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Editorial

CYBERCRIME: IN DISGUISE CRIMES

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ABSTRACT

Cybercrime is commonly defined as any criminal act in which a perpetrator breaks or hacks into a computer or computer network in order to illegally obtain sensitive information or disseminate destructive computer software. Common examples include Internet fraud, identity theft, credit card account theft, or access to information that can cause harm to an individual or corporation. Web technology has played an important role in giving rise to such crimes. Hacking into a computer these days is like taking snapshots or x-rays of someone's body – there is vast amount of personal information stored in the computer. A person may have actual research or potential ideas for it (the brain), memorable pictures (the heart), work files (making a living) and some additional information stored on the computer. On the surface the hacker is not physically hurting anyone in this scenario, but this is not true in general. The damage caused by these crimes cannot be easily measured. Physical violence is a visible form of crime but cybercrimes are committed in the 'unseen' world of Internet that may be 'accessible' by the world. In this case we could say that this is not physical violence because nobody is physically hurt; however this is no an encompassing definition of violence. According to the World Health Organization (WHO), violence can be defined as "the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, which either results in or has a high likelihood of resulting in injury, death, psychological harm, mal-development, or deprivation." In addition to these, violence can also include exposure to ridicule or defamation of character. In this sense, cybercrimes can cause more psychological harm and deprivation than any other crime committed against a person. The trauma caused by cybercrime can have a long term effects on a person's mental, physical health, and financial affairs. In this paper the authors consider some aspects of how the computer can be used as a tool to commit violent and criminal acts and some key factors to mitigate these risks.

KEYWORDS: *cyber, crime, internet, cyber law, hacking*

1. INTRODUCTION

Before the rise of the Internet, cybercrimes were difficult to commit because the perpetrator had to have a physical access to the computer. Nowadays, hacking has become easier because any computer with an active Internet connection is susceptible to remote access. Hacking or unauthorized access to information stored in a personal or corporate

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computer system can be achieved via website, email, or network with devastating results for the computer's users and/or the equipment itself.

Through a website the hacker tries to find loopholes to access personal or financial information for illegal gain, pleasure or to harm somebody. Websites prone to hacker attacks are those generally used for online shopping, banking, or social media. In 2013, the retail store Target® was a victim of hacking. In this case the website was hacked using the "point of sale" machines to steal credit card information affecting millions of users. This, in turn, caused some banks such as Chase® to limit the amount of ATM withdrawal of all compromised debit cards to a maximum of 100 dollars per day [10]. Users wishing to withdraw larger amounts were forced to visit a bank branch. This is a good example of the users being a victim of cybercrime over which they did not have any control.

Another commonly used method for victimizing computer users is through email. Email hacking can be achieved using social engineering, malware, spyware, worms, viruses, etc. Social engineering is the art of manipulating people so they give up confidential information. It is a non-technical, easy to use, and most successful attack. Social engineering used human interaction to trick people into providing sensitive information because of their trusting behavior. This way the hacker can access personal information including email of highly sensitive nature. Nowadays, a great deal of personal and business communication is carried out using email. Some users may not be well-informed, be technical-savvy or take the necessary precautions to protect their email id/password [9].

A preferred method of hacking is Network hacking because it has the potential of accessing information about a larger number of people. The hacker overcomes the network firewalls and get access through a backdoor or the impersonation of a legitimate user. Hacking techniques on networks also include creating worms, initiating denial of service (DDoS) attacks, or in establishing unauthorized remote access connections to a computer. Other things that could worsen this situation is the existence of many pre-packaged scripts available on the Internet for anyone to use. Sophisticated hackers may study and enhance these scripts to develop new methods of attacks. As reported on the Silicon Angle website, China has one of the most sophisticated filtering systems in the world. However on August 25th 2013, a part of the Chinese Internet went down as a result of the largest denial-of-service (DDoS) attack that it has ever faced. According to the China Internet Network Information Center, the attack began at 2 a.m. and was followed by an even more intense attack at 4 a.m. on the same day. The attack was aimed at the registry that allows users to access sites with the extension ".cn," [2].

In the following sections we will discuss some real-life examples of cybercrimes, cyber law, and the costs incurred due to these crimes and how to mitigate the risks of becoming a victim of these type of crimes.

2. EXAMPLES OF CYBER-CRIMES

2.1. Identity-fraud

In 2012, 12 million people in USA were victims of identity fraud out of which 34% were reported in Florida, 24% in Georgia and 20% in California [7]. Most of the users were hacked using social websites where 15% had unauthorized access to their accounts, 13% had passwords or other sensitive information disclosed through social engineering. A large majority of people, 70%, were asked to visit a scam website via a private message. When using social media websites, people share personal information without even intentionally thinking that such information can be used against them. A 2012 study indicates that 93% people share their full name, 4% their home address, 60% share family names or relatives, and 33% share their current employer. In Facebook™, 30% of its users do not have their profiles set to private and 14% did not know how to change their privacy settings [7].

2.1.1. The Freebie

"In Wichita, Kansas, a man walked into a police station and told the cops that he was an undercover agent who had recently assumed the identity of a local homeowner. He gave them the address of the house he was currently occupying. Therefore, if anyone calls to report him as an impostor or allege that he had broken into the house, the police would have no need to investigate as he had already explained his situation. The cops selected one of the innumerable things about his statement that didn't make sense. They went to the given address and found the same man living there under the original homeowner's identity. He had gotten new credit cards, set up phone service and purchased a few flat screen TVs and computers in the homeowner's name. The man and his wife had also used the homeowner's name to take out a second mortgage. As it turns out, the homeowner had been gone for several months, caring for his mother who had fallen seriously ill in another town. While he was gone, this couple had stolen his house and his name, and then changed the locks and set up a new mailbox before going to the police and exposing their crime [5]."

2.1.2. Life takes a turn

"Simon Bunce was a former RAF (Royal Air Force) pilot and successful business executive living in England. However in March 2004, he was arrested as part of "Operation Ore", a massive British police crackdown on child pornography. Mr. Bunce was taken into custody and his computer equipment and other personal possessions were confiscated. He was immediately fired from his high-paying job and was essentially disowned by his entire family except for his wife. He discovered that in 1999, his credit card information was stolen from an online shopping site, then used by someone in Indonesia to purchase child porn from an American website. Cross-checking the information he collected with his own records, Bunce was able to prove that at the same time he was supposedly buying child pornography, he was at a restaurant in London [5]."

2.1.3. What? I am already married!

"In terms of the stress involved in wedding preparation, obtaining a marriage license usually ranks in between choosing the font for the invitations and figuring out whether or not you can use Masters of the Universe figures as your cake toppers. You go to court, sign some forms, pay a small fee, and you are legally married. At least that's all Rosa Vargas of Queens, New York, was expecting when she filed her application for a marriage license in 2004. So imagine her surprise when she found out three weeks before her wedding, that the application had been rejected by the City Clerk's Office because they found that she was already married to two other men, one in Mexico and one in Ecuador. About five years later, Vargas was served divorce papers from an Ecuadorian man she had never met. She refused to sign the papers, but the man persisted. He showed up at her assumed mother-in-law's doorstep and would not be persuaded until she showed him a picture of Vargas' wedding day, in which the man could clearly see that he was in no way represented. Vargas had lost her birth certificate about 16 years earlier, and over time her name and information had been used by two different women in two different marriages, most likely as a type of immigration scam. Vargas was eventually able to get the phony marriages nullified by a judge, but has since found herself married to a third stranger somewhere on Long Island [5]."

2.1.4. Mail scam

A '4-1-9 Nigerian' scam is a form of an upfront payment or money transfer scam. These types of scams were pioneered in Nigeria hence its name, however, scams of this type can come from anywhere in the world. The '4-1-9' part of the name comes from the section of Nigeria's Criminal Code which outlaws the practice. Scammers usually contact the victim by an email or letter and offer a share of a large sum of money that they need to transfer out of their country. Scammers ask the victim to pay money or provide bank account details to help transfer the money. The money promised will never come to the victim but the scammers will keep asking for more money in form of a "fee" or other administrative costs, informing the victim that everything is being done to send the promised money as soon as possible. Obviously, the money never comes and large amounts of money are taken out of the victim's accounts.

2.1.5. Russian bride scam

Love and Money – the core aspects of this scam. It is important to focus on how the scammers not only are extorting money but also playing emotional games with the victim because they do not want the victim to think rationally. In this scenario, a "female" scammer falls in love with her Internet acquaintance in a short period of time and then shows her interest in meeting with her acquaintance in person. She then informs her acquaintance that money issues are stopping her from meeting him. The victim who falls for the scam will send money for visa and tickets but she may have another excuse to extract more money such as "the money was lost or stolen" or "she is stranded on the airport". The scammer would also mention that she will pay off the money with a job offer she has in the country. As expected, at the end both, love and money, are lost forever resulting in a "broken" heart and a substantially diminished savings or checking account.

2.2. Industrial/Corporation/political espionage and hacking

With the Internet revolution and growth of new technology, cybercrime is also changing its face daily. A new generation of hackers are interested in intellectual property and trade secrets that can be sold in the market for large amounts of money. If a hacker steals a marketing plan from one company, and sells it on the cyber underground to that company's biggest competitor, there is less risk of law enforcement and controversies. Organizations don't like to publicize that they have been hacked so if there are no data breach notification laws, most likely the theft will be kept confidential and secret even if it is discovered.

2.2.1. Operation aurora

In 2009, there was a series of cyber-attacks using the advanced persistent threats (APTs - is a set of stealthy and continuous computer hacking processes targeting a specific entity) that modified source code repositories at security and defense contractor companies in the USA [13]. As a result, the attackers gained accessed to confidential and sensitive source code repositories at these Corporate Mongols.

2.2.2. Night Dragon

Oil, gas and petrochemical companies were attacked using their public Web sites and social-engineering techniques [14]. Even though social engineering intuitively does not sound as a popular method of hacking but it constitutes as a large part of the hacking industry. Persuasive social engineering was used to trick key executives from different countries to divulge sensitive information that would help in accessing the information through the company website login.

2.2.3. Sony hack

The Sony Pictures Hack was the whole entertainment package in itself - the celebrity, the cybercrime and the geopolitics; a thriller - no pun intended - in the making. This attack involved using a destructive malware to steal huge amounts of corporate data, rendering thousands of Sony's computers inoperable and taking the entire network offline [15].

2.3. Politics

In September 2013, the Port Authority of New York and New Jersey unexpectedly closed two access lanes on the New Jersey side of the George Washington Bridge which serves as a major commuter route between the two states. This resulted in a massive, week-long traffic jam that congested the streets. Press releases and court cases that have emerged indicate that this event was an outcome of political retribution to affect negatively the image of the state's governors.

2.4. Revenge

In 2014, a man was arrested by blackmailing women, in particular, his ex-lover, by posting nude and sexually explicit photos of her on his website. The man was charged in California for running a "revenge porn" website. The web is full of sites where split up lovers can post images of an ex-partner for all the world to see [3]. California Governor Jerry Brown signed a bill in year 2013 outlawing revenge porn and imposing possible jail

time for people who post naked photos of their exes after breakups [1]. This shows the necessity of new laws to control the online behavior of individuals and organizations.

We can see from the above real-life example that it is immature to believe that techniques and schemes behind the acts of cybercrime, hacktivism, espionage and cyber warfare would remain separate and easily identifiable [20]. With the evolving technology it will be a challenge to manage these cybercrimes and their consequences.

3. COST OF CYBER ATTACKS

Cybercrime costs about over $100 billion each year [4]. The Ponemon Institute's 2013 Cost of Cyber Crime study concluded that an average company in the U.S. experiences more than 100 successful cyber-attacks each year. These attacks came at a cost of $11.6M which was an increase of 26% from the previous year [8]. This study surveyed over 230 organizations in countries such as the United States, United Kingdom, Germany, Australia, Japan, and France. The study also showed that companies who implemented preventive measures reduced losses by nearly $4M [8].

The Federal Bureau of Investigation (FBI) – Internet Crime Complaint center reported a total of 269,422 Internet crime complaints in 2014; out of which 123,684 complaints reported a loss due to cybercrime costing more than $800M. The top 5 states registering complaints were California, Florida, Texas, New York and Pennsylvania.

First, it is important to note the distribution of the intended malicious attacks versus unintended attacks such as a software glitch or human errors [17]. Figure 1 shows that all attacks are not malicious and also not intentional. Only 41% of the total attacks are intentionally trying to cause harm to the systems i.e. someone intentionally designing a program to hack into a system. The next step is to understand the motivation behind these malicious attacks. As of April 2015, the distribution of the motivation behind the cyber-attacks is shown in Figure 2. Now if we analyze both figures 1 and 2, we can say that 22% of the total attacks are related to cyber-crime, 13% is hacking, 4% is cyber espionage and 2% is cyber warfare [18]. This analysis shows that not all attacks are meant to cause harm to a computer but some of them have ulterior motives such as hacktivism. **Hacktivism** is the act of breaking into a computer system for a politically or socially motivated purpose [19]. The goals of hacking into a computer machine determine if the attack is a cyber-crime or hacktivism. In this paper we will not get into the details of their differentiation but we will note that they belong to different categories.
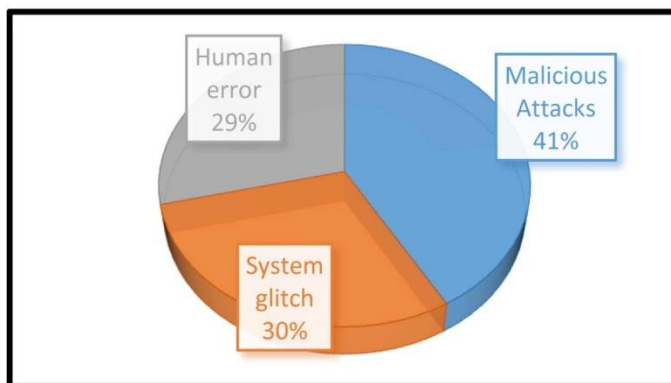
Figure 1. Distribution of the types of attacks [18]

Figure 2. Distribution of the motivation behind the attacks [18]
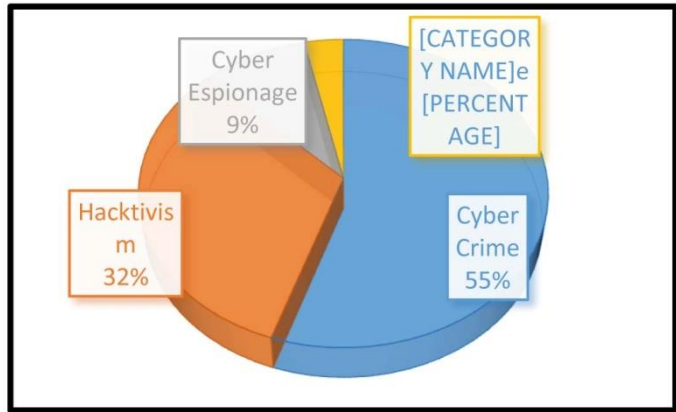
Now that we have an understanding of the types of malicious attacks and the motivation behind them let us focus on the victim of these attacks. Figure 3 shows the findings of the distribution of targets as of April 2015 [18]. The "Other" category include airports, APTs, Internet services, law enforcement, military and religion. Industry is definitely the major target of cybercrime as it benefits from it the most monetarily. The more sensitive the information, the more money can be gained from that crime. Figure 4 amplifies the distribution of accidental incidents which can be categorized as human error or system glitch from Figure 1. We have observed that 59% of the types of attacks are either human error or caused by a system glitch. Therefore, approximately 9% of the accidental attacks are caused due to Email breach (victim unknowingly opening malicious attachments), 19% are caused due to web breach (victim unknowingly opening malicious web sites), and 8% are caused due to improper equipment disposal.
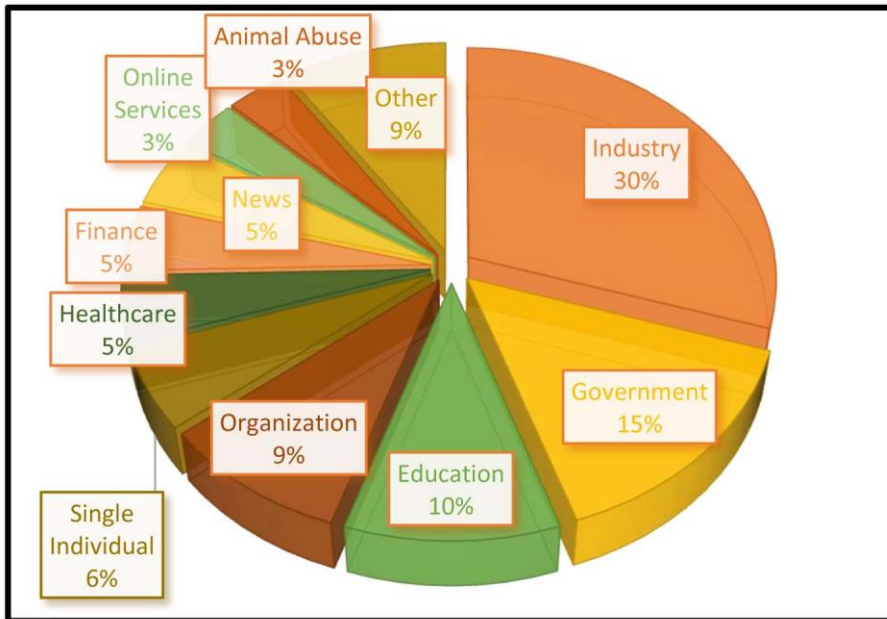
Figure 3. Target of the attacks [18]
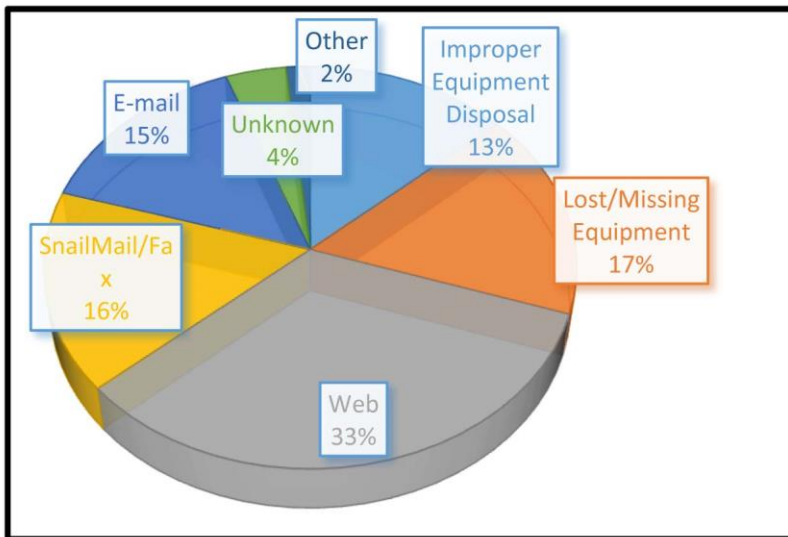
Figure 4. Inside-accidental incidents by breach type [18]

As the previous figures shows that physical damage to hardware and software can be easily measured but the cost of these crimes do not stop there. The more discomforting part of this process is the emotional distress caused to the victims. Photographs, legal documents, and more sensitive information can be made public and accessed by millions of people across the world. This has a long-term effect on cyber-crime victims. Therefore it is necessary to be informed on how people can protect themselves from cyber-criminals.

4. MITIGATING THE RISK

In order to mitigate any risk, we need to understand first the type and nature of the event that creates the risk. The outcome spectrum of that particular risk needs to be evaluated followed by an understanding of the different types of events that can cause it and its various outcomes and consequences. For example, an unsophisticated hacker may cause an accidental event causing a system error results in loss of data that affects the revenue. Another example may be that of a sophisticated hacker who intentionally accesses the system to damage the digital assets or creates system disruption that requires replacement of the physical system components. Other consequences of this type of acts are the loss of revenue due to system downtime, data restoration costs, and verifying the integrity of the data that may have been affected. Therefore, taking into account these events and their consequences a security strategy needs be put in place [12]. With so many techniques being used in cybercrimes, it is recommended that a multi-layer defense mechanism be implemented. Firewalls, along with anti-virus and anti-malware solutions provide a combination of signature-and-intrusion-based detection, heuristic analysis and cloud-assisted technologies can provide a strong defense for the devices and data against new and future threats. However, it is important to include in this strategy to educate the users about all possible threats and how to avoid them.

As of today, the question is not if someone will be breached but when, and, if it does what are you doing to protect yourself? In the late1980s and early1990s, the cyber threats started with unsophisticated attackers who were just experimenting or accidentally created a threat. However, it was not until the Internet became ubiquitous that the next generation of hackers went after systems that had information of some value. The more recent trends, in addition to the now traditionally corporate espionage (where a current or former employee gains financially by selling an intellectual property to the competitor), includes state-sponsored attacks not only of personally identifiable information but military secrets and disability of national defense mechanisms.

5. CONCLUSION

In this paper, the authors, through a series of examples have shown how the computer can be used as a weapon for violence in its most ample definition. The computer, as a medium of communication and sharing information has proven to be both, a blessing and a curse. The computer, if used with mal-intention can inflict tremendous damage upon unsuspected victims and its consequences may last many years. The damages can be both tangible such as physical and mental and intangible such as stolen identity, and exposure of secrets or confidential information. This can be avoided by taking preventive measures that require mostly multi-layered defense mechanism.

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TEACHING SOFTWARE PROJECT MANAGEMENT: THE INDEPENDENT APPROACH

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Ion Bucur [3]

ABSTRACT

The process of learning has continuously evolved throughout time. Several didactic approaches have been designed to meet certain academic needs. In light of today's technological advancements, new educational topics have emerged, some which do not explicitly fit other already defined didactic methods. This paper aims to propose a specifically designed learning approach for teaching Software Project Management in a university-based environment by adapting parts of other general learning techniques into a new and better defined teaching approach for a computer software education field.

KEYWORDS: *software project management, educational models, teaching strategies, collaborative learning, cooperative learning, competition-based learning, mixed collaborative-competition learning, independent learning, anarchy learning.*

INTRODUCTION

Among the different oriented approaches, the following can be distinguished as efficient learning processes: collaborative, competitive, anarchic, independent and mixed.

One of the most frequently used forms of education offered by many academic institutions is independent study, a form of learning that has been applied to a number of different methods and levels of teaching, which aimed to offer students more freedom in pursuing some part of their learning through personal research, a form of student autonomy [1]. Through a low level of collaboration, students improve skills of researching and identifying relevant information, in addition to acquiring knowledge.

Independent study is basically any type of educational activity that a student is capable to carry out with little or no help, advice or guidance. Thus, independent study is considered to be a pure form of self-directed learning (SDL) [2], where individuals may have the possibility of engaging in topics and activities of personal choosing.

Although team-work might be involved, an individual learning plan occurs by establishing the role of each member. The purpose of this paper is to present the particularities of the independent approach through following the students' behavior while developing a "Multiple Choice Testing Application". In spite of assigning the task to a

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team, the communication between the members of that team had to be kept to a minimum level.

The outcome consisting of the students' progress, the overall quality of the products developed and the final grades are indicators for the efficiency of the independent approach.

PREVIOUS WORK

Despite the fact that various studies had been conducted on the different oriented learning approaches applied within groups, most of them tend to favor cooperative learning [3-7], while several others focused on the fact that students tend to struggle with independent learning if they have not been previously acquainted with this study approach [8-9].

Among academics, the exact definition of independent learning is not properly determined, although the concept has been around for some time [10]. The problem lies with the fact that there has not been a consensus for an accurate description because the term itself 'independent learning' has been used synonymous to other similar learning approach like 'autonomous learning, independent study, self-directed learning, student initiated learning, project orientation, discovery and inquiry, teaching for thinking, learning to learn, self-instruction or lifelong learning [11].

While independent study offers a student the chance to adapt the learning process to a self-paced rhythm, applying those self-taught concepts in a small group scenario would depend on the level of peer interaction with fellow workmates based on the characteristics of students, groups and tasks [12]. Mood, emotions, sentiments or other emotional intelligence that members bring to a group could have an important effect on the overall chance of success [13].

PROPOSED APPROACH

The Independent approach aims to put forward a new way of teaching Software Project Management. The method aims for a different manner of training students how to develop computer software and how to work and interact in a small group. Students have the opportunity to interact with different types of hierarchies: didactical hierarchy – communicating with the professor and teaching assistants – or team hierarchy – interacting with other team members in other to fulfil their tasks. Each project can have multiple components which can be independently evaluated.

During the Software Project Management course held at the University POLITEHNICA of Bucharest, several projects were proposed in order to illustrate the independent approach. The students were allowed to develop their own ideas or choose from the following ideas: "Mortar Mayhem", "Fastest and Brightest", "Battleship", "E-commerce Lite", "SimTraf", "Stonemason", "TTSched", "Image Analyzer", "Circuit Designer" or "Multiple Choice Testing Application". The independent approach started as a competition among the students, based on their CVs and the Software Design Document associated with projects. This step represents the first time students get to compete based on their own skills and capabilities for a spot to work on the project they want. They have

the option of applying to multiple projects, therefore they can be easily redistributed in case a project already has a considerable number of students accepted.

As opposed to a traditional approach, where students have to complete a unique general assignment, this approach offers a diverse number of project topics, each with several individual components that require specific skills to develop. This also means that not all project will be equally balanced in terms of difficulty. Some students might find their project to be more demanding especially if the project they're working on was not their first choice.

In the first weeks of the semester, each project was assigned to a small team of students according to the aforementioned selection process, based on the CVs that were handed in. In the early stages the responsibilities were not definite, but every member had to self-determine an individual role within the team before carrying on with the completion of the project. It is of utmost importance for the group to be hierarchized according to a project management schema. The main roles in a team are:

1. Project Manager (PM) – this role implies high responsibility, both in team monitoring and visible progress. A good PM must possess excellent soft skills, ensure that deadlines are met, take decisions in favor of the whole team and motivate the subordinates when necessary. A good PM also communicates with the project sponsor (in this case either the professor or one of the teaching assistants) and briefs the sponsor on the progress and the direction in which the project is heading.

2. Team Leader – covered by two members:

    a. Lead Developer
    b. Lead QA

   It is highly important for a team leader to be sufficiently skilled to guide the other members of the subsequent team. Furthermore, technical knowledge and experience are compulsory in case any issue that requires rapid solving arises. The team leaders maintain a continuous communication between them and the PM in order to maximize the success of the project.

3. Developer – responsible with implementing the project according to the requirements. The members occupying this position are coordinated by the Lead Developer, who is expected to find a solution to any raised predicament.

4. QA Engineer – responsible with testing the project after the development engineers finished implementing it. The testers have to maintain a strong relationship with the developers in case any incident occurs. Besides verifying the functionalities, they also have to periodically report to the lead QA.

The structure presented above can be visualized in fig. 1.
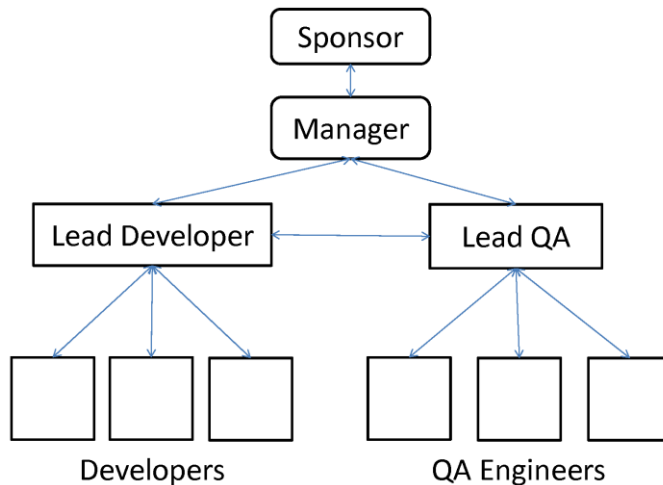
Figure 1. Simple internal group structure used by most teams

It is very important to receive continuous feedback from the sponsor to make sure the project develops according to their needs. Particularly, in a faculty project, the client will be the teacher. If the teacher is pleased with the results obtained up to that point, the development of the project should be carried on in the same manner. Otherwise, the team members should reconsider the initial plan, consult the teaching assistant and find a solution.

Any project may be divided into four phases:

1. Initial phase – marked by the beginning of the project, the assessment of related work and the role assignment among the team members;

2. Planning phase – resource plan, budget, activity plan, milestone definition;

3. Execution phase – the actual product is being developed and tested. There is also a quality check, taking into account possible risks and bug fixing;

4. Closing phase – delivering the product to the client and receiving feedback according to the quality of the functionalities provided.

It comes out as no surprise that the independent approach does not necessarily imply competition or collaboration between the teams. It is easier to find a suitable application for the students as each team implements its own choice, although there is a chance that the difficulty of the main idea will vary among students. Because of that, it is harder to evaluate the overall activity and set the milestones according to everyone's demands. Moreover, team competition arises in order to "present" and "sell" their own application in an original manner. The tasks assignation is done according to the best specifications offer and the best match with the team member skills.

Further an example shall be presented to better understand how the independent approach works. This paper focuses on the development of "Multiple Choice Testing Application".

The project requirements may be structured according to the following schema:

- Document Purpose

- Document Content

- Brief Description of the software product

- Solution Description:
    - Solution Architecture
        - Architectural Patterns
        - Architectural Diagram
    - Development tools and technologies

- The experience of the team in the field of the product:
    - Technical knowledge of the team-members (using the levels: Advanced, Medium, Beginner)
    - Team experience

- Resources:
    - Establishing the role within the team (ex: Developer, Project Manager etc.)
    - Establishing the distribution of the team regarding the roles (how many participants have the same role?)
    - Establishing the effort of each role in a week (x hours/week)

- Delivery Calendar Presentation (when will intermediate stages of the project be shown to the client?)

- Team Motivation

The project was designed as an E-Learning module which would be integrated in an existent platform as a method of evaluation. The application comprises firstly of a teacher interface which includes adding or updating a test and checking the students' details; secondly, it consists of a student interface which allows one to register and take a test. The logic of the application provides features like randomly generated tests based on a list of questions and grade computing.

Initially, the team is established and the members' attributions are determined according to each one's experience and knowledge base. Moreover, the technologies, programming languages and algorithms used in the application development are set. In the planning phase, the requirements are summarized by the technical writer in the Software Design Document. In addition, the budget and the resource plan are taken into consideration by the Project Manager. The execution part is the most time consuming phase of all. The developers are able to work independently on the modules of the application, as they are clearly delimited. At the end of the development stage, the QA engineers test the features

and the bug fixing stage may follow. Each of the testers develops their own test cases and checks the functionalities independently. Although the independent approach encourages little communication between the team members, developers should certainly receive feedback from the testers, thus ensuring the correctness of the application. When the application passes all the test cases, it is considered successful and sent to the client in the closing phase.

Having a wide range of subjects to choose from and working individually, the students have completed their assignment by bringing their personal contribution from an original point of view based on their personal experience, too. The satisfaction of the students is noticeable with the aid of the final results.

Although the communication within the team should be minimal, it would be helpful to exchange opinions, points of view and approaches to improve the project. Regardless of the benefits of this approach, it lacks the incentive produced by sheer competition. However, the students are motivated in this case by obtaining the best final results.

Another example suited for this type of approach is the "Image Analyzer". This is an application that allows image uploading, exporting, visualizing and permits user process definition. Its main purpose is to integrate several image pre-processing techniques including black-and-white binarization, image segmentation and clustering into a complete configurable image analyzing software that can generate output images along with additional metadata files. Below there is an example that shows how image analyzing works. In this given sample, clusters are formed at an approximate five-pixel distance, with each cluster framed within a black-colored rectangle and each member pixel colored with a random-generated cluster-specific color.

Figure 2. Example of an Image Analyzer application result

"Mortar Mayhem" is a multiplayer strategy game, which simulates trajectory-type artillery conflicts. All players are opponents, with each player aiming to eliminate all the other adversaries throughout several rounds. Each player has available several artillery-like weapons that can be deployed as an offensive attack at any other opponent, with the possibility of launching under a specific angle, shooting power and several other battle options. Based on individual performance, players are awarded points and game-credit at the end of each round. With the earned credit a player can buy more advanced weapons, upgrade the existing ones or buy better protecting armor. The winner of a round is determined on the last-one-standing principle. After a user-defined number of rounds a final player ranking is compiled based on the points won thus far.

"Battleship" is a multiplayer strategy 3D game, where each player has available a number of ships to combat the other adversaries. The winner is determined on the last-one-standing rule. The game is played on a user-defined size grid where each player has available a specific number of combat ships. Based on the defined size, the board is divided into a number of square, with different type of ships occupying a specific number of squares on the grid. The ships cannot overlap each other. Each player takes turns in launching attacks with each available battleship. If the targeted square is occupied by a player ship, the ship is considered partly damaged. A ships is destroyed when all of its occupied squares have been hit. At the beginning of the game players can customize a set of variables and arrange their available battleships on the individual grid. The game ends when a player has destroyed all the opponent's combat ships.

The "Circuit designer" allows the drawing of an electrical schema using a symbol library. This is similar to programs like "Proteus", "Multisim" or "Spice". The goal of this project is to implement a circuit drawing application with vector graphics capabilities in order to achieve great graphical quality of the schemas and circuit logic. The application will have a graphical user interface (GUI) that would allow diagram drawing using a library of electronic symbols similar in functionality with other computer software like "Microsoft Visio" or "Smart Draw". In terms of the GUI drawing canvas, the application would allow several operating procedures: put element, move element, connect wire, move wire, make connection, delete object and select element from library. The application would allow several exporting formats, particularly PDF, JPEG and a vector drawing format chosen by the students.
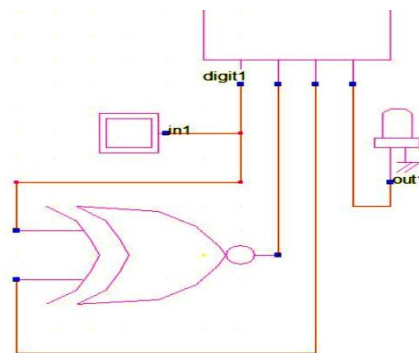
Figure 3. Example of a "Circuit Designer" outcome

"E-Commerce Lite" is a product-oriented data storage platform that can be interfaced using an access application program interface (API). Several higher-level applications are developed on top of the given API: a GUI application for adding, editing and administrating the current inventory, a custom product attribute module and a front-end inventory presentation application in the form of an online store. The system would support a hardware-limited number of simultaneous connections. The platform would consist of several separate modules: a storage module acting as a back-end database of the current inventory, an API module for accessing the storage module, a client module for managing all the user accounts, an inventory administration module for adding, editing or deleting entries in the product database, a data import module for block importing

database entries given in a comma separated values (CSV) format, a custom attribute module which allows users to add customized attributes to the existing list and a front-end inventory presentation application used to visualize the available products.
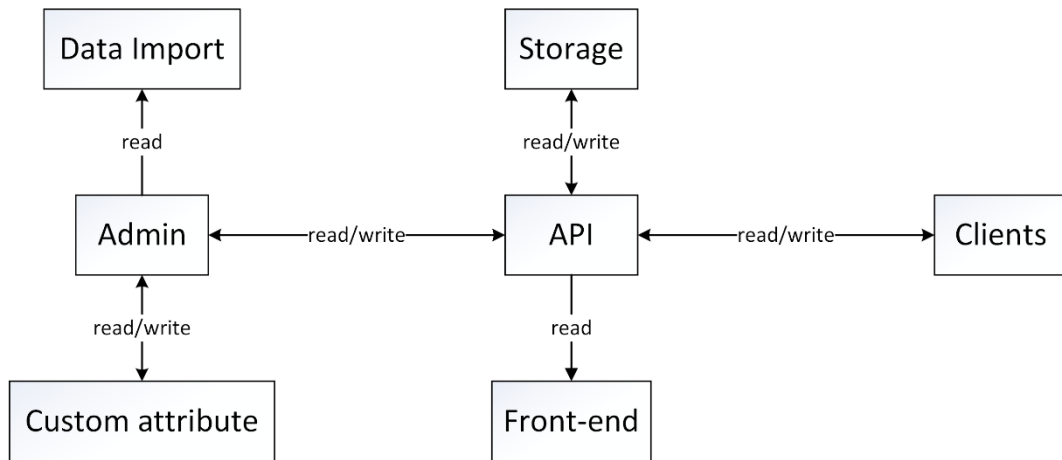
Figure 4. "E-Commerce Lite" module integration scheme

"Fastest and brightest" is a multiplayer game contest which involves agility and intelligence in solving lexical challenges. The game has four different variations, each having two or more game levels designed based on the difficulty of each stage.

The first variation implies find a set of words within a matrix of letters. Each word may occur in either top-bottom, bottom-up, left-right, right-left or in diagonal form. The player who is the first to correctly find all the given words wins. For this variations, a more difficult level would imply a larger input matrix and a fixed time limit.

The second variation has eliminate the set of given words from the input and lets the player look for any lexically correct word from a given language within a time limit. The player who finds the most words that are linguistically correct wins. A more complex level would imply a larger input matrix along with a score penalization if the player fails to find a correct word within the given time.

The third variation follow a similar strategy to the first one, but instead of a list of words, there is only one dynamically given word. The player who is the first to identify the word in the matrix is awarded a number of. If the generated word is not in the matrix there is no score earning. A more difficult level would implement a score penalization for the other players whenever there is one player that finds the generated word. If no player is able to find the given word, all players are penalized.

The forth variation challenges the player to form lexically correct words using letters which are arranged on the face of a clock. For the first level it does not matter the order in which the letters are picked provided that a single letter is not used more than twice. For higher levels there are only nine letters scattered around the clock with one letter in center. Every word generated must include the letter in the center.

C	I	R	E	S	N	I	H	C	O	M	S
F	C	A	S	T	A	N	M	S	D	O	M
B	R	M	P	E	Q	L	T	P	V	L	E
Q	P	W	N	J	U	N	C	C	A	I	S
S	M	S	F	A	A	G	I	I	B	D	T
P	O	L	P	R	U	N	W	S	E	E	E
N	S	R	T	F	A	G	P	K	I	P	A
U	U	A	A	P	B	S	O	Z	U	V	C
L	R	D	Z	P	M	N	I	R	T	S	A
A	O	D	A	M	I	K	F	N	U	C	N
U	C	R	E	R	F	H	T	B	G	N	B
R	S	M	T	C	B	Z	C	D	P	R	M

ALUN	CIRES	MESTEACAN	SMOCHIN
ARTAR	FAG	MOLID	STEJAR
BRAD	FRASIN	NUC	TEI
CAIS	GORUN	PLOP	ULM
CASTAN	GUTUI	PRUN	VISIN
CEDRU	LAUR	SALCIE	
CHIPAROS	MAR	SCORUS	

Figure 5. Fastest and Brightest

"SimTraf" is an urban traffic simulator, which provides the ability to configure various specific features such as traffic congestions, traffic lights duration or the speed limit. The simulation will be visualized on a 2D map consisting of alleys, streets, roads and boulevards bounded by non-drivable areas such as pedestrian areas, flats or buildings. The maps can be predefined or dynamically generated. The road intersections can either be a three-way intersection or a four-way intersection, all controlled with traffic lights. Each road has two traffic lanes per direction of travel. There are only two specific points on the map where simulated cars are generated after a period of time. Throughout the simulation the user can visualize statistics regarding the average speed, the current traffic load or number of cars on the roads. The user cannot control or modify the simulation while it is running. Each statistic is recorded into report that is generated when the simulated has ended.

"Stonemason" is a 3D Breakout-style game. Breakout was an arcade game published by Atari in 1976. The purpose of the game is to destroy several layers of bricks situated in the top third of the screen using a ball that travels around the screen and bounces off the side margins of the screen. The ball must not hit the bottom of the screen and to prevent that the player can turn a paddle to make the ball bounce back upwards. When the ball hits a brick, it destroys it and bounces back downwards. Since its launch there have been numerous block-breaking games inspired by Breakout. Stonemason follows a similar strategy as the original Breakout, but aims to adjust the mechanisms and the game style to a 3D environment. The gaming grid will become a cube, the paddle will move along the lower part of the cube and the wall to-be-destroyed situated in the top third of the cube will be made out of 3D bricks.

"Time Table Scheduler" is an application developed for the automatic management of academic schedules in a university environment. Planning class, laboratory and course time slots present a set of constraints regarding availability of lecture halls, number of enrolled students or necessary laboratory equipment. The structure of the application is based on the Constraint Satisfaction Problem model. The goal of the project is to determine a solution to this particular model by taking into account all the input constraints and generating candidate schedules where time between classes and lectures is minimum and it better complies with high priority constraints.

After the projects are completed the teams will compete in a final-product-selling contest. This is the second time competition is involved in the independent approach. This stage was developed so the students participating will be faced with a real-life scenario: selling the product they worked on. A highly complex and successful project can be poorly received if the team lacks any sales expertise just like a mediocre project can exceed expectations if the team has a superior marketing strategy.

CONCLUSIONS

In conclusion, the independent approach is beneficial not only for achieving a high quality final project, but also to offer a satisfying process in which individuals can perform at their best. Using this approach, even the laziest students get involved.

The purpose of any project is to achieve a final functional product. The time and effort put in by students in order to complete the project was provided with an engaging environment to work in especially because it was a self-selected project, not an imposed one. The students were not displeased by the unbalanced contribution of each team member to the project, as their combined work led to the final result. The teaching strategy was developed so that each student would work both individually as well as in a team, making the individual's evaluation have an impact on one's final score, regardless of the team's achievement.

Research is needed to clarify which mechanisms operate on the group as a whole and which are tied to specific experiences in group interaction. If, for example, increased student morale plays a major role in increasing achievement, then individuals may benefit from the group experience regardless of their own rate of participation.

In conclusion, the independent approach presents both advantages and disadvantages. It works perfectly with projects that are divided into independent modules, whereas it is not suitable for projects that require integration between subsequent modules. Moreover, each individual should have enough experience to work independently, otherwise additional time is implied for research and studying.

FUTURE WORK

Considering the small number of scientific papers on the independent learning process, this topic leaves plenty of room for further research and conduction of case studies. More details about alternate educational approaches in teaching Software Project Management can be found in [13-14].

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THE DIGITAL TECHNIQUE – TOOL FOR LEARNING FOREIGN LANGUAGES

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Mihaela Giurgiulescu [2]
Vanesa Magheruşan [3]

ABSTRACT

The essence of efficient communication is perceived in 45 seconds. Beyond this, everything is just some filler that only outlines the main idea, namely it enriches communication. So we can say that every lesson should be well focused and concentrated into a sequence of no more than 45 seconds. It should be the goal of trainers of foreign languages by means of computers. Therefore, we would like to point out hereby the results of a research conducted on a sample of 1,055 participants, distributed as follows: 10-14 years old, 307 participants; 15 – 20 old years, 212 participants; 21-35 years old, 325 participants; 36-50 years old, 106 participants; 51 - 65 years old, 56 participants; over 66 years old, 49 participants. All participants in experimentation want / need to learn foreign languages, with preference: English, as language of trade and wide circulation and Italian because it is smooth, fine and delightful. Our research aims to improve the use of digital techniques both for trainers and subjects in teaching/learning foreign languages, from A1 to C2, in particular through e-learning. The study's results show the need to involve IT tools in the interactions with adults, young adults and children in learning foreign languages. We would like to emphasize the challenging psycho-didactics in achieving the goal of learning and independent learning.

KEYWORDS: *e-learning, challenge, psycho-didactics, computer science in psycho-didactics, independent learning*

CORPUS

At present in Europe there is an increased focus on learning foreign languages using computer techniques, tools and top-notch software designed for all ages, social backgrounds, specialized in different professional fields and training levels.

Our research should be considered from the following perspectives:

1. Andragogy: the relation between adults and the learning of foreign languages through digital techniques.

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2. Tutorship: the relation between an individual (adult/young adult/child) and their training with the help of digital techniques.

3. Conscious use of digital techniques: the relation between user and the software available for different age and training levels.

ANDRAGOGY

Major difficulties are encountered in *the learning of foreign languages* by adults and the researchers in the field of andragogy highlight or deny it knowingly every time. The reasons are multiple: the most common are those of partial or total rejection of the use of digital tools and software or the lack of thorough training in the native language (grammar in particular). Researchers provide work methods in different areas of training: vertical and horizontal, in groups or individually, face to face teaching, through slides, handouts etc., but in terms of language acquisition, they do not provide a universally valid construct as such would not be possible. Context variables are manifold depending on interest, capability, application, available and accessible tools. Andragogy defined by <u>Kapp, A., (1883) and continued by Knowles, M. (1940) M. Nyls (1980)</u> may be based on computerized pedagogy so as to support programs for learning any language among adults. The appropriate training to define a well consolidated skill is manifested together with the need to create a wide mass of people involved in different communication forms: emigration, economic activities, specialization/training, exchange of information etc. In the article derived from a broad research, Mion Pop, M., Giurgiulescu, M., & Magheruşan, V., (2016) indicate that adults in urban areas are more receptive to using computer tools and software in general and prefer to train in a group of subjects under the supervision of a specialized teacher.

