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OPTIMIZATION OF APPLICATION OBJECTS USED IN THE ECONOMIC ENVIRONMENTS

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Abstract: *The paper presents the Optimization of application objects used in the economic environments. The dynamic character of the economic system necessarily determines a dynamic character of the economic information system. Initially, variations in the behavior of the economic system may be disruptive to the information system, but due to its existence as a cyber system, the information system can adapt and function in full accordance with the economic system. A part of the phases of the informational process (for example the collection of data from the primary evidence) is performed within the operational (managed) subsystem of the economic system. It can be appreciated that the subsystem in which the information process takes place together with a part of the operational subsystem forms the managed subsystem of the cybernetic information system. The character of the cyber system is strengthened by the fact that the economic information system has its own objectives, methods, techniques and resources. At the level of the economic information system, at least two interdependent subsystems can be identified, which ensure the stability of the entire system: the managerial information subsystem and the operational information subsystem. There are many types of data in the economical environment such as simple chained lists that offer a lot of flexibility in storing data. Using these types of data permits the optimization of economical flows designed for economical applications that are implemented in organizations that invests in flexible and scalable information systems.*

Keywords: *economic system, simple chained lists, economical data, information processes, business flows, application modules, analysis of data*

JEL Classification: C23, C26, C38, C55, C81, C87

1. Introduction

An organization must maintain appropriate relationships with other economic, political, and social systems in its environment. The systems group includes several factors such as customers, suppliers, competitors, shareholders, trade unions, financial institutions, government agencies and communities, each with its own objectives relative to the organization concerned. Information systems are those that facilitate the interaction between the organization seen as a system and each of the factors listed.

On the other hand, considering the definition of a cybernetic system (characterized by the existence of at least two subsystems between which there is self-regulation by reverse connection) and analyzing this for the economic information system we can see that it has a cybernetic character. Seen as a system, any organization comprises six interdependent system components: Input - economic resources such as human, financial, material, machinery, land, facilities, energy and information, which are taken from its environment and used in system activities.

Transformation function - organizational processes such as research, development, production, marketing, sales, which transform input into output.

Output - the results of the transformation function, which consist of products and services, payments of employees and suppliers, dividends, contributions, taxes and information to the external system (environment).

Feedback - is the defining element of a cybernetic system, which provides the function of self-regulation, when the output does not correspond to the objectives set (Z) within the system represented by the economic organization (Sandner and Vukics, 2020; Orszag, 2020).

Control - management is the control component of an organizational system, which aims at the functions of the enterprise so that the performance of the system reaches the organizational objectives (such as profitability, market share or social responsibility).

Environment - any economic organization is an open, adaptable system that shares input and output elements with other systems in its environment (Sanderson, 2019; Steeb and Solms, 2021).

2. The simple chained lists used to store and model data in applications

Simply chained lists are homogeneous dynamic data structures. Unlike massive ones, lists are not allocated as homogeneous blocks of memory, but as separate elements of memory. Each node of the list contains, apart from the useful information, the address of the next element. This organization allows only sequential access to list items.

To access the list you must know the address of the first element (called the head of the list); the following items are accessed by scrolling through the list (Reddy, 2020; Grant, 2021).

List structure - In order to ensure a greater degree of generality to the list, an alias was created for the useful data (in our case an integer):

```
// Data associated with a
// item in a list
typedef int Date
```

If you want to store another type of data, you only need to change the declaration of the alias Data.

A self-referenced structure is used to store the list. This structure will take the form of:

```
// The structure of an element
// from a simply chained list
struct Element
{
    // the actual data stored
    Value data;
    // link to the next node
    Next item *;
};
```

If the element is the last in the list, the next pointer will have the value NULL.

The declaration of the list is made in the form:

```
// declare life list
Element * cap = NULL;
```

List operations - The main operations with lists are:

Browse and display the list

The list is traversed starting from the pointer to the first element and advancing using the pointers in the structure to the end of the list (pointer NULL).

```
// Scroll and display the simple list
void Display (Item * cap)
{
    // as long as we have elements
    // in the list
    while (cap! = NULL)
    {
        // displays the current item
        cout << cap-> value << endl;
```

```
    // advance to the next item
    cap = cap-> next;
}
}
```

Insert item - Inserting an item can be done at the beginning or end of the list.

a) Insertion at the beginning

This is the simplest case: you just need to allocate the item, related to the first item in the list and reposition the head of the list:

```
// Insert element at the beginning of a
// simply chained lists
void InsertStart (Item * & cap, Wave data)
{
    // Node allocation and value initialization
    Element * elem = new Element;
    element-> value = wave;

    // link node in list
    elem-> next = head;

    // move the head of the list
    cap = elem;
}
```

b) Insertion at the end of the list

In this case you must first go through the list and then add the item and link to the rest of the list. Also, the case if the list is empty must be considered.

```
// Insert element at the end of a
// simply chained lists
void InsertEnd (Item * & head, Wave data)
{
    // Node allocation and initialization
    Element * elem = new Element;
    element-> value = wave;
    elem-> next = NULL;

    // if we have a live list
    if (cap == NULL)
        // just change the head of the list
        cap = elem;
    else
    {
        // scroll through the list to the last node
        Element * node = head;
        while (nod-> next != NULL)
            nod = nod-> next;
    }
}
```

```

    // add the new item to the list
    nod-> next = element;
}
}

```

c) inserire dupa un element dat

```

void InsertInterior (Element * & cap, Element * p, Date wave)
{
    // Node allocation and initialization
    Element * elem = new Element;
    element-> value = wave;
    elem-> next = NULL;

    // life list
    if (cap == NULL)
    {
        cap = elem;
        return;
    }

    // insert at the top of the list
    if (cap == p)
    {
        elem-> next = head;
        cap = elem;
        return;
    }

    // insert inside
    elem-> next = p-> next;
    p-> next = elem;
}

```

Item search - Searching for an item in a list involves going through the list to identify the node according to a criterion. The most common criteria are those related to the position in the list and the useful information contained in the node. The result of the operation is the address of the first element found or NULL.

a) Search by position

Advance the pointer with the specified number of positions:

```

// Search for item by position
Item * SearchPosition (Item * head, int position)
{
    int i = 0; // current position

    // scroll through the list to
    // required position or up to

```

```

// end of list
while (cap! = NULL && i <position)
{
    cap = cap-> next;
    i ++;
}

// if the list contains the item
if (i == position)
    return cap;
else
    return NULL;
}

```

b) Search by value

The list is scrolled until it is exhausted or the element is identified:

```

// Search for item by value
Item * SearchValue (Item * head, Wave data)
{
    // scroll through the list until you find it
    // item or list exhaustion
    while (cap! = NULL && cap-> value! = wave)
        cap = cap-> next;

    return cap;
}

```

Delete item

a) Deleting an item from the list (other than the list head)

In this case we need the address of the predecessor of the element to be deleted. The connections in the sense of short-circuiting the deleting element are modified, after which the memory corresponding to the deleting element is released:

```

// delete an item from the list
// receiving as a parameter the address of the predecessor
void DeleteElementInterior (Predecessor Element *)
{
    // save the reference to the delete element
    Element * deSters = predecessor-> next;

    // short-circuit the element
    predecessor-> next = predecessor-> next-> next;

    // and delete it
    delete deSters;
}

```

b) Deleting an item from a certain position

If the item is the first in the list, then the head of the list is modified, otherwise the item is searched and deleted using the previously defined function:

```
void Delete Position (Item * & head, int position)
{
    // if the list is empty we don't do anything
    if (cap == NULL)
        return;

    // if it is the first element, then
    // wipe it and move the head
    if (position == 0)
    {
        Element * deSters = none;
        cap = cap-> next;
        delete deSters;
        return;
    }

    // if it's inside, then we use
    // delete function
    Element * predecessor = SearchPosition (head, position-1);
    DeleteElementInterior (predecessor);
}
```

c) deletion after a value

Search for the element's predecessor and use the element deletion function:

```
void DeleteValue (Item * & cap, Date wave)
{
    // if the list is empty we don't do anything
    if (cap == NULL)
        return;

    // if it is the first element, then
    // wipe it and move the head
    if (head-> value == wave)
    {
        Element * deSters = none;
        cap = cap-> next;
        delete deSters;
        return;
    }

    // looking for the predecessor
    Element * elem = none;
    while (element-> next != NULL && element-> next-> value !=
```

```

wave)
    elem = elem-> next;

    // if it was found, then we delete it
    if (elem-> next! = NULL)
        DeleteElementInterior (elem);
}

```

3. Methods of implementation for stored data

Queues and stacks are logical data structures (implementation is done using other data structures) and homogeneous (all elements are of the same type). Both structures have two basic operations: adding and removing an element. Apart from these operations, other useful operations can be implemented: vacuum structure test, obtaining the first element without extracting it (Sandner and Vukics, 2020; Steeb, 2021). The fundamental difference between the two structures is the access discipline. The stack uses a LIFO (Last In First Out) access discipline, and the queue uses a FIFO (First In First Out) discipline (Del Nero, 2020; Chand, 2020).

Stacks and tails can be implemented in several ways. The most used implementations are those using massive and lists. Both approaches have advantages and disadvantages.

To implement a stack using massive we need a massive V of size n to store the elements. The last element of the mass will be used to store the number of elements of the stack (Reddy, 2020; Steeb, 2021).

If the stack is empty, then the element V_{n-1} will have the value 0. Using this representation, the basic operations can be implemented in constant time.

The algorithms for implementing basic operations (in pseudocode) are:

```

add (elem, V, n)
if v [n-1] = n-1 // check if the stack is not full
    return "full stack"
v [v [n-1]] = element // we add the element in bulk
v [n-1] = v [n-1] + 1 // we increase the number of elements
return "success"

delete (V, n)
if v [n-1] = 0 // check if the stack is not empty
    return "empty stack"
elem = v [v [n-1] - 1] // extract the element from the massiv
v [n-1] = v [n-1] - 1 // we decrease the number of elements
return elem

```

The queue can be implemented using a circular vector of size n (element $n-4$ is followed by element 0). The last two elements contain the start and end

indices of the queue, and the penultimate element is a marking used to be able to differentiate between empty tail and full tail cases.

The algorithms that implement the basic operations for a queue stored in the presented form are:

```

add (elem, v, n)
v [n-2] = (v [n-2] + 1) mode (n-2) // move the tail head
if v [n-1] = v [n-2] // check full queue
    return "full queue"
V [V [n-1]] = element // we add the element
return "success"

delete (V, n)
if v [n-1] = v [n-2] // empty queue check
    return "empty tail"
v [n-1] = (v [n-1] + 1) mode (n-2) // move the end index
return V [V [n-1]] // return the element

```

The second way to implement stacks and queues is to use dynamically allocated lists.

In the case of the stack, we will use a simple chained list organized as in the following:

Each node consists of useful information and a link to the next item. The type of information stored in the stack is indicated by the user by defining the TipStiva type. The empty stack is represented by a null pointer. Items are added before the first item (by moving the top of the stack). The extraction is also done from the top of the stack (Sandner and Vukics, 2020; Grant, 2021).

The source code for the library that implements the operations on the dynamically allocated stack is:

```

// An element from the stack
struct NodStiva
{
    TipStiva Date; // user defined type
    NodStiva * Next; // link to the next item

    // constructor for initializing a node
    NodStiva (TypeStiva data, NodStiva * next = NULL):
        Date (s), Next (next) {}
};

// The stack is stored as a
// pointer to the first element
typedef NodStiva * Stiva;

// Create the stiva life
StCreare stack ()
{
    return NULL;
}

```

```
// Check if a stack is empty
bool StEGoala (Hold & hold)
{
    return stack == NULL;
}

// Add an item to the stack
void StAdauga (Hold & Stack, DateStype Tip)
{
    stiva = new NodStiva (date, stiva);
}

// Returns a copy of the top of the stack
TipStave StVarf (Hold & hold)
{
    // Case 1: stiva vida
    if (StEGoala (stack)) // if the stack is empty, then
        return ActivateType (); // return the default value for the
stack type

    // Case 2: empty stack
    return stack-> Date; // turn the top of the stack
}

// Extract the element from the top of the stack
StExtrage Hold (Hold & Hold)
{
    // Case 1: stiva vida
    if (StEGoala (stack)) // if the stack is empty, then
        return ActivateType (); // return the default value for the
stack type

    // Case 2: empty stack
    NodStiva * nodDeSters = hold; // save a reference to the de-
lete node
    TypeStop Res = Stack-> Date; // save the data to be returned

    stiva = stiva-> Next; // we advance to the top of the list

    delete nodDeSters; // delete the delete node

    return rez; // return the results
}
```

Achieving good economic efficiency by enterprises is conditioned by the existence of scientific leadership based on a good knowledge of economic laws, operational and accurate knowledge of supply and demand in the internal and external market, the dynamics of commodity prices, technological trends and how use of the resources at their disposal (Reddy 2020; Orszag 2020).

