.

Unless the number of classes is not imposed by the analyzed problem, there are several methods to decide what is the optimal and the right number of the classes. That assures the high variability between classes and low variability within each class:

- The elbow method suppose calculating and plotting the within total sum of squares for a number of clusters from 1 to 10 (for example), using the k-means algorithm. The optimal number of clusters is represented in the graph by an "elbow".
- The average silhouette method is similar to elbow method, only that the average silhouette is computing and plotted. The k number of clusters is selected to the highest value of the average silhouette width. This technique also "measures the quality of a clustering"¹.
- The function NbClust in R, that "provides 30 indices for determining the number of clusters and proposes to user the best clustering scheme from the different results obtained by varying all combinations of number of clusters, distance measures, and clustering methods"².

¹ https://uc-r.github.io/kmeans_clustering#elbow

² <https://www.r-bloggers.com/finding-optimal-number-of-clusters/>

The GMM (Gaussian Mixture Models) technique for clustering is a probabilistic model that supposes that a population distribution is composed by K normally distributed subpopulations. For each subpopulation, a mean and a variance are computed. For multivariate case the covariance is calculated instead the variance. Each subpopulation has a weight in total population (sum of weights is one) that is learned with other parameters, using expectation maximization technique.

3. DATASET AND RESULTS

The dataset has 22 variables that mainly refer to population that use or have computer or internet. Eurostat is the source of data, and 2017 represent the year of interest. There are 35 countries, including Romania.

Table 1. The dataset description

Indicator code	Description: % of population who
X1	daily use a computer
X2	last use of computer <3 months
X3	use of computer >1 year
X4	never used a computer
X5	ever used a computer
X6	have access to a computer
X7	use mobile (smart) phone for internet
X8	have access to internet
X9	use internet via broadband
X10	use internet via fixed broadband
X11	bought online <3 months
X12	bought online <1 year
X13	bought goods or services online >1 year or never
X14	bought online shares, bonds or funds
X15	took a credit online
X16	don't buy online (<1 year) because prefer to go shopping
X17	don't have the skills to buy online (<1 year)
X18	don't have a payment card to shop online (<1 year)
X19	don't have internet because of costs
X20	don't have internet because of lack of knowledge
X21	are not interested (no need) of internet use
X22	don't have internet because of equipment costs

The table from above represents the variables considered. There are 22 quantitative variables that are measured in percent of individuals and describe the incidence of ITC in European countries from the point of view of equipment with technology, use of internet for different purpose or reasons for not using internet.

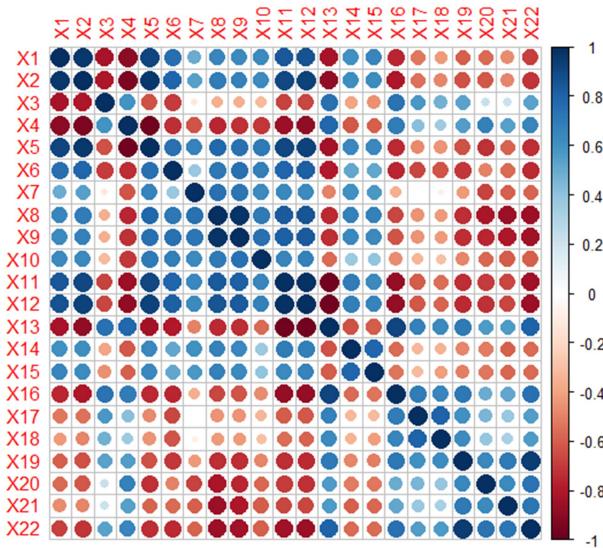


Figure 1. The correlation matrix of variables

Some strong connections between variables are presented in the correlation matrix from above. The bigger and intense the dot is, the stronger is the correlation between the variables, while the color represent the signification of connection. For example the color red is for negative correlation, while blue is for positive correlation. The strong connections between variables represent some redundant information contained by variables, parts of information that is common to two or more variables. This is the reason for applying variables reduction techniques, like factor analysis (FA) or principal components analysis (PCA).