The factors supporting the learning and use of languages by adults often coincide with the financial benefits arising from their use. By definition, andragogy is a science parallel to pedagogy. The key elements that distinguish them are: the age of the subjects involved in training, compulsory/imposed teaching/learning, the consciousness that the subject develops in need of communication.

Computer science, through various routes of any communication, supports language acquisition by any subject eager to learn to them.

Computer Assisted Language Learning - CALL

Communication in a foreign language is a key competence for lifelong learning that sumps up knowledge, skills and abilities (Key Competences for Lifelong Learning - A European Framework, 2006).

Adults today live surrounded by technology and are familiar with its use in everyday life, as an element of normality. <u>Their profile</u> is radically changed at present, compared to previous generations, and they need a different type of learning motivations in line with current needs. Computer use in education is not a new idea. Since the 80s, the emergence of this equipment has proved to be of paramount importance, making the learning process more interesting, increasing the motivation of those who go through the training process with the use of digital technology. Thus, computer assisted language learning (CALL), the

personalized approach to learning foreign languages has become a more commonly used method. The most important features of this type of learning are individualized learning, self-paced, interactive learning with immediate, rapid and efficient feedback (Giurgiulescu M., Turculeţ A., 2015 Konchady M., 2009). The use of the learning triad: audio, video and text in a lesson ensures optimal absorption of information, stimulating both the echoic and iconic memory. Learning vocabulary, for example, can be greatly facilitated by using digital games since early ages (Shahriarpoura, N., Kafib Z., 2014). It is much easier to learn correct pronunciation through the use of multimedia (the pronunciation of simple words can be listened to individually or in context, repetitions can be made whenever necessary, the pronunciation can be recorded and then compared with the correct sound). Along with vocabulary learning, educational software offers learning of foreign language grammar, spelling, writing assessment and everything that really means knowing that language. For a better reception of messages, the working environment can be adjusted within the computer-assisted learning so as to be more pleasant and closer to the learner, the sound can be easily adjusted, the look of the interface can also be chosen, and even the voice (male or female), etc.

Using digital techniques changes learning by memorization (rote learning) into learning through understanding (meaningful learning). Meaningful learning occurs when learners make connections between new knowledge (concepts or statements) and what they have already learned (D. P. Ausubel, 2000). The use of technology in language learning, of computer training facilitates understanding by means of the capabilities to structure information, gradual presentation focused on the individual and their level through the possibilities of active feedback and relationship between information (links, virtual reference).

Training tools

CALL is based on the organization of curriculum and its use. It is obvious that the offer in the field is wide and each author, free to think, comes forwards with a presentation according to what they think fit that the learner should acquire vertically so that they gain solid knowledge. If CALL is assisted, namely with the support of a specialized teacher, then the learner can find their way to success easily. If the subject learns by themselves, then they organize language acquisition based on the personal challenges encountered during training.

The organization of curriculum in CALL follows training rules *in crescendo*, which is very useful especially at propedeutic level. The fundamentals in the organization and use of curriculum consist of the presentation and impact of digital lessons on subjects. According to Mion Pop, M., (2013), Bont, J.I.C., Castilla, C.D.S., & Maranon, P.P., (2004), Landsheere, G., (1979), they should take into account the following:

1. Reference level (A1, A2, B1, B2, C1, C2)

2. Level test: verification of skills (where required)

3. Age of learners

4. Interests of learners

5. Social background of learners

6. Topics

7. Involved parties

8. The environment where the topics are approached

9. Drawings/pictures/maps/tables/graphs relate to the age of learners and topics approached

10. Context chromatic and specific to lessons/topics

11. Literary text adjusted to the age and tasks of the learners

12. The text is clear and matches the drawings/pictures/maps/tables/graphs it refers to

13. The initial presentation/the first cover/the introduction is pleasant, attractive, challenging

14. The music accompanying the introduction is adjusted to the age and level of learners

15. The text is clearly written, with proper spacing between words, lines and drawings/pictures/maps/tables

16. The lesson includes examples and references to the next level

17. The lesson includes words/sentences translated in the context

18. The lesson includes vocabulary meant to support the learning of words and their meaning according to the lesson's topic

19. At the end of each lesson there are applications included

20. The review includes multiple choice exercises with closed or open answers

21. Level test: skills are tested according to the European standards (A1, A2, B1, B2, C1, C2)

22. The assessment of tasks and tests is based on scores/percentages/lit background according to results or virtual awards and/or coins, emoticons

23. Each lesson includes psycho-didactic stimuli

24. There are exercises that allow polysemantic use

25. There are translations and retroversion

26. There is the possibility to compare the translations and retroversion

27. There are models for the translation and retroversion of specialized texts

28. There are bilingual lessons

29. There are lessons that allow the adjustment of the voices of the presenter/character(s)

30. There are lessons that allow the vocal interaction of the learner with the characters

31. The end of each lesson/chapter includes vocal or written goodbyes/acknowledgments

32. The curriculum includes general topics, topics about the tourism, environment, non-discrimination, politeness, religion, economy or social-cultural topics of the speaking people

33. The emotions triggered by the topics on the learner

Transdisciplinarity (Ciolan, L., 2008) must find its place in the learning of foreign languages so that the learner could know more about the people speaking the language they learn precisely for the purpose of communicating with them (Cristea, S., 2005).

Tutorship

Tutoring in this context should be understood as the relationship between individuals (adults/young adults/children) and their training using computer. It suggests here a tutorial of the virtual teacher-evaluator that will help the learner in their training on their digital way for a vertical acquisition of language. Obviously, the learner can receive the consent of the virtual teacher to pass to the next level only based on the results obtained after each lesson.

Conscious use of digital techniques

The conscious use of digital tools must be understood as the relationship between user and foreign language software distributed by age groups and level of skill. Often, the information transmitted through software is chaotic, inadequate, incomprehensible for the subjects or incomplete. If for some subjects, the information can be reviewed, the things are not the same in terms of foreign languages, in particular for a beginner. The acquisition of a polysemic word makes the learner to use it inappropriately in contexts which might jeopardize their mood. We find it helpful to point out that the information received by the learner and how it is transmitted or suggested can put the learner in more or less pleasant situations. Therefore, we believe that information that promotes violence is inappropriate, although in language acquisition the topics approached should be diverse. The topic is important to be approcahed and presented so as not to cause negative emotional states on the learner (Mion Pop, M., Giurgiulescu, M., 2015).

With strong impact on the learners of foreign languages, regardless of their age, is the presentation of concepts that should be learned as easy as possible. Special attention should be paid to translations and retroversion because it is the field where we can easily notice the learner's knowledge and its absence (Pop - Mion, M., & Tacea, F.-A., (2015), Vrăsmaş, E. (1999), Zlate, M. (2004). The connection between the learner and high quality software enhance the possibility to learn and accept them at an early age. If the presentation is approachable, the digital tool will be easily accepted.

RESEARCH

Under the umbrella of language acquisition, our research enables us to contribute to the improvement of the digital path in this field. Taking into account the elaboration and assessment techniques of school textbooks, course books and scientific presentations, we would like to point out the psycho-pedagogical importance of software in the field of

foreign languages. Our research has covered 1,055 subjects. They were asked to indicate the preferred tool by which they would feel challenged/ encouraged to learn English and/or Italian. Young participants prefer to have handy access to internet programs using tools such as laptop, telephone and the computer, between 65% and 100%. Respondents over 66 years old prefer assisted training or are willing to give up if learning is not compulsory or not an urgent necessity. The differences between urban and rural areas are significant, as are those between girls and boys.
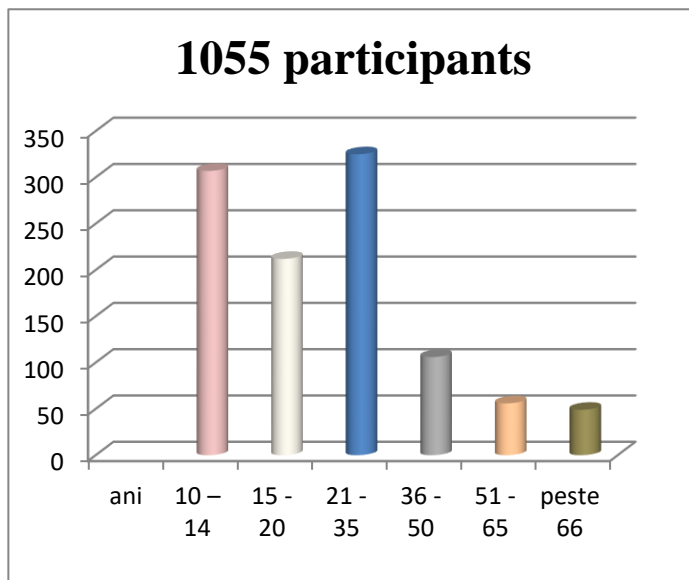
Figure 1. Distribution per age of subjects
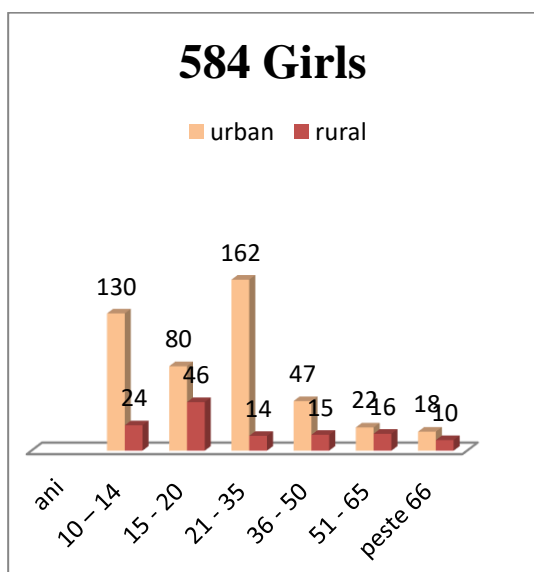
Figure 2. Distribution per age of girls

	ani	10 – 14	15 - 20	21 - 35	36 - 50	51 - 65	peste 66
urban		128	54	144	32	8	15
rural		25	32	5	12	10	6
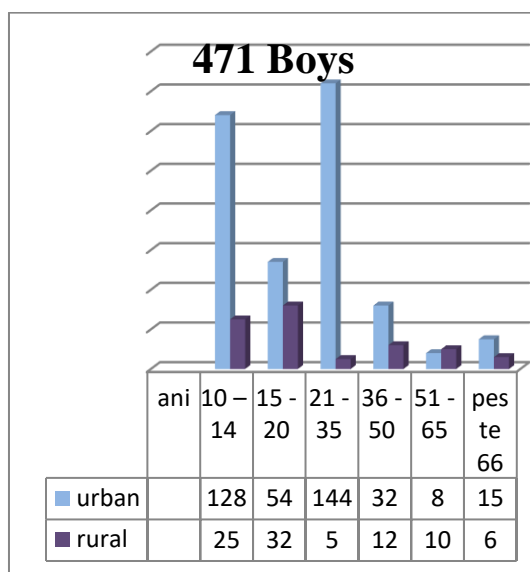
Figure 3. Distribution per age of boys

When asked *when is the adult willing to learn a foreign language*, the reply shows that the adult must be forced/encouraged/challenged to do so. The answers of urban respondents indicate that a person with a high level of culture and education would follow a medium term course to acquire a foreign language; this response is not found among respondents from rural areas even if they have a high level of training.

Children are often forced to participate, during their school years, in courses of foreign languages and they are excited to communicate and demonstrate their competence in the applied modern language. Young people (15-35 years old) are mostly dedicated to learning English rather than Italian.

Which is/are the method/methods by which the concerned subject learns a foreign language easier? The answers come from our respondents and at first glance it can be concluded that young people (10-14 years old) prefer topics focused on action involving attractive characters (speakers of the respective foreign language) with whom they can identify and enjoy engaging in dialogue with; young people between 15-20 years old are challenged by games and songs and like engaging in joint actions and interacting with other friends (speakers of the respective foreign language) and also like organizing group discussions. Quotas remain high at groups of adults (between 36-65 years old) who may be offered with a wide range of software that includes music, movies, attractive characters, and games.

As shown in the table below, we can notice than subjects older than 66 years old are interested in constructive conversations so that the sent message finds a purpose in communication; at a small difference of about 4%, subjects over 50 years old do not have a purpose different than the previous group. Between 10-35 years old subjects like engaging in dialogue even if the sent/received message does not have substance; for them it is very important to talk about anything. This is the age and market segment of the training market that creates moments of comfort or even discomfort/tension on the subject. The psycho-pedagogical impact through which the sent information reaches the subject by means of digital messages (games, movies etc) should be evaluated and controlled. That is why it is comfortable for the learning of foreign languages to be assisted by a specialist in education and training that is responsible and competent.

Table 1. The importance of factors for the learning of the linguistic competence

year	Character(s)/singer	Type and topic of game/lesson/song	Sent message
10 – 14	100%	96%	30%
15 - 20	75%	100%	10%
21 - 35	61%	77%	28%
36 - 50	80%	100%	40%
51 - 65	86%	100%	66%
Over 66	20%	60%	70%

Our proposal:

A solid acquisition and in a relatively optimum period of time can be conducted only through assisted training, focused on the subject, irrespective of their age, but integrated in a group of speakers of higher level, who could challenge the subject every day. Concentrating the material to be learnt in a relatively short period of time forces the subject to practice daily. If we distribute the period of time per levels of language acquisition according to the European standards, level A1 can be learned in maximum 7 days of work for the subject who learns English or Italian; level A2 can be mastered by the subject in 14 days; level B1 in30 days and level B2 in 45 days. The most difficult is to master level C1 and extremely difficult level C2.

Table 2. Distribution of periods of time for the levels of language acquisition

	A1	A2	B1	B2	C1	C2
Period of time	max.7 days	max.14 days	max.30 days	max.45 days		

In our opinion, the results above can be useful to other researchers in the field of digital education, in particular in the acquisition of foreign languages, self-learners, teachers/tutors and authors of digital textbooks, IT publishers.

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EVALUATING SMART COMMUNICATION AND MONITORING TECHNOLOGIES FOR HOSPITAL HYGIENE WORKFLOWS

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ABSTRACT

Hospitals receive many patients and visitors daily, and include a large number of medical staff members, thus, hospitals are eligible environments for infection transmission. The hospital acquired infection (HAI) is situated at the top of the reasons pyramid that lead to death. HAI means that a patient enters the hospital for some reason and gets infected because of another reason. Non compliance with hygiene protocols is a major cause of HAI. Therefore, the automatic monitoring of hospital workflows using the recent communication technologies is a vital factor for infection prevention. In this article, we highlight in details the technologies that could be investigated for monitoring the workflows in a hospital room. We describe the hospital room use case, and we analyze the suitability for each technology. The goal of this paper is to suggest a system for monitoring the clinical workflows and pveventing the HAI. Nowadays, it became possible to perform efficient automated monitoring of hygiene related clinical workflows and we expect such solutions to become widely available within a few years.

KEYWORDS: *Hospital Acquired Infection (HAI), hand hygiene rules, medical workflows monitoring, hospital room, technological choices.*

1. INTRODUCTION

Nowadays, HAI is considered as a big challenge in current healthcare facilities, it leads to enlarging the mortality, expanding the patient stay in the hospital and thus raising the financial burden. Lack of training and guidelines, unsuitable airflow, contamination of equipment and surfaces, and especially contaminated hands are considered as the most popular HAI causes [1]. So using of smart technologies is a crucial factor for monitoring the hospital activities and thus combating the HAI.

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In the last years, a wide variety of wireless communication technologies have become available, with a multitude of applications in all domains. Selecting the most suitable ones for a specific use case is an important challenge, since it requires a deep understanding of their base characteristics, specific advantages and drawbacks.

In this paper, we focus on identifying the most suitable technologies for implementing an important part of an automated monitoring system for preventing hospital acquired infections (HAI); which is the monitoring of the workflows related to room-level hygiene.

We will consider the basic case of a hospital room which contains two patient beds, a washing sink, and a toilet. It contains also a place dedicated for wounds and bandages, another one for used things, as well as air conditioning system. We try to automate the hygiene workflow through a monitoring system based on a group of recent technologies such as Bluetooth Low Energy (BLE), Near Field Communication (NFC), Radio Frequency Identification (RFID), ZigBee, and Wi-Fi.

2. OVERVIEW OF THE AVAILABLE BASE TECHNOLOGIES

2.1. Bluetooth Low Energy (BLE):

Definition: Bluetooth Smart (Bluetooth 4.0) is the latest version of the Bluetooth wireless technology published in 2010 [2], but it has totally different characteristics and purposes. BLE is a low cost, low bandwidth, and low power wireless technology [3]. Due to the fact that BLE sensors are with coin cell batteries that can live up to two years; BLE has a feature of low energy consumption [3] , thus having the ability to deal with the power consumption problem[2] , so it is considered as a promising choice for Internet of Things deployment [4] , [5] , [2] , [6] .

Concept and features: The operating range of the wireless devices stands on multiple factors; the obstacles and barriers, the environment, the device steering, the antenna design, the antenna size and the antenna broadcast Power and the used frequency. The dependable range of the BLE enabled device is 30m-50m line-of-sight, but the effective range, which is able to last the battery lifetime is between 2 & 5 meters [4]. Increasing transmission power leads to expanding the wireless device range, thereby increasing the consumption of resources such as battery lifetime. BLE has a wide spread that the number of electronic devices which include an integrated BLE chip will reach 2.9 billion by 2016 according to Bluetooth SIG (Bluetooth Special Interest Group) [2].

The working mechanism: A BLE device uses two mechanisms to communicate with other wireless devices within its broadcast range. The "*broadcasting"* way is broadcasting data -in one way connection- to any listening device capable of capturing this data within the sender device range. The other communication way of the BLE device is **the *"connections" way,*** which means establishing a secure encrypted connection between two BLE devices for exchanging data in both directions (the connection includes only the two devices) [4]. This way depends on the frequency hopping spread spectrum, which reduces the radio interference and may consume less power than the broadcasting way [4],[5].

The BLE device can be a master, a slave, or both, according to the application and to the communication requirements [4], but it can not play a role of client and server at the same time [6].

Devices that start the communication such as smart phones are called masters that each master device can communicate with many other devices known as slaves (small devices with constrained resources such as individual sensors). The BLE slave device can be connected to many masters at the same time (e.g. a smart phone connects to a lot of remote thermometers placed in some place) [4], [6]. The master device scans the three dedicated advertisement channels permanently, and when the slave advertises one of them, the master discovers the slave and then the communication is founded and data transfer begins. This is called asynchronous wake-up for both connector ends, and when the data transfer ends, they come back to the sleep mode again [5].

Advantages and drawbacks: Due to the rapidly growing in the smart device industry, which include BLE chips, that's a lot of manufacturing produce BLE equipped devices such as tablets and smart phones, BLE is well ahead of other competitor wireless technologies which are asynchronous. BLE products are cheaper and faster than other wireless technologies such as Wi-Fi, GSM, and ZigBee, and the communication does not require pairing before exchanging data. It is easy to use by, any person [6], and provides minimization, and ready reminding service [3]. BLE is fitted with small-size electronic products such as medical devices, and remote controllers. BLE can be considered as a solution of the power consumption problem of the wireless communications [2].

The main drawback of BLE is that the "Broadcasting" is not a secured way for exchanging data, especially the sensitive data that each listening device can receive the broadcasting data. But the "connection" way is considered as safe, that the data is exchanged over a secure encrypted link [4].

2.2. RFID Technology

RFID is one of the vital IoT technologies, which is based on the radio waves to build the communication between RFID readers and RFID tags. The main goal of RFID is to identify and track the everyday objects by means of tags [7].

RFID technology was firstly used in the military applications in the forties of the last century. Low cost RFID TAGS manufacturing appeared in the last decade of the twentieth century. Each of them consists of a small integrated circuit (IC) for storing and processing data, modulating and demodulating the (Radio Frequency) RF signal, the IC is connected to an antenna which is used for receiving and sending the RF signals [7].

RFID tags can store a little amount of data about the monitored object, in addition to small size applications, and they can be attached to or integrated into the daily things to provide them with interactive capabilities. RFID technology marks the daily life objects with unique identification numbers, so it facilitates the communication with those objects, and thus contributes to spread the Internet of Things [8]. RFID tags are either passive or active, passive tags are without power source, very cheap, and can survive and keep readable for a long time. RFID passive tags can operate at all RF frequencies, but active tags operate only at higher RF frequencies [7].

Working principle and components: The RFID system has two devices, **RFID reader** (interrogator), or a mobile phone provided with an NFC wireless interface from one hand and an **RFID tag** from the other hand. The reader could be individually or connected to a background database or provided with an interface for directing the obtained information to other systems. The communication between the reader and the system could be wired or wireless. Similarly to NFC, the RFID reader generates an RF field to operate the RFID tag (transponder) which does not have a power source. The passive tag can get the required power by means of the RF field signal and thus the IC inside the tag can boot up and send data. The RFID reader can read data stored into RFID tags placed within its range [7], [Syed, 2012].

The reader consists of a transceiver, a control unit decoder for interpreting data, and an antenna for broadcasting radio wave signals. When the tag is within the reader's range, it can absorb the required energy from the reader's electromagnetic field. The RFID operating range differs from a few CMs to a few meters. So the reader sends its requests and the tag receives the reader's requests and sends the data back, so that the RFID communication is done in a bidirectional half duplex way [7], [Syed,2012], [10] . Data stored in RFID tags can be encrypted and thus protected not to be stolen or modified by attackers, besides that making copies or original versions of RFID tags is too harder [7].

RFID advantages: It can operate without a line of sight**;** it has the ability to read from, write to and to modify the RFID tag's data. Each RFID tag has a unique code and a unique content, this singularity allows tracking each labeled object or product when it moves, which in turn can keep track theft cases or product loss [7] , [Syed,2012].

2.3. Near Field Communication (NFC)

Definition: NFC is one of the latest technologies which was introduced in the last ten years [Syed, 2012]. It is a wireless communication technology with a short range (0 to 20cm) high-frequency, quickly deployed, and low bandwidth and [Syed, 2012], [11]. NFC provides bidirectional communication between electronic devices in addition to the known mobile services. NFC offers new services to facilitate the daily life and can be considered as the best solution for the Internet of Things proliferation [3], [12], [11].

NFC Components: NFC system stands on three NFC devices:

- **NFC enabled mobiles** are the most effective and commonly used devices.

- **NFC reader** is an active NFC device that could be either **internal** included in an NFC enabled mobile phone and able to create its own radio frequency field, except when the NFC enabled mobile is in the standby or sleep mode [7]. Or **external**, such as a contactless POS (Point of Sale) device which operates as an NFC reader able to read data stored into an NFC enabled mobile phone close enough to it [7].

- **NFC tag:** which is an industrial passive RFID tag, easy to use, and able to store a little amount of data in addition to an exclosive identification number [7], [11].

Concept and communication mechanism: The NFC concept is based on integration of mobile devices, smart card interface, several contactless identification devices and

wireless technologies such as Bluetooth and Wi-Fi [7], [Syed, 2012]. At first, the contactless smart cards have emerged; nowadays mobile phones are available with NFC technology. Reader devices provided with NFC technology such a mobile phone can connect to RFID-tagged things in addition to contactless smart cards [7], [Syed, 2012].

The NFC communication is done between two mobile phones which support NFC technology, or between an NFC equipped mobile phone from one side and either an NFC reader or a tag from the other side by touching an NFC device to another one [7] . NFC technology does not allow more than two NFC enabled devices to communicate with each other at the same time and NFC allows people to interact with the surrounding ubiquitously [Syed, 2012]. NFC technology can operate in three **various modes**:

- **Reader/writer mode** means exchanging (reading and writing) data between an NFC mobile and an NFC tag [7].

- **Peer-to-peer mode** means exchanging data between two NFC supported mobile phones in a bidirectional half duplex communication [7].

- **Card emulation mode** is the most prevalent mode, so that the NFC enabled mobile phone can operate as a contactless card for payment and ticketing. The NFC mobile phone is activated by the RF field generated by RFID readers located in some places [7].

Advantages and disadvantages: Configuring wireless devices to operate with the wireless networks is not an easy work and takes time. NFC can be as a mediator between two wireless devices placed close to each other enabling them to exchange the required settings and to connect to wireless networks without needing to introduce their network parameters [Syed, 2012]. NFC technology can be integrated into many devices, and can be used for a huge variety of applications and services. NFC tags can be implanted into or fixed on everyday objects, that they have a small size, so NFC technology is adaptable.

The NFC mobile phone can provide an identification service, and access control. NFC provides implicit matching and fast communication, that the NFC mobile's application is activated routinely when discovering the matching pairs within its range and is communicated directly without the need for pairing as with Bluetooth. The NFC technology takes into account the users' privacy as in the case of using the NFC mobile phone as a credit card [Syed,2012], [7] , [12] .

NFC technology is deeply adapted with mobile phones that it does not affect the mobile battery as Bluetooth [13]. Due to the short communication range; NFC is considered as a high safe technology more than RFID. Thus, catching the signals during the communication is so difficult [Syed, 2012].

Unfortunately, RFID and NFC commercial applications are vulnerable to attacks, such as tag cloning and tag impersonation. Some attacks want to change the tag's content by displaying false information such as fake phone numbers, counterfeiting of person identities [14], or replacing the original tags by their own tags, so controlling the system as they want. Using cryptographic tags and authentication protocols can make the attacks more difficult. The readers are also vulnerable to theft, vandalism, impersonate the identity of the legal reader for obtaining the high importance information.

NFC Systems provide Benefits for a multitude of domains: that's regarding the transportation systems; passengers no longer need to use cash in order to buy tickets, and drivers no longer need to sell tickets, neither to use money or to make calculations, or even to check tickets in and out, so NFC is time-saving. Transport companies can save operating and maintenance costs that there is no longer a need for ticket dispensers or printing tickets, and it is easier to change the ticket's price or to apply discounts. NFC mobile phones can be used as electronic cards (credit or debit), thus, they provide flexibility that's users no longer have to carry a lot of cards which will not be lost or stolen as real ones. Proximity services enable the users to access services or sharing information simply by only tapping, touching, or waving their NFC enabled mobile phones. Borderless services: users who travel abroad with their NFC devices, do not need to use the new country's money, and they can get the tourist information from smart posters by using their NFC mobiles depending on the location-based services [Syed, 2012], [15].

Working principle: When two NFC enabled devices become within the required range; the active device (the initiator) which have its own power source generates an electromagnetic field to activate the other NFC device (the passive one), and thus the communication is founded [7]. The NFC device which receives the communication is called the target which can be either a passive device that gets its required power from the active device's electromagnetic field, or an active one that has its own power to respond. The NFC application which is installed in an NFC mobile phone is designed to boot up when this NFC mobile phone touches any other NFC device carries compatible data [7]. NFC tags and smart cards are always targets and passive devices [7], [9] and two NFC tags cannot build acommunication and exchange data that they don't have power sources [7].

RFID - NFC Relation: NFC has been just a branch or an extension of RFID technology; it joins smart card technology interface and a reader into one device such as a mobile phone. This RFID son is a new wave of RFID, but it operates with a short range and different frequencies [7], [11]. NFC technology is able to interact with the RFID tags by means of our smart phones, or other readers and it adds further developments to the RFID technology by integrating of RFID technology into mobile phones. NFC enables billions of people to interact with the surroundings by means of RFID technology [Syed, 2012]. NFC reader which can read data stored in RFID tags allows downloading the readable information over the Internet and enable accessing services basing on the wireless communication technologies such as 3G, 4G, and Wi-Fi which are already embedded into mobile phones. NFC supports the RFID tag simulation mode, so that the mobile phone operates as an RFID tag, as if the phone holder is an object from the environment provided with an RFID tag [Syed, 2012]. As a closest brother or sun to RFID; NFC can play a role of RFID cards or RFID readers.

2.4. ZigBee technology

Definition and concept: ZigBee is a low power wireless technology based on the IEEE 802.15.4 and developed by the ZigBee Alliance. It defines a set or a suite of high level communication protocols for battery-powered applications. ZigBee is low cost, [16], [17],

and low-data-rate, its effective range is between (10m – 70m) [18] , it is highly secure and highly reliable that it supports the mesh networking capability, ZigBee device has a high latency, and due to the communication consumes a little power [17], [16]. ZigBee is used for applications with long battery life, such as home automation, military applications, home based healthcare, and consumer electronics [17].

The maximum communication range of ZigBee is about 200m in open-air vicinity [18]. ZigBee is an optimal and an integrated solution for the commercial applications, especially the wireless sensor network applications [8], [16], [19], [20], [21].

ZigBee is a technology specified for Wireless Personal Area Networks (WPAN) and it is a global hardware and software standard for wireless network devices which operates in the mesh network structure with three frequencies 868 MHz, 915 MHz, and 2.4 GHz. These devices can send data over long distances by using of intermediate devices. ZigBee devices stay a very short time in the active mode and they keep in the sleep (power saving) mode for the rest of the time. ZigBee devices take only30 ms or less to wake up, whereas Bluetooth devices take about 3 seconds, so the ZigBee device latency is high. ZigBee characteristics make implementing of a wireless ZigBee network easier than other standards such as IEEE 802.11 [7], [Syed, 2012], [21].

Advantages and Disadvantages: The IEEE 802.15.4 standard supports the possibility of encrypting the messages basing on the Advanced Encryption Standard (AES) [11]. The receiver can detect any modifications in the received message by means of the Message Integrity Code (MIC) which is contained in each coming message, so ZigBee has the possibility of data authentication [20]. In a wireless ZigBee network, intruders can get sensitive information from the network device memory, such as the security keys when these devices are not tamper-resistant nodes. But if the devices are tamper resistant; they can remove their sensitive information in order not to be stolen [20]. ZigBee nodes could stay alive for several years without the need to exchange their batteries. The ZigBee network can have thousands of tiny sensors and it is able to coordinate the communication between them easily, this is known as interoperability [16] .include

2.5. Wi-Fi communication technology

Definition: Wi-Fi is a high data rate and a long range technology dedicated to the Wireless Local Area Networks (WLANs), and based on the IEEE 802.11 standard. Wi-Fi is a wireless version of an Ethernet network developed and owned by Wi-Fi Alliance [7].

Advantages and drawbacks: Wi-Fi is a technology enabled of transmitting data for long distanc with a high rate and a high power. So it is better and faster than other technologies that have the same frequency band. It is integrated in most of nowadays devices such as tablets, smart phones, printers, laptops and personal computers and allows these devices to access the Internet as they are within any Wi-Fi network range. Wi-Fi networks can provide a lot of services for users in local areas such as restaurants and other public places, they can be competitors or harmonious with other wired or wireless communication technologies available in the same place [16].

The main drawback about Wi-Fi is the high power consuming [3] , especially when Wi-Fi network is used by smart phones that it consumes their batteries quickly [6] , [18] . Wi-Fi

networks are almost everywhere and can cause coexistence interference to other technologies such as ZigBee and Bluetooth which operates with lower energy; that is because it runs with higher power and the same ISM 2.4GHz band [22] . Wi-Fi products manufacturers support security procedures proposed by IEEE 802.11 standards (802.11b/802.11i/WPA/WPA2). But Wi-Fi networks still have many shortcomings in security side. Some mechanisms were suggested to solve the problem such as access control which is not an optimal solution due to intruders can listen to the communication and steal the MAC addresses. Wi-Fi uses other security mechanisms such as authentication, encryption, decryption, confidentiality and integrity of data by exchanging encryption/decryption keys between stations. All the mentioned mechanisms do not provide a suitable solution and do not ensure a secure communication for Wi-Fi [16].

Table 1. Comparison of studied wireless technologies [7]

Parameter	NFC	RFID	Bluetooth	ZigBee	BLE
Flexibility	High	Low	High	High	High
Power Consumption	Low	No	High	Medium	Low
Security	High	High	Low	Low	Medium
Personalization	High	High	Medium	Low	Medium
Cost of tag	10 cent	10 cent	$ 5	$5	$5

Table 2. Overview of studied wireless technologies [7]

Wireless Technology	Operating Frequency	Data Rate	Operating Range
802.15.4 ZigBee	2.4 GHz	250 kbps	70 m
802.15.1 Bluetooth 2.0	2.4 GHz	3 Mbps	10 m
802.11b/g Wi-Fi	2.4 GHz	54 Mbps	100 m
802.11a Wi-Fi	5 GHz	54 Mbps	100 m
NFC	13.56 MHz	106, 212, 424 kbps	0–4 cm
RFID	125–134 kHz (LF) 13.56 MHz (HF) 400–930 MHz (UF) 2.5 GHz and 5 GHz (microwave)	1–200 kbps	20 cm for passive 400 cm for active
BLE	2.4 GHz	1Mbit/s	30-50m 2-5m to last the battery lifetime

Table 3. Comparison of active tags and passive tags [7]

Parameters	Active Tags	Passive Tags
Power Source	Embedded power source	Power from RF field
Battery	Yes	No
Data Storage Capacity	High	Low
Manufacturing Cost	Expensive	Cheap
Operating Range	Long range	Up to a few meters
Signal Strength to Tag	Very low	Very high

3. HOSPITAL ROOM HYGIENE

The proposed use case has the goal to monitor, draw attention and increase consciousness about the importance of following the hygiene rules for reducing the HAI. The system is designed to monitor the possible breaching of hygiene rules inside a hospital room.

3.1. Use case description

Room layout: The considered room (Figure1) has two beds for patients separated by a suitable distance (at least 3 feet); a curtain can separate between the two beds; and the beds are placed perpendicular on the inner wall of the room versus to the entrance. A Hand washing sink is seated to the right wall, and so close to the entrance, that doctors and nurses should wash their hands directly when they enter the patient room. Each room has a small and closed place, dedicated to the treatment of wounds and changing the bandages to prevent the infection transmission within the room or outside. The room is provided with an air conditioning system to change the indoor air. A waste bin for unclean services is very close to the hand washing sink, so the used things such as head and face covers, masks, tissues, used towels and gloves can be disposed of directly through this bin. The waste bin is connected to the ground floor in order to prevent the transfer of contaminated purposes within the corridors of the hospital. The room also contains a toilet for the patients.
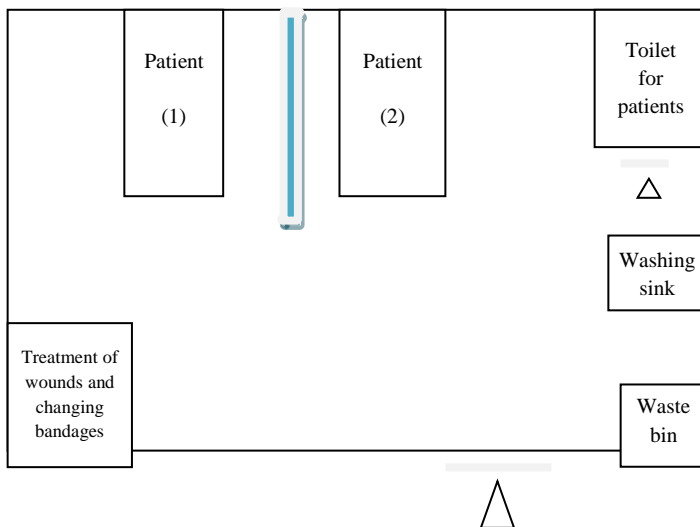
Figure 1. The room layout

Monitored events and rules: The events which must be monitored have the following sequence:

- The Physician's passing through the entrance; the system is able to recognize the physician's identity number while he is entering or leaving the room.
- The Physician's complying with the hand hygiene protocol at the washing sink before heading to the first patient.

- The first patient is treated while he is in his bed, but if this patient has wounds and needs to exchange the bandages, the physician accompanies the patient to the place of treating wounds and changing bandages. After finishing, the physician should go again towards the sink to sanitize his hands before progressing towards the second patient.
- The next patient will be treated in his bed if he is in recovery phase, or he will be accompanied to the place dedicated to changing the bandages. After finishing, and in both cases, the physician sanitizes his hands again before leaving the room.
- After any of the two patients uses the toilet, he should go to the sink to sanitize his hands.

3.2. Technological choices

We will choose the best technology for each monitored event type, based on the following criteria: operating mode and range, power consumption, security issues, cost, flexibility personalization.

Identifying persons passing the room entrance, we need to know the identity of people who are entering and leaving the room.

We use RFID technology for monitoring the physicians (doctors or nurses) entry and leaving into and out of the patient room for the following reasons:

- RFID is a technology dedicated for identification and tracking of people and daily objects and things by means of tags which can keep valid and readable for a long time and can store a unique identity number for each person.
- RFID has very low power consumption, a high personalization and a high security that the tag data is highly encrypted.
- The RFID does not need a line of sight to work like many other technologies,
- The RFID operating range (20 centimeters up to few meters) is very suitable for detecting the physician's ID when he passes through the entrance. These features make the RFID technology a good choice for monitoring the entrance.

NFC technology can also be used for monitoring the physician's passing into and out of the patient room for the following reasons:

- NFC is considered as a highly flexible technical solution; it is simple with only touching or waving one NFC device near the other.
- NFC performs a fast communication, so that the two NFC devices do not need pairing for establishing the connection as in other technologies such as Bluetooth.
- NFC provides a security higher than RFID, because the short distance communication prevents the attackers to catch the signal.
- NFC technology does not require a line of sight in order to operate and it has a high personalization that it takes into consideration the person's privacy.
- NFC also has low power consumption, so that when NFC technology is integrated into mobile phones or wrist bands, it does not consume high power.
- NFC can operate in three modes, so it enables finding solutions, and offers choices to solve problems.

Taking in consideration the hardware equipment, RFID, NFC tags has small sizes (around 0.5 mm2) so they can be integrated easily anywhere. They also are cheap and have a sufficient memory capacity (from kilobytes up to 1Mb and over) to be used.

At the washing sink, the physicians can interact with NFC technology very simply by only using their hands to move, wave or touch their NFC equipped devices close to other NFC equipped ones. At the sink we need to know if the physician complies with the hand hygiene rules or not. Implementing the NFC technology at the washing sink is a guaranteed solution because the NFC operating range is so short (0-4 cm), and will confirm that the hand washing event has been performed. This reason, in addition to the reasons mentioned earlier, makes the NFC technology a suitable solution.

BLE and ZigBee communication technologies face the obstacle problem that the signals spread in straight lines. When BLE uses the broadcasting way to perform the communication; it cannot be considered as a secured technology, that any listening device can capture the signal and steal the transmitted data. Regarding ZigBee technology; if one of the ZigBee nodes (devices) is not a tamper-resistant; then the sensitive information could be stolen. ZigBee and BLE tags have higher costs that RFID and NFC tags.

In the patient vicinity, We need to know exactly if the physician complies with the hand hygiene rules before and after treating each patient. In this case, each of NFC or RFID could also be a suitable solution due to their distinct features mentioned earlier, and that they are able to identify the physician's position, and which patient is being treated in real time. In our case, the complying with hand hygiene must be repeated three times:

- Before handling the first patient.
- After handling the first patient and before starting to treat the next one.
- After handling the second patient.

The idea of treating each patient also includes if any of them needed to go to the place dedicated for treating the wounds and changing the bandages.

When using the toilet, We need to know if the patient complies with the hand hygiene rules after using the toilet. Each of NFC or RFID technology is a suitable choice for monitoring this event due to the reasons mentioned earlier.

4. CONCLUSIONS

This paper focused on the hospital acquired infection as a big challenge of current hospitals. The most recent technologies have been reviewed in details; we demonstrated the concept, the work mechanism, the advantages and the drawbacks for each of them, with comparison tables show the characteristics and the features for each technology. The RFID-NFC relation was clarified precisely. We described a hospital room use-case, and we analyzed the events workflow of the patient room, which has to be monitored. In particular, we analyzed in details which technology is more suitable for each event and we concluded that RFID and NFC are the more suitable choices to be applied for monitoring the workflows due to their superiority over similar technologies especially in security, power consumption, cost, and operating mode aspects.

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TEACHING SOFTWARE PROJECT MANAGEMENT:
THE COMPETITIVE APPROACH

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ABSTRACT

Learning has been the subject of continuous change throughout time. Although cooperation and competition are mostly two different ways of approaching the learning process, the combination of the two might offer promising outcome to the participants. This paper aims to put forward a particularly designed learning approach for teaching Software Project Management in an academic environment by adapting already-defined cooperation and competitive learning techniques to a new and improved teaching approach for a computer software study field.

KEYWORDS: *software project management, educational models, teaching strategies, collaborative learning, cooperative learning, competition-based learning, mixed collaborative-competition learning, independent learning, anarchy learning.*

INTRODUCTION

Among the different oriented approaches, the following can be distinguished as efficient learning processes: collaborative, competitive, anarchic, independent and mixed.

A competitive environment is described as a process in which one participant's success depends on the other participants' failure. The key of maximizing opportunities for learning in a competitive-based environment requires a better defining of the instructional strategies which would nurtures competition and cooperation between participants [1]. Studies have recognized the need to integrate cooperation, competition and individualistic types of learning into a single approach [1-4].

The purpose of this paper is to study the impact of the competitive approach in student learning, analyzing its benefits and when it is more efficient to use.

The competitive approach aims to achieve high learning results through students' self-reliance. While other approaches focus on cooperation among students with a common goal, this learning method implies that motivation is raised by the goal of surpassing one another. This incentive determines each individual to put more effort in their assignments, resulting in increased confidence and self-improvement.

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PREVIOUS WORK

The work of Triplett in 1898 states that cyclists achieved better results when racing than when cycling alone [5]. This implies that competition had favorable results by adding an extra incentive to the race.

A more recent study taken in 2004 by Lam, Yim, Law, & Cheung concluded that competition had a positive impact on performance and learning motivation in an academic environment [6].

Johnson & Johnson [1] describe the results of a research regarding learning in sport management classrooms. It was concluded that the key to maximize students' opportunities was the successful development of instructional strategies and practices applying both competition and cooperation approaches.

A considerable number of studies have analyzed the effectiveness of cooperation, interpersonal competition and personal motives in achieving success and productivity in the learning process. It was found that cooperation is more effective than interpersonal competition or other personal ambitions, but that competition between groups is more beneficial than competition between individual peers. [7]

PROPOSED APPROACH

During the Software Project Management course from the POLITEHNICA University of Bucharest, one particular project was proposed in order to illustrate the competitive approach.

The project consisted of implementing a Formula 1 race simulation. Each student was assigned to a team which had to develop an application that simulates a race between two cars on the Monte-Carlo Formula 1 racing track. When the project is over, all the teams get to compete between each other. The evaluation is based upon the lap times that each team can achieve in their simulation. The team score is calculated as a weighted average between the fastest and the slowest time it takes to complete a lap around the circuit. If a car does finish an entire lap, a negative score is earned.

Each team member had a certain role, the most important of all being the position of project manager. In order to enter the election, the students interested in this position had to provide a CV to the supervising assistant. The latter could turn down an application if he would not think the student was the best choice. In that case, the team had to propose a new project manager.

An important aspect of the competition was that the teams' work would be compared at each of the 4 milestones, each one receiving a score. After each evaluation, all the teams continued working with the winning project as a starting point. Thus, the competition would be as fierce for each milestone in the case of a team gaining advantage.

Figure 1. One sample race circuit (Monte-Carlo Formula1 Circuit) defined as a 1BPP (Black & White) image and the winning team's race simulation (zoom on viewing application followed by full screen dump of the entire running system)

The competition was divided into four milestones:

1. The role assignment among the team members and the creation of the project's documentation: the software requirements specification (SRS), the software design description (SDD) and the programming platform on which the application is developed.

2. The implementation of the project viewing application;

3. The implementation of the racing program;

4. The artificial intelligence (AI) system for the racing cars and the competition between teams;

The project viewing application is a graphical-user interface (GUI) which allows a front-end visualization of the implemented racing scenario. It resembles a usual setup menu, common with most race-based video games, where the players can load their racing strategies and start the simulation.

The viewing application offers a real-time 2D circuit visualization, as seen in Fig. 1, where the competing cars are represented depending on the track position returned by the input AI algorithm.

During the simulation, the time elapsed since the beginning of the race is displayed in the top center part of the viewing window, along with the current race standings in the top right corner and the last lap time for each participant in the top left corner.

A mini-map illustrating the entire circuit, with each participant labeled according to their location on the tracked is displayed in the bottom left corner of the viewing window. The GUI viewer communicates with the server that runs the back-end racing program, which makes all the necessary location-specific calculations.

The implementation of the racing program requires the development of a set of computer game physics to simulate the racing environment. The application runs on a dedicated server which communicates with the GUI viewer by advertising general race status data like current standings, lap times or car position on the track. The program inputs two AI modules which calculate the momentary position of the two competing cars according to the track configuration and the path-finding algorithm implemented by each module. Every calculation made is refreshed according to a quanta of time which can be modified before starting the simulation.

The AI system implements a custom path-finding algorithm that calculates a movement strategy by alternating the current speed of the car. The algorithm should determine when a car shall reduce speed by braking, increase the speed by accelerating, steer left or right. For the simplicity, the speed shall be incremented or decremented by one unit. For a better simulation, the AI system will communicate with the racing program that implements the game physics, which will have an effect on the steering of the vehicle by simulating understeer – the car cannot not turn enough at the current speed and leaves the circuit – or oversteer – the car turns more sharply and could get into a spin.