4. Conclusions

Starting from the fact that, on the one hand, mathematical models represent the scientific component of an information system, and on the other hand, taking into account the facilities offered by the use of information and communication technology (ICT) as a component of the information system, it trace is a real tool in the scientific management of economic activity (Steeb and Solms, 2021); Grant, 2021). There are some of the arguments put forward in favor of the management of economic organizations using information systems such as offering the possibility to simulate economic processes and phenomena both at microeconomic level and at macroeconomic level. Mathematical models can be developed and implemented regarding the forecast of economic development, different plan variants can be elaborated and then the optimal variant can be chosen (Sanderson, 2019; Steeb and Solms, 2021). At the microeconomic level, with the help of SI the available resources are harmoniously correlated with the proposed objectives, ex: planning of overhauls and capital repairs, scheduling scheduling and production tracking, inventory management. The efficient way to store data in stacks, lists or queues offers many advantages and flexibility for the business logic in applications.

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IMPACT OF DEMOGRAPHIC CHANGE IN EUROPE: BETWEEN MAINTAINING THE FINANCIAL SUSTAINABILITY OF PENSION SYSTEM AND ENSURING ADEQUATE INCOME FOR RETIREES

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Abstract: *The Covid-19 pandemic has shown that there is a direct link between the demographic structures and the economic structures of the states. The impact of demographic ageing on the labor market estimates a decrease of up to 18% in the period 2019-2070. Which will definitely influence the size of employability, skills and productivity. And not the last, the size of public spending related to age. Which, if in 2019 they were around 25.2% of GDP, they will have to grow regularly until 2070 in UE-27. The ageing process of European society warns us that there is a need for a change in the needs of society, a change in the services to be provided and to which all persons over the age of 65 have access. On 27 January 2021, the European Commission published "The Green Paper on Ageing", launching a complex public debate on the aging process, focusing on the social and economic impact of current trends in demographic change. All these initiatives will be analyzed together with all stakeholders and will take shape as a result of the lessons learned from the Covid-19 pandemic. (ec.europa.eu)*

Keywords: *ageing process, demographic ageing, demographic change, demographic structures, dependent ratio, employability, labor market, median age, median income, productivity, total age dependency ratio, working age population*

JEL Classification: *A11, H55, J10, L38, Z10*

1. General context

According to data provided by the UN Population Division, the world's population have reached a threshold of 7.8 billion at the middle of 2020. Scientific simulations predict a population of 9.7 billion by 2050, and no less than 11.2 billion by 2100 (an average annual increase of about 43.8 million people). Even though China currently occupies the first position (1.439 billion inhabitants), the demographic analysis projects an interesting change at the end of 2027: India will overtake China and become the most populated country in the world.

It should be underlined that by 2050 seven African countries will be among of the most world populated countries with the most inhabitants (www.un.org). At the beginning of 2020, the estimated population of the EU-27 was about 447.7 million inhabitants (as a result of net migration, demographic changes were positive in 2019, registering an increase of 0.9 million inhabitants).

On the one hand according to Eurostat data, in 18 of the 27 European countries the population has increased in 2019, the highest values being recorded in Malta (41.7 ‰), Luxembourg (19.7 ‰), Cyprus (13.7 ‰), Ireland (12.1 ‰) and Sweden (9.5 ‰).

On the other hand, the other 9 European states have been for a long time in the epicenter of a real demographic storm (massive decline), the most significant decreases among the population being recorded in Bulgaria (-7 ‰), Latvia (-6,4 ‰), Romania (-5 ‰), Croatia (-4.4 ‰) and Italy (-1.9 ‰).

By analyzing only in mathematical terms, it could say that since 1961 there has been a continuous increase of population in the EU-27. But nevertheless, this trend was slightly slowed down after 1980 as a result of the massive decline in the birth rate, which has been associated in recent years with an increase in life expectancy of birth.

The presence of these demographic changes is already noticed in the structure of demographic pyramid: increasing the number of older persons simultaneously with a declining share of working-age persons. (ec.europa.eu)

2. The impact of demographic change in Europe

The current demographic changes will affect the whole European population and will have a huge impact. The echo will most likely perceived by increasing the pressure on working age population, that will have to cover the growing expenditure on social services associated with the aging population (labor force participation). Beyond the fact that the number of people aged 65 years or over is projected to increase, currently the cohort of those borned as a result of the post-war population explosion has already reached retirement age.

The aging population in Europe will have a huge importance in the next years (demographic change can influence the underlying growth rate of the economy, productivity growth, living standards, consumption, investment; unemployment rate). All these consequences of demographic change will probably be the most important challenge for the Brussels administration.

Recent analyzes of the European population structure already describe the consolidation of declining trend of the young (0-14 years) and working age population (15-64 years) and the increase in the share of people aged 65 and over (see Table no. 1).

Table 1. Population age structure by major age groups, 2009 – 2019, EU

EU / ROMANIA			
	0-14 years old	15-64 years old	65 years old or over
2009	15,4% / 15,8%	67% / 68,1%	17,4% / 16,1%
2019	15,2% / 15,7%	64,6% / 65,8%	20,3% / 18,5%

Source: <https://ec.europa.eu/eurostat/statistics-explained>

According to the European Commission's Demography Report, Europe is already undergoing a complex process of demographic and societal transformation. This process puts a huge pressure on the Brussels administration for optimizing the EU equipping process with the best tools providing new solutions and support to the people who need to adapt to these changes.

According to the Report, the main demographic trends that shaping the EU-27 society are following:

- **Life expectancy at birth is constantly increasing** - was estimated at 78.2 years for men and 83.7 years for women (2018);
 - Life expectancy at birth is expected to increase by 2070 at 86 years for males and at 90 years for women;
- **Fertility rates steadily declined from the mid-1960s;**
 - **The average fertility rate is constantly declining** (1.55 children per woman in 2018, ranging from 1.23 in Malta to 1.88 in France);
 - **The average age of a women having her first child was 29.3 years in 2018**, (ranging from 26.2 in Bulgaria to 31.2 in Italy);
- **By 2070, 30.3% of the population is projected to be aged 65 years or older** (20.3% in 2019), while 13.2% will be aged 80 years or older (5.8% in 2019);
- **Families are changing:**
 - The marriage rates down and the divorce rates up;

- There are an increasing number of children growing up in sole-parent or reconstituted families;
- The composition of the family goes through a profound process of transformation: two parents with children, people living alone, single parents or families without children. (www.oecd.org)
- Part of the population prefers moving or living abroad (but the size of these flows is fluctuant, it can change quickly);
- The EU-27's population will be steadily declining (with estimates showing that by 2070 it will be below 4% of the world's population). (ec.europa.eu)

3. European populations: current trends, future pathways

An overview of the current structure of Europe's population, provided by Eurostat, draws our attention to the following issues:

- **The median age in the EU-27 increased by 2.7 years** (on average, by 0.3 years per annum) between 2009 and 2019, rising from 41.0 years to 43.7 years (excepting Sweden where the median age decreased from 40.7 years to 40.5 years);
- **Currently half of the EU-27's population is older than 43.7 years;**
 - The median age ranged between 37.7 years in Ireland and Cyprus and 46.7 years in Italy;
 - The median age was rising by 4.0 or more years in Spain, Portugal, Lithuania, Greece, Ireland and Slovakia
 - Albania experienced the highest increase of the median age over the past 10 years: this increased by 5.6 years, from 31.1 years in 2009 to 36.7 in 2019;
 - In Romania in 2019, the median age was 41.6 years (**half of Romania's population was older than 41.7 years in 2019**).
- **The old-age dependency ratio** for the EU-27 was **31.4 %** on 1 January 2019 (for every person aged 65 and over there were approximately 3 people of working age);
 - There was been a 5.4% increase in this ratio in the last decade, from 26% in 2009 to 31.4% in 2019;
 - The old-age dependency ratio ranged from 20.7% in Luxembourg and 21.6% in Ireland to 35.7% in Italy, 35, 1% in Finland or 34.6% in Greece;
 - **The old-age dependency ratio for Romania was 28,2% on January 1, 2019** (almost 4 people of working age for a person aged 65 or over).

- **The total dependency ratio** (the ratio between dependents, young and old and the population considered to be of working age, between 15 and 64 years old) was **54.9%**, in the EU-27, in 2019;
 - This means that there were fewer than two persons of working age for two persons dependents;
 - There was a 5.9% increase in this ratio in the last ten years, from 49.0% in 2009 to 54.9% in 2019;
 - Luxembourg registered in 2019 the lowest total dependency ratio (43.8%), the highest value being registered in France (61.5%);
 - **In Romania, the total dependency ratio was 53.0% in 2020** (between 2011-2020 increased 6%).
- The aging process of the EU-27 population began several decades ago and will continue in the future. This visibility will be a consequence of its vitimizing by the annual changes of the ratio between the elderly population (growing) and the working age population (decreasing):
 - The „baby-boom” generation (obtained by increasing the fertility rate in several European countries after post World War II) has slowly advanced to the top of the demographic pyramid, increasing the number of elderly people age;
 - The consequence of this process is reversing of trending at the base demographic pyramid (decreasing of the share of the working age population);
 - Everything into in the context of the background of gradual decreasing of the share of the population under the age of 15 (0.2% in the last ten years);
 - The relative increase of the share of the elderly population could be explained by increasing of longevity („aging the top of the demographic pyramid”), but also by reducing the level of fertility (fewer and fewer births in recent years), process called „aging of the base of the demographic pyramid”;
 - Current trends build a scenario that the EU-27 population will reach 449.3 million by 2026, after that it will decline to 416.1 million by 2100. During this entire period, the EU-27 population would continue to age;
 - The same scenario highlights, for 2019-2100 period, a two-and-a-half times increase in the share of population ages 80 and above, from 5.8% in 2019 to 14.6% in 2100;
 - All against the background of constant decreasing of share the people working age, but also the increasing of the dependency ratio (from 31.4% to 57.1%) or of the total dependency ratio (from 54.9% to 82.6%) by 2100;

- It is also projected that the median age of the EU-27 population is likely to increase from 43.7 years in 2019 to 48.8 years in 2100, which means that half of the EU-27's population will be older than 49 years (see Table 2). (ec.europa.eu)

Table 2. Population structure by major age groups, EU-27, 2019-2100 (% of total population)

	0-14 years	15-65years	65-79 years	80+ years
2019	15,2%	64,6%	14,4%	5,8%
2030	14%	61,8%	17%	7,2%
2040	13,6%	58,9%	18,3%	9,2%
2050	13,7%	56,8%	18,2%	11,3%
2060	13,6%	56,1%	17,8%	12,5%
2070	13,6%	56,1%	17,1%	13,2%
2080	13,9%	55,3%	17,4%	13,4%
2090	13,9%	54,9%	17,3%	13,9%
2100	13,9%	54,8%	16,7%	14,6%

Source: Source: <https://ec.europa.eu/eurostat/statistics-explained>

4. Adequacy and sustainability of pension

For the EU-27's retired population, which currently accounts more than 20% of the entire population, the main source of income is the pension, generally obtained through the public pension system.

Against the background of current trends, the public pension systems are currently under a double pressure: maintaining systemic financial sustainability and ensuring adequate incomes for retirees. Both requirements directly affect the labor supply. Offer which, as the data show, decreases year to year.

The debate is a complex one. Whether setting the main objectives of public policies on pensions supposes a natural challenge the challenge to reach them is a major one.

This is because there's a need of building a complex range of public policies that would guaranteed „**income adequacy in old age**”, would optimize the process of „**sustainability of public pension system**” or would identify „**employment solutions**”.