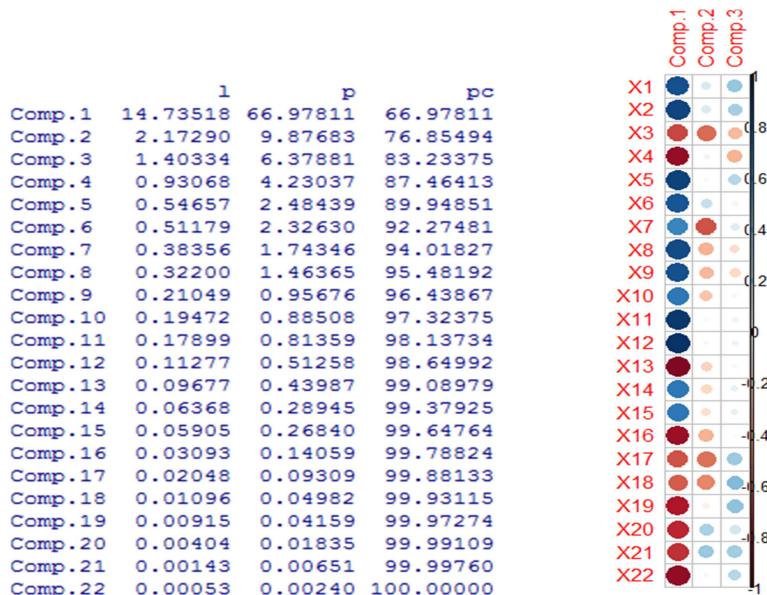


Figure 2. The Principal Components Analysis (PCA) results

Principal components analysis (PCA) results are presented in the figure 2. According to Kaiser criteria applied for standardized data 3 components should be considered in further analyses. These components have the variance higher than unit - 1 column from above. These synthesize 83% of total information, the pc column from above, from all 22 variables. The correlation matrix from the right side of the image from above is the factor matrix, which shows the connections between PC and initial variables. From this point of view, the first PC (W_1) is highly correlated with most of the variables and is positively correlated with variables that represent the use/access to computer/internet and negatively correlated with variables that show the "indifference" to technology and could be named the incidence and interest in ICT. The second PC (W_2) is highly negatively correlated with X_3 and X_7 and shows the use of computer more than a year ago and the use of mobile internet, while W_3 represent the lack of skills of individuals to buy online and the lack of a payment card for online shopping.