Due to the team-based structure of this project, the students relied on each other to successfully meet the milestones involved. Even though each student was graded

individually, a few features of the collaborative approach can be remarked in this project. However, due to the competitive spirit, the team members motivated each other in order to accomplish their goals.

Each individual received grades from his team's project manager, thus resulting in a personal score. The project manager was evaluated by the supervising assistant. However, the score of the project manager was used as a scaling factor for each team member's score. In this way, no team member could have a greater score than the project manager, thus resulting the motivation to apply a CV and to be elected the project manager.

This assignment managed to combine multiple levels of competitiveness through the competition between teams in order to win and receive the highest team score and the election of the project manager position from between team members. Through this system, each student had enough incentive to work had both for the team and for himself.

CONCLUSIONS

As the scoring was based upon a ranking system, these results show that the competitive approach enabled the students to learn and participate efficiently in the development of the final products. As a result, even though a few projects were exceptional, the teams could not be awarded maximum scores, thus raising the incentive for each individual to provide better work for their assignments.

As most of the team members had close grades, this demonstrates an equal effort provided by each individual in order to achieve the team's and their own goal.

In addition, the competitive approach was proven to be successful by the students' and assistants' positive feedbacks. Most of the students reported an increase in interest due to the competitiveness of the project and some stated that having a competitive goal even made the project more enjoyable.

In conclusion, the competitive approach presents both advantages and disadvantages, proving to work perfectly with projects that are divided into independent modules. In addition, each individual should have enough experience to work independently, otherwise additional time is implied for research and studying.

FUTURE WORK

Research is needed to clarify which mechanisms operate on the group as a whole and which are tied to specific experiences in group interaction. If, for example, increased student morale plays a major role in increasing achievement, then individuals may benefit from the group experience regardless of their own rate of participation.

In addition, there are many ways in which the competitive approach can be combined with other work methodologies. Through the potential of combinations with the collaborative and independent approaches, this topic leaves plenty of room for further research and conduction of case studies.

More details about alternate educational approaches in teaching Software project Management can be found in [8-9].

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INFLATION IN ROMANIA AND ITS EVOLUTION IN VIEW OF ACCESSION TO THE EUROZONE

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ABSTRACT

In recent decades, the main problem of the world economy was a general rise in prices of goods. The pressure generated by the increase in prices leads to significant distortions in the monetary, economic, political and social areas. Inflation is the main factor of economic crisis by discouraging investment and causing migration of capital. The deteriorated stability created by inflation is strongly affecting private sector decisions to invest or develop, with final effects in reducing production and eventually stagnation. After years of high inflation, Romania has faced in recent years with a significant process of disinflation. This has very strong implications in the development of Romania's economy and foreign trade activity. In econometric models, the main statistical indicator for inflation rate is HIPC. Accession to the EU increases the importance of the HICP. Inflation nominal convergence criteria for joining the euro area is given by the HICP and the ECB defines price stability as an annual increase in the HICP of less than but close to 2%.

KEYWORDS: *inflation, index of consumer prices, Security Market Line, optimal structure, regression model.*
JEL Classification: *C01, C51, C52, E22, F2, P45.*

INTRODUCTION

"*Inflation is always and everywhere a monetary phenomenon*" M.Friedman.

Monetarists claimed that when the money supply is evolving faster than the growth rate of national income, the inflationary phenomenon will occur.

Modern economic thinking is based on the quantity theory of money, which is mentioned by J.Locke. It is based on the fact that the purchasing power of money is determined by the intersection of supply and demand for money. "This theory is essentially an application of the general theory of supply and demand on the special court for money" L.Von Mises.

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The quantity theory of money is expressed as MV = PN, where M is the money supply, V is velocity, P = price index, N = national income. By this equation, the monetarists argue that what produces inflation is unduly increasing the money supply.

V.Slăvescu was characterising inflation as "immeasurable creation of monetary signs" or "an excess of circulation of money." (Slăvescu, 1932)

The market economy exists because of the signal transmitted through prices. When in an economy is a steady state, which has a normal economic growth and reduced unemployment rate to its natural level with a balanced state budget, the inflation rate should be reduced. However inflation is maintained at a similar level year after year. A cause of maintaining inflation could be given by enhancing product quality and their modernization.

P.A.Samuelson, claimed in the second edition of "Economics" that an annual inflation rate of 5% is an acceptable goal. Over four years, in the third edition he said "If price increases could be maintained at an average of 3% per year, such a moderate and steady inflation should not be a reason for concern ". (P.A Samuelson, 1951). At the publication of the fourth edition in 1958, the reference level to fell to 2%, and at the publication of the fifth edition, 1961, under 2%. In the most recent edition, published in 1998 P.A Samuelson does not assess inflation as an "acceptable" one.

In the last thirty years, the school has managed to impose monetarist idea that a lower rate of inflation is desirable despite higher one. This view is based on the fact that, in the long term, economic growth is not influenced by inflation (than, at most, by downsizing it!), so inflation does not bring anything good.

M.Walden answers the question "What is the ideal inflation rate? " This question was circulated by economists for decades, and the conclusion at the moment - if you can say that economists agree on one thing - is that a inflation rate of 1-2% is optimal. "

INFLATION BY DEMAND

Inflation by demand is favourite to occur when aggregate demand in an economy outperforms the aggregate economy. This implies higher inflation while GDP increases and unemployment decreases as the economy moves along the Phillips curve. This is usually described as "too much money for too few goods". Specifically this would have described as "spent too much money for too few goods" because only money spent on goods and services can cause inflation. This would not be expected to persist in time due to supply growth, unless the economy is already at a full employment.

According to Keynesian theory, most companies will hire more people employed and aggregate demand will increase. This increased demand will make firms hire more staff to produce more. Due to capacity constraints, this increased production will become so small that asset price will increase. At first, unemployment will decrease, going from AD1 to AD2, which increases Y (Y2-Y1). This increase in demand means the need for more workers, and AD will translate from the AD3 AD2, but this time there will be much less than in the previous pass, the price level increasing from P2 to P3, an increase much higher than in the previous pass. This increase in price is known as inflation.
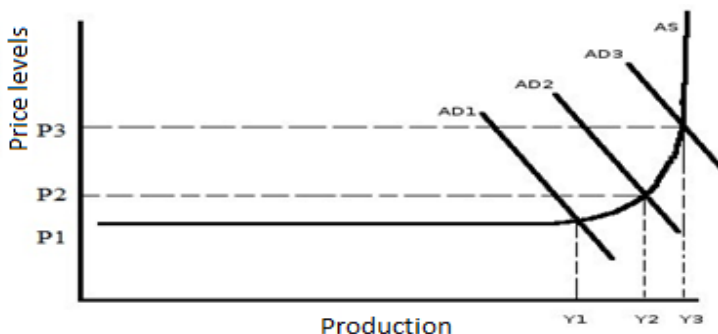
Figure 1. Aggregate demand increasing faster than production

Inflation by demand occurs when aggregate demand grows faster than the supply base. This may be easier to imagine if we look at the offer as capacity level. If the ability to produce is growing at 3% and demand increase at the same pace or slower then we have no problem. We produce everything we need. However, if capacity increases to 3% but demand is growing faster, then we have a problem. In fact, we have "too much money for too few goods" and fail to produce everything we need. Something has to give up, this thing being made by the prices that are forced to grow, this way inflation appears. It can be seen in Figure 1 that when aggregate demand curve moves to the right, the price increases resulting inflation. There are lots of reasons for increased aggregate demand and to realize this we need to look closely at the components of aggregate demand.

$$AC = C + I + G + (X - M)^1$$

Therefore, an increase in aggregate demand might exist because consumers are spending more, maybe because interest rates are down, taxes were reduced or simply because there is a higher level of consumer confidence. It could be because companies are investing more in future growth expectations. It could be that the fact that the government increase spending on defense, education, health, etc. Whatever, it will be inflationary if demand grows faster than supply.

It would be nice to stop at that point and we could say that we understood inflation, but is not so simple. There are differences between economists about the causes of change in demand and also on the effects that these changes have.

The effect of change of aggregate demand depends on ht shape of aggregate supply and here, economists are divided. There are two specific ways: Keynesian way and Classical way. The classical economists have a fundamental belief in free markets called "laissez-faire economy." They think the economy should be left free, that it will find that independent full balance. If the economy is below full employment, the following things will happen: unemployment (surplus labor) → → →lower wages → → → more workers are employed resulting full employment is restored. This process happens automatically through the market mechanism, so there is no need for the government to intervene in the long term. This means that aggregate supply curve on long term (AS) will be vertical.

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[1] C=consumer expenditure I=investment G=Government Expenditure X=Exports M=Imports
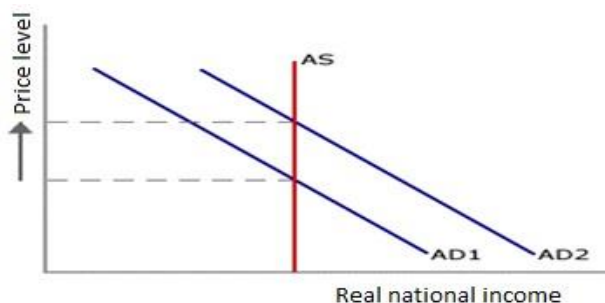
Figure 2. Vertical aggregate supply (AS)

Any attempt to stimulate the aggreagate demand on long term by using reflationist policy, will be simply an inflationary movement because the AD curve will shift upward to the AS curve. In the short term they recognize that the AS curve will be upward sloping due to negative yield, but any reflationist policy will be in a continuous storage of inflation for the future.
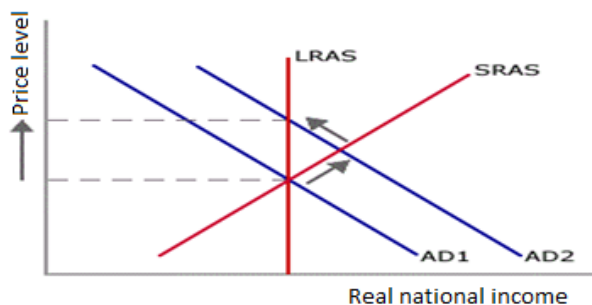
Figure 3. Long-term aggregate supply curve

In this graphic we can see that the reflationist policy has changed demand curve to the right which increased real output in the short term, but long-term increase in prices erased this and there was no overall increase in the real level of production.

Keynesian economists had a different view of work in the labor market and argued that it does not work perfectly. They find that salaries are hardly went down. This means that any increase in unemployment will not necessarily lead to a drop in wages. This means that an employee that has been fired once will not be rehired. Dropping unemployment means a state intervention to stimulate demand enough to be employed as many people again. They argue that on both long-term and short-term, AS curves will be the same and that to reduce unemployment, the government should use reflationist policies to stimulate demand. The classical economists stand up for "laissez-faire" or the state should not interfere in the economy, while Keynesians are for government intervention.

The difference between classical and Keynesian policy can be summed up in their approach. The classical economists argue for "laissez-faire" or that the state should not intervene in the economy, while Keynesians are for government intervention.

COST-PUSH INFLATION

Inflation through costs is defined as a phenomenon in which general price levels increase (inflation) due to increased costs of wages and raw materials. This is determined by supply factors (cost-push inflation is different from the demand that arises undergoing aggregate demand growing faster than aggregate supply).

Inflation through costs can lead to lower economic growth and often causes a decrease in living standards, although often proves to be a temporary thing.
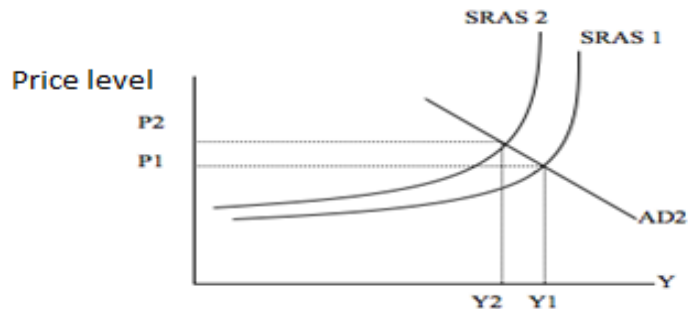
Figure 4. Inflation through costs

THE NOMINAL CONVERGENCE CRITERIA FOR EURO ADOPTION

The Maastricht Treaty provides for achieving a "high degree of sustainable convergence" as a precondition for euro adoption by a member state. Assessing whether this requirement is met it is performed by reference to the following criteria:

- Price stability: inflation should not exceed by more than 1.5 percentage points the average inflation rate of the three EU Member States that had the best results in terms of price stability

- The sustainability of the fiscal position: the budget deficit not exceeding 3% of GDP and public debt at 60% of GDP

- Exchange rate stability: observance of the normal fluctuation margins provided for ERM II for at least two years without devaluing the national currency

- The convergence of long-term interest rates: their average does not exceed by more than 2 percentage points the average rate of the three EU Member States that had the best results in terms of price stability
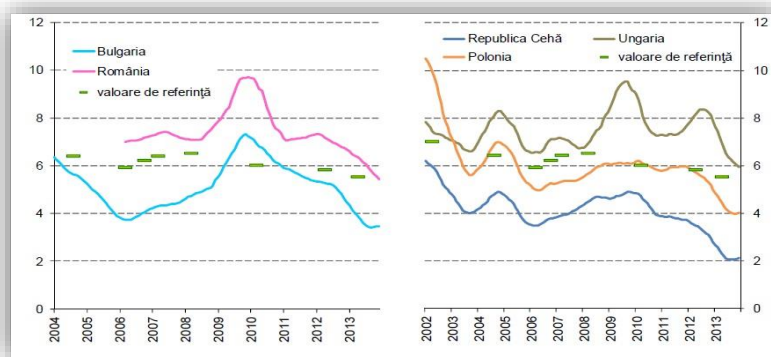
Figure 5. Harmonized Index of Consumer Prices (HICP) annual average (%)
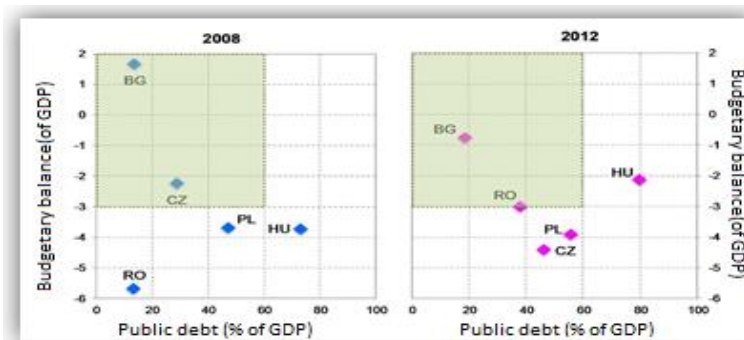
Figure 6. Excessive deficits have been adjusted and will be removed in the near future
Interest rates are below the reference value in most states. 1

MAASTRICHT CRITERIA (NOMINAL CONVERGENCE INDICATORS) [2]

Nominal convergence indicators	Maastricht Criteria	Romania	Difference compared to criterion
The inflation rate (HICP) (percent, annual average)	≤ 1.5 pp above the 0.3% * (average of 3 best performing EU members)	3.2 (december 2013)	+1,4 pp
Long-term interest rate (percent, annual average)	≤2 pp above the 3.4% ** (average of 3 best performing EU members in terms of price stability)	5,4 (december 2013)	
The exchange rate against the Euro * (appreciation (+) / depreciation (-) Percentage)**	±15 percent	+0,8 / -6,6	

[1] Sources: Ameco, Eurostat, BNR

[2] Sources: Eurostat, INSSE, BNR, MFP

The consolidated budget deficit **** (percent of GDP)	less than 3 percent	3.0	
Public debt **** (percent of GDP)	less than 60 percent	38,0	

*) reference level December 2013 (Cyprus, Latvia, Bulgaria).

**) reference level December 2013 (Bulgaria, Latvia).

***) Calculated as the maximum deviation of the exchange rate against the euro during February 2012 - January 2014 compared to the average recorded in January 2012, based on daily data.

****) 2012; ESA95 methodology.

CASE STUDY

Romania's EU accession requires an increase in the importance given to the harmonized index of consumer prices (HICP) because the nominal convergence criteria for inflation that needs to be fulfilled for entry into the eurozone is expressed in terms of the HICP and the ECB defines price stability as being given by an annual growth of the HICP below 2%, but close to this level. Thereby a brief analysis of the concept and definition of differences from the national (IPC) is needed.

HICP measures the changes in prices and tariffs for goods and services covered by the retail trade in Romania, the weighting coefficients being derived from the structure of expenditure for this purpose by Romanian and foreign consumers. Therefore, the harmonized index is based on "internal" consumption concept, taking into account consumption of all households on the economic territory of the country. Specifically, the index definition requires not only consideration of residents consumption, but also the costs incurred by foreigners in Romania.

From a conceptual standpoint, this is a major difference from the CPI, which uses the principle of "national" consumption or intended consumption expenditure of residents whether those are performed within or outside the country.

Another difference between the HICP and national definition methodology consists of using the HICP concept of "net expense reimbursements" for medicines (deducted amounts offset) and insurance premiums (deducted compensation).

Between the national CPI and HICP definition there are a number of differences at a conceptual level, but their influence on the final outcome is marginal - less than 0.1% at annual rates in the period 2007-2014 (Table 1). The motivation for this is the insignificant share owned by the expenditure of foreign tourists in Romania and Romanian citizens abroad respectively, an explanatory element is probably insufficient statistical information on the two components.

Table 1

INFLATION RATE[1]	2007	2008	2009	2010	2011	2012	2013	2014
EU	2.3	3.7	1	2.1	3.1	2.6	1.5	0.6
Romania	4.9	7.9	5.6	6.1	5.8	3.4	3.2	1.4
USA	2.6	4.4	-0.8	2.4	3.8	2.1	1.3	1.3

The main aim of the monetary authorities in Romania after EU accession was to keep inflation in the proposed target. In this context it is necessary to develop a model to study the development of inflationary process due to several significant factors of influence. A very important variable factor is the average interest rate on credit institutions with direct implications in domestic demand. Other variables that influence are net income and unemployment rate. All these conditions are taken into account in the development of multiple regression models for Romania in the EU.

In recent decades, the main problem of the world economy was a general rise in prices of goods. The pressure generated by the increase in prices leads to significant distortions in the monetary, economic, political and social environment. Inflation is the main factor of economic crisis by discouraging investment and causing migration of capital. The deteriorated balance created by inflation strongly affects private sector decisions to invest or develop, with final effect in reducing production and eventually stagnation.

After years of high inflation, Romania faced in recent years with a significant process of disinflation. This has very strong implications in the development of Romania's economy and foreign trade activity. In recent years, inflation was close in all periods in the lower half of the target band. Over this period, the main source of disinflation performance was volatile prices, whose annual growth rate has slowed further in recent times.

In the econometric models, the main statistical indicators for inflation is the Consumer Price Index (CPI). Inflation rate models from the paper are based on the evolution of this index. Accession to the EU increases the importance of the harmonized index of consumer prices (HICP). Nominal convergence criteria for inflation joining the euro area is given by the HICP and the ECB defines price stability as an annual increase in the HICP lower but close to 2%.

HICP measures changes in retail prices of goods and services in Romania, weights to calculate the index being extracted from the structure of consumption expenditures of residents and non-residents. In fact, the definition of the index requires consideration not only of consumption by residents, but also the costs incurred by foreign visitors in Romania.

The status of the two indices has not changed after Romania's EU accession, except HICP increased frequency of economic analysis, particularly for comparing the performance of inflation with other Member States. The HICP does not aim to replace national CPI, but to ensure comparability at European level.

To develop a regression model of inflation underlining the importance of the main factors of influence is needed. These factors are very diverse as the action in the national

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[1] Source: *Eurostat*

economy and external sources. Of the large number of factors influencing inflation only factors with a significant share in inflation in Romania will be selected.

After a preliminary analysis, it appeared that the main factors influencing the inflation rate in Romania are:

Table 2

The labor market	The labor market is an economic space where they meet face and freely negotiate supply and demand for labor.	J.M.Keynes (1936) M.S.Morgan (1995) D.F.Hendry (1995)
Exchange rate (EUR / RON)	Represents the price of currency units of the currency of a country expressed in monetary units of another country. A more precise definition of the exchange rate takes into account the type of quotation linking the two currencies participating in the exchange rate	C.Şipoş (2006) C.Preda (2006)
Interest rate	The interest rate used as a reference for contracts providing for interest adjustment. This may take the form of an index reference currency (Euribor, Libor, etc.), the interest rate on government securities or an internal rate of interest.	T.C.Mills (1993) R.N. Markellos (1993)
Industrial Production Price Index (IPPI)	IPPI measures changes of prices for goods and / or services manufactured and delivered during the first marketing stage by domestic producers in a certain period (called current period) as against a previous period (called base or reference period).	D.L.Rubinfeld (1998) D.Salvatore (2002) D.Reagle (2002)
Monetary aggregate (M2)	Money supply components as fully existing funds in a country's economy at a time or on average over a certain period, are studied using monetary aggregates. M1 is the mass of narrow money and broad money M2 is intermediate.	M.L.Berenson (2004) D.M.Levine (2004) T.C.Krehbiel (2004)
Non-governmental credit	Non-governmental credit is the credit granted to individuals and companies. Since the peak in 2008, the balance of loans continues to fall and the economy continues to contract. RON loans is in most cases consumer loans to households and loans to finance current capital for companies.	C.T.Mills (1993) W.Wasserman (1996) J.H.Stock & M.W.Watson (2003)

The first important influencing factor for inflation in Romania is the labor market. The most important indicators of the labor market are unemployment rate and the net income of employees. The unemployment rate was significantly lower in recent years in Romania, with direct implications in the process of slowing inflation. In the past three years, net income of employees in Romania's has been steadily increasing, with direct impact on inflation. Unifactorial regression models between CPI and unemployment rate (RS), respectively, between CPI and net income (VN) show strong linear connection during 2007-2014 (Table 3 and 4).

Table 3. Linear regression model between CPI and Unemployment

Dependent Variable: IPC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003637	0.000476	7.640436	0.0000
RS	0.008128	0.019098	0.425624	0.6714
R-squared	0.001944	Akaike info criterion		-7.887678
Adjusted R-squared	-0.008788	Schwarz criterion		-7.833912
F-statistic	0.181156	Hannan-Quinn criter.		-7.865952
Prob(F-statistic)	0.671365	Durbin-Watson stat		1.366875

Table 4. Linear regression model between CPI and net income

Dependent Variable: IPC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003401	0.000473	7.185926	0.0000
VN	3.46E-05	1.45E-05	2.380679	0.0193
R-squared	0.057442	Akaike info criterion		-7.944889
Adjusted R-squared	0.047307	Schwarz criterion		-7.891124
F-statistic	5.667633	Hannan-Quinn criter.		-7.923164
Prob(F-statistic)	0.019320	Durbin-Watson stat		1.425273

In both tables adjusted R-squared is relatively close to 0, which means that the connections between the evolution of the CPI and unemployment, respectively, net income in the period studied are strong.
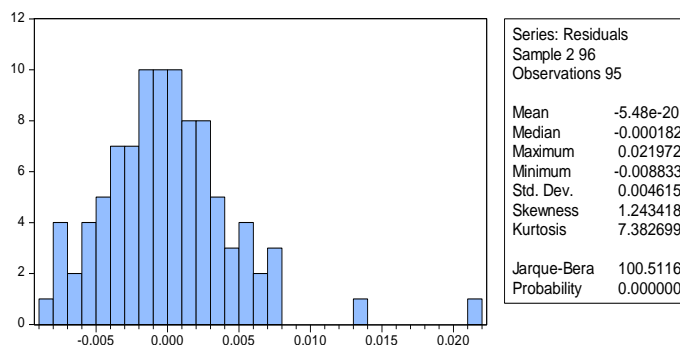
For a normal distribution:

- Coefficient of asymmetry (skewness) is 1.24, it means the normal distribution is asymmetrical.

- Kurtotic (kurtosis) 7.382. As this indicator is less than 3, the distribution is called leptokurtotic.

According to this model, media distribution is less than zero, it presents a negative asymmetry and the kurtosis has a value over 3, which means the distribution is leptokurtotic.

Weibull distribution is a skewed asymmetry distribution coefficient dependent on the value of the parameter shape. The degree of degradation as we move away from the center depends on the value of the parameter shape. For this dataset, the asymmetry coefficient is 1.24 and kurtosis is 7.38, which indicates a moderate asymmetry and kurtosis.

Table 5. Linear regression model between the CPI and the exchange rate

Dependent Variable: IPC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003668	0.000482	7.615476	0.0000
RSCH	-0.010007	0.025549	-0.391672	0.6962
R-squared	0.001647	Akaike info criterion		-7.887380
Adjusted R-squared	-0.009088	Schwarz criterion		-7.833614
F-statistic	0.153407	Hannan-Quinn criter.		-7.865655
Prob(F-statistic)	0.696196	Durbin-Watson stat		1.346675

Table 6. Linear regression model between CPI and interest rates

Dependent Variable: IPC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004018	0.000491	8.180386	0.0000
RD	0.031046	0.013395	2.317645	0.0227
R-squared	0.054604	Akaike info criterion		-7.941883
Adjusted R-squared	0.044438	Schwarz criterion		-7.888117
F-statistic	5.371480	Hannan-Quinn criter.		-7.920158
Prob(F-statistic)	0.022662	Durbin-Watson stat		1.525292
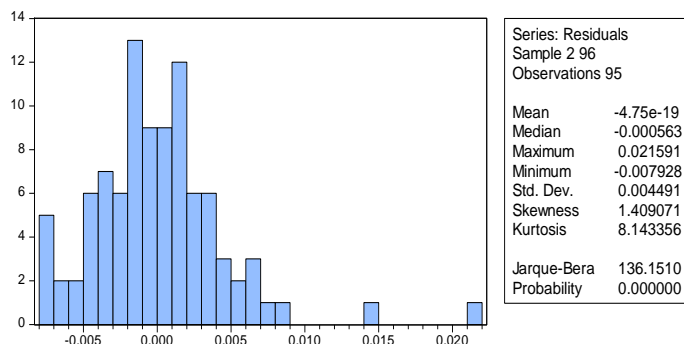
In Table 5 and 6 R-squared and Adjusted R-squared values are close to 0, which means that the links between the evolution of CPI, exchange rate and interest rate are not very strong. The last set of variables affecting inflation in Romania is given by the producer price index (PPI), money (MM2) and non-government credit (CNV). Unifactorial linear models for these three indicators during 2007-2014 are shown in Table 7, 8 and 9.

Table 7. Linear regression model between CPI and producer price index

Dependent Variable: IPC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003547	0.000468	7.575201	0.0000
IPP	-0.008700	0.004255	-2.044504	0.0437
R-squared	0.043013	Akaike info criterion		-7.929697
Adjusted R-squared	0.032723	Schwarz criterion		-7.875931
F-statistic	4.179996	Hannan-Quinn criter.		-7.907972
Prob(F-statistic)	0.043730	Durbin-Watson stat		1.357901
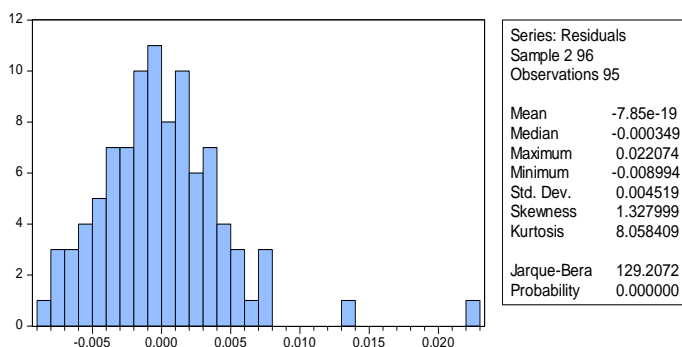
Table 8. Linear regression model between IPC and MM2

Dependent Variable: IPC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003543	0.000523	6.774766	0.0000
MM2	0.009583	0.021367	0.448513	0.6548
R-squared	0.002158	Akaike info criterion		-7.887893
Adjusted R-squared	-0.008571	Schwarz criterion		-7.834127
F-statistic	0.201164	Hannan-Quinn criter.		-7.866167
Prob(F-statistic)	0.654826	Durbin-Watson stat		1.402128

Table 9. Linear regression model between IPC and CNV

Dependent Variable: IPC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003355	0.000519	6.465414	0.0000
CNV	0.032815	0.024824	1.321933	0.1894
R-squared	0.018444	Akaike info criterion		-7.904348
Adjusted R-squared	0.007889	Schwarz criterion		-7.850582
F-statistic	1.747506	Hannan-Quinn criter.		-7.882622
Prob(F-statistic)	0.189433	Durbin-Watson stat		1.471942
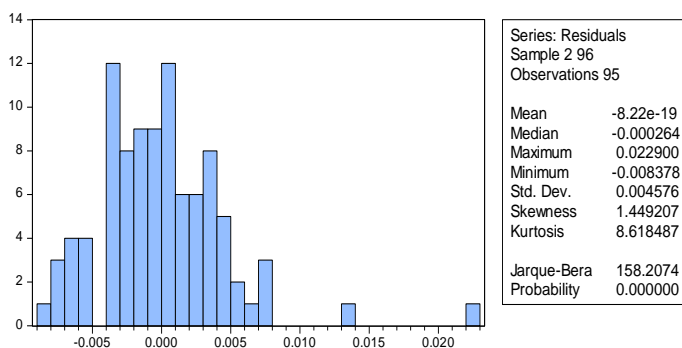
In the case of monetary and non-government credit, the influence has a gap of one month. As with other variables in Tables 7, 8 and 9 R-squared and Adjusted R-squared values are pretty close to 0, which means that the links between the evolution of CPI, PPI, money

supply and governmental credit are strong, it can be seen a negative slope during the crisis on PPI (it halved its value since January 2009).

Durbin Watson statistic (DW) is a statistical test to test serial correlation of errors. If errors are not correlated, then the value of DW will be around 2.

After the main influence factors were found and explain the next step is developing multiple regression model of inflation. It is a classic regression model with standard parameters. The regression coefficients are estimated with the method "Least Squares".

The positive estimated coefficient RS (unemployment rate) and VN (average net income) means that in the studied periods, unemployment rate, average net income (two interrelated factors for the labor market) and of CPI have similar tendencies. It can be observed a negative influence of exchange rate and production price index. Romanian RON depreciation against the euro has accelerated, especially in the last year. The main forces behind the Romanian currency depreciation were lower inputs of capital and unfavorable business conditions in the domestic market. The negative value of the estimated coefficient PPI means that PPI has been growing withing the studied periods while CPI has decreased. Producer prices inflationary pressures for industrial products have remained high. Agricultural prices have increased significantly, both in the vegetable and animal products, this impact being felt strongly at the beginning of the crisis.

Table 10. Linear Regression Model of CPI

Dependent Variable: IPC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003330	0.000575	5.794955	0.0000
RS	0.002368	0.020915	0.113217	0.9101
VN	0.032383	0.018425	1.757543	0.0823
RSCH	-0.088414	0.033707	-2.622982	0.0103
RD	0.029135	0.013582	2.145075	0.0347
IPP	-0.009631	0.004973	-1.936491	0.0561
MM2	0.021733	0.024144	0.900118	0.3705
CNV	0.049536	0.029225	1.694991	0.0937
R-squared	0.187047	Akaike info criterion		-7.966497
Adjusted R-squared	0.121636	Schwarz criterion		-7.751434
F-statistic	2.859599	Hannan-Quinn criter.		-7.879596
Prob(F-statistic)	0.009830	Durbin-Watson stat		1.544304

CONCLUSIONS

The market economy exists because of the signal transmitted through prices. Prices are showing the position towards which the demand is going, supply adapting accordingly. So, to take account of this: when the demand for a product increases, there will be an increasing trend on the price of the product. The manufacturer, seeking higher returns, increases production, which leads to restoring the balance between supply and demand. The opposite plan, when the demand drops, the price drops also, directing to another product manufacturer. This proves that price stability does not mean also their fixity: the prices of certain items rise, others fall, depending on the evolution of supply and demand on the market.

Changes of prices occur when production conditions are changed. Once with the development of the technology, gains induced by those will result in the end in lowering of prices. There is also the reverse effect in which difficulties appear in obtaining raw materials and also severe measures imposed by environmental organizations lead to a rise in prices - followed by adaptation to the new conditions of use.

There are, of course, periods where all prices have an upward trend. Inflation has become a lengthy process after they have been scattering paper money after the connection between the precious metal and money has decreased.

When in an economy exists a steady state, which has a normal economic growth and a reduced unemployment rate to its natural level with a balanced state budget, the inflation rate should be reduced by a few percent annually. However inflation is maintained at a similar level year after year. A cause of maintaining inflation could be given to enhancing product quality and their modernization.

Inflation reduces the value of money: initially, it was possible to be able to buy a product at a certain price, a bread for one monetary unit, for example. After the effects of inflation you will have to pay more for the same goods, for example, the same piece of bread will cost 1.5, 2 or even 2.5 monetary units. As a result, the amount of money available reduces and the amount of money that could be saved is now spent to cover additional costs needs.

This reduction directly affects the purchasing power. With the rising prices of basic commodities such as sugar, fuel, vegetables, etc. you will have to spend more money to buy the same quantity of goods.

ACKNOWLEDGEMENT

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A STUDY ABOUT IMAGE NOISE REMOVAL

Ioana Gabriela Radoi [1]*
Emil Ioan Lenard [2]

ABSTRACT

This paper presents a comparison between different techniques of noise removal such as NL-means algorithm, local smoothing filters, bilateral filtering, wavelet thresholding and median filtering, based on current researches. The main goals of this article are to recover the original image after applying a noise measurement, smoothing the images and preserves the edges.

KEYWORDS: *bilateral filtering, NL-means algorithm, wavelet thresholding, median filtering*

1. INTRODUCTION

There are many methods proposed for removing the noise and recovering the real image, but all these methods have something in common: they involve an average (Gaussian smoothing model, anisotropic filtering, neighborhood filtering, and wavelet thresholding methods).

Paper [1] proposes a method of decomposition D which is expressed in equation (1), where „v" is the noisy image and „h" the filtering parameter. Authors propose a method which involves the average of all pixels in the image. A comparison is presented between the NL-means algorithm and the local smoothing filters. A solution for modeling the effect of noise for a digital image is using Gaussian noise. For the formula (1), the Gaussian value is n(i).

$$v(i) = u(i) + n(i) \quad (1)$$

Paper [2] presents a method of bilateral filtering. The approach is smoothing the images and preserving the edges. It is non-iterative, simple and local. It works with gray levels or colors based on geometric closeness and photometric similarity. The method preserves edges for human perception. Bilateral filtering is different in comparison with other filters because it produces no phantom colors along edges for colored images, and reduces phantom colors in the original image.

In [7] the authors present median filtering algorithm for image noise reduction. Image filters are classified as linear and nonlinear. The median filter is a nonlinear digital filtering technique, often used to remove noise. The median filter is very effective in preserving edges in an image while reducing random noise. It is also useful in reducing an impulsive type of noise and particularly effective at removing 'salt and pepper' type of

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noise. To replace the value of each pixel with the median value of neighboring, the median filter has to move through the image pixel by pixel and calculate it sorting all the pixel values from the window into numerical order.

Under ideal conditions, the signals are without noise or, if they are affected by noise, this noise may be decreased to a negligible level while the signal increases. In reality, it is often needed to reduce/remove the noise corrupting a signal in order to recover the original signal. The noise removal can take place in time-frequency or time-scale. In the domain of signal processing, time-frequency analysis means that a signal is studied simultaneously in time and frequency domains (two dimensional signal) [8].

A basic form of time-frequency analysis is the short-term Fourier transform and a better method is using wavelets. Wavelet transform is among the most popular time frequency transformations. The transformation should not allow changes in shape but in time extension. The simplest type of wavelet is the Haar wavelet. Noise removal/reduction is the process that reconstructs the original signal from a signal with noise. Current methods are lacking in solving local structures. This is required when dealing with signals that contain structures of various sizes and amplitudes. The analysis and signal processing, speech and audio processing, as well as image processing, we often encounter nonlinear signals [8].

2. PROBLEM DEFINITION

Article [1] proposes a method of decomposition D which is (2), where „v" is the noisy image and „h" the filtering parameter. A formula is applied (3) which assumes that the value of "x" is a mean of the values which look like the ones in the neighborhood of x. It uses all possible self-predictions for the image. In the formula (3), it is a constant which is normalized, is a Gaussian kernel and „h" is a filtering parameter.

$$v = Dhv + n(Dh, v) \quad (2)$$

$$NL[u](x) = \frac{1}{C(x)} \int_\Omega e^{-\frac{(C_a * |u(z+.) - u(y+.)|^2)(0)}{h^2}} u(y) dy \quad (3)$$

Article [2] presents a non-iterative scheme for the edge in a way of preserving smoothing. The scheme could be implemented by a single layer of neuron-like devices for one operation per image. First: a low pass domain filter is applied to the image and produces an output image defined in (4), where „c" is the geometric closeness between the center x and a nearby point.

$$h(x) = k_d^{-1}(x) \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(\xi) c(\xi, x) d\xi \quad (4)$$

In [7] the authors try to obtain performance in noise-reducing of the median filter:

$$\sigma_{med}^2 = \frac{1}{4nf^2(\underline{n})} \approx \frac{\sigma_i^2}{n + \frac{\pi}{2} - 1} \cdot \frac{\pi}{2} \quad (5)$$

$$\sigma_0^2 = \frac{1}{n}\sigma_{i.}^2 \quad (6)$$

Paper [8] explains why wavelet transformation is a good option:

- The output of the wavelet transformation is maximal when the input signal is very similar to the mother wavelet because the transformation performs a correlation analysis

- If the energy of a signal is concentrated in a small number of wavelet dimensions, the coefficients will be considerably higher in comparison with a signal or noise that distributes the energy over many coefficients

The term of white noise means:

- The values of the noise aren't correlated in time

- Has equal power at all frequencies

- Affects every single frequency component over the whole length of the signal and for that is considered the most difficult to remove.

3. AVAILABLE METHODS

Paper [1] evaluates several classical local smoothing filters: Gaussian filtering [2], anisotropic filtering [3], the total variation minimization [4] and the neighborhood filtering [5]. Bilateral Filter is presented in [2]. In [7] and [8] are presented wavelet thresholding and median filtering.

Gaussian filtering

The approach is built around the Gaussian kernel $x \to G_h(x) = \frac{1}{(4\pi h^2)} e^{-\frac{|x|^2}{4h^2}}$, where „h" represents standard deviation. Equation (7) represents the theorem 1 and shows the convolution of the image method noise with and „h" is small enough.

$$u - G_h * u = -h^2 \Delta u + o(h^2) \quad (7)$$

The Laplacian cannot be small near edge or texture, the Gaussian noise is zero only in harmonic parts of the image.

The anisotropic filtering

The anisotropic filtering is convolving the image „u" at point „x" in the direction orthogonal to Du(x). It is presented in (8), where $D_{u(x)} \neq 0$ and G_n has variance h^2.

$$AF_h u(x) = \int G_h(t) u\left(x + t\frac{D_u(x)^\perp}{|D_u(x)|}\right) dt \quad (8)$$

Equation (9) represents the image noise. With curv(u)(x) we make note of the curvature.

$$u(x) - AF_h u(x) = -\frac{1}{2}h^2 |Du| curv(u)(x) + o(h^2) \quad (9)$$

The Total Variation minimization

The approach is based on a given noisy image v(x), and aims to recover the original image u(x). It uses formula (10) and theorem (11) where we calculated the Total Variation minimization. TV(u) shows the total variation of „u", γ is a given Lagrange multiplier.

$$TVF_\lambda(v) = arg\ minTV(u) + \lambda \int |v(x) - u(x)|^2 dx\ _{10}u(x) - TVF_\lambda(u)(x)$$

$$= -\frac{1}{2\lambda} curv\big(TVF_\lambda(u)\big)(x)\quad (11)$$

The neighborhood filtering

Neighborhood filters create a new pixel by taking an average of similar gray level value of neighboring pixels. Yaroslavsky (1985) makes an average of pixels with the similar gray level value which belongs to the spatial neighborhood Bρ(x) (12).

$$YNF_{h,p}u(x) = \frac{1}{C(x)} \int_{B_p(x)} u(y)e^{-\frac{|u(y)-u(x)|^2}{h^2}}dy\quad (12)$$

NL-means algorithm

In (13), v is the discrete noisy image, NL[v](i) is the estimated value which is computed as an average of weights of all the other pixels. The family of weights is formed based on the similarity between the pixels "i" and "j". The similarity between two pixels i and j depends on the intensity of gray (v).

$$NL[v](i) = \sum_{j \in I} w(i,j)v(j)\quad (13)$$

The weights are defined in (14), where „h" is a filter parameter, and Z is a normalizing constant which is defined in (15).

$$w(i,j) = \frac{1}{Z(i)} e^{\frac{||v(N_\iota)-v(N_\iota)||_{2,a}^2}{h^2}}\quad (14)$$

$$Z(i) = \sum_j e^{\frac{||v(N_\iota)-v(N_\iota)||_{2,a}^2}{h^2}}\quad (15)$$

The NL-means compares the gray level in a single point and the entire configuration for the neighborhood.

NL-means consistency

j {1,.. ,n}, in (16) explains the conditional expectation theorem. The theorem shows that the algorithm is not trying to separate the noise, but rather correcting the noise in the image.

$$|NL_n(j) - r(j)| \to 0\quad (16)$$

Bilateral Filter

Bilateral Filter [2] is a simple range filter applied to the window. The filtered image is the result of a local remapping and it is different at different points in the image. From (4), they obtain (17), so the filter is shift-invariant and „c" is only a difference function and is a constant.

$$k_d(x) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} c(\xi, x) d\xi \quad (17)$$

Range filtering is defined in (18), where „s" measures the photometric similarity between the pixel at the neighborhood with center „x" and the center of the nearby point.

$$h(x) = k_r^{-1}(x) \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(\xi) s\big(f(\xi), f(x)\big) d\xi \quad (18)$$

Then the normalization constant is replaced by the constant in (19).

$$k_r(x) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} s\big(f(\xi), f(x)\big) d\xi \quad (19)$$

They name as bilateral filtering the combination between domain and range filtering. Combined filtering is shown in (20), and the normalization is shown in (21)

$$h(x) = k^{-1}(x) \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(\xi) c(\xi, x) s\big(f(\xi), f(x)\big) d\xi \quad (20)$$

$$k(x) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} c(\xi, x) s\big(f(\xi), f(x)\big) d\xi \quad (21)$$

Median Filtering

The "window" is the pattern of neighbors which slides pixel by pixel over the entire image. The output of median filtering is $g(x, y) = med\{f(x - i, y - j), i, j \in W\}$, where f(x,y), g(x,y)are the original image and the output image respectively. "W" is the 2-D mask. The mask size can be 3x3, 5x5, n x n and the shape may be square, circular, cross, linear etc.

Image Denoising using Wavelet Thresholding

When wavelet transform is linear wavelet denoising works fine for additive noise:

$$W(a, b)[f + n; \Psi] = W(a, b)[f; \Psi] + W(a, b)[n; \Psi];$$

The 3 steps of general method are:

- Step 1: Decompose signal using DWT;

- Step 2: Perform thresholding:

    - Finite length signal with additive noise:

    - y [n] = x [n] + σ r [n], $0 \le n \le$ N-1, where $x[n]$ - signal, σ - standard deviation, $r[n]$ - noise ~ N(0,1), $N - 1 = 2^{j+1} - 1$ - dyadic sampling.