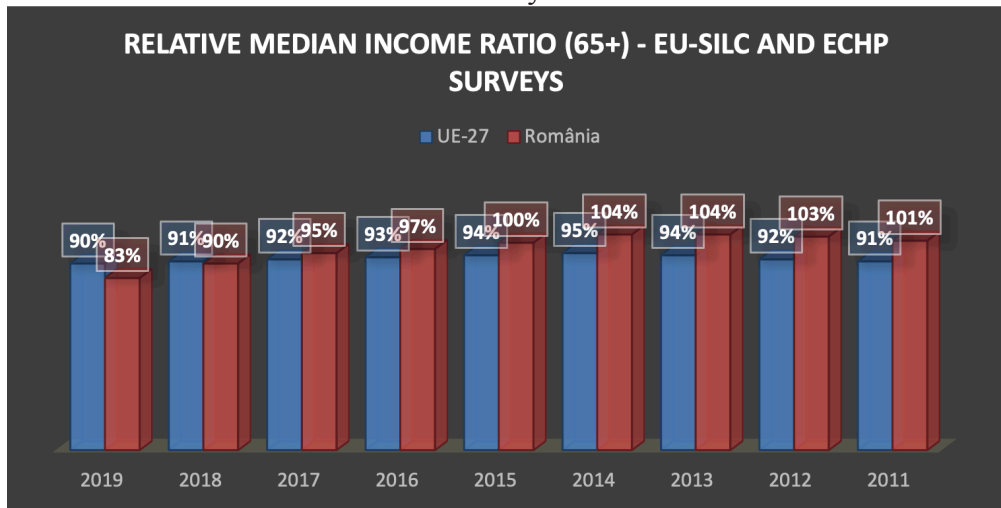
The pension adequacy process incorporates three measurable dimension: **the ability to prevent poverty, capacity to replace the income from professional activities and duration of pension**. The distribution of income and the inequalities play a fundamental role in public policies. We can't

develop public policies for combating poverty and social exclusion without closely knowing the inequalities into society whatever their nature (economic or social):

- The 20 % of the population with the highest disposable income in the **EU-27 in 2019** received **4.99** times as much income as the 20 % with the lowest disposable income:
 - The states with the highest inequality index within the EU-27: Bulgaria (8.10%), **Romania (7.08%)**, Latvia (6.54%), Lithuania (6.44%) and Italy (6.01%);
 - At the opposite pole there are Finland (3.69%), Belgium (3.61%), Slovenia (3.39%), Slovakia (3.34%) and the Czech Republic (3.34%);
- According to Eurostat data, in 2019 people aged 65 and over had a median income of **91% of the median income** of the population under the age of 65 in EU-27;
 - In Luxembourg, France, Greece and Italy the median income of the population aged 65 or over was higher than the median income of the population under aged of 65;
 - In Hungary, Spain, Austria, Portugal, **Romania** and Slovakia, the median income of the population aged 65 or over was between **90% -100% of the median income** of the population under the age of 65;
 - The lowest rates were for the populations of the Baltic states (Lithuania - 65%, Latvia - 58%, Estonia - 57%);
- **The median income of the persons at risk of poverty in the EU-27 was 24.5 % below the poverty line in 2018;**
 - From this perspective, Romania was on top of the EU-27's member states with the largest gap between the median income of people at risk of poverty and the poverty line - **35.2%**; (ec.europe.eu)
 - According to INS data, in 2019 approximately 33.9% of the population aged 65 or over in **Romania** was at risk of poverty and social exclusion (a return to the values of 2016 when the risk rate at poverty and social exclusion was **34%**); (Innse.ro (2020b))
 - Moreover, in the same year, the severe material deprivation rate for people aged 65 or over was 15.9% in Romania; (Innse.ro (2020c))
- The lowest poverty risk gap in the EU-27 was measured in Finland (14.2%), Czech Republic (15%) and Ireland (15.2%);
- The median income ratio of the population aged 65 or over in the EU was in 2019 about 90% of the median income of the population under the age of 65 (**83% in Romania**);

- If for the first years after retirement the income of pensions is more than half of the last salary (approximately 58% in the EU), over the years it decreases;
- The replacement rate for people with higher average earnings tends to be lower due to the redistributive nature of most public pension systems.

Table 3. Relative median income ratio (65+) - EU-SILC and ECHP surveys

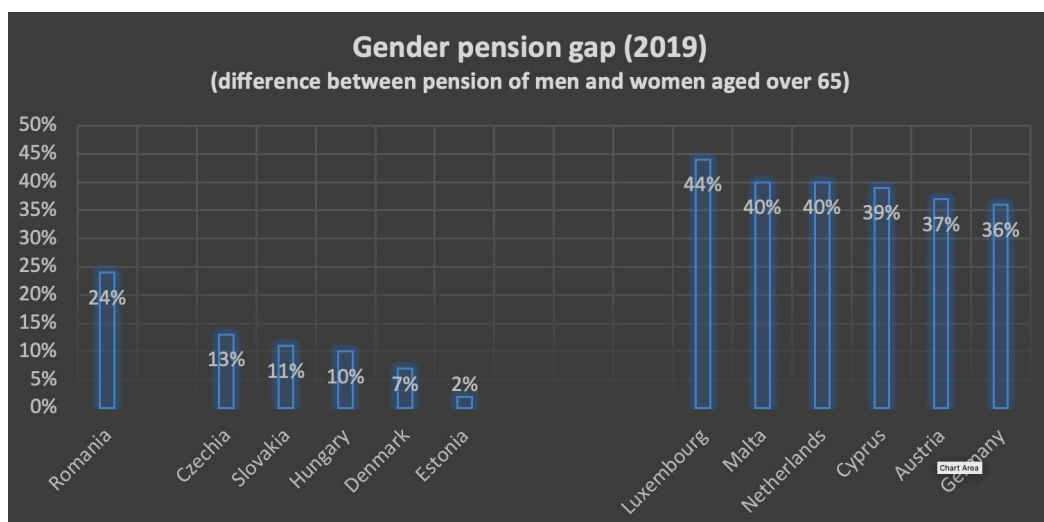


Source: Eurostat - Data Explorer (europa.eu)

- According to the Eurostat data, **in 2019, the proportion of pensioners aged over 65 at risk of poverty in the EU was at 15.1%**;
- Compared with the gender pension gap, at-risk-of-poverty rate for pensioners has been rising gradually since 2014, when it stood at 12.3%;
- Between 2010-2019 in the whole of EU-27 the proportion of female pensioners aged over 65 who were at risk of poverty was with 3% - 4% higher than the rate for male pensioners;
- The proportion of pensioners aged over 65 who were at risk of poverty in 2019 was between 10% and 30% across of the EU Member States;
- The highest rate at-risk-of-poverty were in 2019 in Latvia (54%), Estonia (51%), Bulgaria (36%) and Lithuania (35%);
- At the opposite pole, the lowest rates in 2019 were noticed in Luxembourg (7%), Slovakia, France, Denmark (all 9%) and Greece (10%);
- In **Romania**, in 2019, the proportion of pensioners aged over 65 who are deemed to be at risk of poverty was **23,5%**; (ec.europe.eu)

- In virtually all European countries, **women receive a lower pension than that the men**;
- In 2019, women aged over 65 received a pension that was on average 29% lower than that of men;
- According to Eurostat data, the gender pension gap has been decreasing and is now almost 5 percentage points (pp) lower compared with 2010 (34%);
 - The largest difference was noticed in Luxembourg (44%), Malta and the Netherlands (both 40%), Cyprus (39%), Austria (37%) and Germany (36%);
 - The smallest difference in pension income between women and men was noticed in Estonia (2%), Denmark (7%), Hungary (10%), Slovakia (11%) and Czechia (13%);
- In Romania the difference was in 2019 24%;

Table 4. Gender pension gap by age group (EU-27)



Source: Eurostat - Data Explorer (europa.eu)

- **Between 2010-2019, the gender pension gap has decreased in the almost of EU Member States**;
- The largest decreases were in Greece (from 37% to 24%), Denmark (from 18,1% to 7,4%), Slovenia (from 27,5% to 16,4%) and Bulgaria (from 32,5% to 22,8%);
- At the opposite pole, between 2010-2019, the gender pension gap increased in 6 EU Member States since 2010. The largest increase was noticed in Malta (from 22% to 40%), Latvia (from 9,2% to 14,8%), Lithuania (from

15,4% to 18,7%), Slovakia (from 8,2% to 10,8%), Croatia (from 26% to 27,6%) and Italy (from 31,1% to 33,2%).

- In **Romania**, between 2010-2019, the gender pension gap has decreased **from 29,8% to 24%**;
- Regarding the average **duration of pension period**, according to Eurostat data it generally varies between 16.5 and 24.5 years;
 - It is very important to measure the ratio between working life and the length of the retirement period, which at the beginning of 2018 had an average of about 50% (varying as limits between 37% in Latvia and 61% in Iceland);
 - **Expected duration of working life for the EU-28 adult population** (of at least 15 years) **was 36.4 years in 2019** (increased by 3.5 years compared to 2000);
 - The EU-27 Member States with the longest expected working life are the follower: Sweden - 42.1 years, the Netherlands - 41 years; Denmark - 40 years old, Germany - 39.1 years old, Estonia - 39 years old, Finland - 38.9 years old;
 - At the opposite pole were: Italy - 32 years, Croatia - 32.5 years, Greece - 33.2 years, Poland - 33.6 years, Belgium - 33.6 years, **Romania - 33.8 years**;
 - **Romania is the only EU-27's member state in which expected duration of working life has decreased in recent years** (from 36 years in 2000 to 33.8 years in 2019);
 - For the same period (2000-2019) the greatest progress was made by Malta (7.6 years), Hungary (6.9 years) and Estonia (5.6 years);
 - Although the gender gap was reduced, the Eurostat data showed that men have worked more than women in 2019 (38.3 years versus 33.4 years). (ec.europe.eu)

Conclusions:

- The impact of demographic change has a wide range of facets. The management in this area is focused of adapting policies in specific fields of public finances, public health or public life, but also of some aspects that aim at access to vital services;
- The decline of the working age population will involve finding solutions for economic growth by increasing productivity or greater involvement of citizens in the labor market;
- The aging of European society will put pressure on the health and care system, that will need to adapt;

- Public financing spending in the field will be more expensive as we age;
- The main question is **how could the public pension system to balance adequacy and sustainability objectives**;
- Generally every government knows that the pension promises „are subject to a large of risk and uncertainties” (d’Addio, 2014);
- What we notice is that currently the increase in life expectancy and the decline of birth rate have resulted in population aging and growing cost of paying for pension;
- Even though the EU projects to implement a lot of reforms of the public pension system it will not be easy to put into practice mechanisms of growing the capacity of pensions to replace the income of work;
 - EU expects that for a person with an average income and a standard seniority the Theoretical Replacement Rate (RIT) should be in 2053 between 40.1% and 92.5% of previous income (ec.europa.eu);
 - Despite this, the pension income available in the future for a person who earns little and who have a short employment seniority will continue of remaining well below the poverty line;
- Demographic change will also have an impact on Europe’s position in the world - its share of the population and global GDP will be much lower;
- Probably **the main challenge** that countries European Economies will face is **how to increase the effective retirement age**.

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INTERNATIONAL MIGRATION OF THE POPULATION UNDER THE COVID PANDEMIC

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Abstract: *The COVID-19 pandemic is an unprecedented challenge, with very severe socio-economic consequences. We are committed to doing everything necessary to meet this challenge in a spirit of solidarity (Buck, Arnold, Chazan, Cookson, 2020). A coordinated and comprehensive strategy is needed to address urgent health needs, support economic activity and prepare the ground for recovery. This strategy should combine short, medium and long-term initiatives, taking into account the spreads and links between our economies and the need to maintain confidence and stability. Several measures have already been taken at national and EU level, as set out in the Eurogroup statement, in an inclusive format from 16 March. Medium-term and longer-term planning is needed for how the economy is rebalanced and revived following this crisis. A comprehensive socio-economic development plan, including sectoral sectoral plans and an ecosystem that encourages entrepreneurship so that those with strong and sustainable business models can flourish. Governments and financial institutions need to constantly reassess the situation and ensure that things do not get out of hand (Marek, 2020).*

Keywords: *Labor force migration, development, COVID-19*

JEL Classification: *J1, J61, C33*

1. Introduction

The pandemic and its aftermath have affected the lives of people around the world. But migrants are much more affected than any other population group.

This is what the Organization for Economic Cooperation and Development has found. Migrants have managed to ensure the functioning of sectors such as health, trade and logistics, even during restrictions. In the midst of the pandemic, governments have taken exceptional measures, such as the one decided by the Berlin executive to allow foreign seasonal workers access to Germany.

According to data published by the OECD, migrants represent on average 24 percent of all doctors and 16 percent of care staff, thus being at the forefront of the fight against COVID-19. Due to the higher number of direct contacts but also, often due to inadequate living conditions, in overcrowded areas, a large percentage of migrants became infected with coronavirus. Several studies conducted in a number of OECD member countries have revealed that the risk of infection is twice as high among migrants as the local population. (Ellis, 2020).

At the same time, migrants are more affected by the economic consequences of the pandemic than other groups. Many of them work in gastronomy, in hotels, in tourism - so exactly in the industries that are now fighting for survival. In the so-called HORECA sector in the EU, about a quarter of employees come from third countries, twice as many as in the rest of the economic sectors. Employment contracts in the field are often very short-term. As such, migrants are the first to be sent into unemployment (GmbH finanzen net, 2020). There are not enough data yet, but it is already clear that migrants are severely affected in southern European countries, Ireland, Sweden, Norway and the United States.

An important aspect is the closure of schools. The children of migrants have been and remain particularly affected when the courses take place online. Parents have, on average, less resources, for example, they do not have a computer, they have less living space and, in the absence of language skills, they cannot help their children with homework. Home-schooling puts migrants' children at a greater disadvantage.