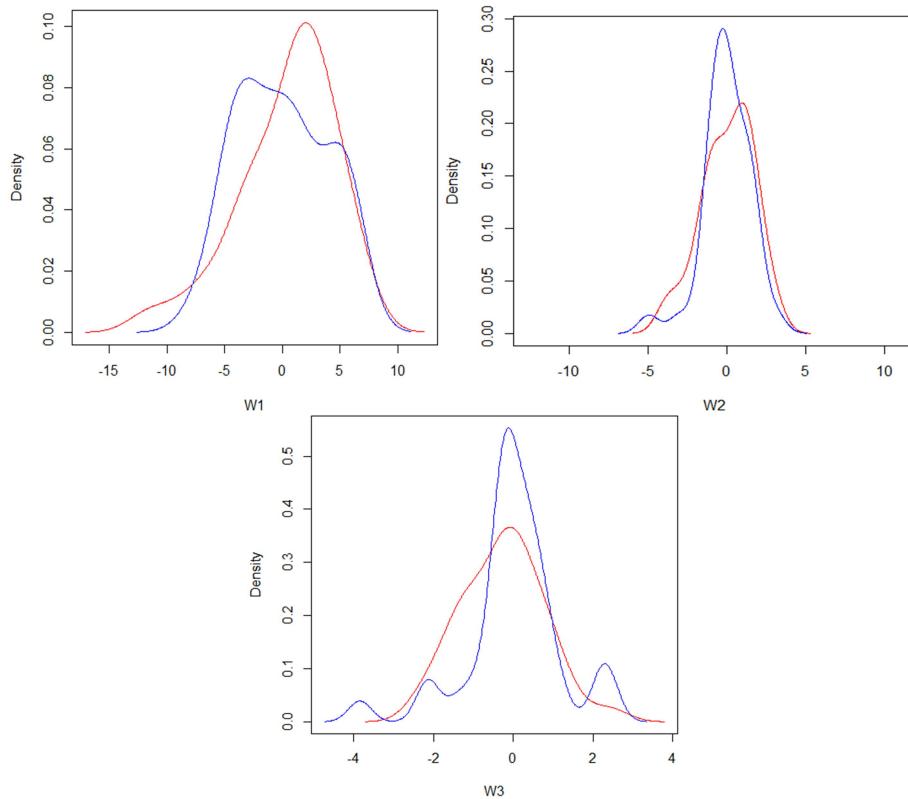


Figure 3. The PC's PDF

The figure from above show the comparison between normal distribution PDF and each of three PC retained for further analysis. For each component it was generated a normal distribution with the same mean and standard deviation ($n=35$) and PDF was plotted for both component (blue line) and generated data (red line) in order to compare the shape of PDF graph. First two PC have similar PDF graph with normal distribution while the third is not normal. Each component is a linear combination of initial variables, variables that are generally not normal.

```

> st1=shapiro.test(c[,1:1])           > st2=shapiro.test(c[,2:2])
> st1                                > st2
                                         Shapiro-Wilk normality test
                                         data: c[, 1:1]
W = 0.94142, p-value = 0.06184          data: c[, 2:2]
                                         W = 0.93666 -> value = 0.04431
                                         > st3
                                         > st3
                                         Shapiro-Wilk normality test
                                         data: c[, 3:3]
W = 0.91413, p-value = 0.009697

```

Figure 4. The Shapiro-Wilk test for PCs

The Shapiro-Wilk test (figure 4) shows the results similar to PDF graphs from above. The first test corresponding to the first PC has a p-value higher than 0.05 and show the acceptance of null hypothesis that states that the variable is normally distributed. The second test's p-value is not far from 0.05, but show the rejection of null hypothesis, and the non-normality, while the last test's p-value is obviously lower than 0.05.

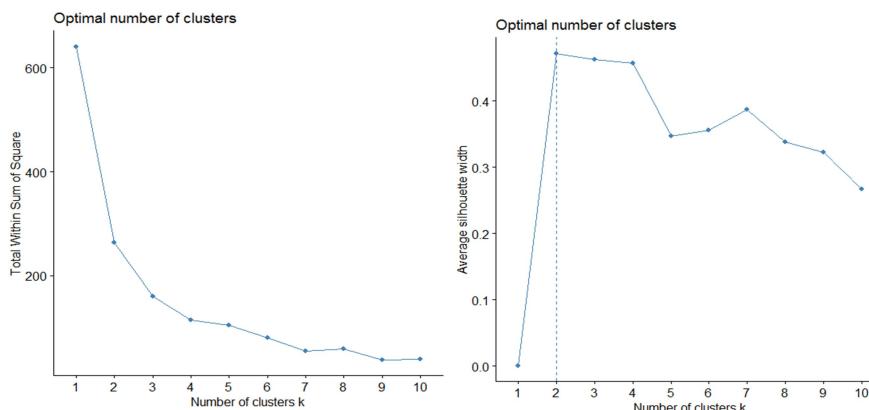


Figure 5. Elbow and Silhouette methods for number of clusters

For the optimal number of classes, the elbow method from above, represented in the first graph, show that three or four clusters should be taken in consideration. From a higher than 4 number of classes, the ratio between the between sum of squares and total sum of squares "tends to change slowly and remain less changing as compared to other k's"¹. On the other side, the Silhouette method shows that for two classes, the average silhouette values is maxim.