- Step 3: Threshold DWT coefficients for signal reconstruction: $x\hat{} = W^{-1} X\hat{}$

Thresholding Methods

- Hard Thresholding
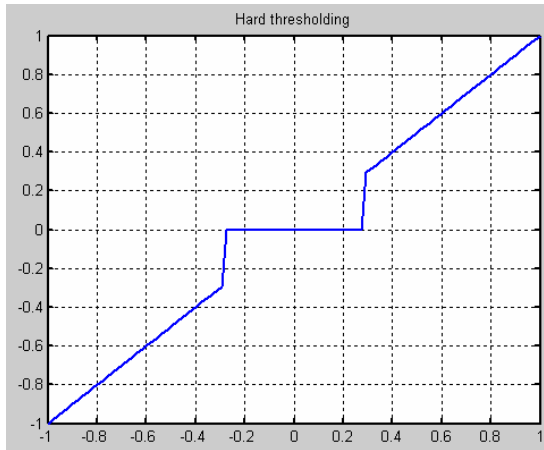
Figure 1. Image taken from [8]

$$y_{hard}(t) = \{x(t), where \ |x(t) > \delta; \ 0, where \ |x(t)| < \delta \}$$

- Soft Thresholding

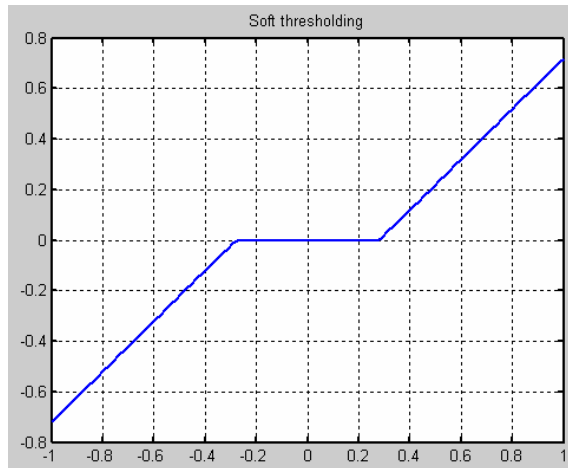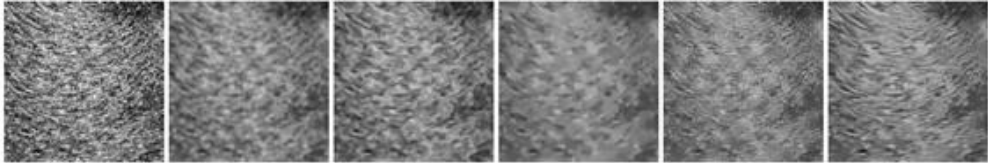Figure 2. Image taken from [8]

$$y_{soft(t)} = \{sgn(x(t)) * (|x(t) - \delta|), where \ |x(t)| > \delta; \ 0, where \ |x(t)| < \delta\}$$

4. RESULTS AND DISCUSSIONS

This section, compares the local smoothing filters, NL approach, bilateral filter, median filtering and wavelet thresholding.

Figure 3 displays a comparison of the results of the approaches presented. Fig. 3 presents a denoising experience for a natural texture and Fig. 4 presents an experience on a natural image.

Denoising experience on a natural texture. From left to right: noisy image (standard deviation 35), Gauss filtering, anisotropic filtering, Total variation, Neighborhood filtering and NL-means algorithm.

Figure 3. Image taken from [1]
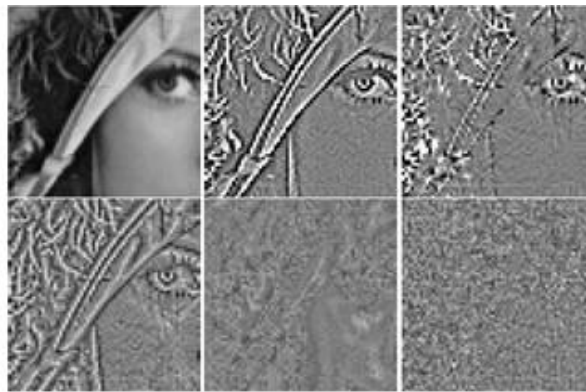
Method noise experience on a natural image. Displaying of the image difference $u - D_h(u)$. From left to right and from top to bottom: original image, Gauss filtering, anisotropic filtering, Total variation minimization, Neighborhood filtering and NL-means algorithm. The visual experiments corroborate the formulas of section 2.

Figure 4. Image taken from [2]

Applying Bilateral Filter we can obtain the following pictures (Fig. 5).
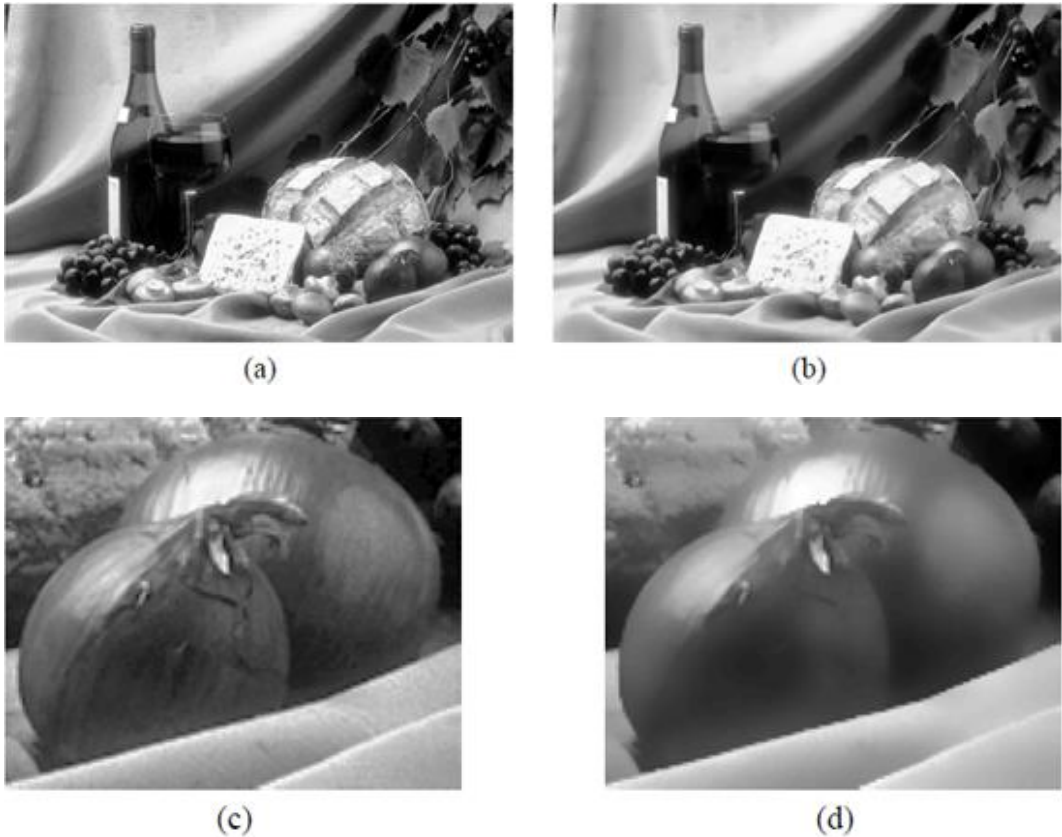
A picture before (a) and after (b) bilateral filtering. (c,d) are details from (a,b).

Figure 5. Image taken from [2]

Results for median filtering techniques are the following:

- 1-D simple signal:
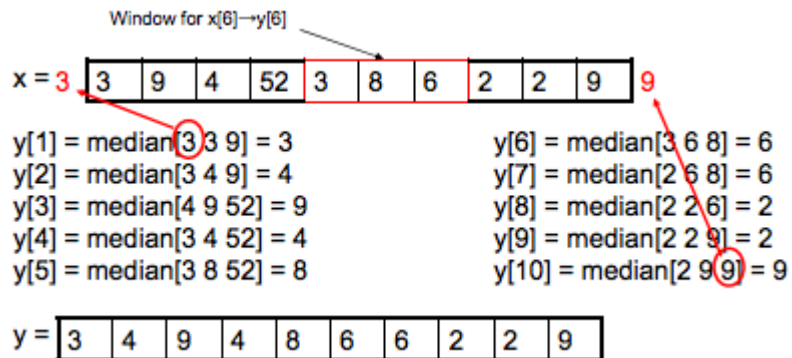
Figure 6. Image taken from [7]

Figure 7. Image taken from [7]

In Fig.7 the image on the left contains a significant amount of "salt and pepper" noise. After processing with a median filter we obtain the same image but without noise on the right.

- Simple two dimensional signal (2-D) - example using 3 x 3 sampling window:

  ➢ If we keep border values unchanged:
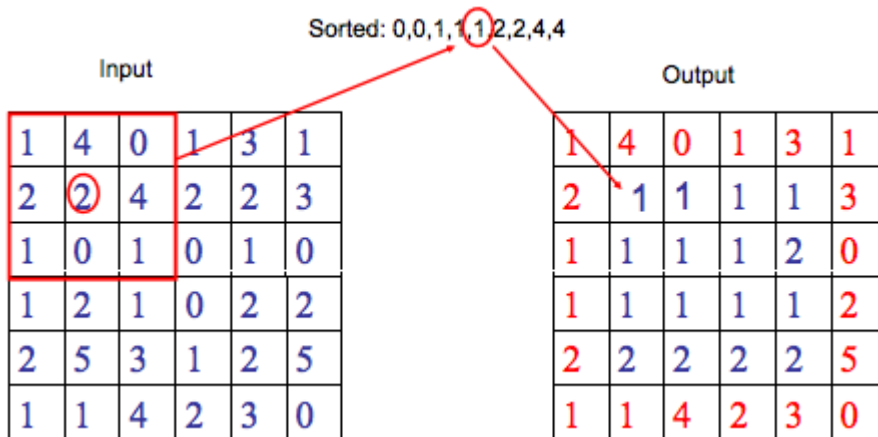
Figure 8. Image taken from [7]

➢ If we extend border values outside with values at boundary:

Input — Sorted: 0,0,1,1,1,2,2,4,4 — **Output**

| 1	1	4	0	1	3	1	1
1	1	4	0	1	3	1	1
2	2	2	4	2	2	3	3
1	1	0	1	0	1	0	0
1	1	2	1	0	2	2	2
2	2	5	3	1	2	5	5
1	1	1	4	2	3	0	0
1	1	1	4	2	3	0	0

2	2	2	2	2	2
1	1	1	1	1	1
1	1	1	1	2	2
1	1	1	1	1	2
1	2	2	2	2	2
1	2	2	3	2	2
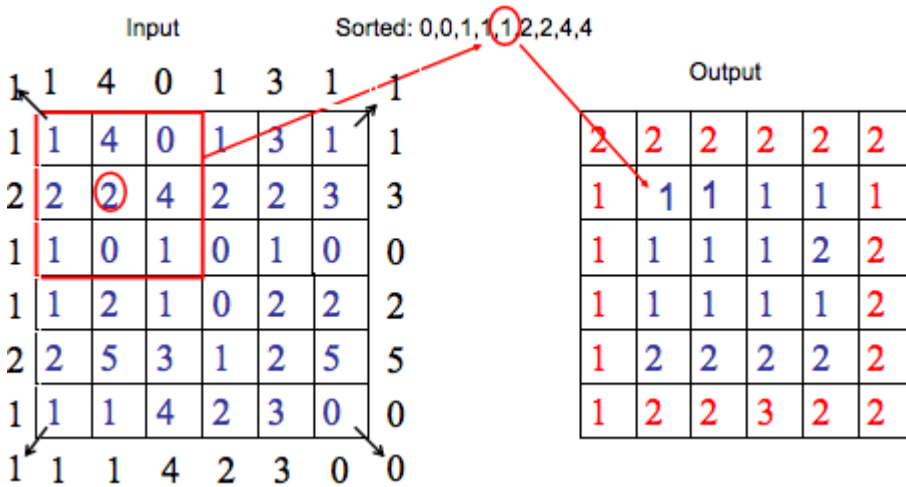
Figure 9. Image taken from [7]

➢ Extending border values outside with 0s:

Input — Sorted: 0,0,1,1,1,2,2,4,4 — **Output**

0	0	0	0	0	0	0	0
0	1	4	0	1	3	1	0
0	2	2	4	2	2	3	0
0	1	0	1	0	1	0	0
0	1	2	1	0	2	2	0
0	2	5	3	1	2	5	0
0	1	1	4	2	3	0	0
0	0	0	0	0	0	0	0

0	2	1	1	1	0
0	1	1	1	1	1
0	1	1	1	2	1
0	1	1	1	1	1
1	2	2	2	2	2
0	1	1	1	1	0

Figure 10. Image taken from [7]

In [8] are presented why, in some cases, it is good to apply the soft threshold to a few detail levels, and the hard one to the rest.

Figure 11. Image taken from [8]

As we can see in Fig. 11, the hard thresholding keeps the edges but doesn't remove much of the noise. On the other hand, soft thresholding removes almost all of the noise, but doesn't provide the same edge preservation.

5. CONCLUSIONS

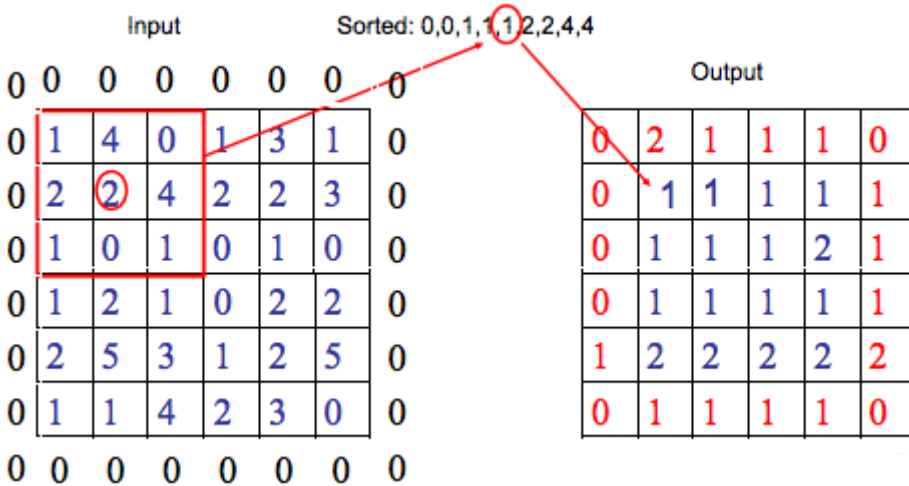This paper presents the current techniques used for noise removal such as NL-means algorithm, local smoothing filters, bilateral filtering, wavelet thresholding and median filtering. We presented how these techniques are used, the advantages for each one and some experiments that other researchers have made.

The advances in noise removal techniques may prove extremely useful in other noise-sensitive image analysis and processing areas like: binarization based on locality statistics [9], line or other primitive detection using Hough transform and data post-processing [10], OCR automatic text improvement [11] and layout analysis from image segmentation [12].

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EUROPEAN SUSTAINABLE DEVELOPMENT THROUGH NETWORKED ELECTRONIC SERVICES

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ABSTRACT

An important percentage of the projects undertaken at EU level are mainly set up in view of creating strategies, methods and models for developing the digital infrastructure of the Member States, but also to ensure sustainable development at national, European and international level. The European Sustainable Development Network has set priorities that need to be and are addressed within the framework of the majority of the projects aforementioned.

KEYWORDS: *sustainable development, electronic services, European, development, e-SENS.*

1. INTRODUCTION

According to the reviewed literature (Waas et al. 2010) (Robert et al. 2005) (Breheny 1992) "sustainable development" is a complex concept and it presents more than one definition. However, it is widely accepted by scholars that "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:*

- *the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and*

- *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.*"

On September 25th 2015, the 193 countries of the UN General Assembly adopted the 2030 Development Agenda titled Agenda for Sustainable Development containing the 17 Sustainable Development Goals (SDGs) including goals like: no poverty, good health, affordable energy, industry, innovation and infrastructure, sustainable cities and communities, and so on. These goals "allow for a range of measures, including financial support and debt relief, the transfer of technologies and scientific know-how to developing nations on favorable terms, and the establishment of an open, non-

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discriminatory and equitable trading system to help developing nations increase their exports."[11]

ICT can support the 17 goals by combining new technologies with social and institutional innovation in order to reduce the environmental footprint human activities. "It can facilitate the networks, partnerships and actions we need to work things out in a complex and connected world. The digital revolution could spread benefits to all sectors of society and all corners of the planet, bringing benefits to all regardless of location, age, disability or income."[12]

Figure 1. UN Sustainable Development Goals diagram
Source: https://sustainabledevelopment.un.org;

This could be achieved by replacing the business model that is based on products and material possessions with business models based on services. For example, instead of buying physical products or travelling we can replace them with digital alternatives.

Many public services such as personal documents, tax claims, company registration or VAT are available online only at a national level in some countries. The European Commision supports cross-border solutions through Large scale pilot projects (LSPs) that have been developed and run under the ICT Policy Support Programme in five main areas: eID, eProcurement, eBusiness, eHealth and eJustice to engage public authorities, service providers and research centres across the EU.

2. NETWORKED ELECTRONIC SERVICES

a. Tourism

Nowadays, thanks to continuous development, electronic services (Anghel, 2013) (Lindgren, 2013) have applications in many areas, such as:

- tourism (Maha, 2012);
- healthcare;
- research;
- education;
- transport, etc.

With regards to tourism some of the electronic services offered to users are:

- information related to tour preparation, in order for tourists to decide what to visit, what time to visit, sights localization, incurred costs, comfort and safety information, etc.;

- relevant information about the trip offered at the right time to allow completion of routes by passengers with maximum comfort and safety.

Tourists are not accustomed to receiving intermodal information or think in an intermodal way. For example, pre-travel decision: the tourist is not quite able to compare different types of travel modes easily and efficiently with the information available. Even travel agencies are largely unable to do that.

The situation is the same in the case of information during the journey, which is largely supplied by the operators of the individual modes, irrespective of complementary ways, even in intermodal terminals. The full range of information dedicated to tourists and designed to meet their needs to be as dynamic information.

b. e-Health

The development of electronic systems in the health field is a continuous and timely research. The European Union and other developed nations, such as the U.S., Canada, Japan, Australia went from stage projects and achievements point to projects of national interest, even continental, current telemedicine services, computer networks and data transmission dedicated telemedicine.

One such project is the European Large Scale Project (LSP): epSOS (www.epsos.eu, 2014), which defined how Member States can cooperate and integrate their processes in order to implement e-health services for the entire European continent.

This new reference model is available under open source licenses, thus allowing the project to share developments with others. The architecture and work plan of the project are shown in Figure 2.
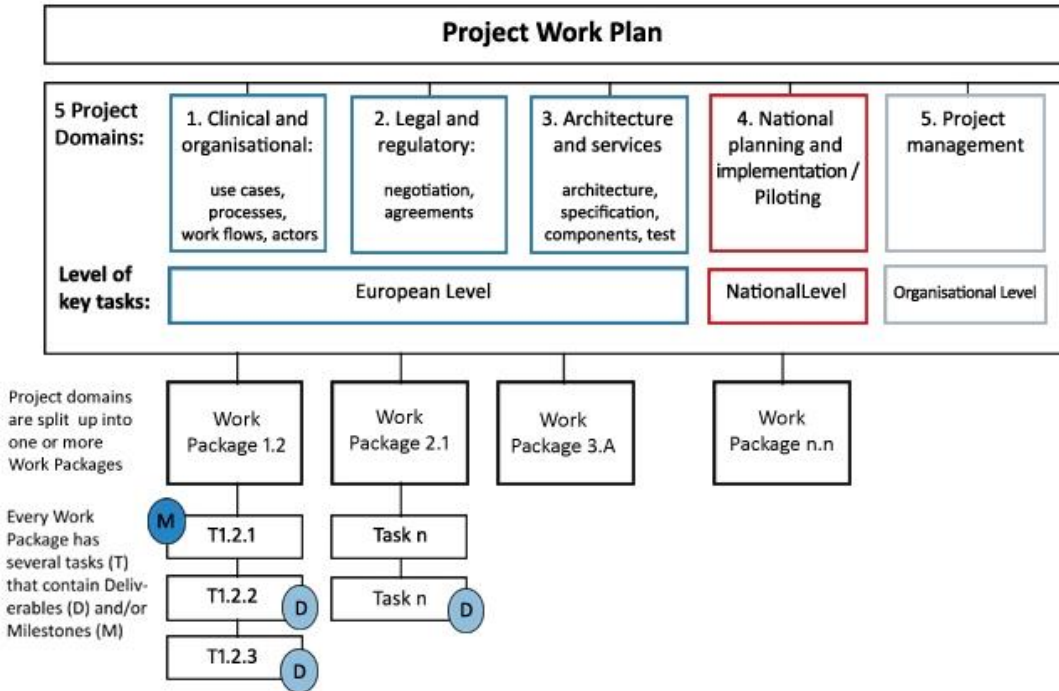
Figure 2. The architecture of the epSOS project
Source: www.epsos.eu, 2014

The epSOS project demonstrates that medical treatment for citizens residing in foreign countries can be improved by providing health professionals with the necessary patient data in a secure electronic format.

The international concerns in the area of e-health have presented and still present major influences in Romania, as such currently, a number of projects financed by either government institutions or European funds for electronic services in e-Health are being implemented at a national level.

c. e-Learning

Distance learning and educational electronic services open up new ways of learning for many people. An educational program or software installed in one place can be accessed and used by thousands of students and others around the world regardless of location or time.

Factors that generate demand for electronic services in education include:

- tendency to prepare of the students;
- degree to which teachers are trained to use innovative methods to educate;
- degree to which they are applied new pedagogical approaches.

Elements taken into account in determining these factors are:

- structure and culture of the national education system;
- pedagogical approach in schools, higher education and industry;
- how curricula are developed and controlled;
- the freedom of teachers to experiment;
- amount of stiffness in the pedagogy;
- literacy level in the country;
- level of innovation in education and training;
- level of preparation of teachers, trainers and the methods by which they are trained in the use of electronic services.

In the railway transport sector aims to integrate rail transport modes guided total chain mobility through the development of railways and railway systems advanced management approaches based on user-friendly and cost-effective by introducing modern instruments already available in the new information society.

Passenger of trains should be provided with clear and well organized dynamic information created specifically for their individual needs. It would be easier for passengers where information could be provided in a standard format that can make it easier to assimilate. Requirement dynamic passenger information is expressed in all areas of transport.

Identifying relevant data defining standard coding rules, ergonomic design and user interface, creating appropriate database also applicable to trade multi-modal traffic management and routes are subject to a number of studies considered and research projects. Therefore, standardization of protocols and interfaces is essential to achieve an easy and effective access to information through electronic services.

For road transport were possible development of electronic services in the area of providing information for the driver due to:

- compatible receivers with different service;
- the demonstration provide information about emergency, parking, weather;
- conventional signs with messages were used to disseminate dynamic travel information and messages to drivers in order to investigate the effect on traffic management strategies.

Research support infrastructure for air transport providers contribute to the provision of electronic services for operators of transport, as defined in the entire transport sector.

The safety function has been developed with a view to minimize the impact of their operations on a regular traffic. Cost-benefit analysis and validation processes have established successful project results in electronic services for air transport.

3. EUROPEAN SUSTAINABLE DEVELOPMENT

The European Sustainable Development Network - ESDN (www.sd-network.eu, 2014) is an informal network of public administrators and experts in various fields that deal with sustainable development and sustainable development strategies in Europe.

As stated in the introductory chapter „sustainable development implies meeting the needs and requirements present generation without compromising the ability of future generations to ensure these needs and necessities". Moreover, sustainable development offers a vision of progress that integrates short- and long-term goals, locally and globally.

Sustainable development requires profound changes in thinking, in economic and social structures in consumption and production to be taken by the company as a principle of life for the average citizen.

The European Commission adopted in October 2007 the first report on the Sustainable Development Strategy [http://ec.europa.eu/eurostat]. The monitoring report was published and its findigs were based on an analysis of an extensive set of sustainable development indicators.

The overall objective of the EU Sustainable Development Strategy is to identify and develop actions that will help in an achieving continuous improvements regarding the long-term quality of life through the creation of sustainable communities able to manage and use resources efficiently.

Thus the Strategy establishes objectives and actions to following key challenges priority, Figure 3 (ec.europa.eu, 2014):

- sustainable consumption and production;
- conservation and management of natural resources;
- sustainable transport;
- public health;
- climate change and clean energy;
- social inclusion, demography and migration;
- global poverty and sustainable development challenges.

Figure 3. Sustainable Development Strategy

4. INFLUENCE OF ELECTRONIC SERVICES ON SUSTAINABLE DEVELOPMENT

Electronic services can influence in many ways the sustainable development of Europe.

The e-SENS project (www.esens.eu, 2014) (Electronic European Simple Networked Services) is a Large Scale Project which aims to develop the European Single Digital Market through innovative solutions in digital information and digital public services. Through its piloting Work Packages (WPs) this project will strengthen, improve and expand technical solutions that will promote interaction in the online public administrations in Member States.

The project has been structured into six core work packages, with the aim of showing a distinction between non-technical work (general coordination and communication), technical work and the actual piloting. A work package can be thought of as a sub-project, a building block from a structure that allows the project management to define the main actions necessary for achieving the project goals. The six work packages under e-SENS auspices are:

- Work package 1 - Project Management (General Coordination, Administrative Management & Advocacy) - comprises functions of leadership, management, team building, and administration. The leadership function encompasses effective project organization and the specification of roles, responsibilities, and authority throughout the project.

- Work package 2 - Communication and Marketing - supports alignment activities needed to both raise awareness around the project as well as ensure access to knowledge. The main task of this work package is to communicate the project solutions to a wide group of stakeholders: representatives of public administration, IT industry, and end users.

- Work Package 3 - Sustainability and Long-Term Governance - goals are: to pave the way for sustainability and long-term governance of high-level building blocks such as electronic identities, electronic signatures, electronic delivery and electronic documents and to propose recommendations for further policy development concerning the governance and sustainability of the interoperability architecture of the building blocks.

- Work Package 4 - Project Legal Expertise Centre - provides a network of legal experts who offer legal advice on request, both on the topics of the pilots as well as on general, cross-sector EU legislation.

- Work Package 5 – Piloting – aims to demonstrate that deploying real-life ICT services within European countries is feasible and sustainable, applied to a number of use cases with different national systems. Based on technical building blocks, real transactions among public administrations, or between them and citizens and businesses, will take place under WP5.

- Work Package 6 - Building Blocks Provision- focuses on providing architecture driven solutions and building blocks for cross-border transactions, while fulfilling the pilot requirement in the target domains, providing them with state of the art technologies. The work will include interoperability areas of infrastructure, semantics and security.
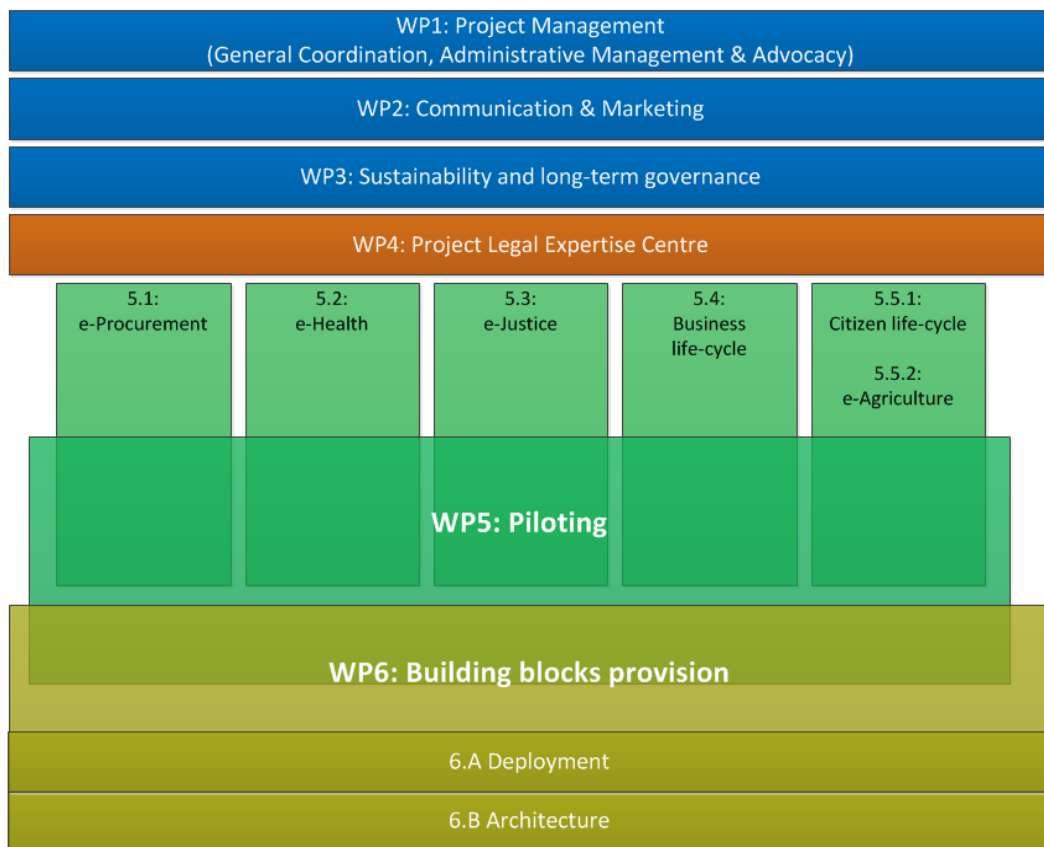
Figure 4. e-SENS Work Package Structure
Source: http://www.esens.eu/about-the-project/structure/;

The project is piloted in six domains (http://www.esens.eu/real-life-piloting/):

- e-Justice aims to simplify access to cross-border legal procedures and legal means for citizens and businesses. e-Justice comprises several fields in law and is viewed as a horizontal topic gathering all fields which have cross-border dimensions, including many areas of civil and criminal law.

- e-Health pilot within e-SENS focuses on the e-Health domain and will provide cross-border access to health services at EU level. The health services domain is at this moment regulated by Directive 2011/24 EU concerning the application of patients' rights in cross-border healthcare, which provides the legal framework for the e-Health pilot within the e-SENS project. The usecases piloted are ePrescription - the electronic prescription, and eConfirmation - confirmation of patient ensurance status.

- e-Procurement domain aims is to take seamless cross-border e-Procurement to its next level, supporting the implementation of the new public procurement directives (2014/24/EU, 2014/25/EU) and the continued standardisation of public procurement processes. This implies the development of specifications and services for the process leading to the award of a contract (pre-award tendering), as well as continued efforts

towards streamlining the processes for ordering and invoicing (post-award procurement).The goal is to offer services that allow tendering processes and support for electronic ordering and invoicing across countries.

- e-Agriculture' has a main objective to assist farmers in accessing all digitally available services, while improving cross-border interoperability. The availability of a technical connection between countries is an essential precondition, as this will provide all citizens from all Member States (MS) with secure and reliable access to online services from other MS using their own national e-ID.

- Business Life-cycle will enable seamless online cross-border services and procedures for administrations and businesses by developing the specifications and services for cross-border or national processes relating to business registration in a Member State. The work conducted within this domain will support the evolution of the Services Directive (Directive 2006/123/EC of 12 December 2006 on services in the internal market), which provides the general framework for both temporary and permanent establishment of business in another MS. The work will also facilitate the interconnection of business registries for specific types of companies.

- Citizen Life-cycle's goal is to set up a framework for different kinds of e-services relating to citizens in the EU member states. This piloting domain includes a collection of national e-services that all have one thing in common – they serve citizens digitally.

Considering that the e-services provided to citizens vary between the different Member States (MS), the use cases might be different across Member States it is possible that one country offers an e-service that no other country offers. Envisaged use cases are: Tax, Study, Work, Pregnancy, Birth, Heath, Pension, Education and Citizen master data.

The aim of piloting is to demonstrate that technical solutions developed within the project can be deployed successfully at European level, while providing a unique opportunity for business and citizens to benefit from digital single market. The e-SENS pilots will prove that seamless electronic communication with public administration is possible in the EU. Actual transactions between business/citizens and public administration based on generic building blocks will be available in a wide spectrum of domains and environments.

The e-SENS pilots are dedicated to all European citizens and businesses acting across borders who: want to set up a company in the EU, need to access health care while travelling abroad,want to tender in public procurement in EU countries, face legal difficulties in the EU.

The six piloting domains of e-SENS directly or indirectly influence the priority elements of the Sustainable Development Strategy, Figure 3.
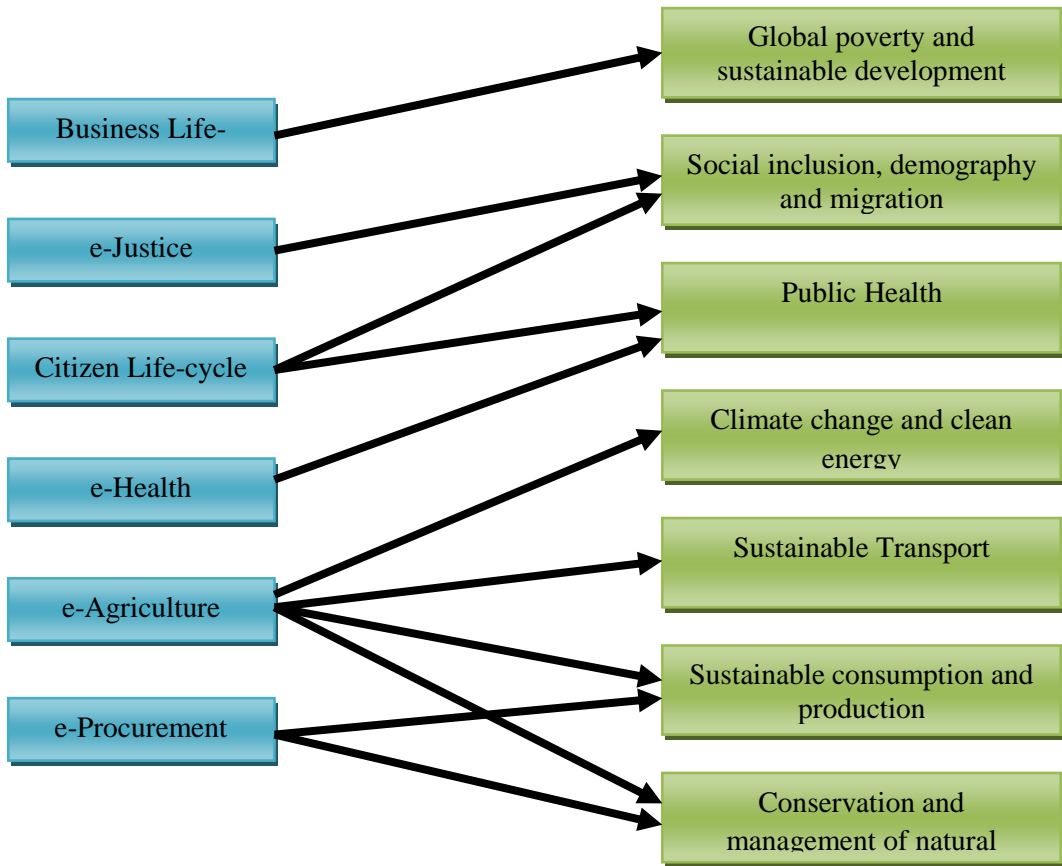
Figure 5. Influence of electronic services on sustainable development

In this way most of the elements of the strategy of sustainable development are influenced by the scope of the project e-SENS.

5. CONCLUSIONS

Influence of electronic services on sustainable development and priority elements of the aforementioned Sustainable Development Strategy demonstrates their importance and how to achieve effective electronic public services including European projects.

UN working groups conducted a research that reached valuable conclusions among which: "Although the costs of using ICTs to build national information infrastructures which can contribute to innovative knowledge societies are high, the costs of not doing so are likely to be much higher" [9].

Electronic services in health bring added value in public health and thus increase the element found in the Sustainable Development Strategy promoted by ESDN.

Electronic services in the e-Procurement domain bring improvements for both sustainable production and consumption through consumer filtering and thus a supplier for the sale of consumer goods is optimally chosen. These electronic services have a beneficial influence for the conservation and management of natural resources as the optimal consumption of products leads to an optimal use of resources and thus they are preserved for future generation consumption.

Electronic services in eAgriculture domain allow farmers to use e-IDs to perform transactions with his or her own national government and with the government of another country thus supporting sustainable development thru efficient production and placement of agricultural product. This results in contributing to achieving some of the 17 Sustainable Development Goals (SDGs) goals for sustainable development: No hunger and Partnership for the goals.

As a result Electronic Networked Services as the ones provided by LSP's, regardless of the domain they apply, bring consistent added value for longtime sustainable development and support the 2030 Agenda for Sustainable Development.

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TEACHING SOFTWARE PROJECT MANAGEMENT:
THE ANARCHIC APPROACH

Adrian Firculescu [1*]
Ion Bucur [2]

ABSTRACT

Throughout time, education has faced several adjustments depending on the nature of the subject it aimed to teach. Although anarchy has often been confused with chaos, an anarchical system tries to achieve social stability by encouraging individuals to make self-initiated decisions towards the benefit of the community. This paper aims to apply that anarchic philosophy in an academic-based environment, while teaching Software Project Management, and adapting these principles to a computer science study field.

KEYWORDS: *software project management, educational models, teaching strategies, collaborative learning, cooperative learning, competition-based learning, mixed collaborative-competition learning, independent learning, anarchy learning.*

INTRODUCTION

Among the different oriented approaches, the following can be distinguished as efficient learning processes: collaborative, competitive, anarchic, independent and mixed.

This document focuses on the concept of anarchic management. Anarchy is a term that is often misunderstood, so it should be clarified from the start. An anarchist seeks to abolish the state; thus the fundamental principle is that it holds no moral authority over the individual [1]. Therefore, anarchy is often confused with chaos – the lack of a form of authority – which is not what this ideology proposes.

Anarchism can be viewed as a stable society where the government fundamentals are initiated by the individuals. Given these principles, anarchy outlines a community of people based on reciprocity and equality.

As opposed to other learning processes, the anarchic learning approach abandons deeply rooted classical teaching rules and promotes the "survival of the fittest" psychology among students confronted to the method. This means that opportunities have to be found and gained [4], implying that power bases are earned, not given, and are based on knowledge, initiative and the capability to employ oneself. By using this method, students learn proactively how to search information, reflect and act. Thus, they become aware of the fact that success is achieved through one's ability to create one's own career path.

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However, anarchic approaches limit the learning possibilities due to unclear roles, tasks and lacking systematization, which may lead to improperly exploited personal resources, develop insecurity and encourage competitive-aggressive behavior.

PREVIOUS WORK

The anarchic approach is implemented in multinational companies such as Google, GitHub and Valve and is also a key element in education.

Within the university framework, the academic library reflects the characteristics of an organized anarchy. Academic libraries possess unclear organizational technologies. There is little overall agreement in the field as to what services a library should provide or how these services relate to the outputs of the educational process [5].
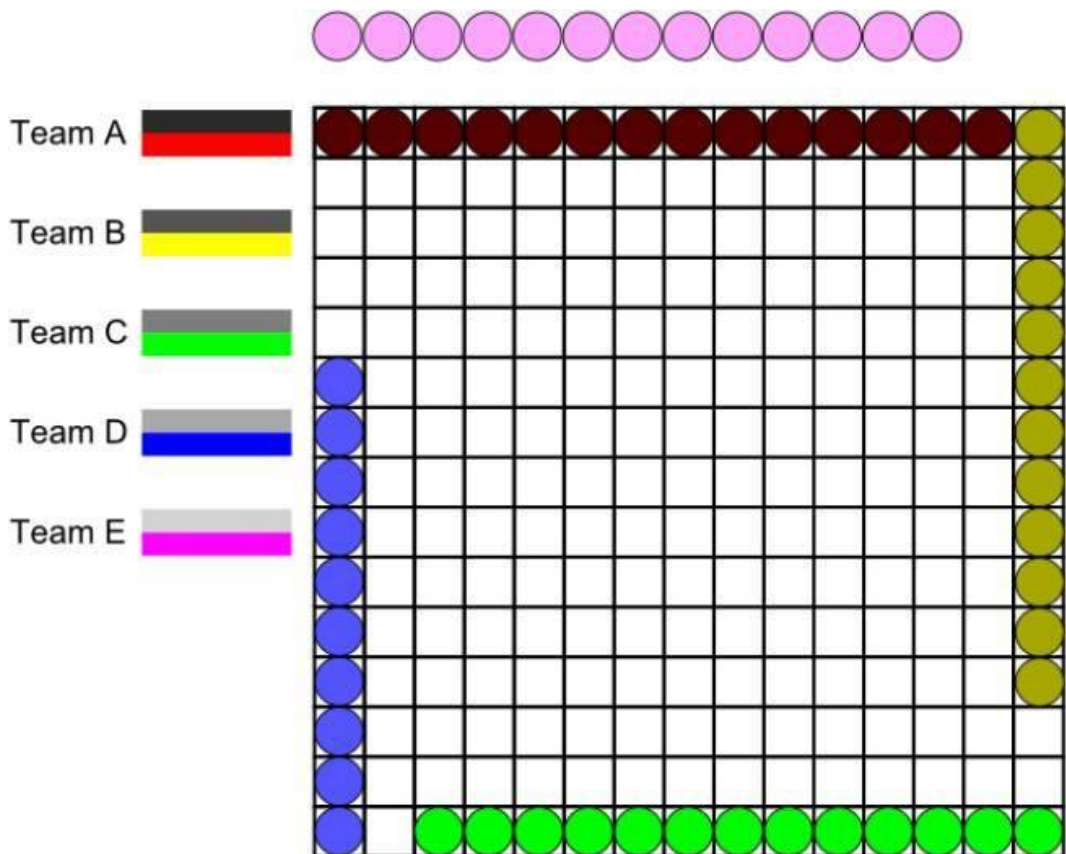
PROPOSED APPROACH

Figure 1. Start Game

During the Software Project Management course from the POLITEHNICA University of Bucharest, one particular project was proposed in order to illustrate the anarchic approach.

The project was actually a board game, in which each player (student) represented a pawn with a unique code. The purpose of each player was to ensure their own teams' success by protecting their team mates while creating a clear path so that one team member could reach the opposite side of the board.
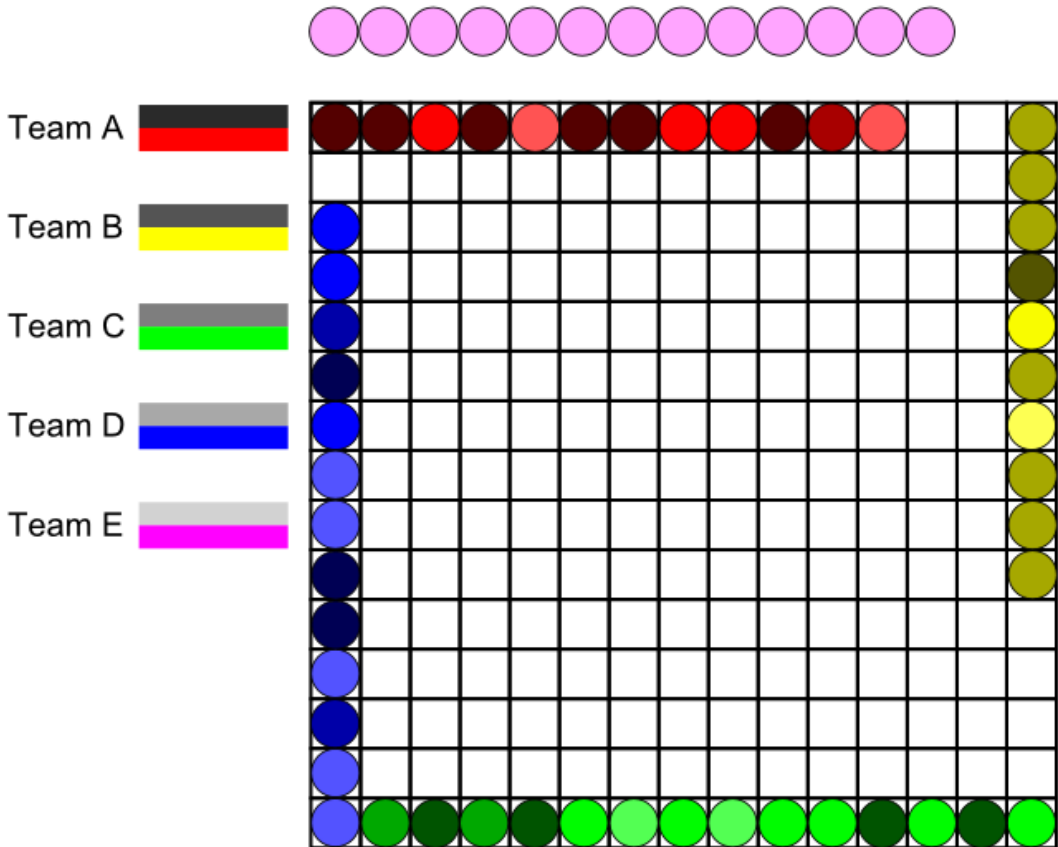
Figure 2. Shuffling – 5 teams playing

When a game starts, pawns are shuffled between teams, therefore one player may end up in a different team, while some would remain in the original formation. The number of pawns in a team sizes would be randomly determined. This mechanism of having opponent pawns within the team eliminates the possibility of implementing a predetermined strategy based on having a leader that would know where a pawn may end up on the board.

An important aspect of the game is that the pawn can reconsider its move at any moment in the round. For example, if a pawn is set to move forward, it could switch to moving in a different direction, therefore making an independent decision. Thus, a pawn may have an individual strategy, enhanced by algorithms or other heuristics. These would be helpful in identifying a saboteur pawn and analyzing its strategy in order to gain a surprise advantage. Moreover, a pawn may be programmed to act against any predetermined team

strategy, but it cannot know if the team it acts against is its original team, or it has been redistributed in a competing team.

Every time a team wins, all the members, whether redistributed or not, earn a point and the team, represented by the color, earns a point, too.

The individual grade for the application is calculated from the number of times a pawn belonged to a winning team and the group grade is calculated from the number of times the original team (color) won.