The pandemic has drastically reduced migration to OECD countries. According to initial estimates, in the first half of the current year, the migration rate has halved. The closure of borders, the restriction of passengers, the cessation of air transport has determined this evolution. The OECD does not believe that the situation will change too soon, even if the economy returns to normal capacity. One reason is that, during the pandemic, many jobs were replaced by telework, which means much less human mobility (Gamal, Lawler, Astakhova, 2020).

The obvious effects of COVID-19 are also felt in the countries of origin of migrants. Bank transfers from those working abroad to families left at home have fallen sharply. OECD analysts also believe that the coordinated actions

of the authorities in the countries preferred by immigrants to combat illegal migration have led to increased frustration in the countries of origin.

Against the background of rising unemployment, the OECD also believes that xenophobia will be much more present in everyday life, because immigrants are seen as potential competitors. In some states, there are campaigns to combat the idea that immigrants are competitors in the labor market and guilty of spreading the virus (Rediff Realtime News, 2020).

The OECD considers migration to be fundamentally positive, “an integral part of our lives”, “something that binds us”. It is the pandemic, isolation and barriers that have shown us “how much we need others,” explains Stefano Scarpetta, director of social affairs and labor at the OECD. There is a danger that through the pandemic and its consequences, the progress made in the field of migration and integration will be partially annihilated. Governments should see the integration of migrants as a long-term investment in the interests of all.

2. The situation of the diaspora

The situation of the mobility diaspora has a particular relevance against the background of the health crisis caused by COVID-19, as well as the economic crisis generated by the medical crisis, in the context in which it is estimated that 3.4 million Romanian citizens lived in OECD countries in 2016, constituting the fifth diaspora in size in OECD countries. The situation of the diaspora and the dynamics of departures and arrivals among those who leave the country for longer or shorter periods of time to work in other states raise a number of epidemiological, social and economic issues. A large diaspora also implies the existence of a flow of people circulating between Romania and the destination countries, representing a potential risk of spreading the new coronavirus.

Migrants have a more vulnerable situation on the labor market compared to the native population, and job insecurity exposes them to the risks of social exclusion in crisis situations, to a greater extent compared to the native population. Social and professional integration at the destination also means the recognition and equivalence of diplomas and professional qualifications, which leads to overqualification for the jobs they hold, especially in the first years after reaching the destination, while lower language proficiency in compared to the natives increases the gap in access to the labor market (Sohrabi et al., 2020). Thus, migrants generally occupy lower-paid jobs on the labor market at their destination, with a fixed-term contract or, in some cases, even without a contract, with a reduced working hour or at non-standard time intervals (eg shifts nightly).

The economic crisis has put in difficulty some of the Romanian migrants in states severely affected by the pandemic, being those with a precarious position on the labor market, as well as those involved in economic sectors severely affected by the effects of the medical crisis. It should be noted that Romanian migrants in the EU and whose mobility is aimed at work fall into two patterns of migration, represented to a greater or lesser extent: long-term migration, with low circularity, and high-circulation migration, associated with seasonal jobs in economic sectors such as agriculture. The impact that the crisis generated by the pandemic has on the Romanian diaspora is influenced on the one hand by the type of migration (long-term versus short-term circulatory), by the level of damage of the destination country, as well as by the type of economic activity. which migrants carry out their activity (Wilson, 2020).

For long-term migrants with low circularity, the health crisis did not lead to the need for an urgent return to the country, while for short-term migrants, staying at the destination in the context of the pandemic was not necessarily an option. Also, not all sectors of the economy were equally affected in the destination states, just as the impact of the health crisis on the economy was not the same in all states. Sectors such as health care, the elderly or people with disabilities, agriculture, courier services or call centers have intensified their work in need of additional manpower. In the context of the EU closing its borders to workers outside the Community, the demand for certain low-skilled jobs has increased, leading to new opportunities for intra-Community workers / potential workers.

In order to estimate the potential effects of the pandemic on migration flows to and from Romania, we will describe in this section Romania's border traffic between March and April 2020, and the situation of the Romanian diaspora in EU countries with emphasis on their position on the market. to estimate the extent to which the current context places members of the mobility diaspora in a vulnerable group.

In agriculture, for example, where work depends on the nature of the harvest and there is no continuous, constant flow of activities of the same type, fixed-term employment contracts are concluded. This type of employment is a niche for immigrant workers, given their temporary nature and working conditions, which are more difficult than in other economic sectors, but also the low level of skills needed to achieve them, including language skills. destination. Studies show that Germany has promoted migration of this type, in the case of Romanian citizens, but seasonal migration is also found in other destination countries. Given that avoiding or limiting, as far as possible, a possible economic crisis involves keeping lucrative activities at a level similar to the pre-pandemic, this type of cross-border mobility is expected to continue. In turn, this brings with it the need for precautions to stop the spread

of the virus, and increased attention to living and working conditions at the destination (Plante, & Patel, 2019).

It is worth mentioning, here, the case of seasonal workers in Romania recruited for work in agriculture in countries like Germany and Great Britain (Icociu, et al., 2019b). This type of international mobility is a problematic aspect during this period, being associated with risks both for workers, due to the nature of work and working and living conditions, and for the inhabitants of the destination, respectively origin with which migrants would interact, they may be vectors of virus circulation. A case that has been intensely debated in the media is that of Romanian workers recruited for asparagus harvests in Germany: in the context of the pandemic, the way in which their departure to the destination country took place / was organized, including the way home to the airport of departure, was a hotly debated topic in the press, due to non-compliance with the rules imposed by the state of emergency (social distancing, the establishment of quarantine in an area of Suceava County, from which, however, people came out to go to Germany).

This episode has been analyzed from many points of view, including as an indicator of existing social inequalities at European level, or as an example of dysfunction in terms of how the rules are followed / their compliance is ensured by the authorities. At the same time, it is expected that a significant number of individuals will no longer be willing to engage in such an occupational trajectory for fear of health hazards, and others will no longer have access to it (declining job supply, restricted mobility) (Icociu, et al., 2019a).

Regarding the integration of Romanian migrants on the labor market in the four destination states, the type of economic sectors differs from one country to another and therefore the risk of unemployment varies in the four states. According to the International Labor Organization (ILO 2020), seven economic sectors have been severely affected by the COVID-19 pandemic, sales, retail and car repair, industry, the real estate market, various administrative activities and support services, hotels and catering, transport and storage, art, recreation and other services. According to OECD estimates, the largest share of Romanian migrants working in economic sectors severely affected by the pandemic is in Germany, with 57.9% of diaspora members in this country being vulnerable to the crisis.

Conclusions

Based on what is presented in this section, some conclusions can be drawn regarding the cross-border mobility of the mobility diaspora and its degree of vulnerability in the context of the COVID pandemic. Although it is not possible to give a sharp answer regarding the return to the country of the members of

the mobility diaspora, as a result of the medical and economic crisis, some ideas related to their situation can be drawn (Plante, & Patel, 2019). The COVID crisis generated an increase in inflows into the country, compared to outflows, an increase that was transitory and lasted about a month (March 11 - April 8). During this period, in addition to those who were abroad for short periods of time for personal, professional or medical reasons, seasonal workers whose contracts were terminated or suspended due to the state of emergency returned to the country, as well as those who were in a situation of accentuated precariousness in the destination country and who, with the loss of their job, were left without means of subsistence. This return trend ended with the departure of seasonal workers to Germany and the Netherlands.

In the case of long-term migrants, the vulnerability to the economic crisis differs from one country of residence to another, the variations being largely determined by the level of education, the type of employment and the economic sector in which they worked. The high share of employment without a contract, in the informal labor market, or in fixed-term or part-time employment puts many members of the Italian diaspora in a situation of high risk of poverty and social exclusion (Gheorghe, 2012). To these are added the low educational capital of many of the members of this diaspora. In the case of Spain, the risks are more limited due to the high formal employment among Romanians there, but the lower educational stock is a factor that increases the degree of exposure to the risk of poverty.

The German diaspora is at high risk due to the overwhelming involvement of its members in economic sectors affected by the crisis. However, the fact that involvement in the informal labor market is limited reduces the risk of poverty and exclusion (Gheorghe, 2017) in the case of the Romanian community in Germany, technical unemployment being accompanied by social protection measures similar to those enjoyed by German citizens (Knieps, 2020). It is difficult to estimate whether the mobility diaspora will decide to return to the country, to remigrate or to remain in the current state of residence. This will depend on when and how each country of residence will overcome the medical and economic crisis and how attractive Romania could become as an offer for members of the diaspora facing economic and health risks.

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NEUROMARKETING - A SCIENTIFIC TOOL TO HANDLE CONSUMER BRAIN INFORMATION

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Abstract: *The article addresses a relatively new topic on the Romanian market, namely Neuromarketing as a field of scientific research that has a wide applicability in business. Neuromarketing is an emerging field, being located on the border between psychology, neuroscience, marketing and neuroeconomics. It is of great interest to marketers, as it can bring considerable information about the mechanisms underlying the consumer behavior and the decision-making process. This paper first outlines a brief overview comprising definitions of the concepts which will also be later used in the article like neuroeconomics and neuromarketing. It also documents the evolution of the market over the last century until today and explains how the use of neuromarketing techniques can help the further development of the domain. The second section of the paper explains and reviews the findings of a primary neuromarketing case study which was conducted in partnership with a multidisciplinary research group. The data were collected with the use of an EEG headset and were used as the basis of real business decision making.*

Keywords: *Neuromarketing, Neuroeconomics, EEG, Paradigm, Customer behaviour*

Introduction

The human mind and the functioning of the brain are the focus of a subfield of science known as neuroscience. Neurobiology, psychobiology,

neuropsychology, psychophysiology, and cognitive psychology are the most important. Essentially, the primary goal of neuroscience is to fully comprehend how the brain, mind, cognitive processes and subconscious functions work.

Concerned with the limits of economic agents' rationality, behavioral economics theory investigates both the effects of psychological, cognitive, emotional, cultural, and social factors on economic decisions made by individuals and institutions, as well as the consequences of these effects on market prices, yields, and resource allocation, as well as the impact of different types of behavior in various environments with varying experimental values. In recent years, the term behavioral economics has been increasingly used in American writings to describe behavioral models that integrate perspectives from psychology, neuroscience, and microeconomic theory, models that cover a wide range of concepts, methods, and fields of analysis (Ariely & Berna, 2010).

As a result, the study of behavioral economics focuses on the analysis of how market decisions are made and the identification of the mechanisms that determine public choice, discussing the three major theoretical themes as follows (Alvino & Franco, 2018):

- Heuristics: people use mental shortcuts or thumb rules to make 95 percent of their decisions.
- Framing: is the collection of anecdotes and stereotypes that comprise the emotional filters on which people rely to understand and respond to events.
- Inefficiencies in the market: include incorrect pricing and irrational decisions.

Neuroeconomics is well-prepared to regulate the concept that defines how to make decisions by identifying mental states. Neuroeconomic models are activated and improved by psychological outcomes and are grounded in biological processes, according to the research *Can Neuroscience Assist Us in Constructing Better Patterns of Economic Decision-Making?*, published in *Frontiers in Behavioral Neuroscience* (2017) (Lazaroiu & all, 2017). When the results of separate procedures are consistent with a normal mechanical clarification of what generates the choice, as interpreted by a computer model, this is considered progress in neuroeconomics.

Neuroeconomic experiments combine advanced imaging and brain stimulation tests from cognitive neuroscience with microeconomic systems and advanced game theory tests from economics. According to research, neuroeconomics aims to use additional information obtained from brain investigations in conjunction with the decision-making process in order to better understand the thinking / decision-making process and use future results to improve economic models.

Neuroeconomics is the study of how people make decisions based on values and how those decisions are transmitted neuronally, cognitively, and behaviorally (the greatest progress has been made in understanding the sense of stimulus-reward and how the brain discerns to assign them value).

Neuromarketing, also known as *avant-garde marketing*, is a growing field that uses neuroimaging techniques such as nuclear magnetic resonance, electroencephalography, and magnetoencephalography to study and define consumer responses to various marketing stimuli. As a result, brain activity in specific areas of the brain can be monitored and measured to determine how consumers make decisions, highlighting the link between the decision-making process and the areas of the brain involved in receiving marketing stimuli.

The term itself is based on a nineteenth-century theory known as the neuron doctrine. Although neurons account for only 10% of brain mass, such specialized cells, according to this theory, form the primary mechanisms of thought. Knowing that the human brain only uses 2% of its energy for conscious activities, concentrating the majority of its resources on the subconscious, it becomes clear that verbally rendering buyer reactions to a specific product is impossible. Thus, the vast majority of human thoughts and emotions are the result of subconscious activity, making it extremely difficult to find reasons for the act of acquisition and/or consumption through the lens of conscious intervention.