¹ <https://www.r-bloggers.com/finding-optimal-number-of-clusters/>

```
*****
* Among all indices:
* 9 proposed 2 as the best number of clusters
* 12 proposed 3 as the best number of clusters
* 2 proposed 5 as the best number of clusters
```

***** Conclusion *****

* According to the majority rule, the best number of clusters is 3

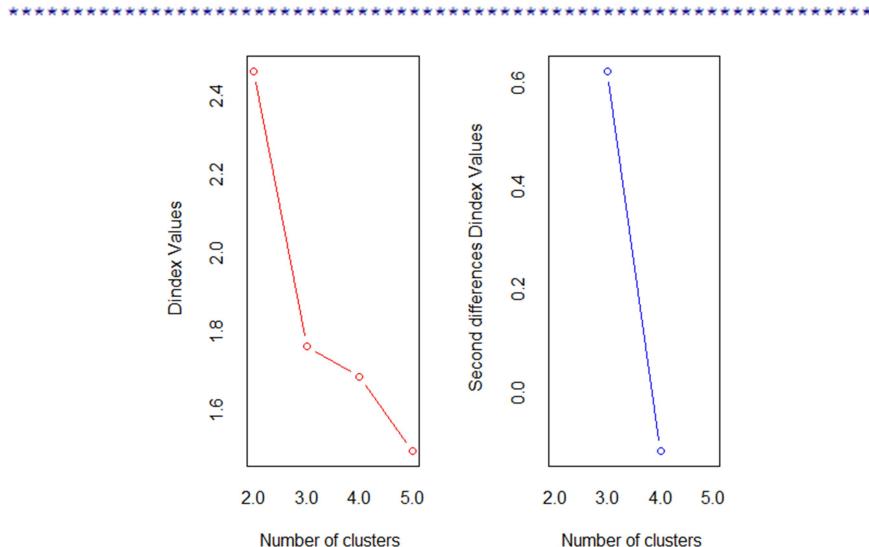


Figure 6. Criteria for optimal number of clusters

The results provided by NbClust package (figure 6) show that three is the optimal number of clusters. There were 12 proposals for 3 as the best number of clusters, so the conclusion according to the majority rule is 3. From this point of view, in clustering algorithm from below, 3 clusters will be considered.

```
$centroids
      [,1]      [,2]      [,3]
[1,]  5.2417644 -0.5838452  0.1996014
[2,]  0.7359372  0.6921286 -0.2897132
[3,] -3.7976108 -0.1834192  0.1042975

$covariance_matrices
      [,1]      [,2]      [,3]
[1,]  0.5067563  0.2061801  0.1618604
[2,]  1.2740371  0.8831907  0.2188617
[3,]  2.2933996  3.7734135  2.9930092

$weights
[1] 0.2562706 0.3266945 0.4170350
```

Figure 7. The GMM results

The figure from above show the centroids, the covariance matrices and the weights for each of the three classes selected. Taking into account the significance for each PC, given by the factor matrix and the fact that the centroids represent a virtual observation that could be described as the average value for components, each class has a different signification. The first class has the biggest average value for W_1 and W_3 and the lowest value for W_2 . The countries that belong to this class have a high percent of individuals that have/use computer/internet, including for online purchasing. Also, in these countries, the individuals use the internet on mobile or smart phones, have the skills to buy online and also have an online payment card. The third class has countries where individuals are reserved in using technology and consider that the costs for equipment or for internet are too high. Also, the lack of skills prevents individuals to use internet and many individuals do not have a payment card for online transactions or do not have the skills to buy online. The class 2 represents the middle class and it contains countries that are developing from ICT point of view.