Since the selection process was anarchic, no specific rule for the role allocation among the participants was imposed. Therefore, flexibility was encouraged and opportunities arose for student socialization and positive interpersonal relationships.

In order for the anarchic approach to reach its goals, setting the subject of the project according to the students' knowledge is essential.

Students lack motivation when confronted with fields where they have little to no skills. Students should have some milestones set and receive periodical feedback on their work; otherwise there is a great chance that they lose their interest in the project.

The anarchic approach suggests that programmers work directly with the customer, which builds more trust and understanding about how the software development life cycle is affecting the final product.

The elements of the Organized Anarchy are described below [2]:

   I.   Problems

  II.   Solutions

 III.   Participants

 IV.   Flow structures:

- Unrestricted / Democratic;
- Hierarchical: Priority is given to important actors, problems, or solutions;
- Specialized: Creating specialized problems and actions solved by nominated members.

Some well-known models illustrate the anarchic learning methodology. The first one is called Lindblom's muddling-through model. Charles Lindblom came up with the model by looking at decisions made in connection with public-sector budgets in the USA [3]. The advantages include the simplicity of the method and the efficient use of the time resource.

This method is characterized by realism because little changes can be handled with ease by the decision-makers. On the other hand, the overall picture of the project fades into the background, due to the lack of an in-depth debate.

The second anarchic model is known as the garbage can. The opportunity to make a decision is described in this model as a garbage can into which the organization's decision-makers put all kinds of different problems and solutions [3].

This model infers that the problems find their solutions – or fail to – following (anarchic) paths.

CONCLUSIONS

Since communication is one of the key aspects of the anarchic management, an educational environment is a very good ground to experiment this approach. Satisfactory results can be achieved because individuals know each other well; they have common goals, and similar philosophies within the domain in which they interact.

Also, ideas should originate from all directions, decisions should be made based on discussion and mutuality, and processes reflect respect for the individual even as they respond to the needs of the whole. These factors are fundamental for a successful social anarchy.

The anarchical approach on projects is a phase every student should have to face in their development. Because its usage has increased, especially in software developing companies, getting used to it may help students in their future careers.

The success of this type of management lays especially in the team composition. Some teams may be fit for this leadership style, while others may be not.

It is hard to impose this kind of freedom on students that are used to have others take decisions for them and that need guidance all through the project. It is even harder to do this with students that do not possess knowledge in the field of the project or lack motivation.

The perfect team for this kind of leadership is one in which members can collaborate with each other without supervision, including highly passionate and professional members.

Still, this kind of approach brings some advantages when using it for education. First of all, grades are a much better reflection on the student's submitted effort. In this case lazy students won't thrive on the work of others while hard working students will be rewarded.

Moreover, the anarchical management allows students to improve or develop skills such as: the ability to manage tasks and think on their own, the ability to come up with their own ideas. Nevertheless, it might teach them to isolate themselves from the group, losing the ability to collaborate with others.

FUTURE WORK

There are many ways in which the anarchic approach can be combined with other work methodologies.

A. Pair Programming

Pair programming should be taken into consideration, as it is a largely known collaborative learning method. Students program in pairs, not individually. This approach significantly improves students' programming competency, increases the likelihood of students getting a major degree in computer science and working in the same field in the future.

During pair programming, students work *two-by-two* on the same computer while completing regular programming assignments. The *"driver"* controls the mouse and keyboard while the *"navigator"* makes suggestions, points out errors, and asks questions.

The partners routinely switch roles to gain the benefits of each role. If there is a group of students working on a project, they could discuss ideas, make decisions and reach conclusions as a group, just like in the anarchic approach, but when the actual developing starts, they could choose a partner and do pair programming. Doing this, they take full advantage of both methodologies.

B. Jigsaw Procedure

The anarchic approach could also work well combined with cooperative learning. For example, the Jigsaw Procedure is a method that ensures the organization of classroom activities, so that it makes students dependent on each other to succeed. It divides classes into groups and decomposes assignments into pieces that the group assembles to complete the (jigsaw) puzzle.

The technique splits classes into mixed groups to work on small problems that are afterwards collated into a final outcome. The groups can then take an anarchic approach of solving the problem at hand by discussing and making decisions as a team, without relying on a leader.

C. Optimizing Programming Anarchy

A project should be viewed as a final product, regardless of the stage it is currently in. Given the fact that every individual can choose tasks on their own, important changes can have repercussions on the other team members.

An interesting concept is dividing the project into a *master* – a model designed for production and *individual branches* [1].

The main goal is to provide a master that is ready to use and has completed all the given features. The freedom of the individual is respected by the existence of the branches in which the individual could work without affecting everyone. The established rules should imply organized freedom. An individual can make changes to the master code only if the respective code has clarity, can function alone, and includes tests for all the code changes.

Another important aspect is communication. The work in progress that is divided into individual branches should be known by all group members and summarized [1]:

- Internal processes (individual's decision)

    1. Formulate an approach
    2. Write your code and tests
    3. Organize your branch

- External processes (interaction with the community)

    4. Present code for review
    5. Iterations based on feedback
    6. QA & deploy

In conclusion, given the amplitude of this learning process, this topic leaves plenty of room for further research and conduction of case studies. More details about alternate educational approaches in teaching Software Project Management can be found in [6-7].

ACKNOWLEDGEMENTS

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FISCAL AND ACCOUNTING OPTIONS AND POLICIES ON TAX RESULT

Alice Ţînţă [1]*

ABSTRACT

According to international accounting standards (IAS 12 Income taxes), income tax includes all domestic and foreign taxes which are based on taxable profits. Meanwhile, income taxes include withholding taxes that are paid by a subsidiary, associate or joint venture on distributions to a reporting entity[2]. The main problem that arises in accounting income taxes is the way current and future tax consequences of recovery, future liquidation, or book value of assets/liabilities are accounted for, that are recognized in the balance sheet of a company and the transactions and other events of the current period that are recognized in an entity's financial statements. When it is probable that recovery or settlement of an asset or liability will result in future tax payments smaller or larger than their value, then the recovery or settlement would have no tax consequences, so the company must recognize either a deferred tax liability or a deferred tax asset.

KEYWORDS: *income tax, accounting options and policies, fiscal policies and options, deferred tax, fiscal consequences, assets, liabilities.*
COD JEL: *M41*

1. INTRODUCTION

The issue of accounting for income tax is based on the **two international existing approaches**, an approach that should recognize only income taxes currently payable, deferred taxes are not recognized (method of payable tax) and an approach that in addition to current tax must recognize even deferred taxes.

Based on the second approach, IAS 12 *Income Taxes* states that when it is probable that recovery or settlement of an asset or liability, lead to future tax payments larger or smaller on taxes than their value, If the recovery or settlement would have no tax consequences, the company must recognize a deferred tax liability or a deferred tax asset..

IAS 12 – Income tax, addresses the financial results of the entity from two points of view, accounting and taxation. Differences arising between the accounting and tax result that don't have tax repercussions on future taxes exercises represent *permanent differences.* *Temporary differences* between the accounting and taxation arise from the time lag between when an item has appeared in accounting and its inclusion in the fiscal result. Temporary differences are described in the literature as differences in timing, *that are actually taxable temporary differences resulting in deferred tax liabilities.*

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[2] CECCAR, 2015*,* International Financial Reporting Standards 2015 Part A (conceptual framework and provisions), **Publishing House CECCAR,** pg. A844.

2. DISCREPANCIES ON CURRENT TAX - DEFERRED TAX

Conflicts between supporters of the two approaches appeared with the initiation of the IASB project to develop an accounting standard applicable to small and medium sized entities[1]. Some of those who prepare financial statements of SMEs maintain that addressing temporary differences in the accounting for income taxes is difficult to implement: SMEs do not develop *tax balance sheets and generally don't track the tax bases of many assets[2]*, so they considere that separating a tax into two parts, one for the current year and another for the next year is useful because on one hand it warns the entity of payments / debts or receipts / receivable tax, on the other hand it ensures the creation of a source of financing a future tax.

Other reviews mention that the introduction of fundamental deviations from the recognition principles in IAS 12 - *Income tax* is not justified from the point of view of cost - benefit. The final conclusion was that deferred taxes satisfy the provisions for recognition as assets and liabilities and therefore can be measured reliably.

Initially (IAS 12 - *Accounting for income tax*) there were two ways to account for deferred tax by an entity: deferral method and liability method based on the profit and loss approach. The revised version (IAS 12 *Income Taxes*) banned the use of deferral method and provided the use of other methods of debt based on a balance sheet approach. While the income approach dealt with time differences[3], the balance sheet approach treats temporary differences[4]. Timing differences are differences arising between the accounting and taxation that find their origin in a financial year and are reabsorbed in one or more future exercises. Temporary differences are differences between the tax basis of an asset or liability and its carrying amount is recorded in the balance sheet. Tax balance sheet method seems most equitable in terms of the relationship between the state and entity because it takes into account all changes in deferred tax balance between opening and closing. Even if the temporary differences are seen as temporary differences, there are some situations of temporary differences that don't give rise to timing differences:

- subsidiaries, associates or joint-venture who have not distributed the whole benefits for their parent company or another investor;

- assets are revalued and an equivalent adjustment is not made in terms of tax;

- the identifiable assets acquired and liabilities assumed in a business combination are generally recognized at their fair values but no equivalent adjustment is performed from a fiscal point of view.

In addition, there are some temporary differences which are not timing differences, such as when the temporary differences:

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[1] In June 2004, the Council published a discussion document: Preliminary Views on Accounting Standards for Small and Medium Enterprises.

[2] 2011, A. F. Popa, Company accounts and taxes result, Ed. CECCAR, Bucharest, pag. 288

[3] The differences between taxable profit and accounting profit that originate in one period are grouped in one or more future periods.

[4] Differences arising between the tax basis of an asset or liability and its carrying amount is stated in the statement of the financial position.

- Non-monetary assets and liabilities of an activity (branches) are valued in their working currency , but their tax base is determined in a foreign currency;

- Non-monetary assets and liabilities are treated as provisions according to IAS 29 - *Financial reporting in hyperinflationary economies*;

- the initial carrying amount of an asset or liability is different in time from its initial tax base.

The main differences between the two versions of IAS 12 relate to the following:

- the *original version allowed*, but did not require, an entity to defer recognition of the benefit of tax losses until the period of execution;

- The *revised version* requires the recognition of deferred tax assets when it is probable that taxable profits to which a deferred tax asset can be utilized will be available. The revised IAS 12 prohibits the recognition of liabilities and receivables relating to deferred tax arising from certain assets or liabilities for which carrying amount is different at initial recognition from their initial fiscal basis. Revised IAS 12 *Income Taxes* [1] requires an entity to account future consequences of transactions and other events in the same way that it accounts for the transactions and other events, namely:

- for transactions recognized in the profit or loss statement, any related tax effects are also recognized in profit and loss;

- for transactions recognized outside profit and loss (either in the global result or straight into equity), any related tax effects are also recognized outside profit and loss (either in the global result or straight into equity).

3. LIMITS ON THE ACCOUNTING RESULT, THE FISCAL RESULT, PERMANENT AND TEMPORARY DIFFERENCES

International Accounting Standards (IAS 12 - *Income Taxes*) address the financial results of the entity in terms of accounting and taxation. *Accounting result* is profit or loss for a period before deducting tax expense. *Tax result (taxable)* is profit or loss from a given period, determined in accordance with rules established by the tax authority, on which tax is payable or recoverable. L. Cernuşcă (2007) *mentions that international accounting doctrine takes into account two types of distortions between the accounting and tax result, which manifest as permanent differences and temporary differences*. M. Ristea defines as permanent differences reincorporated elements or deducted from the final tax outcome (M.Ristea, 1995). They include the following types of income and expenses (A.Stoian, 2001)):

⇨ *non- deductible expenses for tax purposes for which the non- deduction is final;*

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[1] CECCAR, 2015, International Financial Reporting Standards 2015 Part A (conceptual framework and provisions), Publishing House CECCAR

⇨ *income for which tax authority renounces permanently to tax, because they come from already taxed results (dividends received from a subsidiary);*

⇨ *granted tax relief to encourage certain economic activities promoted by the state.*

Permanent differences don't give rise to deferred taxes because they appear within the year as generating only extra restatement. Temporary differences are the differences which arise when the carrying amount of an asset or liability recorded in the statement of financial position differs from their tax base. It follows that they appear due to the fact that fiscal frequency of tax transactions or events takes place at a different time from the moment of recognition in accounting. Temporary differences may include:

⇨ *differences between the accounting and taxable income, such as:*

• *revenues recognized* for accounting purposes in years prior to tax recognition, for example, the result for which contracts for building is recognized in the accounts as they advance work, and as tax when work is completed;

• *income recognized* for tax purposes in exercises prior to accounting recognition, such as fees received in advance, which are taxed in the year of receipt, but are recognized in the profit or loss statement in the year it is due;

• *expenses recognized* for tax purposes in exercises prior to accounting recognition, such as prepaid rents are recognized in tax payment in the year that they are payed, and in accounting in the exercise that is due the rent;

• *expenses recognized* for accounting purposes in years prior to tax recognition, such as: adjustments for impairment of receivables recognized in the accounting year in which recovery is uncertain, but tax deductible in the year in which the court ruled that customer is bankrupt.

⇨ *differences arising from the adjustment of balance sheet items* - this can include for example revaluation of property if there are no similar adjustment for tax purposes;

In accordance with the international accounting rule IAS 12 - Income tax, temporary differences may arise from:

➢ ❶ *taxable temporary differences* - are taxable amounts in determining taxable profit or tax loss to future periods in which the carrying amount of the asset or liability is recovered or settled. A taxable temporary difference arises in two situations:

⇨ for balance sheet assets (figure no.1a) when the carrying amount of an asset> its tax base;

⇨ for liabilities balance sheet (figure no.1b) when the carrying amount of a debt <tax base.

a) balance sheet assets

| Taxable temporary difference | = | Net value of asset | - | Fiscal value of asset |

b) balance sheet liabilities

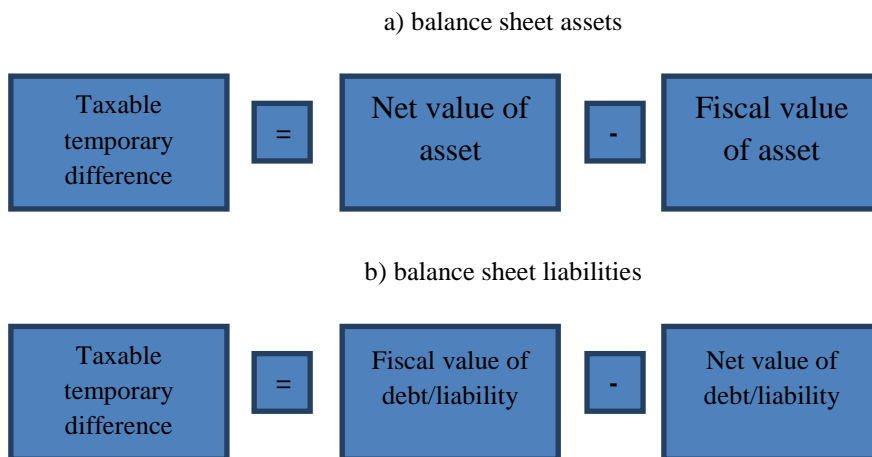| Taxable temporary difference | = | Fiscal value of debt/liability | - | Net value of debt/liability |

Figure 1. Defining taxable temporary differences
Source: own projection

In case of taxable temporary differences, the value of economic benefits exceeds the amount allowed by the tax authorities for deduction for tax purposes. The temporary difference is reversed as the recovery of the carrying amount of the asset or settlement of the carrying amount of the liability takes place. In this case the entity will achieve taxable profit and will have to pay income tax.

An example can be presented if an entity brought into use a machine worth 4,000 m.u. on Jan. 1 year N. For accounting purposes the equipment is amortized on a straight-four year's system. Tax depreciation for the machine amounts to 1,300 m.u. On 31.12.N. the situation is:

The carrying amount of the machine: 4.000 m.u – 1.000 u. m = 3.000 m.u.
The tax base of the machine: 4.000 m.u. – 1.300 m.u. = 2.700 m.u.

Since the carrying amount of the machine is higher than its tax base it results a taxable temporary difference of 300 m.u.

Transactions and events that give rise to taxable temporary differences may affect both the profit and loss account (depreciation of an asset is different from tax depreciation, etc.) and the entity's balance sheet (costs of a loan are deductible at the time of initial recognition of a loan, etc.). Taxable temporary difference leads to an increase in tax payable in future periods resulting in a deferred tax liability.

The following are accounting records:

- establishing deferred tax liability:

Debit					Credit		Amount
6912	Expenses	with	deferred	=	4412	Deferred income tax	X
	current income tax						

- deferred tax debt assumption:

4412	Deferred income tax		=	7912	Income from	X
					deferred income tax	

> ❷ *deductible temporary differences* - are those differences that will result in amounts that are deductible in determining taxable profit or tax loss of future periods when the carrying amount of the asset / liability is recovered / settled.

Deductible temporary differences will result in lower future tax payments on income tax. A deductible temporary difference leads to a decrease in tax payable in future periods, giving rise to a deferred (receivable) tax asset. Deductible temporary differences arise in the following situations:

⇨ for balance sheet assets (figure No. 2), when the value of an asset <tax base (tax) of that asset

⇨ for liabilities balance sheet (figure no.2b), when the carrying amount of debt> tax base of that liability

a) balance sheet assets

Deductible temporary difference	=	Fiscal value of asset	-	Net value of asset

b) balance sheet liabilities

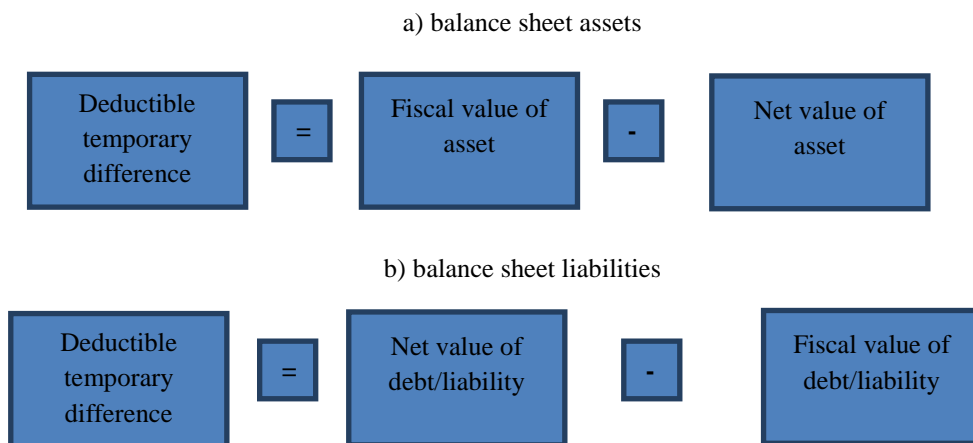| Deductible temporary difference	=	Net value of debt/liability	-	Fiscal value of debt/liability

Figure 2. Defining deductible temporary differences
Source: own projection

Deferred tax assets must be recognized for all deductible temporary differences to the extent that it is probable that a taxable income will be available against which the deductible temporary difference can be utilized.

According to international accounting standard IAS 12 - *Income taxes* (Ceccar, 2015, p. A837):

⇨ *deferred tax liabilities* are the amounts of income taxes payable in future periods in respect to taxable temporary differences (figure no.3).
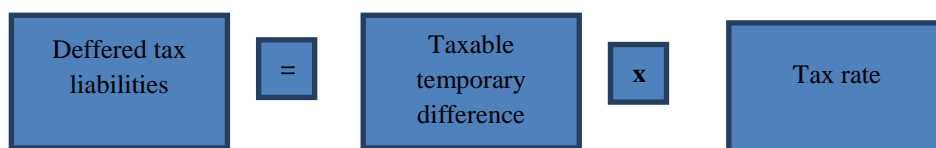
Deffered tax liabilities	=	Taxable temporary difference	x	Tax rate

Figure 3. Defining deferred tax liabilities
Source: own projection

⇨ *deferred tax* assets are the amounts of income taxes recoverable in accounting periods relating either to deductible temporary differences, or to fiscal losses/fiscal credit unused (figure no.4).
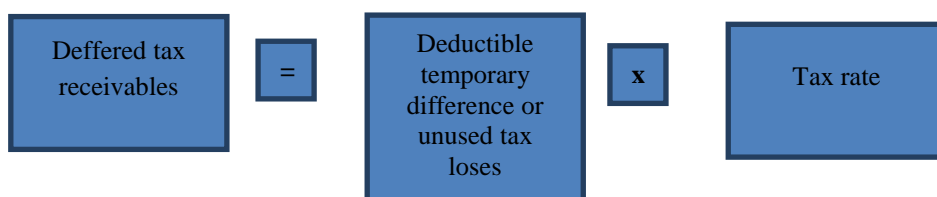
Deffered tax receivables	=	Deductible temporary difference or unused tax loses	x	Tax rate

Figure 4. Defining deferred tax receivables
Source: own projection

4. THE ACCOUNTING BASIS AND THE TAX BASIS OF ASSETS AND LIABILITIES. VALUATION OF RECEIVABLES AND DEFERRED TAX LIABILITIES

4.1. The tax base of an asset

The taxable amount of an asset is the amount that can be deducted from taxable economic benefits when it recovers the carrying amount of an asset, given that the economic benefits will not be taxable, the tax base of an asset will be equal to the net book value and no temporary differences will result as a consequence[1].

The taxable amount is the amount that may be deducted from taxable economic benefits, when the carrying amount of an asset is recovered.

To determine the taxable value of interest receivables there are two way of thinking:

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[1] Morariu A, Radu G., Păunescu M., 2005, Accounting and taxation in business development, Publishing house Expronto, Constanţa pg 208.

First: IAS 12[1] specifies whether the economic benefits when the company recovers the carrying amount of an asset are not taxable, then the tax base of the asset is equal to its carrying amount, so income from dividends is not taxable in determining the outcome of tax base therefore claims relating to the taxation of income of a dividend is equal to the carrying amount of claims relating to income from dividends.

Second: Income dividend is taxable, the taxable income related to these receivables is 0 lei. There is a taxable temporary difference between the carrying amount and tax base. Income dividend is income that will not be taxable either at registration or thereafter, upon receipt. It follows that the tax rate applied to the taxable temporary difference is 0%, and therefore does not create any deferred tax liability.

In conclusion, *we can say that the income that will never be taxable will never generate temporary differences; however, income that is not taxed in a particular year but is taxed in a subsequent year generates taxable temporary differences.*

4.2. The tax base of a liability

The tax base of a liability is its carrying amount, less any amount that will be deducted for tax purposes in future periods in respect of that liability. Current liabilities include accrued expenses at a book value. The related expense will be deducted for tax purposes after cash accounting; expenses have already been deducted for tax purposes.

Case 1: The carrying amount of debt on interest (the value stated in the balance sheet) is 100 m.u. Base tax liability is zero interest (interest expense is not deductible in year N but the following year the pay will be made). Next year, the debt interest will have taxable base of 100 m.u. In year N, the taxable amount of debt interest is null and its carrying amount is 100 m.u. less 100 m.u. that is deducted for tax purposes in future periods in respect of that liability. The carrying amount of interest debt is higher than the taxable amount of debt on interest, which leads to a deductible temporary difference of 100 m.u. which gives rise to a deferred tax asset of 16 m.u. (16% x 100).

In year N, the interest expense was not deductible, it was gathered in accounting profit to determine taxable income and the entity paid more with 16 m.u in taxes. Next year, interest expense will be deductible in determining taxable income and the entity will pay less tax by 16 m.u. than would be normal for accounting purposes, if such a transaction would not have tax consequences, which is why there is a deferred tax asset of 16 m.u.

Interest expense in year is deductible when calculating taxable income.

Current liabilities include fines and penalties with a carrying amount .Fines and penalties are not deductible for tax purposes. The carrying amount of fines and penalties debt is equal to the taxable amount of debt on fines and penalties, as a result there are temporary differences.

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[1] CECCAR, 2015, International Financial Reporting Standards 2015 Part A (conceptual framework and provisions), Publishing House CECCAR

4.3. Recognizing assets and liabilities from payable tax

Recognizing tax payable for assets and liabilities of the current year and the previous ones must be recorded as a liability. If the amount already paid, on behalf of the current year and previous years exceeds the amount due for these exercises, the excess must be counted as an asset. As a tax loss can be carried back to recover payable tax of a previous financial year, this advantage should be counted as an asset.

IASB states that the benefit obtained from the use of tax loss must be accounted for as an asset during the year in which the tax loss occurs because it is probable advantage for the enterprise and can be measured reliably fulfilling the conditions of an asset.

4.4. Recognizing deferred tax assets and liabilities

In all the cases when taxable temporary differences arise, a deferred tax liability must be recorded, except in the following cases:

- goodwill for which the amortization is non-deductible;

- the initial accounting of an asset or liability resulting from a transaction that is not a business combination and affects neither accounting result, nor taxable at the transaction date.

In all the cases when there are deductible temporary differences a deferred tax asset must be accounted, to the extent that it is probable that taxable profit will be available, on which these differences will be charged, except when:

- badwill is treated with a deferred income in accordance with IAS 22 enterprise clusters;

- the initial recognition of an asset or liability resulting from a transaction that is not a business combination affects neither the accounting result nor the taxable one at the transaction date.

Accounting for all deferred tax assets is explained by the fact that the carrying amount of the liability will be settled in future periods to come, by an outflow of resources, which attracts accounting for liabilities. If this resource exiting the entity is deductible in a subsequent year in which the accounting was done, then a deferred tax asset is generated on behalf of tax on earnings.

Regarding badwill, this rule does not authorize accounting for a deferred tax asset arising from temporary differences associated with it, which is treated as deferred income in accordance with standard IAS 22, as badwill is a residue, and accounting for a deferred tax asset would increase the carrying amount of it. The initial recognition of an asset or liability is the case of a non-taxable public subsidies related to an asset that is not allowed to be deducted from the tax base of the asset. The carrying amount of the asset is less than its tax base, resulting in a deductible temporary difference that is not permissible in accounting for deferred tax assets.

In conclusion, *we can say that those expenses that will never be deductible don't generate temporary differences; however, expenses that are not deductible in a given year, but become deductible in a subsequent year generate deductible temporary differences.*

There are countries where the tax authorities charge different tax depending on how an asset or liability will be recovered or liquidated. Liabilities or deferred tax assets are determined using on the one hand, the tax rates in effect at the time the value of an asset or liability will be recovered or disposed of, and on the other hand, tax rates specific to how it is expected to recover or liquidate an asset or a liability.

5. CONCLUSIONS

IAS 12 – Income Taxes addressing the financial results of the entity from two points of view, accounting and taxation. Differences arising between the accounting and tax result that don't have tax repercussions on taxes of future exercises are permanent differences. Temporary differences between the accounting and taxation result arise from the time lag in accounting between when an item is accounted and when it is included in the fiscal result. Some differences that are temporary come when income and expense is included in accounting profit in one period, but they apear in the taxable income of another period. Such *temporary differences are described in the literature as differences in timing*, that are *actually taxable temporary differences resulting in deferred tax liabilities*. Examples include:

- interest income –The tax base on such revenues is null because the revenues do not affect taxable profit until cash is collected;

- depreciation used in determining taxable profit – may be different from that used in determining accounting profit. In this regard, a taxable temporary difference arises, and results in a deferred tax liability, when tax depreciation is accelerated, being more rapid than accounting depreciation;

- development costs – They can be capitalized and amortized over future periods to determine accounting profit but deducted when determining taxable profit in the period they are incurred.

The importance given to deferred taxes lies in the numerous debates on financial reporting. Deferred tax should be recognized only for temporary differences. An entity should account for tax consequences of transactions when these are recognized in the financial statements. As a result of the complexity of issues relating to deferred taxes, the experts consider the application of IAS 12 *Income Taxes* as a process difficult to implement.

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A SURVEY ON EDGE DETECTION IN IMAGES

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ABSTRACT

This paper presents the main edge detection methods currently used. Given the importance of the issue in processing imaging domain, over time there were developed several techniques. They behave relatively close in terms of noise, but in practical situations, some may look more favorable than others. This paper aims to be brief conceptual and mathematical presentation of the most popular methods of edge detection.

KEYWORDS: *edge detection, classical operators, Robert operator, Sobel operator, Prewitt operator, Gaussian based methods, wavelet base methods, zero crossing, Laplacian of Gaussian, colored edges methods*

1. INTRODUCTION

One of the most common operations in the field of image analysis and at the same time one of the fundamental problems in this area is contour detection. A contour or edge is the boundary between the object and the background, it is therefore useful knowledge for the following steps of the image analysis: segmentation, registration and identification of objects.

Edge detection is a very important stage for different areas such as automated interpretation systems and machine vision. It is also frequently used as the front-end processing step for higher level object recognition and interpretation systems as we can find in [1].

An edge detector represents in mathematically terminology an operator of small spatial extent that responds in some consistent manner to discontinuities, commonly classifying each image pixel as representing an edge or not [2].

From the scientific point of view, an outline is defined as all pixels that have abrupt discontinuities of levels of gray.

In binary images, border crossings are defined as black pixels having at least one white neighbor in the vicinity, therefore pixel location like (m, n) where u (m, n) = 0 and g (m, n) = 1, where:

$$g(m, n) = [u(m, n) \oplus u(m \pm 1, n)]. \text{ OR. } [u(m, n) \oplus u(m, n \pm 1)]$$

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For a continuous image f (x, y), its derivative assumes a local maximum in the direction Edge. Therefore, an edge detection method is the measurement of the gradient of f along r in θ:

$$\frac{\partial f}{\partial r} = \frac{\partial f}{\partial x}\frac{\partial x}{\partial r} + \frac{\partial f}{\partial y}\frac{\partial y}{\partial r} = f_x cos\theta + f_y sin\theta$$

2. PROBLEM DEFINITION

Edge is a border along which brightness intensity suddenly changes, so it is characterized by sudden changes in intensity. It can be defined as a border separating the two areas of different intensity. Edge detection is a fundamental problem in the processing of images, it allows extracting useful information from an image, information necessary for image analysis. In image processing, edge is interpreted as a single class of singularities. In a function, singularities can be easily characterized by discontinuities, where the approach gradient is infinite. Edge detection is an important task in image processing. It is the main tool in pattern recognition, image segmentation, and scene analysis. An edge detector is essentially a high pass filter that can be applied to the extraction point edges in an image.

Edge detection is a fundamental problem in image processing area because it allows the extraction of the main information from an image, that is needed for the further computer analysis and understanding of it.

Edge detection is used in various image processing applications. As we can see in [3], these application can be: optical character recognition [4], infrared gait recognition [5], automatic target recognition [6], detection of video changes [7], medical image applications [8], machine vision an automated interpretations systems, satellite television, magnetic field resonance images and geographical information system [9] [10] [11].

Border detection in images is based on operators that approximates the gradient or the Laplacian image in discrete plane.

3. AVAILABLE METHODS

This Section presents the most important edge detection methods and explains their advantages and disadvantages and the relation between them. We will present some works in more details because of their major impact, while others will just referring at.

Border detection relies on operators that approximates the gradient or Laplacian image in discrete plane. Gradient vector represents direction and maximum magnitude of intensity variation within a point of an image and is defined by the partial derivatives of image function.

There might appear some problems in the process of edge detection. These are the potential problems in extracting contours, and in segmentation are the following: changing lighting conditions, changing the background, luminance and geometric characteristics, noise (which has a very big impact in edge shaping), detection of certain edges, detection of false edges, changing edge position from the real location.

Classical operators

The usual gradient operators are Roberts, Sobels and Prewitts operators and are defined for images with multiple levels of gray, but their use can be extended to color images. In the case of color images, how to apply the gradient operators is decomposing image in three fundamental areas of color (R, G, B) and then detecting, for every space, a border detection operator.

Laplacian operator that detects sudden transitions intensity of image requires fewer calculations, it is defined by second order partial derivatives:

$$\nabla^2 f(x,y) = \frac{\partial^2 f(x,y)}{\partial x^2} + \frac{\partial^2 f(x,y)}{\partial y^2}$$

Classical edge detectors uses groups of predefined templates for defining edges of each picture segment of a fixed size. 2D discrete convolutions are used here for finding the correlation between pre-defined templates and sample image segment.

These templates are represented as filters, which are vectors (1D) or matrix (2D). For faster performance, the size of these filters are 1x3 (1D) or 3x3 (2D). In terms of functions, filters are discrete operators of directional derivatives. Instead finding the local maximum gradient, it is set a threshold and establish those points of gradient below the threshold as points of edges.

Figure 1. Grayscale test image of brick wall and bike rack [12]

Robert operator

Figure 2. Gradient magnitude from Robert cross operator [13]

The components of the gradient at a pixel (x, y) is approximated by:

$$D + (x, y) = f (x + 1, y + 1) - f (x, y) \quad D (x, y) = f (x, y + 1) - f (x + 1, y)$$

D + and D - is calculated with these two masks convolution [14]:

Figure 3. Masks used by Robert Operator [14]

Usually, the output produced by this detector is only the amplitude matrix, viewed as a gray scale images.

The main advantage of using this detector is simple calculations: addition and subtraction operations with the values of only 4 pixels.

The disadvantage: because it uses a very small nucleus, is very sensitive to noise. Also, response to real borders is weak if they are not very "abrupt" (a very intense transition).
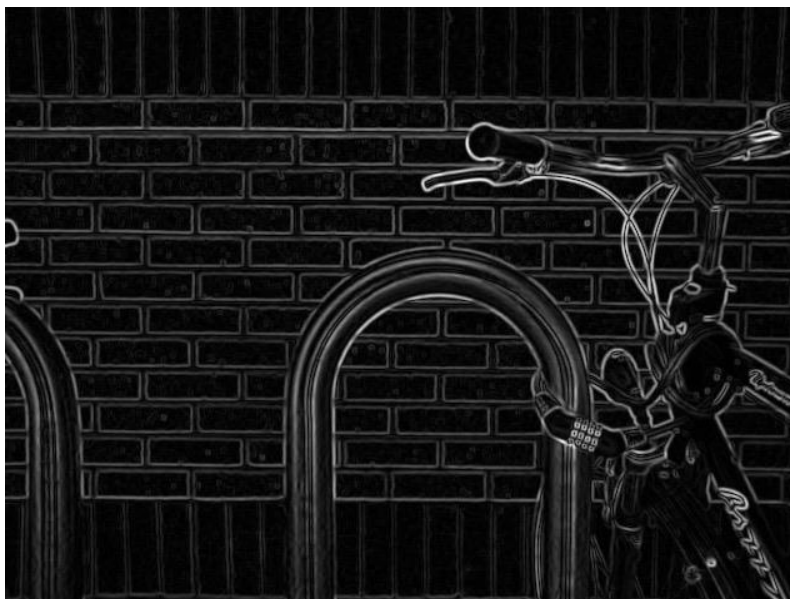
Sobel operator

Figure 4. Gradient magnitude from Sobel operator [15]

The gradient is approximated by convolution of the image with the following masks [16]:

Figure 5. Masks used by Sobel Operator [16]

The masks are designed for maximum response at fronts with vertical and horizontal directions. They can be applied separately to input image, then they are used to calculate the magnitude and direction in each pixel of the front entrance.

Sobel operator require more calculations than Roberts operator, but because convolution mask is larger, it smooths more the image and is therefore less sensitive to noise. It produce amplitude values higher than those produced by Roberts operator, for the same borders. Matrix amplitudes produced by this operator can be visualized as a gray scale image.

Due to the smoothing effect that it has, boundaries often appear as lines whose width has more pixels. Border thinning post-processing is required, such as that of "hysteresis" Canny algorithm.

Prewitt operator

Figure 6. Gradient magnitude from Prewitt operator [26]

It is similar to Sobel detector and is used for detecting vertical and horizontal edges in images. It uses masks [17]:

Dx   Dy

Figure 7. Masks for the Prewitt gradient edge detector [17]

Gaussian based methods

They are symmetrical along the edge, and also reduce noise by smoothing the image. The most important operator is Canny operator.

Canny operator is the most used today, even though it's not part of the newest detectors being invented in 1986. It was created by John Canny under his dissertation thesis for a Master at MIT. He addressed the issue of detection of edges as an optimization problem of signal processing [18] therefore he implemented a function, then he optimize it for operator designing. The function was designed so that:

- To maximize SNR to provide better detection,

- Develop a good location to mark with precision edges,

- To minimize the number of responses for a single edge. This promotes the true negative, which involves marking points that are not edges.

Based on these criteria, Canny detector performs firstly an image smoothing for noise removal. Then it calculates the gradient image to highlight areas with high intensity variation. Next, the algorithm goes through these areas and remove any pixel that is not a local maximum gradient direction. The gradient matrix is further reduced with hysteresis. Two thresholds are used, T1 < T2. If the amplitude value is below T1, the pixel is removed; if the value is greater than T2, the pixel is retained as pixel border. If the pixel amplitude value is between two thresholds, then the pixel is removed if there is no way from it to a pixel with amplitude gradient greater than T2, otherwise it is noted that pixel border.

The Canny's edge detection algorithm checks if its amplitude is larger than that of its neighbors and marks a point as an edge in this case. The problem here is that this algorithm does not check if the differences between this point and its neighbors are higher than what is expected for random noise as we can see in [19]. Thereby this technique induces the algorithm to be slightly more sensitive to weak edges. In the same time it makes it more susceptible to spurious and unstable boundaries every time there is an insignificant change in intensity. We can observe this problem for example on smoothly shaded objects and on blurred boundaries.

Wavelet base methods

If the image is affected by noise, classical operators can not differentiate between a pixel affected by noise and a pixel belonging to an edge and can get rid of edge pixels. To solve this problem, wavelet transform can be used. In fact, every operator can be described as a discrete model of orthogonal functions.

Edge detectors are actually discretized wavelet functions. Convolution with edge detectors provides an image at a correct scale to wavelet transform. Here, the continuous wavelet model is approximated and it will became a classical edge detector at discretization. Once we have continuous model, we can change the scale and detect edges on different levels of scales.

In [20] we can notice how Heric and Zazula have described an edge detection algorithm using Haar wavelet transform and Haar wavelet as the main wavelet function, these being orthogonal, without spatial shifting in the transform space and also compact. They showed the intensity magnitude variation between adjacent intervals on a time-scale plane by applying WT. They proved that the wavelet transform within the edge region was constant and solely dependent on edge slope and scale considering an extended model of step edge formed mathematically by a slope function affected by noise. They also noticed that edges modulus maxima are larger than noise modulus maxima. In the same time they observed that the influence of noise decreases with progressing toward higher scales. This happened because Haar wavelets perform averaging.

Zero crossing

Previous methods of estimating gradients works best when gray scale transitions are abrupt, step-like function. How the transition region becomes broader, it is more advantageous to apply a second-order derivatives.

A very common operator is the Laplacian operator defined as:

$$\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$$

Laplacian operator requires fewer calculations, but it is more sensitive to sudden transitions intensity and noise. Also, the threshold size produces sometimes double edges. For these reasons, along with that the direction detects no edge, Laplacian operator is not considered a very good operator for detection of edges.

This operator is used rather in relation to its zero crossings, which led to generate a new edge detector, called Zero Crossing. It has fixed characteristics in all directions and is sensitive to noise, like Laplacian operator.

A zero crossing detection is defined as:

$$h(m, n) \triangleq c[1 - \frac{(m^2 + n^2)}{\sigma^2}] \exp\left(-\frac{(m^2 + n^2)}{2\sigma^2}\right)$$

Where σ controls the size of the Gaussian kernel and c normalizes elements sum of a given mask. Zero crossings of an image convolution with h (m, n) give the edge locations. h (m, n) is the sampling impulse response of an analog bandpass filter whose frequency response is proportional to:

$$(\xi_1^2 + \xi_2^2) \exp\left[-2\sigma^2(\xi_1^2 + \sigma_2^2)\right]$$

So zero crossing detector is equivalent to a low pass filter with a Gaussian impulse response type, followed by a Laplacian operator. The parameter controls the output amplitude response of the filter without changing the position of the zero crossing.
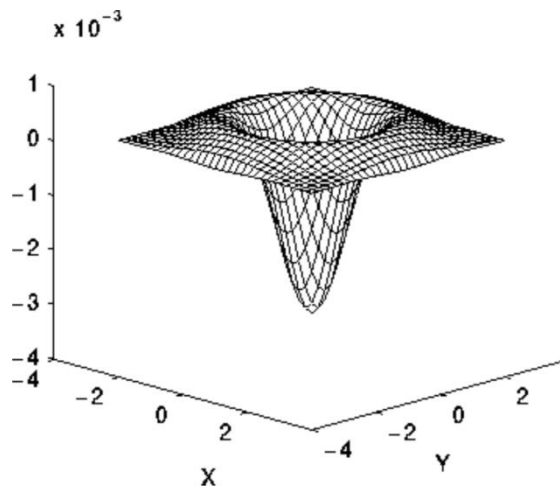
Laplacian of Gaussian

Figure 8. The 2-D Laplacian of Gaussian (LoG) function [21]

This type of detection was invented by Marr and Hildreth in 1980. For an effective edge detection, this method combines Gaussian filtering with Laplace operators and break the image in the places where the intensity varies.

It is about a gradient using Laplacian operator to extract a second order derivative of the image. A difference of intensity in the image appears in the chart of the second order derivative as a pass through zero.

Marr-Hildreth operator began to be widely used for the following reasons:

- The operator is symmetrical. The edges are determined in every direction, as opposed to the operator using the directional derivative of the first order;

- Zero crossings of the second order derivative are easier to determine than are the maximum in the first order derived, because the most important thing are sign changes in signal;

- Zero crossings of closed contours always generates a signal, which is very useful if it is desired to separate objects in the scene.

There are some problems, though with this method:

- Being an operator that uses second order derivative, noise will have a considerable influence

- Sometimes, generation of closed edge it's not realistic, Marr-Hildreth operator creating contours and in places where they do not exist.

Colored edges methods

Most edge detectors operate on the gray level images. This divides to three the amount of data they work with (one channel instead of three), which also produces loss of detail. By incorporating the color component of the image, the detector should be able to detect edges even in regions with small variations in color intensity.

There are other methods worthy of mention like multi-resolution methods, nonlinear methods, statistical methods, machine learning methods, contextual methods, line edge methods. [22]

There are several types of color detectors. Detectors that use fusion methods, multidimensional gradient methods and vector methods.

Fusion methods do edge detection for each channel, R, G and B, after which it combines the three resulted maps into one. In [23] Alberto Salinas et al. shows this algorithm, using a method of regularization to constrain map to fit the image edges and to have few twists.

Multidimensional gradient methods use three channels at the same time to calculate a single gradient. Starting from directional derivatives for each channel, Di Zenzo shows in [24] formulas for the size and direction of the gradient, which is a tensor with 3 dimensions in color space.

Several methods are used to process pixel from vector point of view. Yang and Tsai [25] used a two-level thresholding method using 8x8 blocks to find the best 3D projection axis with which to convert each block in gray levels.

4. RESULTS AND DISCUSSIONS

In [1] article is presented a set of experiments in edge detection domain using the geometric proprieties of a binary image. Connectivity, projection, area and perimeter are important components in binary image processing.

The proposed algorithm receives a grayscale image input as is showed in Fig. 9 and returns the edge detection image output as is showed in Fig. 10. It consist in a classification of all pixels that satisfy the criterion of homogeneousness, then a detection of all pixels on the borders between different homogeneous areas with some intermediates parts [1].
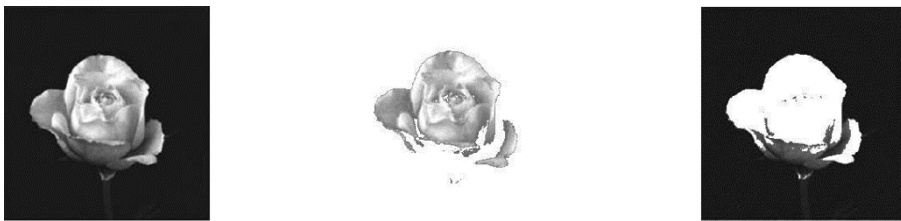

Figure 9. Original Image with its parts [1]

Figure 10. Edge images of original image with its parts and final output image [1]

This algorithm used the characters of Shannon entropy and Rényi entropy, in order to calculate the global and local threshold values [1].

They run the Canny, LOG, and Sobel methods and also the algorithm that was proposed 20 times for each image with different sizes. They noticed that the proposed edge detector works effectively for different gray scale digital images comparing to the run time of LOG, and Sobel methods [1].