So, similar to neuroscientists who can accurately determine which areas of the brain are active at any given time, what we present below are truths about how branding and marketing messages work on the human brain, how our inner psyche reacts to stimuli at a much deeper level than conscious thinking, and how our behavior is controlled by unconscious thinking - usually the exact opposite of what we think we react and behave.

Literature review

Daniel Kahneman, a psychologist, was awarded the Nobel Prize in Economics in 2002 *for his integrated perspective on psychological research in economics*, particularly *in human judgment and decision-making under uncertainty* (Declerck & Boone, 2016).

Ten years later, in the field of behavioral finance, economist Robert J. Shiller was awarded the Nobel Prize in Economics for his empirical analysis of *asset prices*. Economist Richard Thaler was awarded the 2017 Nobel Prize in Economics for his significant contribution to behavioral economics by

establishing that *people are predictably irrational in ways that defy economic theory.*

Outstanding research in the theory and analysis of economic behavior (Kahle & Lynn, 2013) demonstrates that better knowledge necessitates a better understanding of how decisions are made. Similarly, while maintaining the rigor of economic analysis in defining the value-based decision, it turns out that a superior understanding of how decisions are made generates higher expectations about the options that have already been selected. As a result, it is hoped that the association of imaging techniques with the economic model will provide explanations for how individuals choose a strategy when confronted with a wide range of possible options (Boksem & Smidts, 2015).

In defining value-based decision-making, neuroeconomics maintains the rigor of economic analysis while admitting that decision-making is evolutionary and not always optimal. Psychological outcomes activate and improve the descriptive capacity of neuroeconomic models, which are grounded in biological processes (Di Domenico & Ryan, 2017). There is talk of economic prosperity in the second half of the twentieth century, which led to the development of the phenomenon of shopping much more than anyone could have predicted. The recorded purchase rate was significantly higher than in any previous reference period. The open stores served more the companies' desire to take customers away from competitors than the new markets, and customers had to make an effort not to buy. The result, as agreed upon by all experts in the field, has been that sales were „dangerously” high for a long time: too many products for sale, more and more diverse, too many advertising channels, and research that would be a concern for future attempts to substantiate the interdisciplinarity of marketing science on the Romanian market will be established in the paper *Deceptive and subliminal advertising in the slimming product market. Romania Case Study*, published by Ed. Addleton Academic Publishers in New York (Stefanescu & Olivia, 2014).

Furthermore, marketing and advertising researchers (Davidson & Irwin, 1999) have observed for several decades the limitations imposed by traditional market research methods, such as analyses that focus on finding an answer in the post-rational stage.

Another method for obtaining useful information in the field of advertising, which is frequently used for research and market research, is to conduct an opinion poll, a survey for a specific store or merchandise district, or simply inquire (over the phone or in person) about what customers have seen, done, or intend to do. Some studies, on the other hand, attempt to decipher both the processes and relationships of affiliation, attraction, love, and friendship, as

well as prosocial behavior, which includes all individual acts that have a positive impact on society. Another area of study in psychosociology is aggression and violence, which has extremely negative effects in social relations in general, as well as in family life and professional life, disrupting all spheres of activity, including economic (Rubinstein A, 2008)

We're talking about attitudes - self-esteem, prejudice, which are present in everything we do, think, or feel; and persuasive communication - which has been intensively studied in order to decipher the factors and conditions on which the success of a sender's attempts to persuade the receiver to change his attitude toward certain people, goods, ideas, situations, and so on depends. Furthermore, the individual's conformity to the value system of the group to which he belongs plays a significant role in group cohesion and integration (Constantinescu & all, 2019).

Consent or assent, as a form of influence and social integration, becomes a process by which the individual is psychologically „seduced” so that he can then be „manipulated.” Thus, stereotypes and prejudices against specific social groups distort the individual's reduction to the status of a simple representative of a social group, which is sometimes necessary and justified, and sometimes superficial and unjustified.

From a scientific standpoint, our efforts and abilities to understand our own selves, as well as the selves of other individuals and groups of which we are a part, can be studied in a complex thematic field of social psychology known as social cognition, terminology that experts use. Psycho Sociologists scientifically investigate the set of cognitive processes by which each of us forms, spontaneously and unpredictably, partially unconsciously, a set of representations and concepts about social reality, on the basis of which we adapt our behavior to various situations (Stefanescu M., 2017).

Only in recent years has science enabled the development of an effective device that can „decode” customer thoughts: neuromarketing - techniques developed by cognitive psychology and neuroscience specialists that are used to analyze and understand people's reactions to products and promotions (Bondrea & Stefanescu, 2014).

Researchers in the United Kingdom and the United States have focused more on the field of neuromarketing, and it has been studied more and more in recent years, gaining supporters all over the world (Ries & Ries, 2005). There are currently more than 60 neuromarketing agencies in the world, with approximately 31 in Europe.

After six years of research, Stanford University psychiatrists and computing experts, along with neuroscientists and engineers, were able to

replace the light-blocking structure of brain-blocking lipids with a technique that uses ingredients such as acrylamide, bisacrylamide, and formaldehyde to make those areas transparent in April 2013. The method, known as CLARITY (Clear Lipid-exchange Anatomically Rigid Imaging / immunostaining-compatible Tissue hYdrogel), has already been approved and allows for repeated and high-resolution analysis of the brain without sectioning it (Hao & all, 2018). The human brain's „transparency” sheds light on future years of neuromarketing research.

Furthermore, recent research presented with scientists, based on an experiment that used brain scanning, can highlight a person's thoughts, a figure recently seen by him, or memories updated at that time (Stefanescu M, 2017).

One of the world's leading neurologists, Virginia Valentin (2000), began his career as a marketer. He has spent a long time studying how emotions affect our brains, memory, and decision making. According to research, emotions are more inextricably linked to our major cognitive actions: learning, memory, and decision making, rather than being separated from rationality. Thus, emotions symbolically acquire the valences of that yellow marker that „emphasizes” the important aspects of the human mind, information that our brain cannot make decisions without (Valentin & Gordon, 2000).

Methodology

In the course of an experimental neuromarketing project called „The Sound of Wine - consumer preferences in a wine degustation,” I was a member of an interdisciplinary team led by the Polytechnic University of Bucharest between 2019 and 2020.

The study focused on brain waves (EEG) surveillance for five amateur subjects not specialized in wine tasters (oenologists) in order to assess how wine type is chosen during a tasting process. In order to assess whether these variants meet the individual preferences of a particular wine brand, the team looked at variations in Alpha, Gamma and beta brain waves.

Subjects (Participants)

The study included 5 male volunteers, all of whom were amateur wine drinkers between the ages of 30 and 50. There was no history of neurological disease among the volunteers, and they did not use drugs or psychiatric medications. According to the Helsinki Declaration, the study was approved by the ethics committee of the University of Pharmacy Bucharest. Volunteers were informed

about the study and were asked to sign a consent form. The EEG hardware and software for brainwave analysis were created as part of the project.

Methodology for research implementation

Three types of wine brands were chosen for the study. The wines were chosen based on the same type of Cotnari semi-dry grapes, production years 2008, 2015, and mass production 2020.

The wine tasting methodology consisted of four steps that were repeated for each wine.

Step 1: Volunteers rinsed their mouths with water and took a 15-second break.

Step 2: For 30 seconds, the volunteers were exposed to a glass of white wine.

Step 3: Volunteers were required to smell the wine twice, once for a stationary glass and once after spinning the wine in the glass for 5 seconds.

Step 4: The volunteers then tasted the wine, taking 1-2 small sips to fully appreciate its flavor.

The volunteers completed a questionnaire at the end of each wine tasting to conduct a general evaluation of the wines.

The volunteers' brain activity was monitored for 15 minutes while the methodology's four stages were implemented.

EEG Examination

The team's experience gained in the development of the Brain Fingerprint project, which demonstrated that „the brain never lies,” was used to develop the EEG analysis software application, and research in this project was used to implement a prototype for a new system „lie detector” type.

Six electrodes in the international system 10-20 located on the frontal and central cortex (Fz, F1, F2, FCz, FC3, FC4) were used in the neuromarketing study. To reduce the complexity of the EEG sensors, we will try to use only the FP1 and A1 electrodes in the future.

Throughout the study, the EEG equipment simultaneously monitored and recorded the activity of δ , θ , α , β and γ brain waves. The brain waves and their cognitive state are described in Table 1.

Table 1: The brain waves and their cognitive state

Brainwaves	Frequency	State of Mind
Alfa (α)	8-12 Hz	Representing the state of creation, relaxation and visualization that is very beneficial to the generation of vitality and creativity. It is the ideal condition for solving problems
Beta (β)	12-27 Hz	Representing a state of alertness and concentration, keeping the individual sharp and focused. At this time, the brain will be more conducive to the work of message analysis and preparation
Gamma (γ)	> 27 Hz	Representing learning, memory, language processing and the state of consciousness that will disappear from anaesthesia to deep sleep
Theta (θ)	3-8 Hz	It represents one in the state of deep relaxation, meditation and good memory. It usually occurs when an individual enters a light sleep or a conscious dream. It is related to the relief of stress and the memory of long-term memory
Delta (δ)	0.5-3 Hz	Representing an individual in a state of healing and good sleep, usually accompanied by the release of growth hormone

Source: Ismail et al. (2016)

A team of doctors and marketing experts analyzed the spectral data of the brain waves monitored and acquired for each volunteer during the four stages of the methodology. Because theta and delta brain waves can only be stimulated during sleep, only alpha, beta, and gamma brain waves were chosen for analysis.

Results and discussions

Three T1, T2, and T3 tests were carried out in relation to the three rounds of wine tasting. The statistical analysis of three pairs of alpha, beta, and gamma brain wave samples was used to determine the dominant activity of brain waves during the three tasting rounds. Table 2 displays the test results.

Table 2. Test results

Round	Brainwaves	Limit Lower/ Higher	Water Avg Obtained Freq	Wine 2008 Avg Obtained Freq	Wine 2015 Avg Obtained Freq	Wine 2020 Avg Obtained Freq
T1	alfa	7-19.9 Hz	7.4 Hz	23.2 Hz	20.5 Hz	18.5 Hz
T2	beta	15-29.9 Hz	21.6 Hz	20.5 Hz	25.5 Hz	45.5 Hz
T3	gamma	30-99.99 Hz	68.8 Hz	112.4 Hz	90.6 Hz	69.7 Hz

There was a significant difference in beta oscillation activity for each volunteer after tasting the three types of wine, according to the results. Following the initial global analyses, comparative analyses were conducted between wines to determine their impact on beta oscillations. When compared to table wine, the results show an accelerated decrease in beta oscillations for old wines (e.g., quality, color) (general). There were no significant changes in the alpha and gamma oscillations, which remained nearly constant. The old wines (2008 and 2015) were mostly preferred by the volunteers, while the table wine (2020) was less so. The tests revealed an increase in beta wave activity for wines of lower preferred quality and a decrease in beta wave oscillations for wines of higher preferred quality.

Figure 1 depicts the calculation of the unilateral bispectrum of a univariate EEG time series using the fast Fourier transform (FFT) and an autoregressive model-based method (AR). A bispectrum is a third-order spectrum that corresponds to the third moment (asymmetry) of a time series. Asymmetric nonlinearities in the input time series can be detected using the resulting bispectrum.