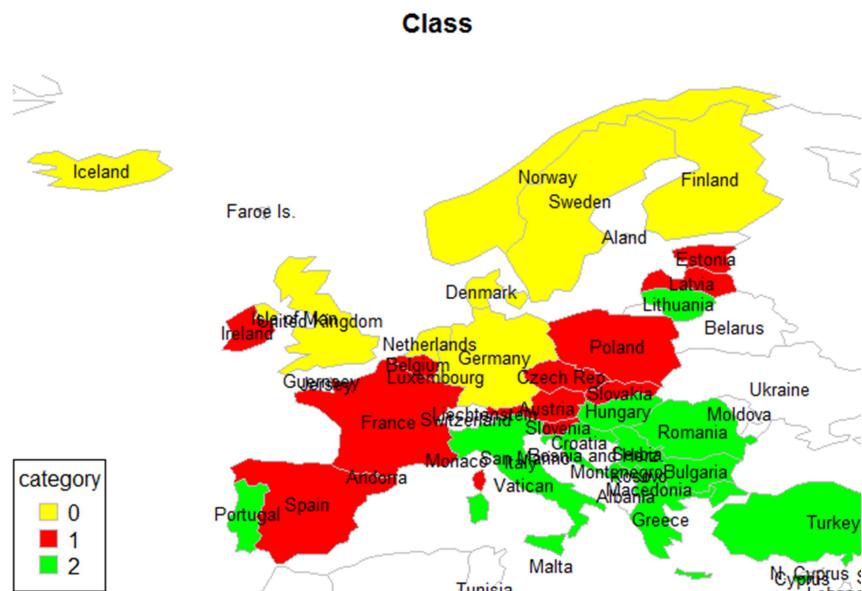


Figure 8. Europe's map with 3 classes

The most relevant representation for classes is the Europe's map from the above figure. Category 0 correspond to class 1 from above, 1 is for the middle class, and 2 is for the third class. The results show a stratification of European countries, so that countries like Romania, Bulgaria, Greece, Italy, Turkey or Portugal have the lowest development rate for ICT usage point of view. On the other side, the most developed countries are the countries from north Europe, like Norway, Sweden, Finland, Iceland, UK or Germany.

4. CONCLUSIONS AND DISCUSSIONS

The unsupervised learning technique used for clustering 35 European countries into three groups of ICT development show that Romania and other south countries are behind other countries regarding the modern technology usage, equipment, skills or even interest. Even

if the efforts for modern technology usage are continuously made, it could pass years and, why not, generations before the full acceptance of a new lifestyle that includes technology. Some similar studies or analyses that show the evolution in time of ICT usage could be made to show the progress of each country.

As further research, other techniques could be applied to predict the evolution of European countries regarding the ICT usage and development. Also, correlations between economic growth and ICT usage can be made, with the assumption that a big economic growth is based on high percentage of ICT usage in providing services.

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ENTREPRENEURIAL GAME SIMULATION E-PLATFORM FOR SUPBIOENT ERASMUS PLUS PROJECT

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ABSTRACT

Business Models are often sustained by computerized software applications that are a great tool needed to organize complex economic business data. An entrepreneurial Game Simulation E-Platform is the Intellectual Output for the O5 Activity of the SupBioEnt Erasmus Plus Project. This article describes the need, opportunity and structure of the e-platform that will be used in teaching students that study in Universities with Biotech profile. The E-Platform stands as a tool for students in learning how to become entrepreneurs in Biotech to begin an economic-social Start-Up company.

KEYWORDS: *E-platform, business model, biotech, Erasmus Plus, Start-Up*

1. INTRODUCTION

The e-platform that has to be designed and used by the Biotech students is part of the SupBioEnt project supported by the Erasmus+ Strategic Partnerships project 2017-1-RO01-KA203-037304 which has as general objective to decrease the unemployment of European higher education graduates by increasing the level of successful Biotechnology graduates following an entrepreneurial pathway. The project target is for short and medium/long terms metrics affecting Biotech and Economics higher education, Biotech business and other Biotech stakeholders, partner organizations, policy makers and general public.