They observed that the proposed method in this article works well comparing to the previous methods, LOG and Sobel as shown in Fig. 11 [1].
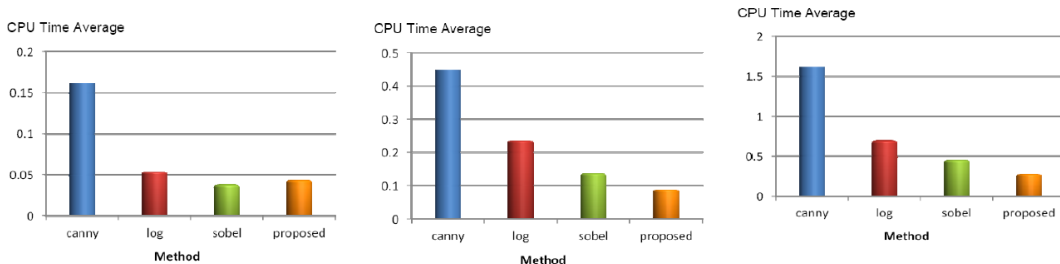

Figure 11. CPU time with 256x256, 512x512, 1024x1024 test images [1]

5. CONCLUSIONS AND SUGGESTIONS FOR FUTURE WORK

The purpose of this paper is to present different approaches in edge detection domain and also some results. For this we summarized the characteristics of the various operators that have been used over the years on this issue.

For noisy images there aren't large qualitative differences between these operators but for practical applications, where there is used ordinary image, the algorithm currently used is Canny. On the other hand the Canny detector color offers even better results than the version with gray levels using fusion methods of color planes.

In this area there are still many opportunities for research, and for this reason, in the future we plan to design an algorithm to provide a new approach for detecting the edges in order to recognize objects.

The advances in edge detection research may contribute to improvements in research area relies on the edge structure and consistency, like: image calibration and validation of slanted edges [28], line and contour detection [29], image segmentation [30], image deblurring followed by edge augmentation [31], document skew detection and correction [32].

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FINANCIAL STATEMENTS – MAIN SOURCE OF INFORMATION FOR THE PROCESS OF MANAGEMENT AND DECISION MAKING

Marilena-Roxana Zuca [1]*

ABSTRACT

*Managerial decisions have certain aspects that are different from the analyzed perspective. From the point of view of human resources to be hired, the management of the entity takes decisions based on the amounts investes in resources and exploitation transactions as well as a proper financing mix. These are the reasons for which **accuracy and the level of detail in information** has to be at a higher level in order to support the business and it increase its value.*

*The quality of **decision-making** is dependent to a large extent on the **amount** and quality of information upon which the decision is **based on**, which, once adopted is considered the most important process that takes place in the management of an entity. This, more so today, as IFRS generated changes in the conceptual sense of fundamental elements of financial reporting and results, as well as increased volatility of indicators results, **leading to consolidation of the interest for information, analysis and decision making**.*

KEYWORDS: *financial statements, users, financial and accounting information, decision process, reporting entities.*

Code JEL: *M41*

1. INTRODUCTION

At entity level there is an organized information system that allows monitoring strategic business. When managers have relevant and timely information they can broaden their vision and perspectives on the business concerned, **using financial information in the managerial act**. Critical areas of business (marketing, sales, production, logistics, human resources, etc.) must be known and treated with deep interest as to not jeopardize the smooth running of the business, but also to lead to development. The most important needs of entrepreneurs and managers are the need to make decisions quickly and accurately, the need to develop management skills, **need to understand and effectively use financial and other business information** in the design and business development.

Studies have shown that among shareholders whose management is based on value, the role of accounting information for decision making becomes evident.

Adequate supply of techniques, for example accurate and complete financial statements, directs managers towards decisions that aim maximizing the value of the entity. Looking at the business environment, there is a similarity between negotiations and accounting practice on how **to earn the trust of users of information in the financial statements, important stake for providers of financial accounting information**.

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2. THE ROLE OF FINANCIAL STATEMENTS IN THE MANAGEMENT OF THE ECONOMIC ENTITY

Building accounting information is based on observation of an entity and its specific activity. Data processing in order to obtain information is done by operating with specific language and means to the accounting system so it will respond to users' needs. Accounting information system is a part of the overall entity specialized in the representation and economic measurement. It proposes a global entity modeling based on rules which ensure the quality of accounting information and not only a list of scattered indicators.

Along with the role it plays in controlling resource management and contribute to decision making by various users, accounting has become more and more the role of social adjustment, lately.

Financial statements are a synthetic information characterizing at some point, blocks of assets and liabilities of each entity and is the official management document, who must render a true, clear and complete financial position and results. They include a system of indicators whose development is based on data supplied by accounting, taken directly or previously processed.

Financial statements also show the results of the entity's management, including the way the management used that resources entrusted to them. Those users who wish to evaluate the administration or management responsibility do so to make economic decisions; these decisions may, for example, focus on the option to keep or sell the investment in the entity or replace or reconfirm the management.

The economic decisions that are taken by users of financial statements require assessing whether an entity is able to generate cash and cash equivalents at a specific time to ensure their safety. Ultimately it depends, for example, on the ability of an entity to pay its employees and suppliers, to pay interest, repay loans and compensate its owners. Users are able to evaluate this ability to generate cash or cash equivalents if they are provided with information focused on the financial position, performance and changes in financial position of an entity.

3. FINANCIAL DIAGNOSIS AND SUBSTANTIATING DECISIONS

As primary source of information, accounting helps prepare the decisions of the entity and its partners. Industrial drive and development of large enterprises, characterized by a separation between shareholders-owners and professional managers, has led during the twentieth century to an increasing need for information of managers and investors. Other external partners, such as banks, customers, suppliers, public power, they also need **reliable information**.

Thus, to the traditional accounting function was added an internal and external decision utility.

The information used for taking decisions by the management of the entity comes mostly from management accounting, which is the main source of information in leadership and

management activities[1]. However, financial accounting, synthesized by the **annual financial statements**, still provides the necessary information for managers to handle relationships with third parties, the choice of investment projects and financing resources. In addition to small and medium entities that do not use sophisticated management accounting, it becomes useful for informing and in taking most of management's decisions. But the main role of the financial statements, as means of information, is to provide useful information in taking decisions for stock investors. This outlook on the role of accounting "appeared in the United States before the end of the Second World War, with the development of large companies with vast and dispersed ownership. Predominant in Anglo-Saxon countries, where businesses are financed largely through public call for capital, it spread after more than fifty years in Europe, under pressure from rising equity markets"[2] .

Accounting information allows investors, current and potential shareholders to make a value judgment about past, present and future events of the enterprise, thus providing confirmation or denial based on initial forecasts. An investor must be able to extract from the published financial statements elements enabling it to decide on the increase, withdrawing or reducing of its investment.

In fact, the other partners of the entity resort to annual financial statements for taking decisions. For example, banks use them to determine lending, public power to grant or deny a subsidy, providers to accept certain terms of settlement etc.

But the usefulness of the information is much larger for the entity's management. Although some of accounting data can be used in a "gross" state in decision-making, many of it reveal its informational value from the review process, which allows establishing a financial diagnosis for the entity.

In general, financial diagnosis[3] aims to analyze the strengths and weaknesses of the entity. To do this, it relies on economic, social, and financial accounting information. Most of the information used, however, is financial and accounting and is extracted from the **analysis of financial statements**.

4. THE ROLE OF FINANCIAL STATEMENTS IN FORECAST PREDICTION

Financial diagnosis necessarily requires a **forecasting dimension**. If studying the evolution of the past and the present situation constitutes an indispensable element of leadership, it requires especially an assessment on developments foreseeable in the near or distant future.

Accounting information has, as you know, a retrospective character or, at best, a timely one. "Of course, temporary limiting of accounting is not as radical as it would appear at first sight and it provides guidance that can lend itself to a forecasting exploitation "[4]. For example, on-balance sheet receivables will generate future revenue and incurred debt, at

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[1] Oprea C., Man M., Nedelcu M., Managerial accounting, Ed. Didactică şi Pedagogică, Bucharest, 2008
[2] Esnault B, Hoarau Ch, Comptabilité financière, Ed. PUF, Paris, 1994
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some point will require subsequent payments. As a result, the information contained in the balance sheet will form the forecasting basis for the study of short-term solvency of the entity. However, exploiting the possibilities offered by the accounting data in a forecasting perspective is not always sufficient, they should be complemented by a clairvoyant perception of the entity's financial prospects.

Ongoing work in, in a highly competitive environment, compels entities to provide leadership to rule. Thus, the forecast becomes a primordial task of modern management and "financial forecast is perhaps the most important activity planning"[1]. Financial forecast uses certain specific means, the entity's budgets, unlike the balance sheet, are not destined for the general public, but to domestic needs guidance in order to achieve the objectives set by management based on realistic forecasting and on managerial activity to achieve it, subsequent events will evolve, more or less, trough by budget orientation.

Because the accounting information is generally the only information that is subject to a normalization and a public disclosures, public - user information - tends to believe that the information emanating from entity will be confused with **producing financial statements or accounting documents synthesis - the balance sheet and profit and loss**. In reality, the accounting information is generally only a tiny part of the information produced by the entity.

In the totality of information, essential is the statistical information which includes data that is not necessarily linked together by the principle of double entry. Most often, **long-term forecast information is considered statistics**, given the difficulty of obtaining the forecast data that will allow making appropriate accounting paperwork.

Without being a historian, the analyst of the entity's performance is interested in the forecast data also. As a general rule, all entities must have a minimum of short, medium or long term statistical forecasting data that allows him to finalize the strategy.

In general, the forecasting demand of the entity is materialized in three forecasting documents and a financing plan[2].

a) **Long term plan.** It is a document related to long-term statistics, announcing in a summary form, the entity uses and resources on a horizon of 5 to 10 years.

b) **Medium term plan.** Uses and resources in the long term plan are detailed and specified when drawing the medium-term plan whose horizon is basically from 3 to 5 years.

c) **Forecast budgets and accounts.** These are annual successive documents that complete the medium-term plan ranking them first on the different functions of the entity. Therefore distinguishing them from the expenditure and revenue:

1. **sales budgets,** vented by main types of income or benefits;

2. **budgets of direct production costs** (decomposed as income) **to reveal margins** on direct costs related to the various revenue;

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[1] Stancu I., Finance, Ed. Economică, Bucharest, 2007

[2] C.G. Dumitru, Accounting. Solved problems, applications, case studies, Ed. Universitară, Bucharest, 2011

3. **budgets of indirect production costs and general expenses.**

Previous budgets are then synthesized into a forecast account which enables determining the **forecasted result.** Considering, however, that the forecast is a random field, in generall the forecasted result is accompanied by a **probability index.**

Projected costs and revenues are then "translated" in terms of cash, leading to the preparation of a **forecasted financing plan** aimed to track annual financial balances.

4. **financing plan.** Once forecasted resources are determined then a financing plan is established for good.

This device is complemented by an **annual forecast balance.**

All essential data of this planning are highlighted in a **scoreboard**, the latter being a statistical statement of the utmost importance.

Obviously financial forecast must be accompanied by budgetary control of achievements towards forecasts, of causes that determined the misconduct in order to modify the forecast if reality ass for it or to act on activity to connect forecast achievements.

In the system budgets are summarized the main areas of activity of the entity. Through budgets, resources and responsibilities affecting each activity center are established. "The budget is therefore a forecast number of resource impairments and insurance responsibilities for the entity's objectives in viable conditions"1.

Forecast income statement is a summary of the estimated revenue and expenditure. He is the main instrument for budgetary synthesis at the forecast level and at budgetary control stage. The form given to this account may be different from the regulated one for profit or loss account, depending on the entity's needs.

Resulting in a forecasted account, revenues and expenses will be generally divided by months or quarters, in order to allow budgetary control and treasury budget developing. Income statement forecast is a projection of future results over a period. As with the Treasury budget, sales forecast is central to programming production and estimating production costs. We can go from evaluating each component of cost of sold goods. It is highly unlikely that a detailed analysis of purchases, production-related wages and general expenses will provide the most accurate forecasts. However, cost of sold goods is often estimated based on past relationships between cost of sold goods and sales.

In terms of content, it is stated that in the forecast income statement it must appear "forecasted results", so by analogy with the annual profit and loss account it must contain:
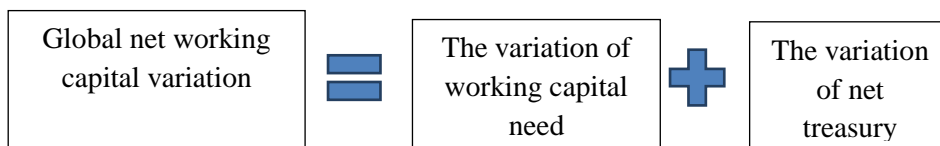
- Operating result;
- Financial result;
- Current result before tax;
- Net result.

The financing plan enables comparison between the provisions and achievements, resulting in a structural identity between the financing plan and **cash funding board**.

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[1] Stancu I., Finance, Ed. Economică, Bucharest, 2007

The cash funding board presents the predictable evolution of financiale entity based on the relationship.

| Global net working capital variation | = | The variation of working capital need | + | The variation of net treasury |

The forecast balance sheet can be discussed as a **"balance plan"[1]** that includes decisions and objectives on the assets and liabilities of the balance indicators showing the forecast balance of these elements at certain intervals**.** Also, the forecast balance sheet may be presented as a "**variations of forecasting**", variation stating the balance of elements at the beginning and the end of the projection period.

Income statement and balance sheet forecast is based on cash budgeting forecast.

The treasury budget allows forecasting at the input and output of liquidity in order to avoid the risk of cessation of payments or the appearance of any unnecessary surpluses. Actually, to revenues and operating expenses (excluding depreciation and provisions), financial transactions and investments will correspond receipts or immediate payments or within a certain timeframe. If during certain periods there is a surplus cash and if it is important, you need to provide opportunities to placing it. Whether, at other times it appears a cash deficit then additional resources to cover outstanding debts will be sought.

Treasury budget is obtained by projecting future receipts and payments of the entity at different time intervals. For forecasts done on small periods we use more often, monthly periods because they take into account seasonal variations in cash flows. When cash flow information is volatile but predictable, it is necessary to draw up budgets on closer intervals. To the contrary, if cash flow is relatively stable, we can draw up budgets quarterly or on longer periods, although practice shows that, if the period is very long, the forecast is uncertain.

The forecast balance sheet[2] is presented as a traditional balance sheet and allows the foresight of consequences of estimated actions for the next financial year and financial structure of the entity. He will thus allow estimating: the evolution of working capital; development of working capital needs; return on capital etc. and it can not be developed until after the result and treasury budget is known.
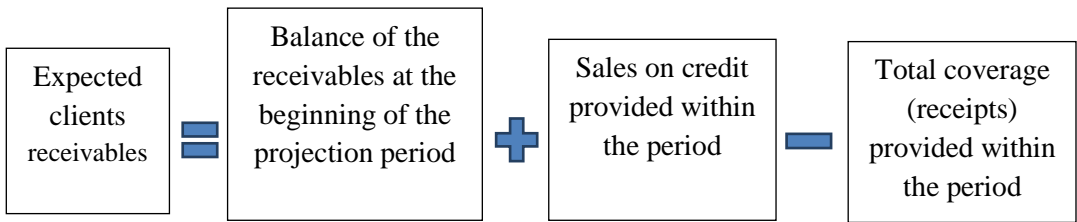
a) Forecasting of accounts receivable.

We can predict the loans and advances to customers on the date of the preview by adding to the balance at the beginning of the period of forecasting total sales on credit provided for in the period laid down and by subtracting the total of the cladding materials provided for within the same period, on the basis of the relationship:

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[1] M. Ristea, C. Ionescu, Gh. Zaman, Current challenges in company accounting. Compendium of Accounting, Ed. Foundation of Tomorrow's Romania, Bucharest, 2015

[2] C.G. Dumitru, Accounting. Solved problems, applications, case studies, Ed. Universitară, Bucharest, 2011

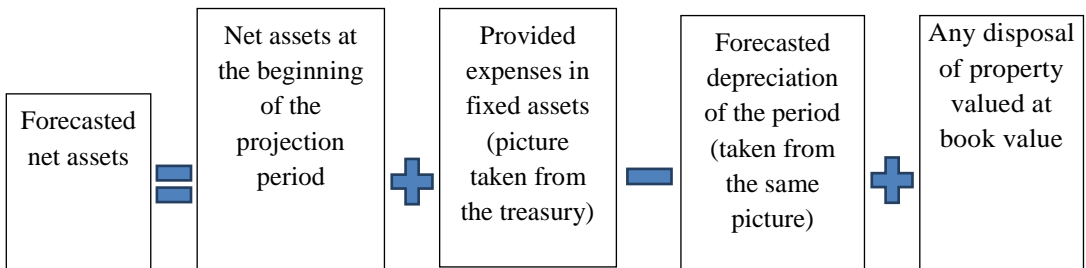| Expected clients receivables	=	Balance of the receivables at the beginning of the projection period	+	Sales on credit provided within the period	−	Total coverage (receipts) provided within the period

b) Forecast of stocks. Stocks can be predicted based on the rotation rate expressing the ratio of cost of sold goods and stocks, resting on past experience. Based on the average we can determine according to the formula the end stock:

Rotation rate = cost of sold goods / (initial stock + end stock) / 2

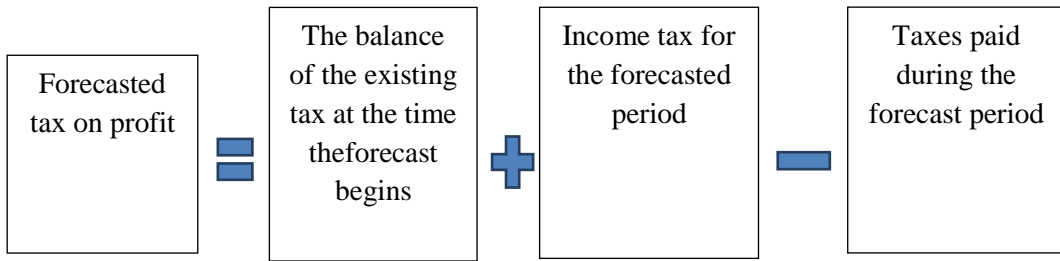*Where* End stock = 2 x cost of sold goods/ rotation rate - initial stock

c) Forecast of net assets. Future net assets are estimated by adding to the net assets owned and by subtracting total expenses and depreciation provided for the period increased, as appropriate, with the transfer of property valued at book value, the relationship of calculation used in this case is:

Forecasted net assets	=	Net assets at the beginning of the projection period	+	Provided expenses in fixed assets (picture taken from the treasury)	−	Forecasted depreciation of the period (taken from the same picture)	+	Any disposal of property valued at book value

d) Forecast of debt - suppliers to be paid. Debts - suppliers to be paid, will be estimated by adding to the existing balance at the beginning of the projection period the total purchases provided for in the period considered, less the forecasted and paid purchases within the same period and paid for,

Forecasted debt suppliers	=	The balance of debt existing at the date the forecast begins	+	Total purchases forecasted for the period considered	−	Forecasted and paid purchases within the same period
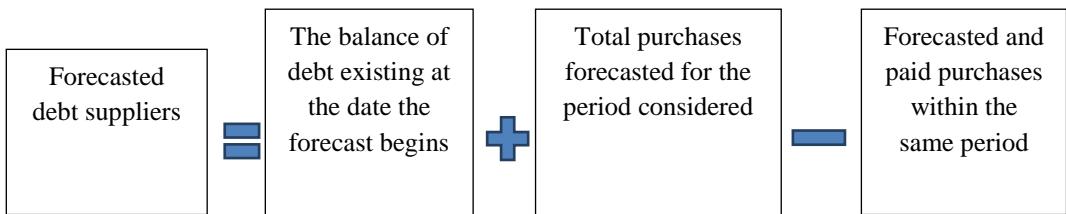
e) Tax profit forecast is estimated by adding the balance of current taxes scheduled for the corresponding profit forecast and subtracting taxes paid.

Forecasted tax on profit	=	The balance of the existing tax at the time theforecast begins	+	Income tax for the forecasted period	−	Taxes paid during the forecast period

5. THE ROLE OF FINANCIAL STATEMENTS WHEN CONTROLLING THE REPORTING ENTITIES

Management of economic and financial resources available to the entity, with maximum efficiency and protection of assets, requires organization and continuous practice or periodic control for some actions.

Control is a function of management that allows knowledge and improvement on the way the assets are managed, provides information to orient the activity of production, distribution and sale. An instrument to mesure wealth created by the entity, **accounting and financial statements** provide the elements necessary to determine various pecuniary rights, such as: dividends due to shareholders / associates, employee participation in profits, taxes and similar payments imposed by state. It also provides qualitative elements that allow to ascertain whether explicit or implicit contracts made between the entity and its partners have been respected. Thus, accounting is a tool for economic, financial, legal and social control.

Economic and financial control can be exercised within the entity, in which case it takes the form of internal control, or by outsiders, known as external control.

Internal control seeks to protect the interests of the entity through expert knowledge of current management operations and setting responsabilities on keeping the integrity of assets.

Although in this form of control the information contained in the financial statements is used, the largest part of the data are drawn from the accounts of the entity and in particular the internal management accounting.

External control is exercised by persons outside the unit that safeguard the interests of specific organs which they represent: the state, other public bodies, investors, banks etc. With some exceptions, the vast majority of the information used in the external audit is contained by financial statements.

So, the annual financial statements serve most of all in actions of control and evaluation exercised outside entity, depending on the purpose of external control. This form of control is found in: control distribution and to control the outcome of the calculation and determination of taxes.

5.1. Control of profit sharing

Financial accounting provides at certain periods in the form of the **annual financial statements**, information useful to the owners of an entity with regard to the financial position at a given moment and the result of the operations conducted in a limited period. The latter increased by profits of prior periods which were not subject to distribution, form the basis for calculating **distributable dividends** to shareholders or associates. Besides the right to dividends, shareholders or associates benefit for the value of capital invested in the entity, the right to intervene in economic and social life of society, particularly through participation in the decisions of the general assembly, and the right to information on the management of the entity.

In order to exercise these rights, **accounting and annual financial statements** provide information that allow associates to control the activity of the management of the entity. Thus, based on the elements contained in the financial statements, associates and shareholders may appreciate the influence of investment and financing decisions on the financial situation and distributed earnings/results.

Ensuring quality of information contained in the financial statements is performed by professional accountants (auditors). Through verifying and certifying financial statements it is confirmed that they give a true, clear and complete financial position, financial performance and results of the financial year.

5.2. Controlling the settlement of taxes

Accounting data is used to establish multiple taxes and assimilated payments to the state budget or other public bodies. The whole of tax legislation applicable to entities is based on **information from accounting**, to the extent that the returns taxable depend, first, on the correct determination of the accounting result. This is corrected to take account of the differences arising between specific accounting rules and tax. Accounting also provides the necessary data calculation of VAT due to budget, and other taxes and duties that are the responsibility of the entity.

Thus, data from the financial statements constitute a tool that favors control by fiscal authorities, the purpose is that the entity will pay the fiscal obligations in time and to prevent tax evasion[1].

In order to ensure the fulfillment of this objective, the legislator has intervened through multiple laws that determine tax obligations of taxpayers, the conditions for deductibility of expenses (by registering them in the accounts) and the right of tax authorities to verify the entity's accounting. This verification is to examine the accounting documents of an entity and to face the facts, to control the statements submitted by the entity and eventually to determine if there are additional taxes. The control of establishing taxes and fees tries to reinforce the fiscal and financial disciple of entities.

As a result, the role of annual financial statements in controlling entities comes first, constituting a support and a guarantee of quality for the information included, for decision-making by both internal users and those outside the entity.

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6. CONCLUSIONS

The foundation of the financial statements is financial accounting, which requires registration, classification and centralization of information on economic events and transactions denominated in a currency unit.

The financial statements are the end product of accounting, their quality depends to a considerable extent on the quality of accounting processing. The financial statements are the result of interaction of three parts: entities as the subjects whose activities are subject to financial information, accounting information users and professional accountants or accounting profession in general. From all these pieces, the role of improving the content of financial statements and the credibility of accounting information is attributed to the accounting profession.[1] Hampton[2] stated in his studies that the financial statements are an organized collection of data according to logical and consistent accounting procedures. By default, the financial statements present the results obtained by managing resources by the entity's management, which means, in fact, that this structure is competent and legitimate.[3]

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TEACHING SOFTWARE PROJECT MANAGEMENT:
THE COLLABORATIVE APPROACH

Costin-Anton Boiangiu [1]*
Ion Bucur [2]

ABSTRACT

The process of learning has been subject of change in order to meet new principles of study in emerging technologies. There is a consensus that collaborative learning is a method in which participants achieve success more often. This paper aims to combine the benefits of collaborative learning and apply them while teaching Software Project Management in a computer science academic education field.

KEYWORDS: *software project management, educational models, teaching strategies, collaborative learning, cooperative learning, competition-based learning, mixed collaborative-competition learning, independent learning, anarchy learning.*

INTRODUCTION

Among the different oriented approaches, the following can be distinguished as efficient learning processes: collaborative, competitive, anarchic, independent and mixed.

A rather recently used model of learning, the collaborative approach, focuses on concepts such as: team-work, interaction and acknowledgement of the abilities and contributions of peers' work. It is a concept in which students team up together in order to understand and study a more complex subject, or work to create a meaningful project [1].

The underlying premise of the collaborative approach is based upon consensus building through cooperation by group members, therefore this approach may be defined as a philosophy of interaction and personal lifestyle. Individuals are responsible for their actions, including learning and forming and applying interpersonal skills.

It is important to note that there is a difference between cooperative learning and collaborative learning. Although many psychologists have defined them similarly, cooperative learning is considered a special case of collaborative learning, where participants work together on a project following a better structured activity [2].

The purpose of this paper is to present the particularities of the collaborative approach through following the students' behavior while developing an "Automated Data Analysis and Extraction System". As the system was logically divided in separate, interconnected sub-systems, each team was assigned to develop a certain module of the final project.

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The outcome consisting of the students' progress, the overall quality of the products developed and the final grades are indicators for the efficiency of the collaborative approach.

PREVIOUS WORK

In regards to the collaborative approach, David Kaufman, Elliott Sutow and Ken Dunn identified the following elements as essential to the success of collaborative learning [3]: positive interdependence, individual accountability, group processing, social skills, being given a specific task and face-to-face interaction.

Various studies had been conducted on the different oriented learning approaches applied within groups, most of them tending to favor cooperative learning [4-7]. Although there is considered to be a difference between cooperative and collaborative learning, several psychologists, notably Johnson & Johnson, Slavin or Cooper [8-10], have used similar ways to describe the two approaches.

More recently, studies in collaborative learning have started to focus on how the group itself involved in the project, rather than how individuals function in a group [11].

PROPOSED APPROACH

During the Software Project Management course from the University POLITEHNICA of Bucharest, the collaborative learning method was applied in the development of an "Automated Data Analysis and Extraction System".

The functionalities provided by the system consisted in: digital image enhancing, image segmentation, entity hierarchy generation and optical character recognition, with the latter being the most complex.

The optical character recognition module was structured as an interconnection between smaller sub-systems:

- Document Processing Manager
- Web based Processing Manager
- Preprocessing Graphical Interface
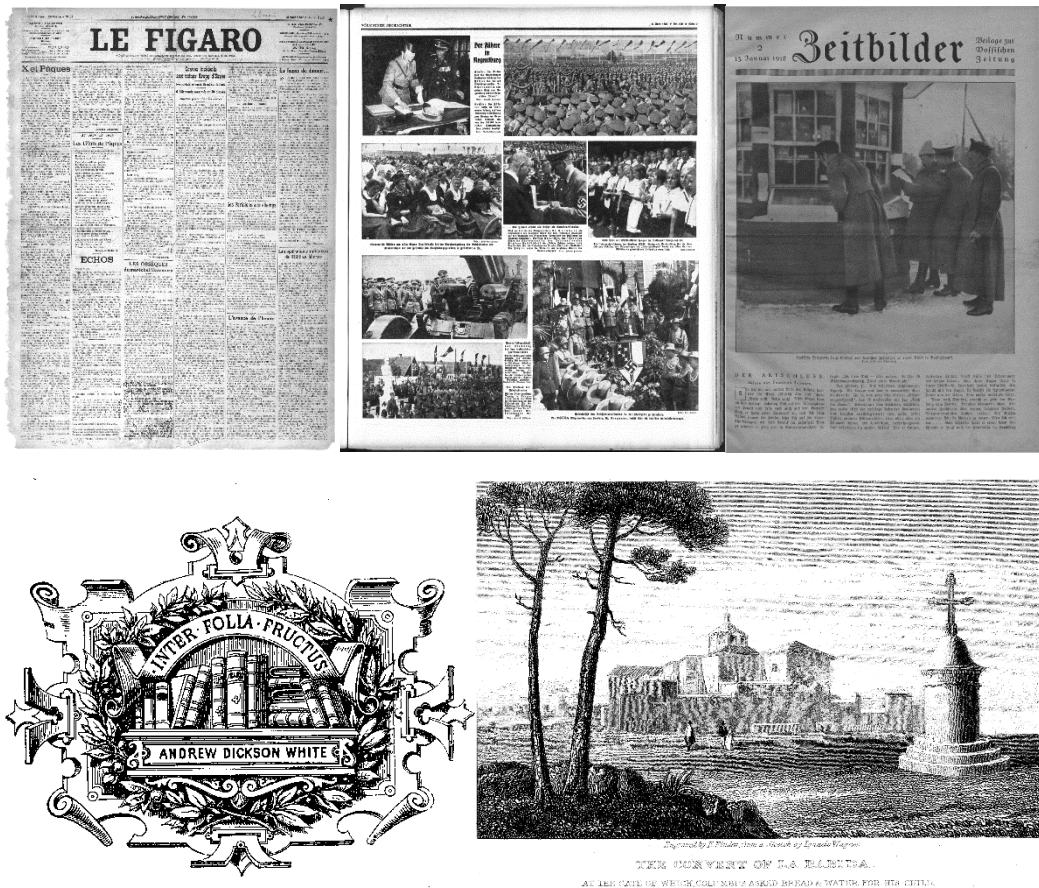- Layout Analyzer
- Hierarchy Analyzer

Figure 1. Example of input files, thus illustrating image document diversity

The Document Processing Manager and Web Based Document Processing Manger had to deliver an executable able to manage a complete workflow of data processing, from image color to obtaining PDF files based on the chosen images.

The purpose of the Preprocessing Graphical User Interface was the creation of an executable which performed the visual evaluation of the results provided by the several available preprocessed data and the binary elements.

The Layout Analyzer had to obtain an executable allowing the correction of errors regarding the grouping of characters into lines and of lines into block texts, error of formatting and text content.

The Hierarchy Analyzer created an executable allowing the correction of errors regarding the grouping and classification of blocks from several image-documents.

All the modules described above had to communicate through XML files.
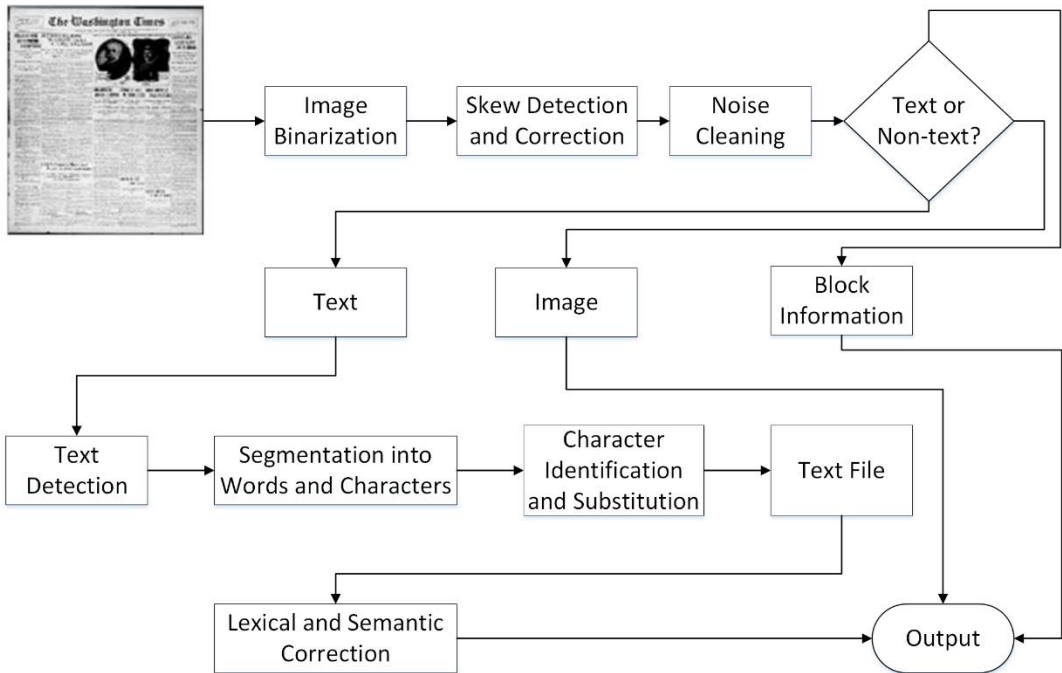
Figure 2. Main processing flow inside a Document Image Analysis System (DIAS)

Students were organized into ten groups of five to seven members, every two teams having to develop one of the five sub-systems described above. Specific details on the implementation process were provided and milestones during the semester were set to ensure the success of the development. The team-members were not assigned specific or different roles within the group and were encouraged to display interest and implication in the project.

In order to motivate the students as individuals in particular and as teams in general the following marking rule was followed: 60% of the grade was based on the whole project's performance and 40% was based on the work completed individually. The results obtained valued 50% of the course grade.

All the projects were divided into four phases:

1. Initial phase – marked by the beginning of the project, the assessment of related work and the role assignment among the team members;

2. Planning phase – resource plan, budget, activity plan, milestone definition;

3. Execution phase – the actual product is being developed and tested. There is also a quality check, taking into account possible risks and bug fixing;

4. Closing phase – delivering the product to the client and receiving feedback according to the quality of the functionalities provided.

Achieving success implied interaction between team-members, but also between teams, since the communication process of several components of the project was vital.

In addition, for obtaining a positive outcome, it was essential that the students acknowledged that they worked for a common objective, and that they depended on and were accountable for each other.

CONCLUSIONS

The high grade obtained by the students for the project indicated that the collaborative approach suited the students' needs and enabled them to learn and participate noticeably in the development of the final products.

Another important indicator for the collaborative approach efficiency is represented by the feedback provided by the students and teachers involved.

Although being part of self-organizing team put some pressure on the members, it ensured reaching a high level of creativity. In addition, debating, negotiation and communication skills were developed. Students had to reason which each other, find suitable solutions for each problem and support their ideas with convincing arguments.

The disadvantages of this approach are represented by the assumption that every individual is involved and willing to participate at their full potential. The existence of disinterested, uncooperative and inefficient team-members may lead to frustration and have a negative impact on the final product. In addition, assigning different tasks to each team might lead to dissatisfaction, as the tasks could vary in difficulty, which may probably reflect in the final grade.

Research is needed to clarify which mechanisms operate on the group as a whole and which are tied to specific experiences in group interaction. If, for example, increased student morale plays a major role in increasing achievement, then individuals may benefit from the group experience regardless of their own rate of participation.

In conclusion, the collaborative approach presents both advantages and disadvantages. It works perfectly with projects that require integration between subsequent modules, whereas it is not the most suitable for projects that are divided into independent modules.

FUTURE WORK

Even though plenty of studies have been conducted on the collaborative approach and its advantages, there is still room for further research. There are a lot of variables involved when it comes to human interactions within groups.

Further studies could focus on how the groups should be organized and how different personality characteristics, knowledge and skill levels of the members involved influence the team and the final results. More details about alternate educational approaches in teaching Software Project Management can be found in [12-13].

ACKNOWLEDGEMENTS

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[12] Costin-Anton Boiangiu, Alexandru Constantin, Diana Deliu, Alina Mirion, Adrian Firculescu, "Balancing Competition and Collaboration in a Mixed Learning Method", International Journal of Education and Information Technologies, ISSN: 2074-1316, Volume 10, 2016, pp. 73-81

[13] Costin-Anton Boiangiu, Adrian Firculescu, Nicolae Cretu, "Combining Independence and Cooperation as One Anarchic-Style Learning Method", International Journal of Systems Applications, Engineering & Development, ISSN: 2074-1308, Volume 10, 2016, pp. 97-105.

INSIGHT INTO PROJECT RISK MANAGEMENT

Mihai Alexandru Botezatu [1*]

ABSTRACT

The unprecedented development of project work within all types of organizations and activities, makes specific project issues be largely presented and analyzed in the literature. Project management, as a temporary management activity with precisely defined objectives and resources, has a number of features that require the managerial skills, knowledge and excellent competencies. Lately, increased complexity, duration and diversity of the issues addressed in projects have triggered hazards making room to risk situations which are more and more present. Under such circumstances, risk management is designed to anticipate, prevent, manage and establish the reaction of the project team to possible risk situations, thus becoming an important component of management. This article presents several risk management aspects and ways of taking action for achieving a successful project.

KEYWORDS: *risk, uncertainty, risk management, risk assessment, risk scoring matrix, diagram risks, decision trees*
JEL code: *A2, C7, D1, D2*

1. RISK IN ORGANIZATIONS AND PROJECTS

Our approach is based on the assumption that projects in which we are often involved in display various degrees of risk, specifically uncertainty, and the uncertainty degree varies greatly from one project to another, due to the diversity and variety of the environment in which they appear and evolve. Even projects similar to previous ones may be at high risk, as there are new specific requirements and new risk factors, which are further detailed in our current approach. If we generally define risk, as an uncertainty regarding the achieving of objectives, expected results, then it is a combination between the possibility of an event appearance and its impact. Its result can be measured/assessed by a certain level of risk, such as *high*, *medium* or *low*.

Specifically, any risk appears in every activity or organization, and is often called "the possibility of suffering a loss,"[2] or:

- "Probability of losing"
- "Possibility of losing"
- "Uncertainty about a result"
- "Hazard or possibility of losing "[3]

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[2] (http://www.webster-dictionary.org/definition/risk)
[3] Constantin Opran (coord.), Sergiu Stan, Steluţa Năstasă, Bogdan Abaza, *Managementul proiectelor*, comunicare.ro, Bucureşti, 2002.

The Explanatory Dictionary of the Romanian Language defines risk as "the possibility of becoming a hazard, having to face a trouble or to bear a loss."

Therefore, the concept of risk involves uncertainty notion and always has a cost associated which measures/assess the impact of the respective event and the sum of the suffered loss.

For a project, the suffered "loss" has various forms, such as:

- The end products have poor or lower quality than the quality originally planned;
- The costs to achieve the goals of making the end products are higher than originally foreseen;
- The resources have not been exploited effectively, they were either consumed or damaged;
- The term of "delivery" of the end product and project closure has been exceeded;
- The project is a total failure.

This means that *the risk* occurs either as a result of an unplanned event that appears, or as a result of a planned event which does not proceed according to plan. This means that, as it is impossible to predict with certainty the future, all projects include a dose of risk.

Since "*each project represents a set of unique activities aimed at an objective with a high degree of novelty and a complex workplan*"[1], it means that *risk management* is an internal element of coordination and control, with the help of which important risks are identified in the project activities in order to keep these risks at an acceptable level.

The Risk, as a probability for not reaching an objective of the project, has the following characteristics:

- It involves the notion of uncertainty and a cost is associated with it;
- It is an event that has *negative* effects in the organization or during a project;
- It is a possible occurrence of a situation, usually unfavorable, for which the generated effects are not known with certainty.
- For a given event, risk has two primary components:
- Probability or possibility of occurrence of that event;
- Impact or effect of the event appearance which is usually assessed in costs.

Under such circumstances, the risk is the uncertainty associated with any event. This may mean the probability of occurrence of an event or the effects of that event, if it occurs. One can therefore determine that risk occurs when:

- An event is certain, but its outcome is uncertain;
- The effect of an event is known, but the occurrence of the event is uncertain;
- Both event and its effect are uncertain.

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[1] Mariana Mocanu, Carmen Schuster, *Managementul proiectelor*, Ed. AllBeck, Bucureşti, 2001

This means that it can become an **element of risk** anything that is likely to produce a considerable deviation from the objectives, from the initial plan. On the other hand, experience shows us that the risk is even greater when:

- The project takes longer;

- The interval between the planning and execution phase is greater;

- The project manager, project team and the organization lack the needed experience;

- The methodology and technology used for the project is newer and less known[1];

We do emphasize, however, that there are specialists who unconditionally do not associate the risk with a loss, but they consider it "an event or an uncertain condition which, if appears, has a positive or negative effect on the set objective ... Risk includes both threats to objectives and opportunities to improve these objectives[2]".

2. THE RISK MANAGEMENT - A TOPICAL ISSUE

Achieving the objectives of an entity, a project or an activity requires risk acknowledgement and risk-taking of multiple risks which are even more diversified and can occur at its level. The Risk management has become an essential part of the management of an organization or project. Considering the increased complexity of activities carried out in various types of projects, the quality requirements for products, while reducing the execution time or costs involved, the risk management has become a very important activity in the economy of a project. This activity includes those processes for the identification, approach and mitigation or avoidance of risks that may arise during a project, which actually defines the reaction to risk.

The **risk management** is, in this context, the activity of identification, assessment and prioritization of risks followed by coordinated and economic allocation of resources to minimize, monitor, and control the probability and /or impact of unfortunate events (hazards) or to maximize opportunities.[3]

In this context, the role of risk management is to provide and manage risk and uncertainty levels so that the project could be completed successfully by the organization. The project team should identify any possible risks, the ways in which they can be minimized and the costs for management strategies.

The main processes specific to project risk management are:

- The *risk identification* by examining each area of the program and each technical process important to identify and describe any associated risk. They have to be identified especially the activities which tend to be critical as they have the

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[1] Stanley E. Portny, *„Project Management for Dummies"* ,Wiley Publishing, Inc. 2001
[2] Project Management Institute, *Guide to Project Management Body of Knowledge*, 2000
[3] Hubbard, Douglas (2009). *The Failure of Risk Management: Why It's Broken and How to Fix It.* John Wiley & Sons. p. 46.

greatest impact on the deadline of project completion. Therefore, these activities will be viewed most frequently, will be tracked during their progress status and the human resource allocated to them will be well-selected to include experienced specialists in the required field.

- The *risk assessment*, by identifying and analyzing the program areas and the described risks to increase the likelihood of achieving the cost, performance and execution objectives in due time.

- The *risk management*, by identifying, evaluating, choosing and implementing one or more strategies to mitigate risks or eliminate them, according to the conditions and objectives set out in the program.

The risk management plan is thus an annex of the project implementation plan. It can be detailed or very general, standardized or non-standardized, according to the needs and specificities of each project.

The risk treatment plan consists of pre-defining actions to be executed when an undesirable event occurs. Usually it is part of the risk management plan, but it can be integrated into other components of the implementation plan, such as, for example, the quality management plan.

The risk management program control is the process of quantifying the implemented measures for risk management which leads to possible corrections during project execution. This includes all the means and techniques of risk management, including procedures, guidelines, organization charts, administrative or technical policies.

3. THE STAGES OF RISK MANAGEMENT

The risk management process is presented as a continuous process, comprising several stages, such as risk identification, analysis, use, monitoring, planning and continuous documentation throughout the process. They are summarized as follows:

- Planning - is the process of drafting and searching for a strategy to identify and track risks, develop risk treatment measures, ongoing risk assessments, and identification of resources needed to detect and mitigate the risks.

- The identification of risk, danger, hazard - is a review process of critical activities for events which pose risks, by providing the necessary costs, and elaborating both programs for mitigating the risks and programs for performance objectives. The risk may not necessarily mean a loss but may occur as an opportunity to carry out some activities or processes in better conditions of time, cost or quality, provided they are identified and used as such.

- The manipulation or risk analysis, is the process of evaluating each risk individually, to determine their likelihood, their consequences and their association with other processes that pose risks, establishing the necessary measures. It is thus determined the probability for event occurence, who and what will be affected by its appearance, which are the effects, etc. This analysis identifies how risks relate to one another and in the end it will result in a list or

database of risks, which can be ranked by their probability of occurrence and the impact corresponding to each type of risk.

- The risk control - is the process of identifying, evaluating, selecting and implementing risk mitigation measures to ensure an acceptable level of risk, closely with the existing constraints in the project;

- Risk monitoring is the process of tracking and evaluating constantly the results of the actions taken for risk assessment, by comparing the results with the limits set out in the project;

- Documentation about risk systems - is the process of registration, storage and reporting of the risk, the effects of the risk treatment measures, the results of risk analyses as well as the communication of the results to the members of the risk management team.

- Continuous improvement - is the process of review and improvement of risk management processes by improving the skills and defining future needs.

- A graph of the risk management process is shown in fig.1 below[1].
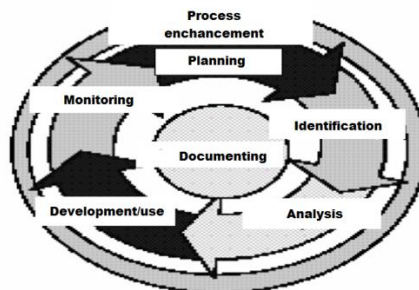
Figure 1. The Risk Management Diagram

4. MODERN METHODS OF RISK MANAGEMENT

Nowadays, risk management approaches have become very complex as there is the possibility of risks occurrence which have unpredictable effects on all activities and their stages at all times. Therefore, there are major concerns for solutions through which to identify potential risks in the various stages of an activity or project solutions to attenuate their potential effects or even to eliminate them completely.