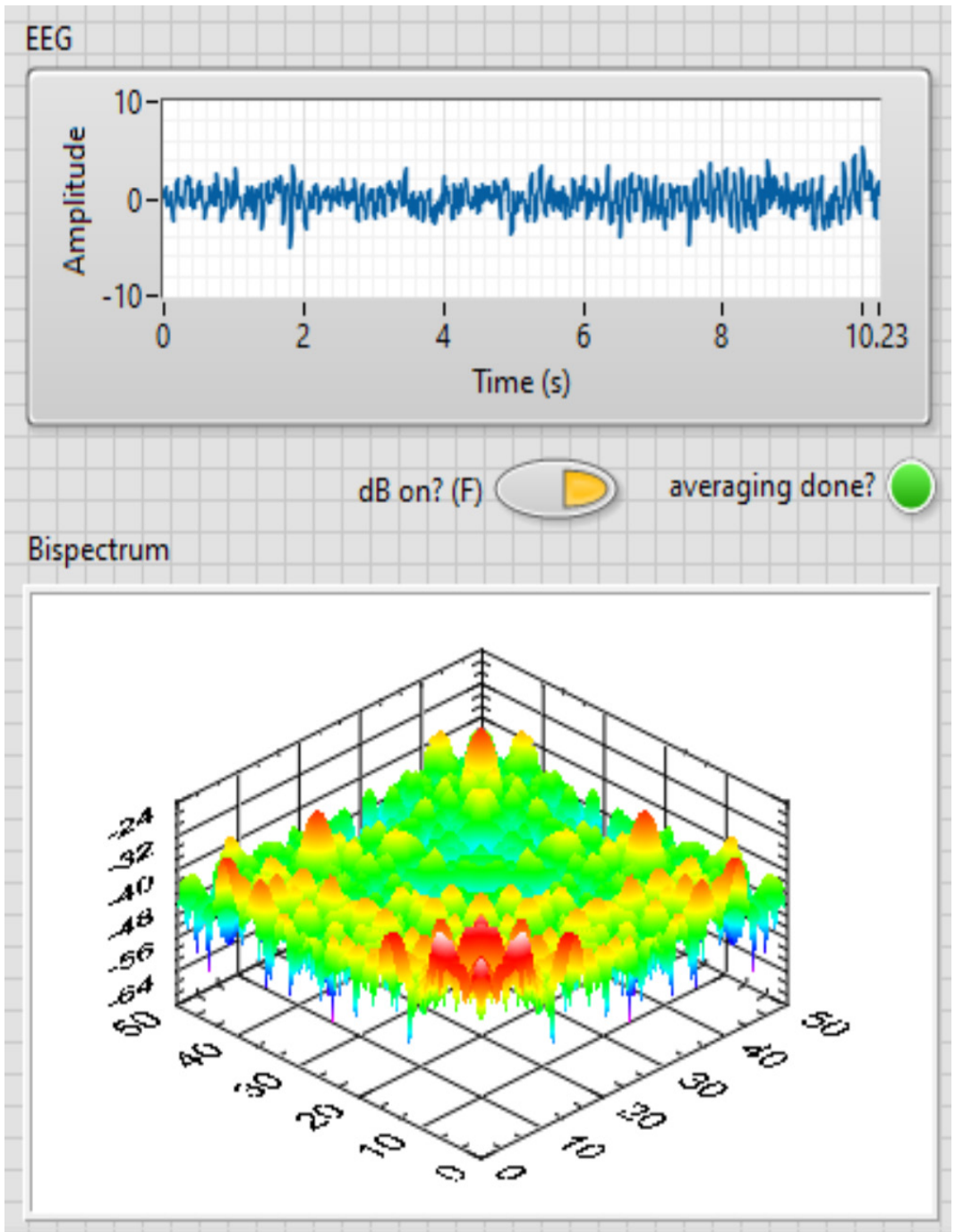


Figure 1. Calculating the unilateral bispectrum of a univariate EEG time series, using the fast Fourier transform (FFT) and the method based on the autoregressive model (AR).

The purpose of this study was to determine the contribution of brain waves to the study of the consumer profile in terms of his preferences and behavior. Following a comparison of the three alpha, beta, and gamma brain waves, we discovered that changes in beta oscillations during the experiment could be related to individual preferences for a specific wine (wine tasting). The findings show that changes in volunteers' perception during wine tasting have an effect on brain oscillations. As a result, tasting different qualitatively differentiated wines (their age) may influence the visual and gustatory cognitive process, as well as people's preferences for a specific quality of them. The results confirmed that the beta wave oscillations increased in intensity based on the consumer's individual preferences, and the decrease in activity of the beta wave oscillations indicated the consumer's preference for a specific type of wine based on its quality (age).

During the wine tasting in the T3 test, a musical (auditory) stimulus was introduced. When a musical stimulus was introduced, there was a significant correlation of gamma waves with the oscillating activity of decreasing beta waves, which determined the consumer's preference for a higher quality of wine.

The findings of this study cannot be applied to watching a movie, for example, because it employs different cognitive processes (visual and acoustic attention), which differ from the cognitive reactions used in wine tasting (olfactory and gustatory sensations). It's possible that the oscillations of beta waves that characterized volunteers' cognitive preferences during wine tasting behave differently in response to the visual and acoustic stimulation of watching a movie (advertisement).

EEG data could be used to gain a better understanding of how cognitive mechanisms (both neural and psychological) work to define consumer behavior when interacting with a specific product. The findings from this study to identify consumer cognitive behavior during product interaction are still in the research phase; current research focuses on basic research to understand the consumer's emotional mechanisms. Therefore it is necessary to carefully examine the results achieved by using EEG tools in the evaluation of the cognitive (emotional) state of a consumer. In reality, many of our perceptions of branded items as consumers appear to be based on complicated subconscious patterns (patterns) of action that develop in our minds in the form of „reasons” for pleasure or constitute a reason for generating pleasure or, simply, triggers that reason enough: we like it „just because.” In this context, emotions play an important role in the consumer's decision-making process, accounting for approximately 50% of his final decision.

Conclusion

Neuromarketing tools include methods and techniques created and developed by neurology and cognitive psychology specialists in order to identify people's reactions to various products, as well as specialized tools for observing the human brain's reactions to various marketing stimuli and its electrical activity. Brain waves, as measured by the EEG, do not lie. They don't hesitate, they don't give in to peer pressure, they don't hide their pride, and they don't say what others want to hear.

There are still debates about these rational-emotional relationships today, especially since the conventional view holds that we should not be influenced by emotions when making decisions. We learn through experience, and we improve through repetition. Human thoughts and emotions are the result of this subconscious activity, so the actions triggered by them cannot be explained in a conscious context, which is why most market research fails to reveal the true preferences of the subjects involved. According to new research, the consumer's response to advertising is based on cognitive efficiency rather than marketing manipulation.

New research in the field of highlighting the negative effects of advertising on the human psyche is emerging. The findings explain why direct exposure to repeated advertisements increases consumers' preferences for advertised products, particularly those advertisements for which consumers are the last to be informed (aware) of their very repetitiveness (that they have seen them before). The human brain devotes the majority of its resources to the subconscious, while conscious action consumes only 2% of its energy.

Future neuromarketing research using EEG analysis will consider delta oscillation variations, and alpha, beta, and gamma brain waves will be divided into two categories of lower (low) and upper (high) values.

The integration of neuromarketing in marketing is a long process because this field is still in its infancy. Performing neuromarketing analyzes can determine the consumer's profile from a cognitive point of view, the analysis of brain waves, but it can also use Affective Computing systems and systems for detecting emotions in the voice. Currently, in the EU, the use of personal data and data obtained through neuromarketing are regulated by GDPR legislation. This aspect leads to people's reluctance for such marketing studies.

Finally, instead of concluding, *I propose the following reflection scenario:*

2050: Individual connectivity to the Internet (IoT) will make information abundant, from diverse sources (e.g., sensors, scanners, colleagues), highly granular (information flows being associated with individuals, time and space),

and intimate (biometric elements, thoughts - by brain scanning and affective computing).

Data availability and progress in processing capabilities (graphics processors, quantum computer) will lead to a qualitative leap in understanding emotions. Sophisticated markers for emotion detection and analysis and their interpretation will be widely available. These devices perform facial and gesture recognition - brain computer interface - and will be incorporated into portable devices (smart phones, headphones - Brain Fingerprint, smart video cameras). In such a scenario, the population will be made up of „emotionally transparent” generations, with a greater desire to share emotions through „emotion-oriented” or „directed emotion” gadgets. People will look for new experiences using complex social networks, different from the existing networks. The Internet of emotions, part of the IoT, will fully enter the daily life of the population. Interpersonal communication will be achieved almost exclusively through brain waves transmitted via IoT. Socialization will focus on the virtual side, people becoming part of artificial intelligence. The advantage of this communication system will be the detection of the real feelings of the interlocutors, and the language between the brains, brain to brain, will no longer be able to be disturbed by hidden intentions. Will the lie disappear?

In the general context, companies and politics will seek to integrate this technology into their current activity. Economically, companies will seek to provide emotional experiences, while governments will explore opportunities to understand citizens’ emotions and gain feedback to develop better policies, but also to achieve political victories.

However, the impact of IoT communication on the population can have different directions: some will try to exploit the opportunities of new technologies, others will be concerned about the threats that emotional relationships can generate in all areas, personal and professional: in relationships with parents (emotional control), employment („emotional analysis”), education (emotion-based learning methods), healthcare (monitoring and personalization) and last but not least in the decision-making process (emotion-based policy - neuromarketing / mind control).

Brain-to-brain communication, using Artificial Intelligence, will allow humanity to develop its „seventh sense” in terms of emotional intelligence.

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ACCOUNTING DIFFICULTIES REGARDING FICTITIOUS OPERATIONS

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Abstract: *Fighting against tax evasion is well known at European and national authorities. This article draws attention to the limitations of the professional accountant in detecting fictitious operations. Accounting as a post-factum operation cannot bring objective assessments regarding the actual reality of an operation recorded in the received documents. Only from the simple examination of an invoice or other supporting documents prepared by the parties, does not result the elements of fact and the circumstances in which the operation took place, these being known only by the persons who issued or ordered the issuance of those documents.*

Keywords: *tax evasion, accounting documents, fiscal risk, fictitious operations, public administration*

JEL Classification: *F62 O50*

Introduction

In the Romanian legislation in force, in art. 2 lit. f) of Law no. 241/2005, the fictitious operation was defined as representing the concealment of reality by creating the appearance of the existence of an operation that does not actually exist.

The Constitutional Court in the decision no. 673 / 17.11.2016 (paragraph 39), published in the Official Gazette of Romania, Part I, no. 193 / 20.03.2017, ruled that the phrase “*not based on real operations*” refers to those operations that do not correspond to the factual or legal reality, and “*fictitious operations*”

refers to those imaginary operations, non-existent in fact or unrelated to the taxpayer. Therefore, the registration of a fictitious operation involves the recording in the primary documents and in the accounting records, with fiscal relevance, of some expenses that were not actually made or that are higher than those made or for which there are no supporting documents, therefore non-existent. and legally but transposed in the written record.

Fictitious operations are performed either by falsely entering expenses in legal documents, in the sense that they were not based on supporting documents, or by recording false supporting documents for expenses, in the sense that those expenses were not made or were much smaller than those recorded.

The I.C.C.J. by the criminal decision no. 272 / 28.01.2013 (file no. 11664/121/2011 of the Criminal Section), stating that the fictitious operation may consist, inter alia, in expenses that did not exist in reality or that are higher than the real ones or expenses for which there are no supporting documents, but which are registered in the legal documents”, as well as by the criminal decision no. 1113 / 15.02.2005 (file no. 4306/2004 of the Criminal Section), in which he showed that “by registering expenses that are not based on real operations is meant the elaboration of false supporting documents for expenses that were not made or were lower than those recorded in the supporting documents, and based on these false supporting documents, unrealistic expenses are also incurred in the other accounting documents, with the consequence of decreasing the net income and, implicitly, the fiscal obligation to the state.”

Starting from this hypothesis of expenses that are not based on real operations, in the sense shown above, the fiscal consequence would be that the documents in which they are recorded (eg invoices, bank account statements, receipts, etc.) would not you still meet the substantive conditions regarding the quality of supporting document, according to the law, and consequently, it would be necessary to include the total amount related to the taxable base to the category of non-deductible expenses regarding the calculation of profit / income tax and considering VAT as acquisitions. without the right to deduct (only the amounts considered by the taxable person, in question, as tax deductible, according to its accounting and tax records).

But what are the possibilities for the professional accountant to detect whether a supporting document, represented by the invoice issued for the provision of services, contains the record of a real or a fictitious operation?

1. The obligation to record the operations in supporting documents

According to the art. 6 of the Accounting Law no. 82/1991: “(1) Any economic-financial operation performed shall be recorded at the time of its performance

in a document underlying the accounting records, thus acquiring the quality of supporting document.”

According to the art. 11 of the same law: “the possession, by any title, of material goods, securities, cash and other rights and obligations, as well as the performance of economic operations, without being registered in the accounting, are prohibited.”

From the two legal provisions we note that any operation is recorded in a document and the respective document is subject to registration in accounting. If the documents are registered in the accounting registers, the supporting documents underlying the accounting entries shall be the responsibility of the persons who drew them up, endorsed and approved them, as well as of those who registered them in the accounts, on the art. 6 paragraph 2 of Law No. 81/1990.

But, in accounting it is forbidden to register (in accounting documents or other legal documents), expenses that are not based on real operations or register other fictitious operations (art. 9 paragraph (1) letter c) of Law no. 241/2005 for the prevention and combating of tax evasion, with subsequent amendments and completions). It follows, in conjunction, that although they may meet the formal legal requirements to meet the status of supporting document, documents recording unrealistic transactions or expenditure not based on actual transactions will hold the responsibility for those persons who drafted, endorsed and approved as well as those who registered them in the accounts, as the case may be the subject of analysis from the perspective of committing an offense (classification that belongs exclusively to the competent judicial bodies).

Here are the provisions on the fulfillment of the following requirements to have the status of a legal supporting document:

- Mention of the parties participating in the economic-financial operation (when applicable);
- The content of the economic and financial operation and, when necessary, the legal basis for it;
- Quantitative and value data related to the economic and financial operation performed, as the case may be;
- Name and surname, as well as the signatures of the persons responsible for carrying out the economic-financial operation, of the persons with preventive financial control attributions and of the persons entitled to approve the respective operations.