Computerized Information Technology is needed nowadays to accompany every social and economic activity. The use of IT offers tremendous support in conducting processes of data analysis and data management. Well organized data and optimized automated data processing is a basic need and demand for any activity that comes in relation with other activities. By defining the relationship that is established between different levels and categories of data generates lists and reports that offers support to any decision making for the decisional apparatus of a social-economic entity.

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2. THE NEED OF AN E-PLATFORM

E-platforms are now not only an important tool but also indispensable. The main purpose of an E-platform is to store and manage all the information that a company or an individual need to handle at its activities. E-platforms can, from a technical point of view, be as application or as web-based application. Desktop application has now not so many uses anymore because they function in an off-line environment and the need of information and access to collaborative features must be done in Realtime with online connectivity to the Internet. Given this, most of the E-platforms are now using web-based technology. The designed E-Platform will be used in a summer school with students from all the projects partners. The project has 6 partners from which 4 universities providing Biotechnology education as USAMV, one university providing Economics and IT education as URA and a Biotech professional Association as NGO.

The use of Internet as main transport utility for needed data structures has brought and maximized the efficiency in information management and access. Web-based application offer a real-time access to updated versions of information through advanced data management and data mining tools.

For students and entrepreneurs who want to learn and test economic interactions activity, a protected and simulated economic environment can be used by using special designed E-Platforms that can function through the concept of gamification. In such a way an online platform for even new startups can be used to better understand economic interaction between entities and its key activities.

Such a tool gives the advantage of engaging in virtual data optimizations and a large spectrum of analysis over tasks and actions that must be taken in parallel in a real social and economic entity through a simulated E-platform environment that gathers in a game or play type interactions of many simulates competitors economic.

3. STRUCTURE AND TECHNOLOGY

Such online Platforms that simulate economic interactions need the following structure as necessary sections and functionalities:

- Database structure design must suite the data flexibility for generating complex reports
- Platform general technical sections:
 - Responsive Web Interface design adaptive for different displays
 - User management with different complex user roles
 - Forms with flexible and versatile design
 - Lists design with multiple filter possibilities
 - Designing internal forms for storing specific simulated Entrepreneurial documents to upload: Setting up the Start-up; Recruiting and hiring employees; Business Plan; Quality Assurance and Marketing; Commercial activities; Research and development; Periodic evaluation of employees; Financial reporting and accounting

- Security modules for preventing IT attacks
- Import / Export data for backup of data
- Multilingual capabilities of the platform

The needed elements of innovation expected impact and transferability potential that must be included in the E-platform are related to the active and joined interoperability among the following elements:

- Connecting start-up accounts to communicate and evaluate each other's uploaded documents
- Filtering information based on accounts roles from within
 - o one start-up
 - o or comparing documents uploaded by multiple start-ups
- Joining users from different countries to work as a team to operate a start-up



Figure 1 – E-platform Game Simulation sample

The platform must provide an interactive framework for all users involved in the simulated project on all legal and linguistic peculiarities to all procedures implemented. In this regard adopt a spiral development cycle specific to IT projects with the following steps.

After sizing the number of potential users and identify the hardware infrastructure available the platform administrator references architecture for the client / server application type having following levels. Database level, prior studies showing the use of SQL, followed by the interrogating to be achieved through web programming language interface by assuring low cost of developing the application using Open Source Tools. In the design phase the formats will be described in detail and their relationship will

influence the forming of the relational database system and tools necessary for load processing.

The Database structure has two main data types called: Simulation Business Game and Company for The Business Model Canvas.