Thus, a number of methods for project risk management are defined and described in the literature, such as: the process mapping, the classification of risks, the risk scoring matrix, the method for determining the risk profile, etc.

4.1. The determination of the risk profile

It is a modern method for assessing the risk profile of a company, enabling transparent and comparable assessment of the possible risks. This method involves making annual

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[1] http://omicron.ch.tuiasi.ro/~mgav/pdf/EMR/Curs_11.pdf

reports on risk management activities, achieving constantly "the assessment and strategic, systematic and structured monitoring of existing risks"1.

This method allows permanently, throughout the project, risk control without deviations from the targets and the established planning indicators. A renowed UK organization (Atomic Energy Authority (AEA) Technology, 2003), which provides risk management solutions, consider that this method is composed of five stages, namely:

1. Identification and definition of risk units;
2. Establishment of degrees and a chart of priorities;
3. Identification and assessment of threats;
4. Classification of risks and identification of controls;
5. Monitoring and action plans for risk control[2].

The identification and definition of risk units is a stage specific to all activities which is tightly connected to the production, finance and human resources departments. It involves identifying all possible events that may pose potential risks to the activities defined in the project The identification of risks does not have to be a static process that takes place only once. Choosing a particular method of identification is achieved by the risk manager, in consultation with a large number of specialists outside the risk management department.

The identification of a risk may be performed in several ways, as follows:

- Lists of sources for potential risks, causes for their appearance, etc.
- Verification of documents which are associated with similar activities
- List of possible risks from the outside
- The specialist consultation, based on the experience that they have in the field.

The identification of a risk is followed by its proper registration. Basically, long before the beginning of the risk identification process it has to be developed and implemented a system for registering them, so that, and for any identified risk, all relevant data could be registered to be used in the analysis of the next period, as a benchmark.

Establishing degrees and a chart of priorities - is the stage which makes use of different techniques, a risk categorization, through which they get varying degrees, depending on the impact (severity) and likelihood (frequency) of their occurrence. The risk classification and grading needs to be simple, accurate and easy. *The matrix for risk scoring* is a tool proposed by the AEA to grade the risk and it establishes the severity of risks (none, minor, moderate, significant and impressive) and the frequence of risks (occasional, reduced, unlikely and unbelievable), as shown in Figure 2.

Severity *Frequency*	*None*	*Minor*	*Moderate*	*Significant*	*Impressive*
Occasional	Medium	Medium	High	High	High
Rare	Low	Medium	Medium	High	High
Improbable	Low	Low	Medium	Medium	High
Not believable	Low	Low	Low	Low	Medium

Figure 2. Matrix for risk scoring in terms of severity and frequency[3]

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[1] Dickson, C.G. (2003). *Risk analysis,* 3rd edition, Witherbys Publishing, New York

[2] Petre Brezeanu, Laura Elly Novac, Metode moderne de identificare a riscurilor în managementul riscului

[3] Petre Brezeanu, Laura Elly Novac, Metode moderne de identificare a riscurilor în managementul riscului

The value of the risk degree is given by the intersection of the severity column with the line corresponding to the risk frequency. The classification of risks by degrees: *high, medium and low* is achieved according to AEA classifications through the color system: *red, yellow and green*.

The prioritization of threats makes possible the distribution of those resources that are limited to significant risks which could deviate the objectives of an organization. This method is considered abstract, and hence in larger companies risks may be ignored or wrong decision may be taken to assess risks, whereas in small companies low priority risks may be ignored.

Identification and evaluation of threats – is a stage which focuses on the risks identified for each activity, the main threats, and hazards that may occur. The assessment is being performed considering both risk characteristics: frequency and severity.

Risk classification and identification of controls – is a stage in which it is achieved the classification, a grouping of risks so as to identify both risks with a high degree of occurence and those with a low degree of occurrence.

Making action plans and monitoring - is a stage focused on finishing to implement control solutions and on getting feedback periodically to identify any new risks.

4.2. The process mapping

The process mapping is a graphical representation of the processes in the form of a diagram; hence the risk manager is trying to improve the activity of the organization by identifying all elements that could adversely affect the project as a whole.

The processes are events which transform the inputs of the organization into outputs that meet the needs of the organization. The inputs of the processes are the elements required to achieve them (human, financial, logistics, technology, knowledge). The outputs of processes are the results of processes (products, services, information).

The process mapping is basically a diagram which shows the concrete activity of the organization and the processes by which it is achieved. Process mapping presents in an order of their necessity, the important elements within each process, the inputs (resources) of processes and the corresponding outputs. The objective of achieving a map is to identify the workflow so that risk management could bring an increase of efficiency, safety and could reduce hazards and costs involved.

It is used, in the process mapping method, the diagram for process definition which describes each process in detail and identifies four important components in the development of any process or activity (Fig 3) as follows:

- *Inputs of the processes* are the elements needed to continue the process, which are processed or consumed during the process, thus leading to its results.

- *Outputs of processes* are those goods or services resulting from the execution process.

- *Restrictions*, either internal (procedures, internal standards or budgets) or external (national legislation or international standards, limited resources) are particularly important as they design and influence the processes.

- *Resources* are needed in the process to achieve its outputs. Resources are different from inputs as they are neither transformed nor consumed during the process.
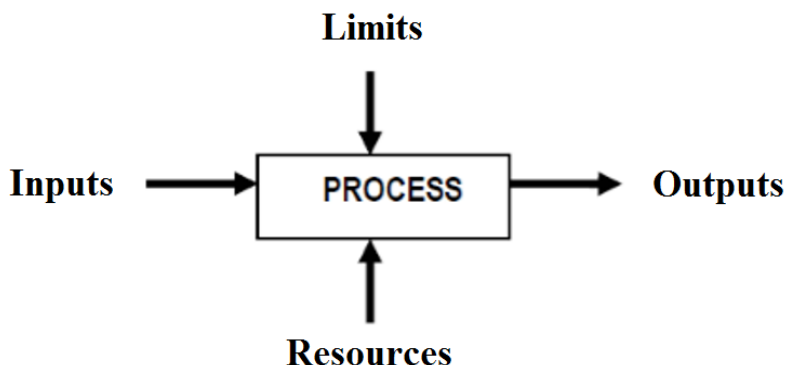

Figure 3. Diagram of the process definition.
Source: Audit Scotland. The Map to Success (2000).

In practice, the detailed maps of processes are the result of a standard methodology entitled the *integration definition for modelling functions*.[1] There are software products for this integration definition for modelling functions, in which the mapping process is a complex process that requires a great deal of effort, money and time.[2]

The process mapping is a method that encourages the „culture of employee motivation" within the organization, urging them to identify and investigate the causes of losses and to find ways to prevent them in the future.[3]

The technique is complex, as it uses numerous charts that causes confusion, the results may become limited or even be a waste of time, effort and resources. Therefore, the method requires an analysis and a rigorous planning of the resources necessary to the project.

4.3. Risk Scoring Matrix

Specialists use the method called risk scoring matrix to identify strategic risks; it is based on the idea that improving an organization's performance can be achieved mainly by quantifying key indicators of performance[4].

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[1] Petre Brezeanu, Laura Elly Novac, Metode moderne de identificare a riscurilor în managementul riscului
[2] Black, K., Life and Health Insurance, 13th edition Upper Saddle River, Prentice Hall, 2000
[3] Institutul Managementului de Risc, Risk Analysis, Editura Witherby, London, 2003, p.34
[4] Petre Brezeanu, Laura Elly Novac, Metode moderne de identificare a riscurilor în managementul riscului

Key indicators of performance indicators are mainly those that imply clients, internal operations and financial management. A variant of this method is the *risk scoring matrix*-FIRM (financial, infrastructure, reputation, medium).

The method focuses on the evolution of risks over time, their impact on the organization and correlation between the risk exposure and the organization's capacity to react to risks. In this way, the risk scoring matrix method demonstrates the complexity and the effects of risks on the entire organization.

The method divides risks into two categories, namely: internal risks (financial, infrastructure) and external risks (reputation and environment).

The financial risks are risks which impact the financial resources and the balance sheet, specifically the available funds available and the controlled incomes[1].

These risks can be quantified easily, because they quantify the losses or the missed opportunities due to mismanagement. People involved in financial risk assessment are the CFO, risk manager, accountants and internal auditors who are aware of the internal financial control systems.

In this case, control systems include authorization for acquisitions and internal financial control procedures.

The infrastructure risks are usually called "settled risks" and those risks are covered by insurance and similar mechanisms[2].

As examples, we include the equipment, buildings, employees and other parties affected by the activities of the organization. The risks in this category may influence the effectiveness of the organization through routineless events. Therefore, this type of risk can be measured relatively easily, being generally of a domestic nature. The staff involved in assessing these infrastructure risks consists of the production manager, the risk manager and the safety manager. The mechanisms of control involve procedures, maintenance and insurance mechanisms.

Reputation risks relate to the organization's image to customers, suppliers, shareholders and society. These risks, however, are varied and difficult to quantify. As an example, we include the company management, ethical issues, legal issues, and their outcome may be a negative image that damages the company's reputation[3].

Therefore, the risks in this class may affect the organization's relationship with the customers and suppliers of the organization, the organization's image and its brand. The insurance procedures and procedures for crisis management and business continuity represent accepted the acceptable control mechanisms.

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[1] Ciurel, V., Asigurări şi reasigurări: abordări teoretice şi practici internaţionale, Editura All Beck, Bucuresti, 2000

[2] Badea D.; Ionescu L., Asigurări de persoane şi reflectarea lor în contabilitate, Editura Economică, Bucureşti, 2001

[3] Tănăsescu, P.; Dobrin, M., Teoria şi practica asigurărilor, Editura Economică, Bucureşti, 2002

The medium risks are risks related to the organization's position on the market, the commercial risks which affect customers, the organization's ability to maintain contracts with partners, the market profile and the organizational performance[1].

Quantifying medium risks can be achieved by indicators such as: low income, turnover and profit. Control methods include planning and carrying out proper risk assessment strategies and opportunities for new projects.

If we consider all such risks, we can determine *the risk capacity in an organization*, and, on that basis, the organization will be able to accept the four sections of the risk scoring matrix (FIRM).

The formula for calculating the risk capacity of an organization is:

Risk capacity = acceptance of control + tolerance for hazards + appetite for opportunities

4.4. Decision trees

Decision trees are graphical instruments with the help of which one can describe the interactions between decisions and the random events as they are perceived by decision makers.

The *tree branches* represent decisions and are represented by squares, whereas the *random results* or *uncertain results* are represented by circles.

The following figure shows an example of a decision tree[2].
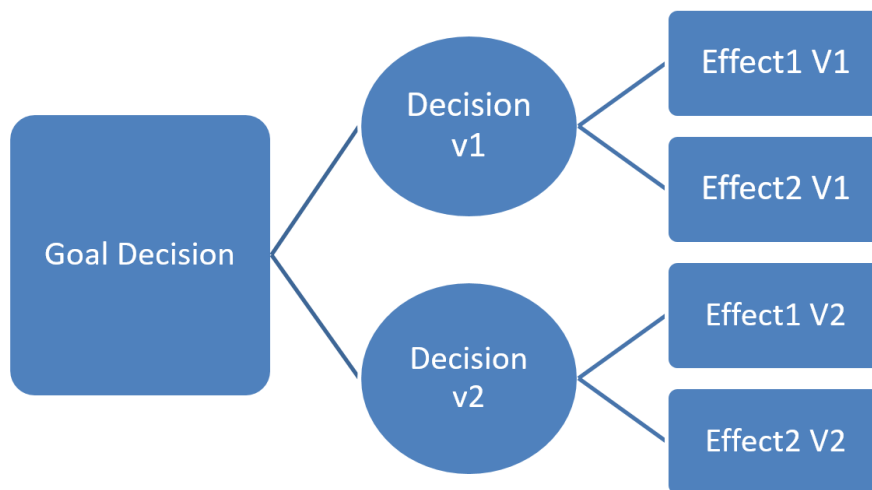
Figure 4. Decision Tree. Ecample

In a decision tree, it can be calculated the expected value indicator (EV), both for one effect, and for a decision. Thus:

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[1] Tănăsescu, P.; Dobrin, M., *Teoria şi practica asigurărilor,* Editura Economică, Bucureşti, 2002
[2] http://ebooks.unibuc.ro/StiinteADM/cornescu/cap5.htm

The expected value of an effect = the effect x probability of effect appearance

and

The expected value of a decision = the sum of expected values of all effects resulting from that decision.

For complex projects, the process of building a decision tree is often very complicated. The decision trees contain decision nodes, represented by squares, in which the decision makers have to choose one of the possible options. The circles represent points of opportunity that will produce a random event.

Making a decision tree graph requires, as a rule, three steps:

- Building a logical tree, from left to right, which will have to identify and represent every decision point and every opportunity point;

- Establishing probabilities of states occurrences on each branch, achieving a probability tree;

- Adding the conditioned results, thereby achieving the decision tree.

Having calculated these values, we can say a project that has a high expected value becomes a program or an "aggressive" project and the one which has a lower expected value is "conservative".

If decision makers have to choose one of the mentioned programs which comparatively have far different expected values, they can opt for the aggressive one to the conservative one or the vice versa, depending on the project peculiarities in terms of scope, specificity, defined constraints, terms and costs of implementation.

This method can be used to choose at the beginning one option or other for project completion, if it is a complex one, in which the uncertainties, the hazardous events can generally occur at any moment, and the decisions that can be taken are very varied, with different effects on the development of the project. Thus, one can choose at the beginning the most convenient option for the implementation of a complex project, in which the likelihood of hazards is minimized.

5. THE REACTION TO RISK

The reaction to risk is defined as the activity that establishes possible steps to exploit the opportunities and respond to threats which can appear throughout the project. The reaction is basically the concrete risk-stage action within risk management and it focuses on taking proper measures to eliminate, mitigate and distribute the arisen risks.

The reaction can occur for various threats in several ways, such as:

1. *Avoiding the risk*, which involves removing a possible threat by eliminating the cause that can determine it.

2. *Reducing the negative effects of risk*, which involves reducing the estimated cost of a potential risk, by reducing the probability of its occurrence.

3. *Acceptance*, which means accepting the consequences of the risk, with all the costs involved.

As a result, during the course of a project, one can be in one of the following situations:

1. Threats which are taken into account, specifically there will be reactions to these threats.

2. Threats are ignored, specifically their effects will be accepted.

The available tools and techniques to get a reaction to these threats could be:

1. The acquisitions, as appropriate actions to certain types of risk. They can, however, often determine the shift of a risk into a new risk.

2. Planning of possible future actions, which sets out the steps to be followed where there is a signal of possible threat.

3. Alternative strategies, defining methods or techniques to prevent or avoid risk signals.

4. Insurance which represents a special way of facing certain categories of risk.

The direct results of the reaction to risks may include the following:

1. The Risk Management Plan, which defines the methods to be used in risk management project. It encompasses the results of the processes of identification and quantification of risk, mentions the people who will deal with various types of risk, how to implement future action plans and how to allocate reserves as necessary resources.

2. The inputs for other processes

3. The possible future action plans

4. The reserves which are included in the project plan for attenuating cost-related risks or project schedule-related risks.

5. The agreements concluded for insurance, service and other aspects in order to avoid or to minimize the potential threats.

The control of reaction to risk is a mandatory activity within the project management and tracks all changes that imply possible risks during project. This means that if changes occur, the activities of identification, risk quantification and reaction to risk must be repeated. This cycle repeats throughout the execution of a project until its completion.

6. CONCLUSIONS

It is obvious that the considerable complexity and diversity of projects, their spread in more types of organizations and activities may trigger hazards, unpredictability, random events of the internal and external environment during the development of projects, effecting their execution. More and more organizations whose expertise span various fields, are currently working on projects funded by various sources; they have clear objectives, a well-defined budget, and financial, human, technical, communication

resources, limited periods of time which are well-defined and thoroughly monitored during the project implementation. Any unforeseen event will directly influence the results of project implementation, such as schedule, costs, quality constraints of achieved products, etc.

It is, therefore, highly important for risk management, as part of project management which identifies and deals with risks is an ongoing activity designed to note errors and correct them on time in order to minimize their effects as much as possible.

It is important that the identified risks be monitored and that new risks be identified in each moment.

Any identified risk has to be properly registered. Basically, before starting the identification of risk it has to be developed and implemented a registration system for the identified risks. All important data about the risks that have been identified will be registered in a database to be later used in the risk analysis for the next period.

In this way, the reaction to risk will not be random, but it will be based on the successful actions of previous periods of time or similar projects.

We identify, based on our experience in projects, a series of events, actions or processes that may be elements of risk in a project, including:

- A long period for implementing a project may attract numerous elements of risk

- Big acquisitions planned in the last stage of the project

- Key persons in the project lack experience in the field

- Many important activities take place in parallel

- Lack of progress reports during project execution; they must be available and be required at intervals that hinder the appearance of hazards, without having the possibility of intervention and correction thereof.

Therefore, the constant actions of the project management or an organization to identify and deal with the risks, are carried throughout the execution of ongoing projects and they require the use of modern IT tools for registering all risks. Thus, effective opportunities are possible such as: searching the database for registered risks, looking for new methods and developing solutions to monitor and profile them for a better and accurate reaction to any unforeseen event, achieving afterwards, based on this data, mathematical models, econometric or statistical analysis of the emerging risks profile, identifying ways to mitigate their effects and offering examples of best practices for facing different types of risks. All these measures can create the framework for an effective risk management in projects in order to implement and complete complex projects successfully.

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PREDICTING THE EVOLUTION OF BET INDEX, USING AN ARIMA MODEL

Florin Dan Pieleanu [1*]

ABSTRACT

Trying to predict the future price of certain stocks, securities or indexes is quite a common goal, being motivated by different reasons and being based on various techniques. The present article has the same purpose, employing an ARIMA model, due to its proven effectiveness and success. Used data is comprised of monthly values for the mentioned index, on a four-year period, from 2010 to 2014, which lead to 60 recordings. The main steps for the analysis are identifying the model, estimating the parameters and the prediction itself.

After each one of them is carefully conducted, a comparison is made: the predicted values for BET versus the real values for BET, in order to see if any resemblances exists, or if the differences are significant. Those resemblances or differences are explained, while the conclusion will highlight ARIMA's capacity or incapacity of forecasting in an accurate way, in the presented context.

KEYWORDS: *ARIMA, BET, prediction, moving average, autoregressive*

I. INTRODUCTION

Trying to predict the price of securities or financial indexes was always a tough mission. The reasons for that are multiple, and they show the complex nature of the capital market. But the continuous wish of the investors to get easy profits led to the development of new forecasting models. Among those, several proved to be more efficient, like the neural networks, who succeeded in the process of "learning" data structures. Also, ARMA and ARIMA models were remarked, especially for shorter periods of time.

The present article shows the building of an ARIMA model, then its utility for short term predictions, which may help the investors in their decisions in the capital market. The rest of the article is organized as such: section II reminds the main characteristics of ARIMA models, section III highlights the used methodology, and section IV discusses the results and also draws conclusions.

II. THE ARIMA MODELS AND LITERATURE REVIEW

ARIMA (autoregressive integrated moving average model) was introduced by Box and Jenkins in the '70, and represents a generalization of ARMA (autoregressive moving average model). Its main purpose is either to better comprehend the used data, either to develop predictions of the variables for future periods of time. ARIMA knows success even when the series are not stationary, because applying a difference of some degree leads to reducing or eliminating non-stationarity [1-4, 6, 11].

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The model can be written ARIMA (p,d,q), where p,d and q parameters mean: p = the order of the AR autoregressive model, d = the difference degree and q = the order of the MA moving average model. ARIMA constantly proved its capacity to generate short term predictions, topping many other models.

The future value of a variable is, according to ARIMA, a linear combination of the past values and residual terms, as such [13]:

$$Y_t = \Phi_0 + \Phi_1 * Y_{t-1} + \Phi_2 * Y_{t-2} + \Phi_3 * Y_{t-3} + \ldots\ldots + \Phi_p * Y_{t-p} + \xi_t - \theta_1 * \xi_{t-1} - \theta_2 * \xi_{t-2} - \theta_3 * \xi_{t-3} - \ldots\ldots - \theta_q * \xi_{t-q}$$

where:

Y_t is the time series for the studied variable
Φ_i, θ_j are the coefficients' series
ξ_t is the residual terms' series

The steps for building the ARIMA model are: identifying the model, estimating the parameters and the prediction itself.

The model was highly used in studies along time, and below can be found only a brief list of them:

- [5] used ARIMA on the Korean market

- [7] considered ARIMA for the Indian market

- [8] used ARIMA for water consumption forecast, finding it fit for such a purpose

- [10] analyzed the market in Malaysia using ARIMA

- [13] compared ARIMA with other models in the Indonesian market

- [14] successfully used ARIMA for ozone consumption forecast

III. METHODOLOGY

Identifying the model

In this study, the used data represents monthly values for BET index (one of the indexes used on Bucharest Stock Exchange), from January 2010 to December 2014. This leads to a number of 60 recordings. Figure 1 shows the graph of the series, in order to check for stationarity:
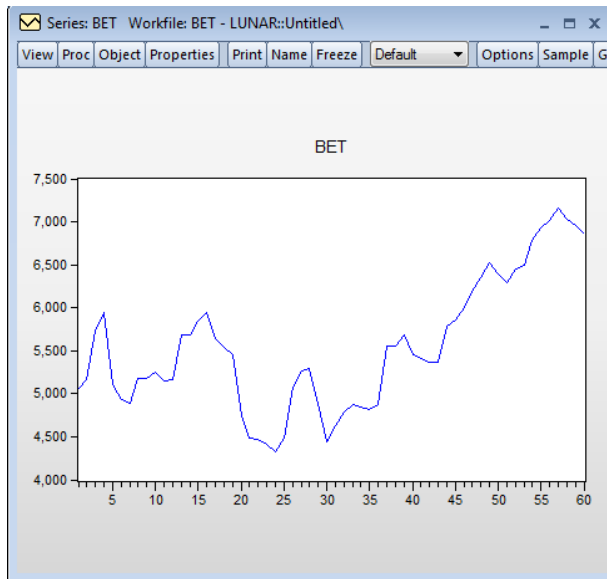
Figure 1. Graph of the original time series

It can be observed that the series follows a random walk pattern. The correlogram confirms this:
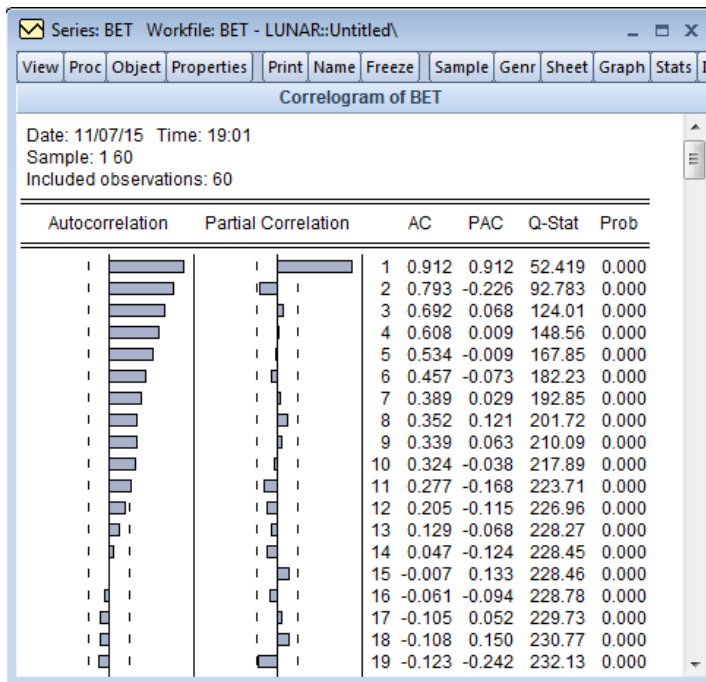

Figure 2. Correlogram of the original time series
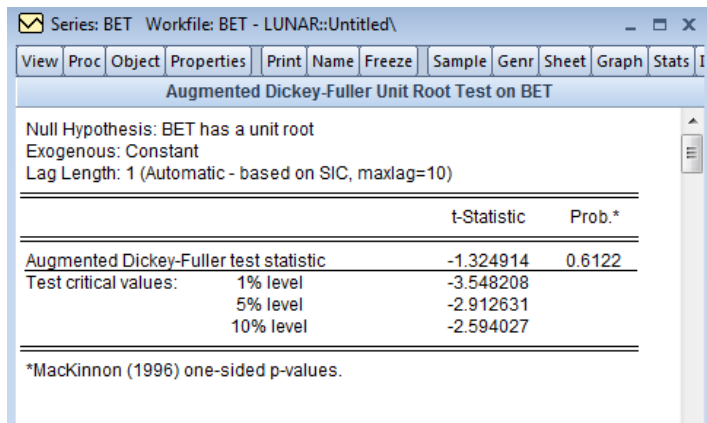
Also, the Dickey-Fuller tests shows:

Figure 3. Dickey-Fuller test for the original time series

All these prove that the original series is not stationary. In order to make it so, using first difference may help. The graph becomes now:
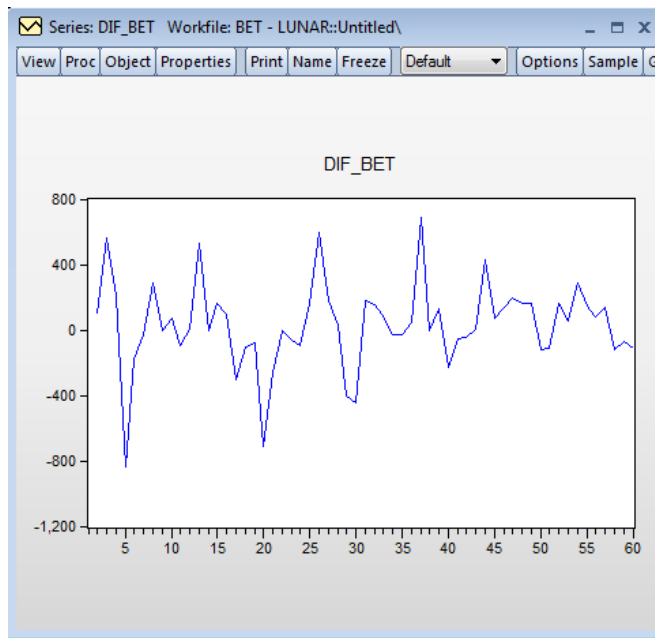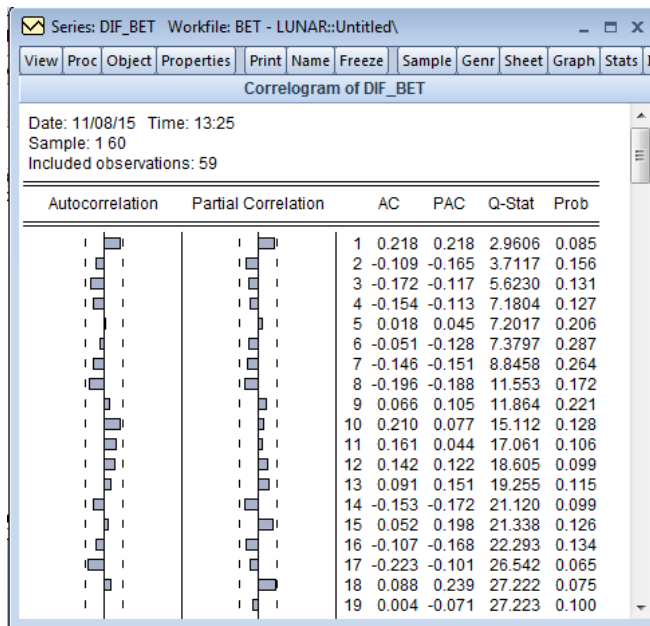
Figure 4. Graph of the time series after applying first difference

,and the correlogram:

Figure 5. Correlogram of the time series after applying first difference

,with the Dickey-Fuller test:
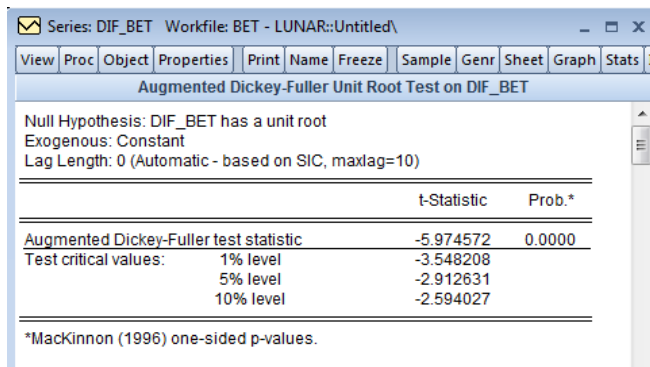
Figure 6. Dickey-Fuller test for the time series after applying first difference

The series is now first-order integrated, because the first difference made it stationary. So the model will be ARIMA (p,1,q), with the next step being to determine the p and q orders.

Estimating parameters

Considering that the autocorrelation (AC) and partial autocorrelation (PAC) from the correlogram are slowly, not sharply, decaying towards zero, probably an ARMA model will describe best the evolution of the studied variable. If AC would sharply fall, and PAC

would slowly fall, then a moving average (MA) model would fit best. On the other hand, if AC would slowly fall, and PAC would sharply fall, then an autoregressive (AR) model would be the best. But, for certainty reasons, several AR and MA models will be tested, in order to establish which one serves entirely the goal. Firstly, an AR(1) model will be approached, with the following results:
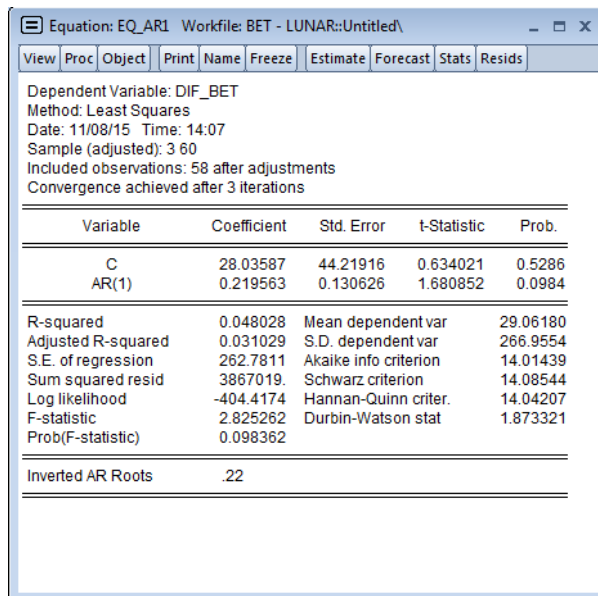

Figure 7. Results for AR(1) model

,not being satisfactory, due to lack of significance. An AR(2) is being obvious that this one isn't optimal either, because its parameters are not statistically significant.

The next array of models: AR(3), MA(1), MA(2), MA(3), ARMA(1,1), ARMA (2,1), ARMA (1,2), ARMA (2,2), ARMA (2,3), ARMA (3,2), ARMA (3,3) will be also employed. The criteria selection are: relatively small Akaike, Schwarz and S.E (standard error) values, relatively high adjusted R2 value. The table below summarizes the obtained results:

Table 1. Different ARMA models and their values for chose criteria

Model	Akaike	Schwarz	Statistic significance	Adjusted R^2	S.E
AR(1)	14,014	14,085	no	0,031	262,781
AR(2)	13,964	14,072	no	0,040	254,138
AR(3)	14,002	14,147	no	0,028	256,752
MA(1)	13,984	14,054	yes	0,044	258,892
MA(2)	14,012	14,117	no	0,032	260,447
MA(3)	14,027	14,168	no	0,032	260,433
ARMA(1,1)	14,019	14,126	yes	0,041	261,302

ARMA(2,1)	13,996	14,139	no	0,025	256,088
ARMA(1,2)	13,994	14,136	yes	0,080	255,919
ARMA(2,2)	13,846	14,025	partially	0,174	235,686
ARMA (2,3)	13,877	14,092	partially	0,161	237,535
ARMA (3,2)	13,885	14,102	partially	0,163	238,212
ARMA (3,3)	13,849	14,102	partially	0,205	232,167

Only MA(1), ARMA (1,1) and ARMA (1,2) have statistically significant parameters, so the choice will be made between them. For this purpose, analyzing each of them is helpful:

ARMA (1,1)

To determine the adequacy of this model, a comparison will be made: theoretical versus empirical values for AC and PAC. The situation looks like this:
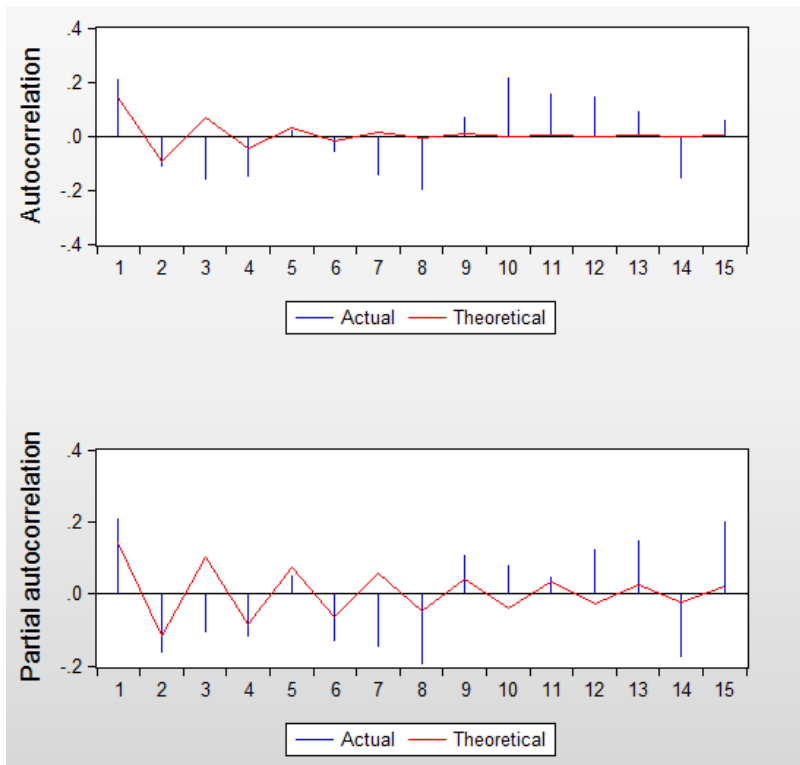
Figure 9. Actual vs. theoretical ACF and PACF for ARMA(1,1)

Also, the correlogram of the residuals, which care establish if they are independent, shows:
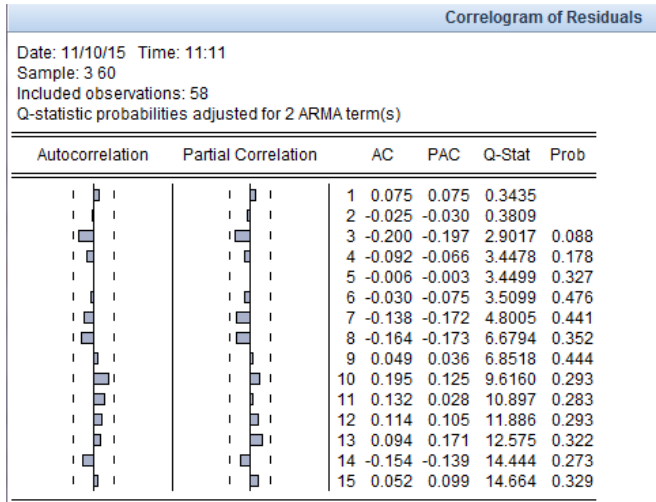
Figure 10. Correlogram of residuals for ARMA(1,1)

We can surely say that the residuals represent white noise. So, the ARMA(1,1) model can be suitable for our goal.

ARMA (1,2)

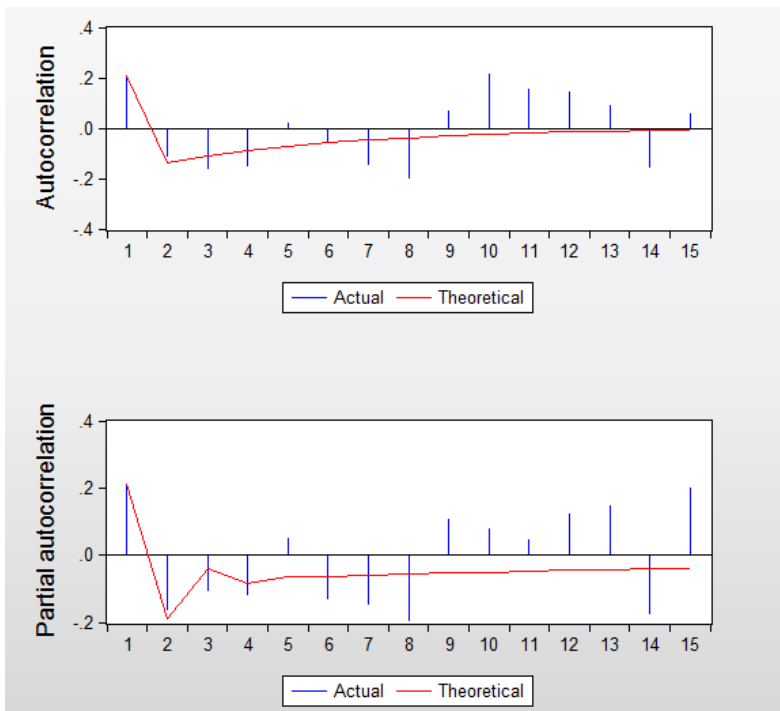The same steps will be followed. The AC and PAC graph shows:

Figure 11. Actual vs. theoretical ACF and PACF for ARMA(1,2)

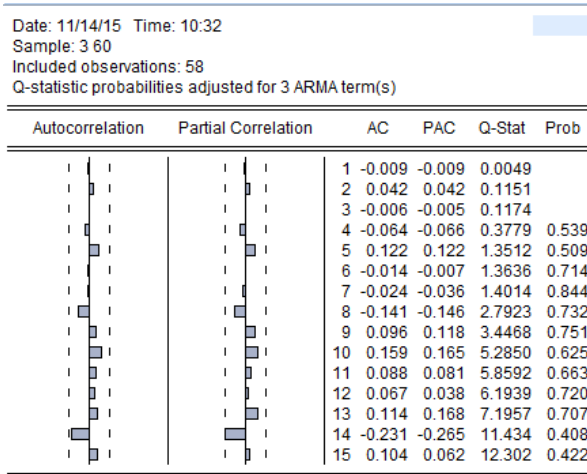,not being as exact as ARMA(1,1). Correlogram of the residuals:

```
Date: 11/14/15  Time: 10:32
Sample: 3 60
Included observations: 58
Q-statistic probabilities adjusted for 3 ARMA term(s)

   Autocorrelation    Partial Correlation      AC     PAC    Q-Stat   Prob

                                          1  -0.009  -0.009  0.0049
                                          2   0.042   0.042  0.1151
                                          3  -0.006  -0.005  0.1174
                                          4  -0.064  -0.066  0.3779  0.539
                                          5   0.122   0.122  1.3512  0.509
                                          6  -0.014  -0.007  1.3636  0.714
                                          7  -0.024  -0.036  1.4014  0.844
                                          8  -0.141  -0.146  2.7923  0.732
                                          9   0.096   0.118  3.4468  0.751
                                         10   0.159   0.165  5.2850  0.625
                                         11   0.088   0.081  5.8592  0.663
                                         12   0.067   0.038  6.1939  0.720
                                         13   0.114   0.168  7.1957  0.707
                                         14  -0.231  -0.265  11.434  0.408
                                         15   0.104   0.062  12.302  0.422
```

Figure 12. Correlogram of residuals for ARMA(1,2)

Also the residual terms are white noise.

MA (1)

For this third model, we obtain:
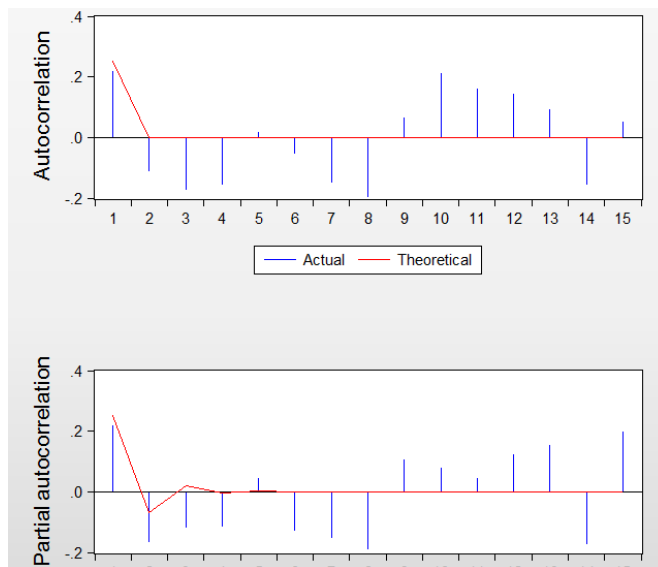
Figure 13. Actual vs. theoretical ACF and PACF for MA(1)

,and:

```
Date: 11/14/15   Time: 10:50
Sample: 2 60
Included observations: 59
Q-statistic probabilities adjusted for 1 ARMA term(s)
```

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.015	-0.015	0.0144	
		2	-0.074	-0.074	0.3609	0.548
		3	-0.116	-0.119	1.2304	0.541
		4	-0.141	-0.154	2.5310	0.470
		5	0.064	0.038	2.8077	0.591
		6	-0.046	-0.083	2.9499	0.708
		7	-0.087	-0.124	3.4748	0.747
		8	-0.190	-0.235	6.0234	0.537
		9	0.070	0.029	6.3724	0.606
		10	0.167	0.094	8.4315	0.491
		11	0.098	0.046	9.1542	0.518
		12	0.084	0.070	9.6947	0.558
		13	0.122	0.227	10.867	0.540
		14	-0.215	-0.179	14.558	0.336
		15	0.123	0.167	15.800	0.326

Figure 14. Correlogram of residuals for MA(1)

The moving average proves itself to be fit, because it is adequate, and the residuals are shown to represent white noise. The selection is to be made between thee MA(1) and ARMA(1,1) models, both being more appropriate than ARMA(1,2). Additional, MA(1) showed smaller values for Akaike, Schwartz and standard error (S.E.) criteria, and a higher value for adjusted R2 criteria. As a consequence, it is chosen as the best model in the presented conditions.

Predicting the variable

Not forgetting that our model is also first degree differentiated, its form to be used for predicting the future values of BET index is an ARIMA(0,1,1) one, with the following forecasting equation:

$$\Delta BET_t = \xi_t - \theta_1 * \xi_{t-1}$$

IV. RESULTS AND CONCLUSIONS

The below table presents both the estimated and the real BET values, for the first 9 months of year 2015:

Table 2. Real and predicted values for BET index, first 9 months of 2015

Period	RealBETvalues	Predicted BET values
January 2015	7003, 421	6.376,55
February 2015	7176, 002	6.409,89
March 2015	7060,128	6.576,49
April 2015	7338,491	6.738,57
May2015	6851,280	6.910,46
June 2015	7343,580	7.032,96
July2015	7437,072	7.066,68
August 2015	7357,447	7.050,14
September 2015	7104,513	6.949,77

,and the common plot of the two series (real and estimated) looks like this:

	1	2	3	4	5	6	7	8	9
Series1	7104,51	7357,45	7437,07	7343,58	6.851,28	7338,49	7060,13	7176	7003,42
Series2	6.376,55	6.409,89	6.576,49	6.738,57	6.910,46	7.032,96	7.066,68	7.050,14	6.949,77
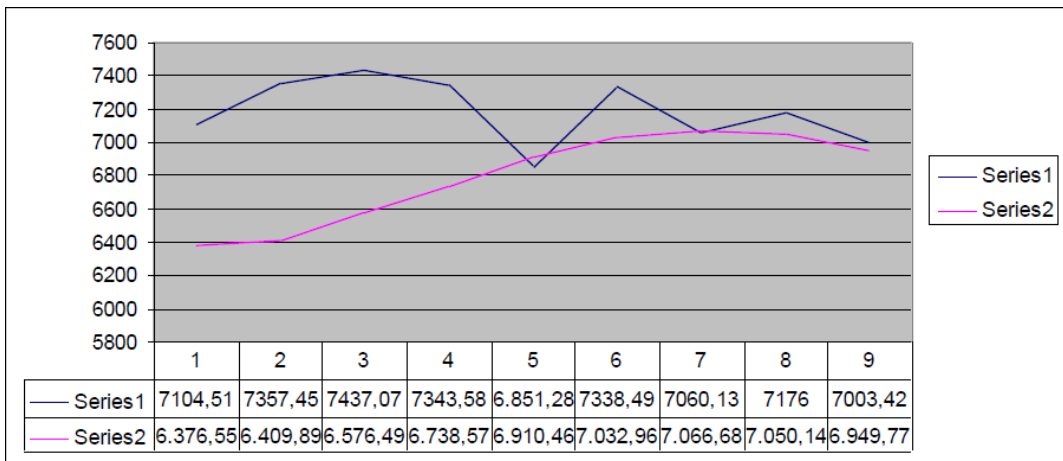
Figure 15. Plot of real and predicted values for BET index, first 9 months of 2015

It can be seen that the prediction's performance is satisfactory, so we can say that the used model behaves acceptable. This result proves one more time the good potential of ARMA/ARIMA models to forecast the evolution of prices, on short and medium term. So, this category of models can successfully compete against other estimation techniques [9, 12, 13].