All the above legal requirements refer to the effective operation.

So, under the condition of validation that the documents in question record expenses based on the performance of real economic and financial operations (aspect that exceeds the competences of the professional accountant), then they can meet the substantive legal conditions regarding the quality of supporting document. If, although all the information elements of a document are completed, fulfilling the formal conditions, if the operations entered in them do not prove to have been carried out, then the expenses recorded in the accounts are not based on a supporting document (expenses recorded without being based on a supporting document prepared according to law). In this case, the expenses recorded in the documents are not deductible in the calculation of taxes and fees due to the general consolidated budget, being recorded without being based on an economic and financial operation.

But what does the quality of a legally prepared supporting document mean?

2. The legal quality of supporting document

The supporting documents are grouped into distinct categories in relation to the object of the economic-financial operation performed by the taxpayer, their form and content being established, as appropriate, by the provisions of tax legislation (Fiscal Code), or the provisions of accounting legislation (e.g., OMEF no. 3512 / 2008 and OMFP No. 2226/2006).

The relevant provisions of the Fiscal Code, the Fiscal Procedure Code and the Accounting Law (including its subsequent normative acts), distinguish between:

i) “primary documents or primary evidence documents” which record and certify the reality of economic operations. The main primary supporting document with this role is the invoice, regulated after 01.01.2007, exclusively by the Fiscal Code, and defined as the document in which any patrimonial operation is recorded at the moment of its performance and which is the basis of accounting records (for situations in which the preparation of the invoice is mandatory and not optional);

ii) “accounting documents or synthesis / centralizing documents” represented by the accounting records with the role of “centralizing” the primary documents and the operations recorded in them, regulated by the Accounting Law and the subsequent normative acts. The preparation of accounting records involves highlighting the operation in a system of registers, forms and financial-accounting documents related to each other, which serve for the chronological and systematic recording in accounting of economic and financial operations performed during the financial year.

In general terms, the main document intended for the registration of an economic and financial operation in accounting is the invoice. The legal regime of the invoice is regulated from the date of accession to the EU, exclusively by the provisions of art. 155 of the Fiscal Code approved by Law 571/2003, expressly developed by the provisions of point 15 of ANNEX 1 - Methodological norms for preparation and use of financial-accounting documents approved by OMEF no. 3512/2008:

“The invoice is drawn up and used in accordance with the provisions of the Fiscal Code.

For supplies of goods or services for which taxable persons are exempt without the right to deduct value added tax and are not required to draw up invoices, in accordance with the provisions of the Tax Code and the methodological rules for its application, economic operations are recorded. based on contracts concluded between the parties and financial-accounting or banking documents certifying those operations, such as: notice accompanying the goods, receipt, payment / receipt order, bank account statement, accounting note, etc., as appropriate.”

It follows from the provisions of the above-mentioned accounting law that: the economic operations in which it is necessary to draw up an invoice are recorded in the accounts only based on the invoice. Only for the operations for which there is no obligation to draw up the invoice, other supporting documents are required (such as the notice of preparation of the goods, the receipt). The consequence of this unequivocal and uninterpretable method of regulation is that the invoice, and only the invoice, is required in the matter of supporting documents for purchasing operations, which is obviously in line with the VAT Directive on the role of the invoice in deducting VAT. In the same sense is the national jurisprudence (of the ICCJ - High Court of Cassation and Justice), as well as the CJEU- Court of Justice of the European Union.

Decision no. 1017 of March 26, 2009 appealed by the Commercial Section of the High Court of Cassation and Justice: The judges of the High Court of Cassation and Justice considered (in the content having as object the ascertainment of the absolute nullity of an invoice) that, based on the provisions of the Accounting Law no. 82/1991 and of art. 46 of the Commercial Code (according to Law no. 71/2011 for the implementation of the new Civil Code, the provisions of art. 46 of the Commercial Code are still applicable in relations between professionals until the date of entry into force of the new Code of Civil Procedure), **the invoice has only the quality of a supporting document underlying the records in the accounts of the supplier or the buyer and is a means of proof of the operation performed.**

According to CJEU jurisprudence, the invoice is a document certifying the completion of a transaction between two traders, containing transaction data (transaction date, object of the transaction, volume and value of the transaction) and information about participants (name, address, tax identification code), and the lack the elements of the invoice referred to by the inspection bodies cannot constitute a sufficient and essential element in the exercise of the right to deduct, and it is necessary to take into account all the relevant aspects of the case in that regard.

Council Directive 2010/45 / EU on invoicing states in recital 10 that **“Invoices must reflect actual deliveries.”** The Directive recognizes the obligation for invoices to accurately reflect the actual supply of goods and the actual provision of services, and therefore requires that the authenticity of the origin, the integrity of the contents and the legibility of the invoices be ensured from the time they are issued until the end of their storage period. This can be done through management controls, which provide a reliable audit trail between invoice and delivery and guarantee the identity of the supplier or issuer of the invoice (authenticity of origin), that the VAT details (content of the invoice required by the VAT Directive) of on the invoice are unchanged (integrity of the content) and that the invoice is legible.

In conclusion, the invoice is a primary justifying document, legally regulated by art. 155 Invoicing from the Fiscal Code, to which art. 2, letter d) of Law no. 241/2005 also refer. Considering that, after drawing up a supporting document, the taxpayer has the obligation to proceed with the registration of the respective document in the accounting records (this involves highlighting the operation in a system of registers, forms, and related accounting documents, which serve for chronological recording and systematic accounting of economic and financial operations carried out during the financial year). Considering that, at art. 80-81 of the Fiscal Procedure Code (old Fiscal Procedure Code approved by Government Ordinance no. 92 / 2003, rep.), The taxpayer’s obligation to keep accounting records is established and based on primary documents and the obligation to submit tax returns. It results from the previously performed analysis, that the mandatory elements and other requirements provided for the documents regulated by OMEF no. 3512/2008, issued in application of the Accounting Law, does NOT refer to the invoice, but exclusively to financial-accounting documents, the invoice being regulated by a special law (Fiscal Code).

We conclude that: The documents underlying the records in the accounting records can acquire the quality of supporting document only in cases where they provide all the information provided in the legal norms in force.

3. European views on combating fraud, tax evasion and possible abuse

From the point of view of VAT, when, although the existence of invoices and their related payments is ascertained, if the substantive conditions regarding the performance of the operation are not met (e.g.: if the acquisitions are fictitious / not based on real operations), then the transactions are not carried out with payment, respectively if the amounts paid do not match the supply of goods or services, the transactions are not for consideration, and consequently, the transactions entered in the invoices would no longer fall within the scope of VAT, failing to meet cumulatively the legal conditions to be taxable transactions. In that regard, the proceedings of CJUE in Case C-285/10 Campsa Estaciones de Servicio SA v. Administration, paragraph 25, show that, in that regard, the possibility of classifying a transaction as a ‘onerous transaction’ within the meaning of Article 2 of the Sixth Directive implies only the existence of a direct link between the supply of goods or the provision of services and a consideration actually received by the taxable person. Thus, the payment of a sum of money remains without consideration if the purchases are fictitious.

Regarding the limitation of the right of deduction, the CJEU confirms the principle of the right of deduction, which makes the exceptions to be strictly interpreted and applied, according to the provisions of the VAT Directive, properly transposed in the Romanian Fiscal Code. However, it must be borne in mind that, in fact, the fight against fraud, tax evasion and possible abuse is an objective recognized and encouraged by Directive 2006/112 (see, inter alia, Halifax and Others, paragraph 71, Judgment of 7 December 2010, R., C 285/09, Rep., P. I 12605, paragraph 36, and Case C-504/10 Tanoarch [2011] ECR I-10853, paragraph 50).

In that regard, the Court has already held that litigants cannot fraudulently or abusively rely on the rules of European Union law (see case C-32/03 Fini H [2005] ECR I-0000). I 1599, paragraph 32, and Halifax and Others, paragraph 68, and Kittel and Recolta Recycling, paragraph 54). Consequently, it is for the national authorities and courts to refuse the advantage of the right to deduct if, in the light of objective factors, it has been established that that right has been alleged fraudulently or abusively (see, to that effect, the judgments cited above., paragraphs 33 and 34, and Kittel and Recolta Recycling, paragraph 55, and Case C 414/10 Véleclair [2012] ECR I-0000).

Furthermore, it must be pointed out that Article 21 (1) (c) of the Sixth Directive provides that **any person who mentions VAT on an invoice or other document serving as an invoice is liable to pay the tax.** Specifically, those persons are payers of that VAT on an invoice independently of any obligation

to pay because of a transaction subject to VAT (see, to that effect, Judgment of 13 December 1989, *Genius*, 342/87, Rec., P. 4227, paragraph 19, Judgment of 19 September 2000, *Schmeink & Cofreth and Strobel*, C 454/98, Rec., P. I 6973, paragraph 53, and *Reemtsma Cigarettenfabriken*, C 35/05, Rep., P. I 2425, paragraph 23).

The Court has ruled that, to ensure the neutrality of VAT, it is for the Member States to provide, in their domestic legal order, for the possibility of correcting any invoiced tax without being due, provided that the issuer of the invoice demonstrates good faith (see, to that effect, *Genius* 342/87, judgment of 13 December 1989). Thus, if the operations are susceptible to tax fraud / evasion, the exclusion of loss of income to the state budget is ensured by the obligation to apply a non-deductible treatment to the Beneficiary-buyer, and compliance with the principle of fiscal neutrality is ensured by the buyer's right to obtain from his supplier the refund of amounts paid for the delivery of goods / services which were not finally performed (see by analogy Judgment of 31 January 2013, *LVK*, C 643/11, EU: C: 2013: 55, paragraph 48, and Judgment of 13 March 2014, *FIRIN*, C 107/13, EU: C: 2014: 151, paragraph 55).

Moreover, regarding cases of VAT invoiced without being due to the lack of a taxable transaction, the Court has ruled that, of course, the principles of neutrality and effectiveness do not preclude, in principle, national legislation under which only the supplier may claim from tax authorities. competent authorities to reimburse the amounts which he has paid to them in error as VAT, and it is for the purchaser to bring an action against the supplier to obtain, in turn, the reimbursement of the amounts paid, including VAT. (See, to that effect, *Reemtsma Cigarettenfabriken*, C 35/05, EU: C: 2007: 167, paragraphs 39, 41 and 42). Specifically, the tax declaration of operations in cases of tax fraud / evasion, by both partners of a transaction, requires that, in order to comply with the deduction regime, the formal and substantive conditions of operations, and without prejudice to the principle of tax neutrality, the beneficiary to apply non-deductible tax treatment to transactions which he knew or should have known were not actually carried out, the supplier having, on the one hand, the possibility to exercise at any time the right to regularize, in the mirror, those transactions , and on the other hand, the obligation to reimburse the amounts received from the beneficiary (including VAT), which in this case are constituted as undue payments.

In this context, no confusion should be made between fictitious expenses / which are not based on real operations that have a non-deductible assimilated character, by not respecting the general substantive conditions regarding the actual realization of the operations, and non-deductible expenses, within the express provisions of the non-admission of the deductibility

provided by the Fiscal Code, only the first ones falling under the incidence of the criminal offense, but even in this situation, the tax return of operations by both participants (including the regularization of operations) excludes any loss of revenue to the general consolidated budget, if the elimination of the deductibility exercise to the Beneficiary is ensured, regardless of the exercise of the right to recover amounts paid (although they were undue) to the Supplier and independent of the fiscal behavior of the Supplier. In this regard, the CJEU rules that the supplier can act in good faith and can eliminate in a timely manner any possibility of loss of revenue to the state budget, in which case, he opposes the refusal of the right of regularization of the supplier, who has a right of restitution. of the tax paid in the accounts of the general consolidated budget and refunding the amounts collected, not owed by the Beneficiary, will ensure the effectiveness of the principle of tax neutrality. In this way, the principle of fiscal neutrality, enacted in its case law by the Court of Justice of the European Union, which opposes the refusal to deduct taxes in cases where the partners of a commercial chain highlight and declare their taxable operations, in which case there is no risk of loss. of tax revenue for that Member State, regardless of the factual reality of the transactions carried out in a transparent manner, but only if, in relation to the existence of objective elements, the beneficiary did not know or should not have known that the transactions are vitiated by fraud.

Conclusion

In conclusion, the professional accountant cannot assess the actual reality of an operation only by simply examining an invoice or other supporting documents prepared by the supporting parties. The facts and circumstances in which the operation took place are known only by the issuers, or the persons who ordered the issuance of such documents. In this sense, the possibility to correct any invoiced operation knowing that it did not take place, belongs to both the issuer and the beneficiary, if they demonstrate good faith.