Each of the “Simulation Business Game” have many possible “Company for The Business Model Canvas”. Each main structure has specific database fields presented in the next figures.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Title	title	Node module element		
⊕ Body	body	Long text and summary	Text area with a summary	edit delete
⊕ Date of creation	field_date_of_creation	Date	Pop-up calendar	edit delete
⊕ Company for Business Model Canvas	field_company_for_business_model	Node reference	Autocomplete text field	edit delete

Figure 2 – Structure of “Simulation Business Game”

The last field in the database has a relationship with the structure of the “Company for The Business Model Canvas” table. In this case each simulation game can have many Companies added for the simulation.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Company Name	title	Node module element		
⊕ Description	body	Long text and summary	Text area with a summary	edit delete
⊕ Date of creation	field_fill_date	Date	Pop-up calendar	edit delete
⊕ Members	field_members	Field collection	Embedded	edit delete
⊕ Key Partners	field_key_partners	Field collection	Embedded	edit delete
⊕ Key Activities	field_key_activities	Field collection	Embedded	edit delete
⊕ Key Resources	field_key_resources	Field collection	Embedded	edit delete
⊕ Value Propositions	field_value_propositions_	Field collection	Embedded	edit delete
⊕ Customer Relationships	field_customer_relationships	Field collection	Embedded	edit delete
⊕ Channels	field_channels_	Field collection	Embedded	edit delete
⊕ Customer Segments	field_customer_segments_	Field collection	Embedded	edit delete
⊕ Cost Structure	field_cost_structure	Field collection	Embedded	edit delete
⊕ Revenue Streams	field_revenue_streams	Field collection	Embedded	edit delete

Figure 3 – Structure of “Company for The Business Model Canvas”

Each of the fields listed in fig 3 can have many individual records. There are types of fields in the table structure called *Field collection*. Each of this type of fields have an independent substructure with specific fields. For each field there can be one or many records added for the main record. In this case the structure is hierarchical in which each record has one to many relationships with other sub records. Each of the sub structure is presented as follows in the next figures.

The members field type collection has referenced user type which can enter a personal curriculum vitae.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Position	field_position	Term reference	Select list	edit delete
⊕ Member Name	field_member_name	Entity Reference	Autocomplete	edit delete

Figure 4 – members field type collection

The key partners field type contains fields for description of partner companies that are in relation with the company that takes part of the simulation.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Company Name	field_company_name	Text	Text field	edit delete
⊕ Type of Key Partner	field_type_of_key_partners	Term reference	Select list	edit delete
⊕ Details	field_details_about_the_key_part	Long text	Text area (multiple rows)	edit delete
⊕ Responsible	field_responsible	Node reference	Autocomplete text field	edit delete

Figure 5 – key partners field type collection

The key activities field type hosts fields for specific activities characterized through title, description and actual dates of happening.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Title	field_title	Text	Text field	edit delete
⊕ Description	field_description	Text	Text field	edit delete
⊕ Activity Dates	field_activity_dates	Date	Pop-up calendar	edit delete

Figure 6 – key activities field type collection

The key resources field type is structured in independent subfields for the description of the main resources described in the Business Canvas Model.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ title	field_title	Text	Text field	edit delete
⊕ Type	field_type	Term reference	Autocomplete term widget (tagging)	edit delete
⊕ Quantity	field_quantity	Integer	Text field	edit delete
⊕ Price / Unit	field_price_unit	Float	Text field	edit delete

Figure 7 – key resources field type collection

In the Business Model Canvas the value propositions entry must contain the description of added value that will be delivered to the customer through a specific problem is solved.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Quantitative – price and efficiency	field_quantitative_price_and_eff	Text	Text field	edit delete
⊕ Qualitative – overall customer experience and outcome	field_qualitative_overall_custom	Text	Text field	edit delete

Figure 8 – value propositions type collection

The Customer relationships field type contains fields for the users in the platform to describe business connections that integrate with the rest of the model.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Type CR	field_type_cr	Term reference	Autocomplete term widget (tagging)	edit delete
⊕ Details	field_details	Long text	Text area (multiple rows)	edit delete