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TECHNOLOGIES AND THEIR IMPACT ON AUDIT

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Abstract: *As technology has become indispensable in any field of life and therefore in auditing, this paper aims to study the influence of technology on the audit and how this process can be improved. In an economic environment characterized by frequent changes, technological information and increasingly specialized software are essential and are an invaluable help in conducting a modern audit. Given the pace at which technology is advancing like never before, allowing organizations to process and analyze large amounts of data, the audit is driven to adapt and make profound and rapid changes. The paper analyzes the effect of technology on the skills required by auditors in order to perform a high-quality audit in a digital world.*

Keywords: *audit, technology, Big Data, digital world, challenges*

JEL Classification: *M40, M42, Q55*

Introduction

In the contemporary economic environment, the audit plays a vital role in the business, government, and economy of each country. Investors, financial analysts, bankers, bondholders, and other creditors appreciate the work of auditors and rely on audits of financial statements to ensure that they use reliable information when lending to public and private companies. The management of a company needs reliable and timely information to make different types of business decisions.

Over time, external stakeholders - customers, creditors, banks, governments, the business and financial community, investors, and regulators - have increasingly sought information on the activities, governance, decisions, and strategic direction of companies, based on which they can take important investment or business decisions. In other words, the audit is the way through

which managers find out if the business they lead is reliable and whether it's ready or not to meet potential challenges, and it is the way through which stakeholders receive the assurance on the financial, operational, and ethical well-being of the organization. Moreover, studies argue that both the technology and the work undertaken by the auditor have a major role in guaranteeing the integrity of financial statements (Taremwa, 2019).

As new technologies are accepted and adopted, giving clients accessibility to a great amount of data, investors are looking for broader assurance services in order to reduce risks in their business, beyond the focus on historical information. Certainly, auditors should adapt to the new requirements to benefit from more information available to further improve the quality of the audit of financial statements and to provide an additional perspective.

Internationally, institutions are beginning to use digital and automation technologies, but it will take some time before they begin to understand how to capture value from them. Financial professionals need to start assessing how these technologies will affect their work, as well as the type of talent needed to deliver on the promise of digital instruments. Technology has become indispensable, but it is also very important that these tools be used correctly and efficiently.

If the financial-accounting function had in the past the role of “technical support” then this function must be considered today as a “business partner” that offers vision for the future, helping the company to achieve its objectives and contributing to its long-term success (IFAC, 2019).

Auditing at the Speed of Change

Due to advanced technology, important changes are expected in the field of accounting and auditing, in terms of speed and accuracy of information, but also the adoption of new technologies such as tax software and tools that help accountants improve their traditional working methods, thus reducing the number of mistakes made. In a rapidly changing environment, information technology is becoming an important strategic business partner. The use of IT — the technology used to process, store, and transmit information — improves the organization's performance by helping management make decisions. The digitalization of the business model is the main factor for competitiveness and long-term success.

According to Ursillo (2018), the partner in Cherry Bekaert's Risk Assurance & Advisory Services (RAAS) group, “new accounting technologies

are likely to significantly impact the way auditors execute engagements and client services,” even though traditional audit will remain essential. Until recently, auditors worked in an office. Due to the evolution of technology, auditors can now work remotely, using data and analytics, automation and visualization in real-time. Traditionally, an audit process is performed by following several stages such as accepting and planning the audit mission, evaluation of the internal control, verification of financial statements, and audit report. As organizations increase the adoption of big data, the audit profession is forced to evolve and change the methods employed in audit processes oriented towards improving engagement output (ICAEW, 2018b). It is important for the information systems (IS) auditors “to understand the associated risk and consider approaches to ensuring that the risk is properly managed” (McDermott, 2018).

According to a survey conducted by Harvard Business Review Analytic Services, 72% of the 600 respondents found that the strategies and operations of the institutions they run are sensitive to digital disruptions generated by their competitors that offer simpler and cheaper solutions. These business leaders understand that their ability to perceive and react in time to ever-changing conditions such as internal operational problems as well as external market conditions, all of these are a matter of survival and that only those who are able to use data, analysis and automation to anticipate and take the necessary action will have a competitive advantage. All these realities help us understand the important role that both financial audit and financial accounting activity play in meeting these challenges.

Some researchers (Griffin & Wright, 2015; Earley, 2015) have complained about the lack of big data in the audit. Earley (2015) argues that big data could be a game-changer in auditing. Researchers as Brown-Liburd et al. (2015), Moffitt and Vasarhelyi (2013), Yoon, Hoogduin, and Zhang (2015) embrace the use of technologies and argues that big data would add value in the audit process. In an economic environment characterized by frequent changes, technological information and increasingly specialized software are essential and are an invaluable help in conducting a modern audit. It is essential that auditors and other professionals in this field not only be informed about the recent technological developments but obtain a sufficient understanding of these new technologies to get the most out of them. These technologies require redefining audit processes, frequently updating software tools, and acquiring new skills and abilities from professional accountants.

According to Bloomberg Tax (2020), the major international public accounting firms - Deloitte, PricewaterhouseCoopers (PwC), KPMG, and Ernst

& Young - set a new record in investing billions into artificial intelligence & data analytics products, and changing the way they have traditionally operated. These firms, known as the *Big Four*, also want to train employees to bring advanced digital solutions to all consulting and auditing practices within companies. In an interview on December 2020, Narayanan Vaidyanathan, head of business futures at the Association of Chartered Certified Accountants, declared that “new technology was fundamentally changing the nature of accounting.” Although some of the jobs will no longer exist with the automation of invoices, however, accountants and auditors “will be expected to become business advisers, not just number checkers. They need to be on top of technology and train staff to use it.”

All these technological advances certainly lead to a rethinking of the audit process and we need to recognize that this requires time to happen. Auditors not only need to be sharp as they understand and adopt these new tools, but they must be well ahead of these changes to be able to provide relevant counseling and support services. Before using the new technologies, auditors first need to understand them (Appelbaum et al. 2017).

An overview of technologies that can change audit

In today’s digital transformation, technology and tools such as artificial intelligence (AI), cloud systems, blockchain, and data analytics are key challenges for any organizational activities and processes. In the last 10 years, Big Data has been one of the most frequently discussed phenomena as well as a challenge in many organizations around the world. However, when we are talking about big data, the audit industry lags behind.

Big Data is usually described using the three Vs model. Many information systems (IS) auditors and risk professionals are already familiar with this model, which represents the concepts of volume, velocity, and variety (McDermott, 2018).

The National Science Foundation (NSF, 2012) defined Big Data as “large, diverse, complex, longitudinal, and/or distributed data sets generated from instruments, sensors, Internet transactions, email, video, click streams, and/or all other digital sources available today and in the future.” Big Data can be defined based on large volumes of extensively varied data that are generated, captured, and processed at high velocity (Laney, 2001). Drew Conway, head of data at Project Florida, concluded that “Big data, which started as a technological innovation in distributed computing, is now a cultural movement by which we continue to discover how humanity interacts with the world—and each other—at

large-scale.” Kord (2012) highlighted 4 elements of Big Data ethics: identity, confidentiality, ownership and reputation. Although in the meantime things have evolved, these elements may still be relevant in risk assessment, audit planning and alignment between the company’s documented values and practices in the methods and tools used (such as algorithms), buying, selling, etc.

Artificial intelligence, blockchain and data analytics are game changers for both the finance and accounting sector and the audit profession, transforming the roles of both finance professionals and auditors (ICAEW 2018b). Auditing will continue to be transformed through deep learning. With regard to auditing, it is anticipated that AI will change the definition of reasonable assurance by identifying risk-based anomalies, not just rules.

Blockchain can be defined as a network software protocol, which is a set of rules and conventions which allow network devices to communicate with each other (ICAEW 2018b). Blockchain is like a protocol, a way for recording transactions. Unlike the internet, in which data is shared, blockchain ownership can be transferred from one party to another. The good thing is that “Blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system.” (ICAEW 2018b).

Related to Big Data is also the development of cloud computing. One of the advantages of using cloud services is that users can benefit from these services without having to maintain and operate their own IT infrastructure. According to the US National Institute of Standards and Technology (Mell, and Grance, 2011), cloud computing is a “model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” Cloud computing is the best way to manage information technology (IT) resources, as companies manage to store as much data as they need (Bhardwaj et al. 2010). According to KPMG (2018), auditors need to integrate more cyber security capability in the audits and also, they need to rethink their approach in providing assurance around cloud systems.

There are various technologies like Apache Hadoop, NoSQL, Data Analytics, CATT that can be very helpful in financial audit missions, by simplify audit procedures, improve organizational performance and reduce risk (Cristea, 2020). Hadoop is one of many open-source software platforms that help store and manage large amounts of data. Also, an advantage offered by Hadoop in favor of auditors is the tolerance for errors, resuming the order, allowing security analysis and storage of APT (Advanced Persistence Threats). The adoption of HDFS and Map Reduce makes it much easier and more secure for the auditor to verify information about company transactions. MapReduce can process huge amounts of data at high speed and can also remove duplicates.

These audit softwares add value to the financial auditor in conducting audit activities, creating a hybrid environment in which systems are responsible for monitoring an overly voluminous external data environment (Kraheil, and Vasarhelyi, 2014). All these technological developments tend to lead to the adoption of a continuous audit and the extensive use of IT tools.

The advantages and challenges offered by technical tools

Some research (Marr, 2018) estimate that 90% of the world's data has been generated since 2016, and significant amounts of it are financial data. Furthermore, according to a survey by the International Data Group (2020), 81% of survey respondents reported already using computing infrastructure or having applications in the cloud, compared to 73% in 2018, and another 12% of them projecting to implement cloud-based applications in the near future. Cloud adoption has also reached more than two-thirds in every industry, with about 75% in financial services, and 92% of the organization's total IT environment is at least somewhat in the cloud.

An increasing number of organizations recognize the many benefits of the cloud-computing trend. Among the key benefits of cloud computing, we can list agility, scalability, greater efficiency, reduced costs, data security, business continuity and flexibility, and many others. Given the increasing use of big data by audit clients, it leads to urgency for auditors to conform to the existing trend (Appelbaum et al. 2017).

Technology has the capability to transform the audit. It increases competitiveness in the world market, having a positive impact on organizational processes, including accounting, finance, marketing and human resources. Technology offers the ability to improve the quality of audit and also to add more value (ACCA, 2019). Furthermore, technology can considerably improve the work of the accountant and the auditor, increasing the economic efficiency and speed of the processes. It reduces the time to complete the audit mission because it accelerates the identification of exceptions, simplifies the preparation of worksheets, and the reports are generated automatically. It provides immediate benefits to the audited client by reducing the daily risk, detection of irregularities and fraud, data analysis may indicate forecasts, ensuring greater independence from the audited environment. Technological advances might allow auditors to move toward a more continuous auditing and monitoring process.

The use of IT devices has changed significantly the activity of auditors, and also improves the financial reporting system. For instance, "new technological tools have the potential to enable the auditor to mine and analyze large volumes of structured and unstructured data related to a company's financial information. This capability may allow auditors to test 100 percent of

a company's transactions instead of only a sample of the population" (Harris, 2017). By adopting big data techniques, auditors could provide reasonable assurance about the relevance of the financial statements (Hogan, Rezaee, Riley, & Velury, 2008).

There is no doubt that technology presents opportunities that help increase the efficiency and quality of the audit, but along with these opportunities comes also considerable risk that must be properly managed. An important concern associated with big data is ensuring that adequate safeguards are in place to protect the data and adhere to privacy requirements, particularly for consumer information (ISACA, 2018). Another concern is, When AI and other technologies are fully accepted and put into practice, what happens to the independence of the auditor?

The rapid technological evolution brings opportunities but also challenges for the financial-accounting function. The only thing we know for sure so far is that technology cannot completely replace the "auditor's knowledge, skill, judgment, and exercise of professional skepticism" (Harris 2017), and human involvement is still necessary to effectively communicate and advise investors and information users. Despite these advantages offered by technology, professional reasoning will always be necessary for the audit, the financial auditor's thinking and analysis will not be able to be replaced. "The future is one where humans and machines work together" (ICAEW 2018b). What real effect the technology will have on the audit process is yet to be determined.

Conclusion

Technology has the capability to transform the audit. It enables the increase the assurance that professional auditors must give, thus contributing to ensuring confidence in the system. As recent research highlights (ACCA, 2019), a key skill for auditors in the near future will be the flexibility to adapt to a working environment that will continue to evolve. The auditing profession will certainly not disappear, however, it will need a new approach. To improve audit quality and investor protection, there are several challenges that auditors need to consider. Besides being up to date with new technologies, audit professionals must be able to find information that is important to clients, such as tracking trends and emerging issues, in order to provide more insights to help make more-informed business decisions. In addition, they need to improve their critical thinking, technology skills, professional judgment, and look ahead and provide insights on future challenges and opportunities in order to meet the rising expectations on audit quality.

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