Figure 9 – customer relationships type collection

The Channels position in the Business Model Canvas describe the channels through which the customer segments are reached.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Phase	field_phase	Term reference	Select list	edit delete
⊕ Type	field_channeltype	Term reference	Select list	edit delete
⊕ Get	field_get_	Long text	Text area (multiple rows)	edit delete
⊕ Keep	field_keep	Long text	Text area (multiple rows)	edit delete
⊕ Grow	field_grow	Long text	Text area (multiple rows)	edit delete

Figure 10 – Channels type collection

The Customer Segments are described as for whom the values are created and the most important customers from mass and niche market.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Type C Segment	field_type_c_segment	Term reference	Select list	edit delete
⊕ Description CS	field_descriptions	Long text	Text area (multiple rows)	edit delete

Figure 11 – Customer segments type collection

The cost structure has the aim of determining the most expensive key resources and key activities. This structure has a type field and a descriptive field in which the simulated company members will add cost fields results like salaries, facilities and variable costs.

LABEL	MACHINE NAME	FIELD TYPE	WIDGET	OPERATIONS
⊕ Cost Structure Type	field_cost_structure_type	Term reference	Select list	edit delete
⊕ Description	field_description_cost_struct	Long text	Text area (multiple rows)	edit delete

Figure 12 – Cost structure type collection

4. FUNCTIONALITIES

Implementation of the system will consist on developing effective software product in accordance with the requirements of the detailed design resulting in functional modules of the system based on the standard Business Model Canvas. In terms of functionalities the platform includes the following modules:

- General registration required to access the private content of the application being used as identification in all activities of users on the platform managed by the system administrator;
- Module for managing of roles through which registered users can assign different permissions in the platform such as tutors, entrepreneurs in simulated enterprises, entrepreneurs and startups simulated enterprise employees. The Module for simulated enterprises and startups will support the general description of the business areas and the associative component, simulated enterprises or start-up managed system;
- The administration of specific activities undertaken by companies aiming start-up simulated and providing access to reference documents in the field, patterns of achievement the business plan and various other documents depending on the specific legislation of each partner. Management module for business recruitment and hiring consultants for simulated enterprises that will support specific activity by providing access to reference documents and templates localized for each partner regarding the evaluation of professional work experience and employment;
- Module for employees and individual projects being used for highlighting activities of each employee of a company or simulated startup by conducting technical-economic documentation in the following areas: production and services, acquisitions, sales, human resources, financial reporting and accounting and research / development;
- A Financial Reporting Module that provides support and access to key reference documents on financial reporting methods and localized examples in line with national partners. Individual assessment module is needed which will centralize the evaluation forms that can be used for each activity, specific reference documents and managing results obtained by the participants in the platform.

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Submitted by g.garaie on Fri, 04/12/2019 - 14:45

Date of creation: Friday, April 12, 2019 - 14:45

Members:

Position: Manager

Member Daniela ZIRRA

Name:

[Delete](#) [Edit](#)

Position: Manager assistant

Member Eugen Gabriel GARAIS

Name:

[Delete](#) [Edit](#)

Position: Financial Officer

Member Cristian CHEN

Name:

[Delete](#) [Edit](#)

[+ Add](#)

Key Partners:

Company Name: KoKa Kola

Type of Key Partner: Buyer-Supplier Relationships

Details: A long lasting relationship

Responsible: Cristian CHEN

Daniela ZIRRA

[Delete](#) [Edit](#)

Company Name: Lauritzen Hagebuten

Type of Key Partner: Strategic Alliances Between Competitors or Non-Competitors

Details: Strategic Marketing Alliance

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Figure 13 – Company snapshot details from the E-Platform

It emphasizes that the platform offers a centralized knowledge management in innovation and entrepreneurship containing reference documents that can be used in specific activities related to enterprise simulated and startup giving also access to located resources according to the national character and specific legislation for each of the users.

4. CONCLUSION

The innovative character of the E-Platform is emphasized through central management of system resources knowledge management providing a fully rating system for individual activity and task of a simulated enterprises and startup with possibility of interaction between entrepreneurs and tutors and providing selective access to documents depending by activity and country in which it operates.

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