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http://people.duke.edu/~rnau/411arim.htm

TEACHING SOFTWARE PROJECT MANAGEMENT:
THE MIXED COLLABORATIVE-COMPETITIVE APPROACH

Adrian Firculescu [1]*

ABSTRACT

Education has been the subject of change throughout history. There is a consensus among scientists that collaborative learning has a positive effect on student achievement, while competitive learning depends on a student's self-reliance in order to achieve high learning results. This paper aims to propose a new learning method for teaching Software Project Management in a university-based environment that combines the competitive and collaborative approaches into a mixed approach, and creates better academic-oriented conditions for students to improve their team-working skills in a computer software education field.

KEYWORDS: *software project management, educational models, teaching strategies, collaborative learning, cooperative learning, competition-based learning, mixed collaborative-competition learning, independent learning, anarchy learning.*

INTRODUCTION

Among the different oriented approaches, the following can be distinguished as efficient learning processes: collaborative, competitive, anarchic, independent and mixed.

This type of learning tries to combine the collaborative effort with the advantages of the competitive approach. On the one hand, collaborative management assumes that students have the same goal and sometimes rely on the same outcomes. This is beneficial for learning how to work in a team. On the other hand, the competitive management has different points of view. Each participant works for their own success and for the other`s failure. It also focuses on working against each other and learning independently. This type of learning can be beneficial for some of the students, meaning that it can inspire some of them to be more interested on a certain subject.

The purpose of this document is to present a mixed collaborative-competitive approach that helps students learn and acquire more information about a certain field.

PREVIOUS WORK

Throughout time, there have been a series of case studies regarding the mixed collaborative-competitive approach.

For example, Johnson & Johnson recognized the necessity to integrate these two types of learning, stating that although these two are very different, they can provide benefits for students by combining them. [3]

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Dyson and Grineski [4] highlighted the positive impact on student learning that cooperation can have when employed adequately in a competitive environment, since collaboration emphasizes each person's contributions toward collective goals.

Moreover, Wyne [5] emphasized the necessity of synthesizing these two types of learning (competitive and collaborative). He stated that combining both motivational competition and open collaboration can be done by using inter-group competition between teams whose members collaborate directly.

PROPOSED APPROACH

Throughout our society, competitive and collaborative approaches are evident, especially in the professional area, where there have been a lot of changes regarding teams and working methods.

Both of them have certain advantages and disadvantages and various benefits have been observed regarding either of these two.

For example, they improve the way of thinking by comparing ideas. They encourage innovation regarding the students` participation and learning/teaching techniques. Moreover, they proved to have a higher level of achievement than other learning methods.

Regarding the collaborative approach, there are a few advantages like having the opportunity to learn how to work together and how to communicate as part of a team. Also, students learn to assist each other and they acknowledge the fact that goals in life can be achieved by cooperating. [1] Furthermore, this can be a new enjoyable overview upon school and learning. Of course there are disadvantages as well, like the fact that there is a possibility of uneven engagement in a team.

When it comes to competitive approach, students are encouraged to learn and work for their own success and outcomes. The fact that every person has to work for themselves motivates them to dedicate to their work and by default their performance goals increase. Competition can be seen as "a social process that occurs when rewards are given to people based on how their performances compare to the performances of others doing the same task or participating in the same event".

In this type of approach, the teams compete for positive individual outcomes as well as the team`s results (Wyne) [5]. Throughout time, it was proved that combining cooperation and competition helps motivating students and improve their performances.

Document Image Binarization Contest (DIBCo) is an international contest aimed at creating benchmark procedures representative to the challenges of the binarization process. It is one of the prestigious meetings in the field of document image binarization. The main objective is to record state-of-the-art image binarization advancements by using fixed evaluation procedures [6].

During the Software Project Management course from the POLITEHNICA University of Bucharest, there has been a contest regarding the mixed approach that had as purpose the development of an "Image Binarization System" (IBS). [2]
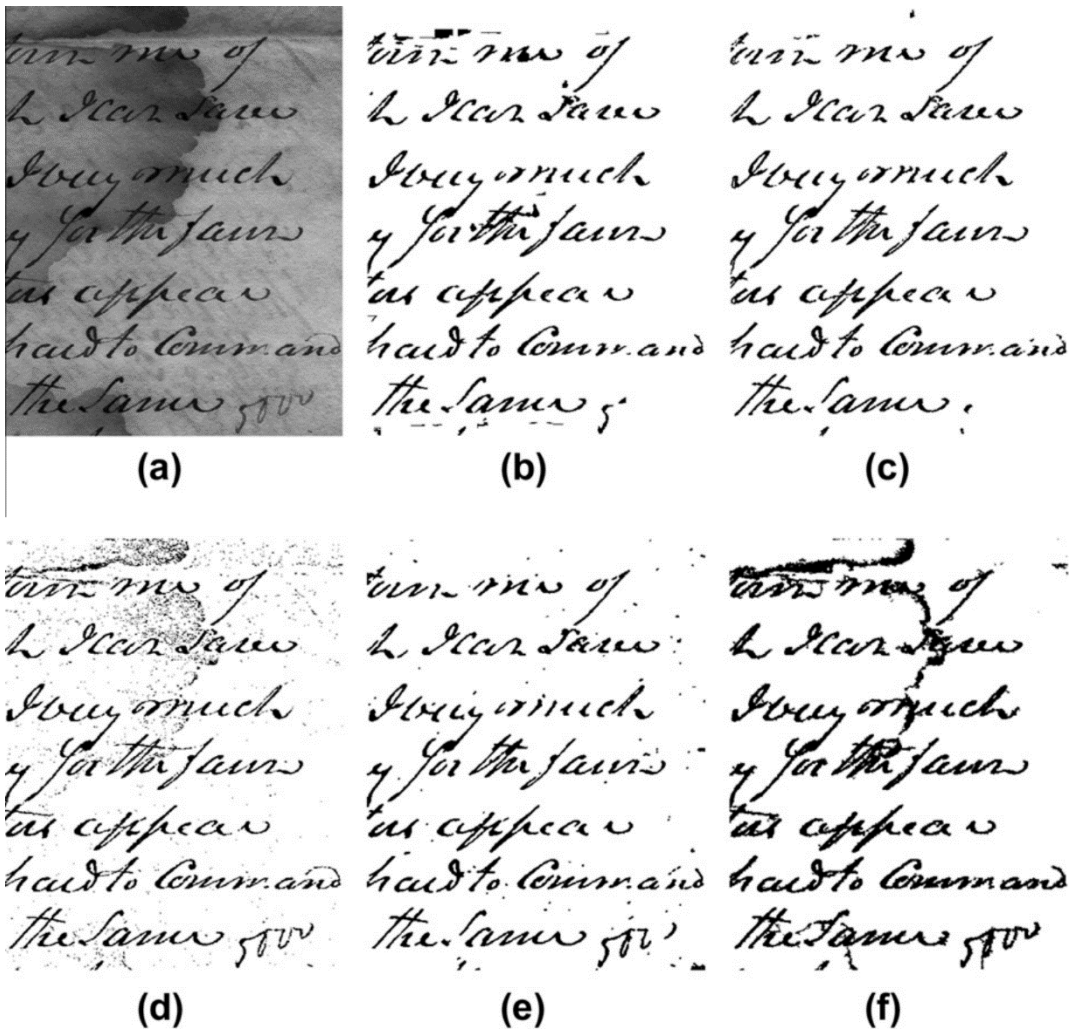
Figure 1. Document images: (a) Representative image from DIBCO-2011 dataset; corresponding binarization result produced by the method (b) Messaoud et al. (2011); (c) Su et al. (2010); (d) Ntirogiannis et al. (2009); (e) Howe (2011); (f) Gatos et al. (2008). Image taken from [7]

The IBS can be used in the process of image document analysis, by doing operations on a simplified black and white version of the original image, which offers a clear separation between the writing and the background.

The IBS project consisted in two components:

- "Binarization Algorithm Module" (BAM) – an executable which will receive an input continuous-tone image and will produce an output binary image;

- "Voting Binarization Algorithm Module" (VBAM) – using more BAMs a "smart-voting" technology will be used to blend the independent results into a binary image;

Students from each laboratory were split into four teams, each consisting of three members. The work was divided as it follows:

- Three teams were responsible for three BAMs;

- The fourth team was responsible for VBAM and project management activities regarding teams` synchronization.

- Each team had to cover 3 roles: research, development and testing and the team members were encouraged to switch their roles every now and then to assure equity.

In a collaborative-competitive approach, the organizer should divide the class members randomly into groups. This should be done to ensure heterogeneity and homogeneity in every team. This aspect is very important because in a professional environment, there is no possibility for one to choose the team in which one will work on.

The BAMs will input a continuous tone image and will output a binarized image. Each team has the liberty to implement a binarization method of their own choosing, either a fixed or adaptive local thresholding method or using a global threshold method [8].

The VBAM will input a numbers of BAMS (Fig. 2) and execute a "smart-voting" algorithm on all the received inputs. This algorithm implements a weighed-decision mechanism to decide each pixel's binarized state according to how the majority of inputs have called it.
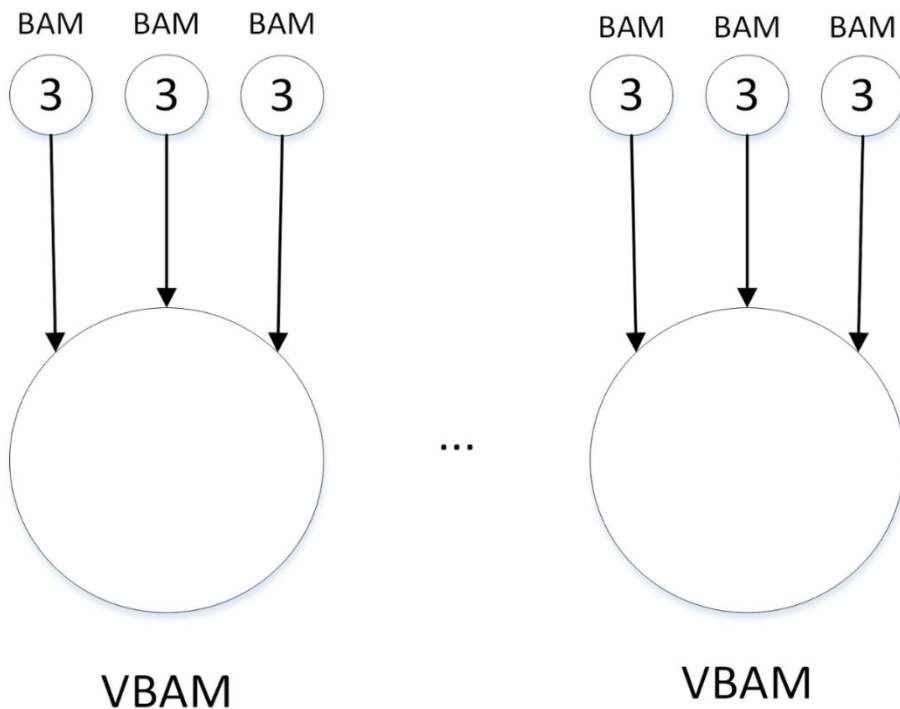
Figure 2. The BAM-VBAM relation in the "smart-voting" process

The final evaluation of the project was blended, regarding multiple aspects:

- All subgroups were set to compete against each other using the VBAMs results;

- All BAMs from all the subgroups has to compete against one another.

- All VBAMs from all the subgroups has to compete;

- The selected BAMs and VBAMs would be tuned to work together.

The rating procedure will involve tests similar to those used in the DIBCO evaluation process [9].

The quality of the OCR output will be ranked using the Tesseract OCR engine, a free open-source optical character recognition software, considered one of the most accurate engines currently available [10-11].

CONCLUSIONS

A benefit for using a competitive-collaborative approach is that the failure of a team in the final functionality does not necessarily mean that the entire project would fail. Also, it is easier to synchronize the teams, given the fact that there was a team that was responsible with the management part.

Moreover, using this type of learning, there is a balance between teamwork and individual activity among the team members.

It is safe to say that the competitive-collaborative approach provides a better environment and student interaction and development for project management.

Although students may initially be reticent regarding this type of approach because they don`t like working in a team or because they would like to choose their own group, this mixed management helps them prepare for the professional part of their life. This is why it is very important for them to understand the implications and the advantages of the collaborative learning on the one hand, and competitive learning on the other.

They need to keep in mind that when working in a company, they won`t be able to choose their team mates and they will have to adapt to the given circumstances.

To sum up, these two types of learning are at first very different from one another, and they present various aspects in the teaching/learning technique, but blending them chooses the best from them.

This is why the mixed approach encourages an individual to explore and to look further into a certain subject in order to succeed, but also it teaches him/her to work with others, even though they don`t know one another.

FUTURE WORK

Considering the importance of the mixed approach in the professional life, it would be a very good idea for teachers to encourage their students to interact with others by working together on some projects, but also to inspire them to evolve individually and for their own good.

More details about alternate educational approaches in teaching Software Project Management can be found in [8, 12-13].

ACKNOWLEDGEMENTS

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SECURITY MEASURES FOR OPEN SOURCE WEBSITE PLATFORMS

*Gabriel Eugen GARAIS[1]**

ABSTRACT:

Open Source Website Projects are widely spread among web developers and web users. The ease of installing and handling Open Source Web Site Platforms is known to be a handy solution but also a risky one. The use of such platforms is under heavy discussion because of the transparency that not only a normal user sees but also a hacker.

KEYWORDS: Open Source Websites, Open Source Projects, Security

INTRODUCTION

Open Source Website Projects that are free for download are a common use for unexperienced users but also for professional web developers. These projects are created by web developers and programmers that gather in form of communities. A project has a certain standard structure that is represented through the database design rules and source code rules. The main standard structure of rules is identified as the core. By definition such a project can be obtained for free from the main community website page. On the main community website can be found installation instructions but also important updates that are crucial for maintaining the integrity of the installed website platform. Updates have different justifications depending what concern it is addressed to. There can be updates as patches for solving simple bugs in the program but also security issues that can risk the vulnerability of the entire platform if left unsolved. This article will refer as a security case study to the Open Source CMS Platform called WordPress as this platform is one of the most used free platforms.

SECURITY THREAT SOURCES AND REASONS

The security issue is a very important part of an Open Source Website platform. The identified hackers, for such platforms, are in most of the cases automated remotely scheduled programs that already know the entire structure of the core platform and search for *open doors* to hack the system. Each issue will be addressed in the rest of this article.

Most common identified threat is ***brute forcing the login forms*** so that the hacker gains access to the administration part of the platform. The hacking program will try to identify the administrator username and password by testing a list of commonly used usernames and passwords. The main security risk for this kind of attack comes from the transparent and available for download standard core structure which permits the hacking code to know all vulnerabilities. Unfortunately the commonly most used username for backend administration is admin which also makes the most used username for brute force attacks. The chart presented in figure 1 [1] shows the daily massive brute force attacks during April 2016 on Websites using WordPress. The observations were recorded by the company that developed one of the security plugin for WordPress called SUCURI.

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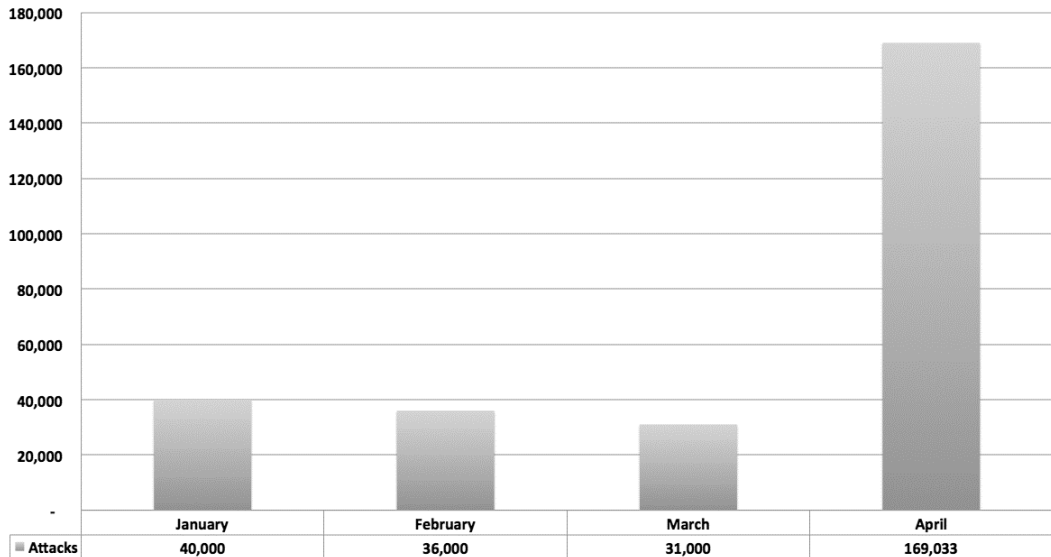
Figure 1 – Daily average number of Brute force attacks on WordPress [1]

The chart in figure 2 [2] presents the number of attacks by usernames during the time span between January and April 2016.
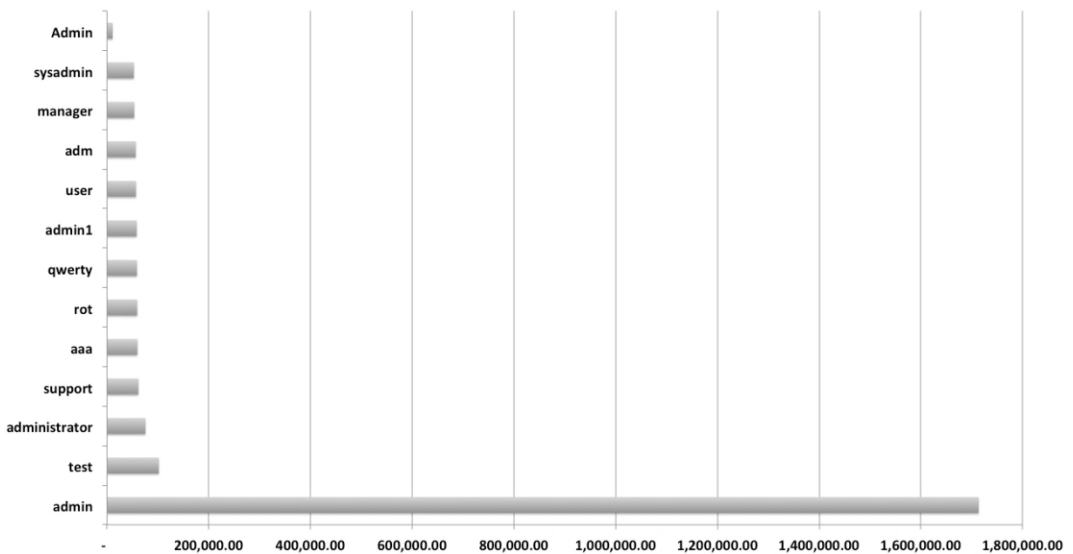

Figure 2 – Username attack distribution [2]

Each open source community project comes with the possibility of adding additional features by installing plugins, modules and themes. Each of these additional features comes with additional source program codding but also with database design adjustments. By adding modifications to the standard core community platform the risk of security vulnerability increases. The risk can get much higher when adding new features from

websites that are not directly owned by the community programmers and designers. Each new feature must be tested by the community programmers for security vulnerabilities and approved so that the security issue is held at a certain level of predictability. Unprotected features can lead to **SQL Injections or virus code uploads** in the core files structure of the platform.

An interesting analysis [3] conducted by the programmers of the *Wordfence* plugin, which is another security plugin for WordPress, shows the actual reasons of attacking a website suggesting that it is not important if the website is hosting important information because if a website is hacked the compromised platform will conduct other further automatized hacks to other targeted websites and so on.
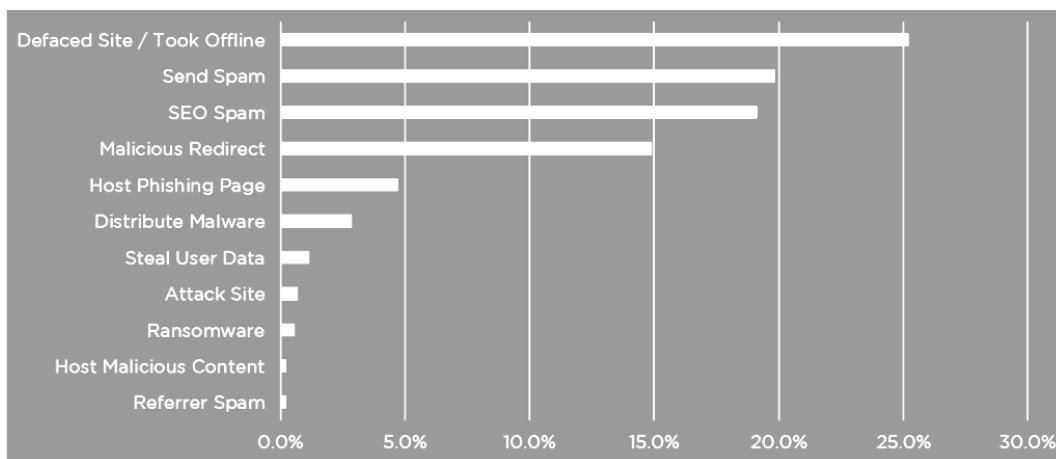
Figure 3 – Purpose for attacking a website by hackers [3]

Each of the presented reasons in figure 3 have different targeted actions but all use almost the same hacking tactics. For hackers the main concern is at first to gain access to the administration backend of the website with full managing privileges then comes the decision of what to use the hacked website for. In most of the cases the hacker uses a complete network of hacked websites to act as soldiers together as an army to hack other websites. This hacking technique has a higher rate of success in hacking systems faster. Using different hacked websites having also different IP's is more successful in hacking because the targeted system has in many cases a firewall which will react to a brute force attack but having many different servers that help in the hacking process has a much more effective success.

To secure a system we first have to understand the patterns and reasons of hacking so that proper security measures can be undertaken.

An Open Source Website platform has a higher probability of being targeted for hacking but also must be taken into consideration that the programmers of the community will be the first to know about new vulnerability risk that can occur and immediately develop security patches that will harden the user platform. Being part of a community that has

many affiliated programmers should give a high level of confidence that when a core security issue occurs it will be solved in a very short amount of time.

According to [3], a *defaced site* is the one that after it has been hacked the content is replaced with new content serving different purposes. In this kind of hacking it is almost impossible not to identify that the website has been hacked because it distributes a totally different content than the original.

The websites that have been compromised and are *sending spam* emails can be identified after the mail queue system blocks with a long tail of emails that can no longer be sent because of the deferrs transmitted back by the targeted email servers. The immediate result of the spam sent is blacklisting the hacked IP and domain name of the website at services like *Spamhaus*. Most of the small companies use a website only to present minimum information about its activities but rely on the email addresses a great deal to communicate with the customers and partners. If the domain name is blacklisted the real emails will no longer be transmitted and the returning error has a 421 answer code. The final issue is getting the domain name reputation destroyed.

Spam can have also a different form called *SEO Spam*. If the site has been hacked having a SEO purpose then the platform will be used to generate sitemaps and pages with backlinks to other targeted websites. Backlinks are an important factor in ranking websites and fake backlinks are still being used to create a fake good reputation to a certain website. Natural and organic backlinks are achieved with hard work and strategy but for spammers it is easier to fake the results by spamming search engines with generated backlinks. Usually if the hacker decides that the hacked website will be used for SEO spamming it will use the next procedure. After the hacker gains access to the entire filesystem, it uploads scripts that will automatically generate pages and sitemaps targeting links as backlinks to other webpages. The implementation doesn't stop here. The hacker will also authenticate itself as owner of the website for example in the *webmastertools* of the Google aps for developers and upload the links of the generated sitemaps. And the procedure continues with submitting the sitemaps to other networks that manage sitemaps of web links. After such an attack the reputation of the domain name that has been hacked will suffer sever damages and must enter in a process of clearing.

Malicious redirects and *hosting malware scripts* are another way of targeting the web pages of a hacked website. The traffic can be entirely redirected to the hackers websites or partially so that the hacking will be discovered much slower. Malware scripts will be detected after a while by search engines and the website will be tagged as dangerous and a message will be displayed like in figure 4.

In attempting to mislead the visitors to give their own personal information a compromised website could host pages that will not only redirect the solicited information to an ambiguous datacenter but will use the *phishing* strategy to identify itself being the site owner and so to convince to visitor cu apply. Through this strategy the hackers will attempt to receive information starting with email addresses and passwords till complete credit card information.
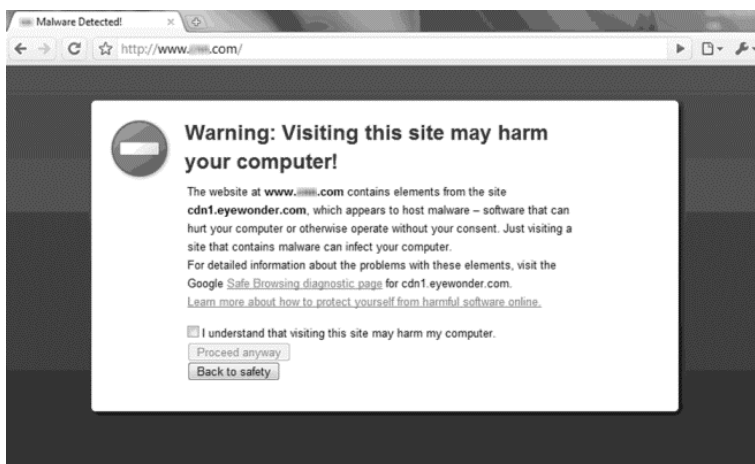
Figure 4 – Malware warning

In the same category as phishing but more aggressively we can also count the *ransomware* scripts that will encrypt and block the access to the website in an attempt to receive money from the real owner of the website. These are actually automated viruses and are very dangerous because removing the virus goes also with losing most of the original website content.

SECURITY MEASURES FOR DEFENDING OPEN SOURCE WEB SITE PLATFORMS

The enumeration of different types of attacks sources and reasons is a good way of understanding how and why a website can and could be hacked. Open Source Web Site Platforms are always a good starting point for hackers because they know the entire structure of the website and now where the vulnerabilities exist. This doesn't mean that such platforms are not reliable but the contrary because of the high number of programmers that defend the community that is gathered around the developed platform. But the final site owner that installs the platform on its own webserver and web domain must implement some security measures and rules to harden the system as instructed by the community. In the rest of the article will be presented measures that must be taken to protect the system.

In the WordPress [4] terminology for implementing security measures it is referred as *hardening* the system. First thing that must be taken care of is the actual usernames and passwords not to be identical or similar to the top list of attempted names used by hacking servers to achieve its goals. Usernames as admin and easy passwords must be completely avoided. Instead ***use longer and complex usernames and passwords*** that contain a combination of small, capitalized letters, numbers and special characters. Such passwords are hard to remember but it has a higher level of protection. This kind of passwords can be also saved in its own browser and manage with a software that act as a vault of passwords. It is highly recommended to use a ***two-step authentication*** that can be easily achieved be installing third party plugin in the platform.

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The core of Open Source Website Platforms have a certain level of secure but the level decreases and the level of risk and vulnerability rises when third party features are added to the system. Every online platform has features added as plugin, modules and themes but this actions must be done in a controlled environment taking care of security suggestions and rules.

Each additional feature including core files structure must be kept *up-to-date*. One important benefit of being part of an open source community is getting important updates through the main website or even directly into the platform. In most of the cases the updates are sent as messages that explain the measures that must be taken and not actually happening. Even if it could generate some incompatibilities with the updates in most of the cases it is advisable to activate the automated update procedure so that patches will be applied immediately as it was announced.

Adding new features to the platform are in some cases for testing purposes. Unfortunately some of the new features remain unused but still active on the platform. It is highly advisable to *completely remove any unused functionalities* on the website to prevent having more vulnerable sections in the website and limit the risk of online hacking through unsafe java scripts or unprotected web forms using post or get sending methods.

When the decision is taken to install new features, *the plugins or modules must be first investigated* even before testing. The investigation procedure must include searching about the vendor and programmer of the released new feature, how many downloads it has, read the users comments after testing the product, search for high rankings and references but most of all the search for the last date of the uploaded update like in the presented example on figure 5.

Figure 5 – Example of high rated new feature on WordPress internal plugin browser

The new plugins can be downloaded for free but they also have premium features, like the example in figure 5, that have additional more complex functionalities. It *is important not to search for free distribution on ambiguous websites for plugins that are available for sale* at the original vendor because in most of the cases the codding has been changed so that hackers could easily take over the platform. Because of the high number of community members there is like in any other high membered market place a great competition so the prices for something very complex is very low. So it is highly encouraged to buy the additional features not only because of the low price but most of all the high security level that comes with the legal engagement.

The file permissions should be changed after installing or changing the source code structure of the filesystem. The practical suggestions about file and directory permissions is not to have the permission like 777 set to directories or files but instead *use permissions configurations of 755 or 750 at folders and 600, 640 or 644 for files*. Limiting such permissions to the filesystem can also mean reducing considerably the risk of a virus uploading to the core structure. It is advisable for directories that are used as a repository for uploaded media files to store a .htaccess file that limits the upload only t certain file types like in to codding example below.

.htaccess codding example to limit file types upload to a directory:

```
<IfModule mod_php5.c>
php_flag engine 0
</IfModule>
AddHandler cgi-script .php .phtml .php3 .pl .py .jsp .asp .htm .shtml .sh .cgi
Options -ExecCGI
```

Regarding also to user accounts security measures it is advisable that the users change periodically their passwords. An important factor to prevent Brute Force Attacks is to limit the number of failed logins and even *obscure the actual login form*. Through a Brute Force attack the login form is repeatedly called using different combinations of usernames and passwords. To prevent such brute force attacks, which is the most common type of attack, certain security measures can be implemented. To *limit the number of failed logins* the system must keep tracking the number of same usernames called by one single IP in a certain amount of time. Through a security algorithm distributed brute force attacks from different IP's can be discovered and blocked. Most of the attacks are driven by automated programs that run by Cron Jobs on a calculated schedule divided through many synchronized different already hacked servers. To block this kind of attacks blacklisted databases of IP's can be queried to prevent the access even before it reaches the login form for a certain IP address and the platform can also collaborate by sending back to the community the initiated attack. *Login forms can be protected for nonhuman submitting's* by so called captcha which nowadays are not so used anymore because of smarter algorithms that can detect if the submitter is human or not.

Among modern strategies for limiting access to the website there is used a service which not only can filter the type of user access but it can also deliver the page content in a much faster cached form to the final user. The CloudFlare system intermediates the entire traffic to the Website Platform through its own servers and delivers a cached but dynamically result in the same time to the end user. The filter that intermediates the traffic can also determine if the online Access has a hacking pattern or not. There is a [5]

released analysis of a DDoS attack which was intermediated and filtered by the CloudFlare servers which states that the attacker used 4529 NTP servers and each used an average of 87Mbps of traffic to complete an over 400Gbps DDoS attack which is presented in the figure 6 chart.
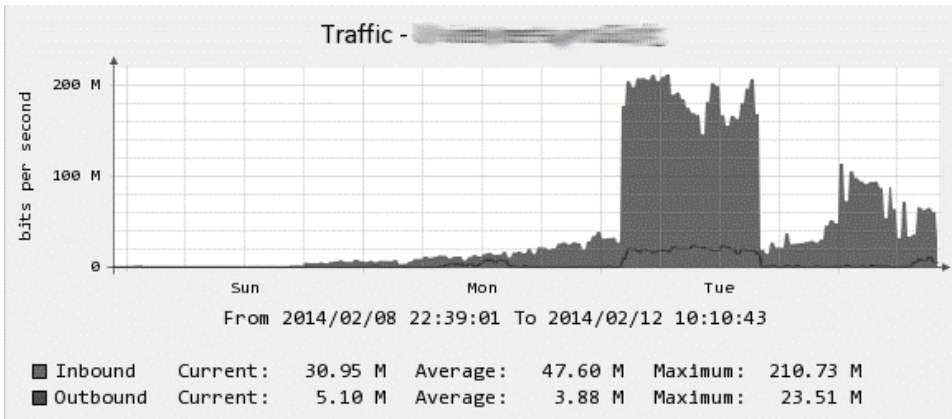

Figure 6 – 400Mbps DDoS attack detected and filtered through CloudFlare system [5]

As a case study for this article regarding the usefulness of using the CloudFlare system the website http://www.depozitulderetete.ro was analyzed during the active action of the intermediate system that was used. The analysis presents charts which indicate the actual traffic that was solicited by users compared with the amount of traffic that actually reached the host server for our case study. First chart in figure 7 presents the amount of cached requests that limited the real traffic to the website server.
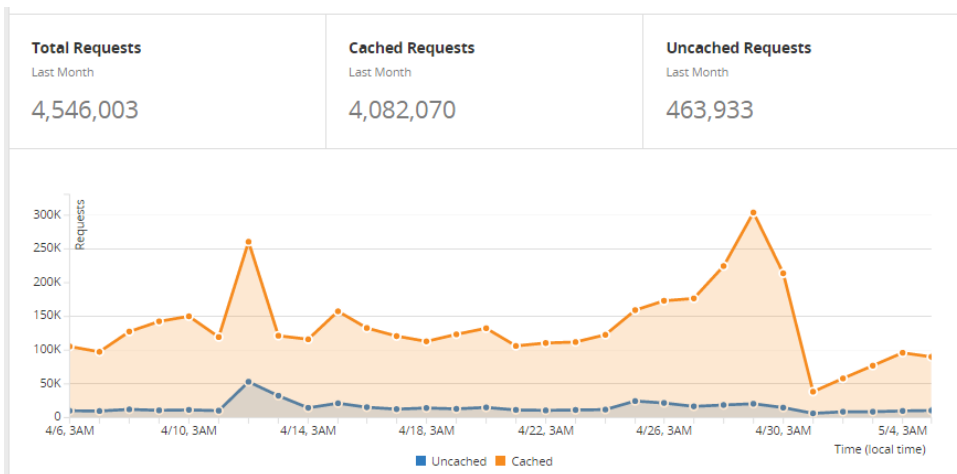
Figure 7 – Traffic cached for all the requests received by the website case study

In figure 8 the compared consumed bandwidth of all the traffic including text, images and client side scripts.
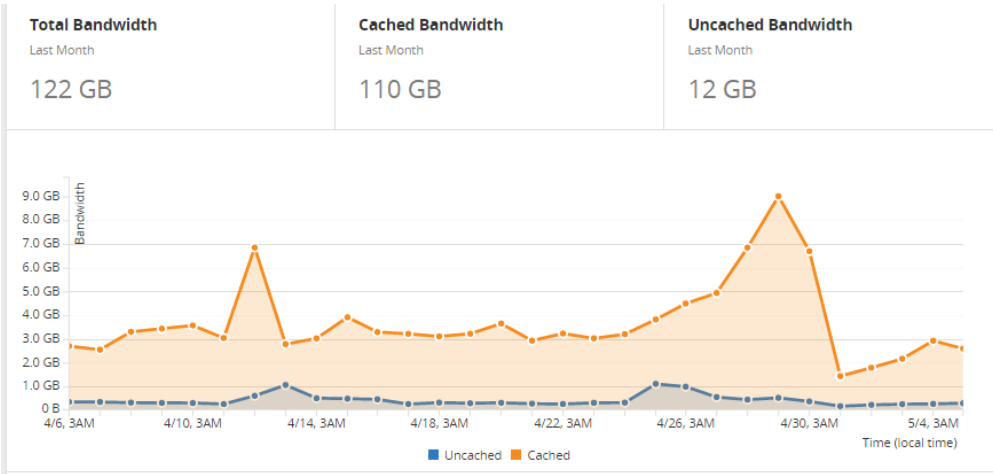
Figure 8 – Total bandwidth saved by using the intermediate system

In figure 9 are presented the total threats that have been intercepted for our web site case study which demonstrates the usefulness no matter the case if it is a small or complex website.
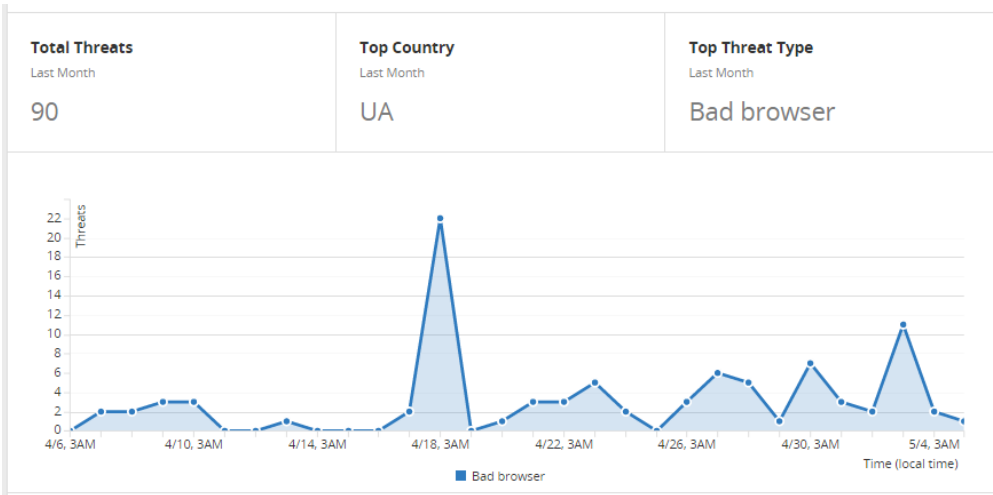
Figure 9 – Threats filtered by the intermediate system for the case study

The final pie diagrams presented in figure 10 show in the most cost effective way the benefits of using such an intermediate system like CloudFlare which among other advantages it is important to mention that it is also a free service.
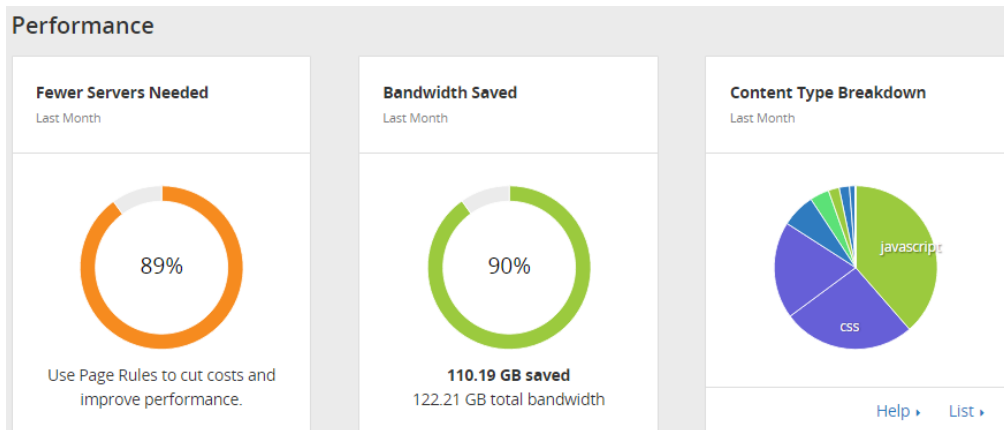
Figure 10 – Overall benefits of using an additional tire of intermediating the traffic

The analysis for the presented case study was conducted for the time period between 6th of April 2016 and 4th of May 2016. If there can be any intermediate system that is different from an antivirus or firewall and it can block malicious traffic then it is a new tire that should be strongly considered to be added to the security system of a website no matter the size. The advantages of such a system starts with lowering the bandwidth traffic that reaches the web site server and end with filtering the type of traffic which significantly can reduce the amount of attacks to the online website platform.

Only securing the system is not enough to have a reliable status of the overall protection. There should be a backup system implemented that preferably runs with a certain frequency. The backups can be stored locally or remotely on a third party server. There are already a number of free plugins that provide backup directly in a Dropbox account, google drive account, SkyDrive account and so on. The backup schedule should include not only the files of the website but also a complete copy of the database. The backups can be used not only when a website was compromised by an attack but also when different combinations of plugins tested committed some irrecoverable damages to the whole platform.

Last in this security article but not least is installing some security plugins into the website platform which also must be updated periodically. The security plugin must be tested before relying on it. One example of highly used security plugin for the WordPress CMS platform is Wordfence. It has over 1 million downloads and high rankings and references. A security plugin or a collection of many security plugins that should be compatible and complete one another through its features must ensure the services like: scanning the entire website filesystem for suspicious codding; limit the login failures, limit internal plugins to upload other file types as configured; throttle suspicious traffic if not completely block it; send messages to the administrator regarding detailed and status of the entire platform; and so on.

CONCLUSION

Using a free open source platform for developing websites which can be small sized or very complex that has also source code available open to hackers can be a subject of discussion when considering the security risks that it involves. But open source platforms compared to proprietary finite-sized software programmed by enterprises have many more programmers to inspect and test the software using wider and broader development base. The potential vulnerabilities and program flaws can be detected much faster and it depends on who detects these flaws faster meaning the community programmers or the hackers. The problem of security will always be an important part of the system no matter if it is an open source or proprietary software.

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SYMMETRICALLY-CLOSED VALUATIONS ON $K(X_1,..., X_N)$

Cătălina Vişan [1]*

ABSTRACT:

In the domain of valued fields K and, more specifically, the extensions of valuations on K to $K(X_1,…,X_n)$, an important category of extensions, namely the symmetric extensions with respect to the indeterminates $X_1,…,X_n$, came recently into attention. This paper deals with the characterization of the symmetric extensions of valuations on K to $K(X_1,…,X_n)$ that are not symmetrically-open, thus not having a simple closed-form expression for definition. We will define the notions of *symmetry degree* and the *most relevant restriction* (symmetrically-wise) of an extension of a valuation from K to $K(X_1,…,X_n)$ and we will use these quantities to characterize this unfriendly class of symmetrically-closed extensions.

Mathematics Subject Classification: 12F20, 12J10, 13A18

KEYWORDS: commutative algebra, non-Archimedean norm, valued fields, extensions of valuations, symmetric valuations

1. INTRODUCTION

The theory of valuation is a rather young field of research in mathematics, becoming a topic of interest only in the last century, when important mathematicians started to contribute important books and papers to this domain ([1], [2], [3], [4]).

The classification of the extensions of a valuation, from K to $K(X_1,…,X_n)$ is a difficult open problem in algebra, leading to serious issues in the domain of algebraic geometry once we get with the analysis to the second indeterminate (X_2) and, thus facing the algebraic closure of the field $K(X_1)$. Several directions in the research of simplifications of this problem were developed, based on the solid foundation laid in [5], [6], [7], [8] and [9], by the complete characterization of the extensions from K to $K(X)$, in [10], [11], [12] and [13].

One of such direction was proposed in [14], by defining a special class of extensions of a valuation from K to $K(X_1,…,X_n)$, called *symmetric valuations*, which treats in an undifferentiated way the n indeterminates. By analyzing this simpler class of extensions and by reducing an extension in general case to a symmetrical one, the mentioned difficult problem is avoided. The first major result in this direction was communicated in [15], by offering a complete classification of those symmetric extensions, called *symmetrically-*

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open extensions, that may prolong their symmetry indeterminately, to any number of extra indeterminates.

This paper intends to analyze the remaining extensions, the *symmetrically-closed* ones, that have a limitation in the number of indeterminates for which their symmetry may still be preserved.

2. GENERAL NOTATIONS AND DEFINITIONS

Let's consider a field K and v a valuation on K. We denote this relation by the pair (K, v). We denote by k_v *the residue field*, by G_v *the value group*, by O_v *the valuation ring* and by M_v *the maximal ideal* of v. We denote by $\rho_v: O_v \to k_v$ *the residual homeomorphism*. For $x \in O_v$ we denote by $x^* = \rho_v(x)$ its image in k_v.

Given two valuations, u and u', on K, we say that u is equivalent to u' and write $u \cong u'$, if there exists an isomorphism of order groups $j : G_u \to G_{u'}$ such that $u' = ju$.

Let K'/K be an extension of fields. We call a valuation v' on K' *an extension* of v if $v'(x) = v(x)$ for all x in K. If v' is an extension of v we may canonically identify $k_{v'}$ with a subfield of k_v and G_v with a subgroup of $G_{v'}$.

Let (K, v) be a valued field. By choosing $\overline{K}$ an algebraic closure of K and $\overline{v}$ an extension of v to $\overline{K}$, the residual field of $\overline{v}$ is, in fact, an algebraic closure of k_v and the value group of $\overline{v}$ will be QG_v, namely the smallest divisible group that still contains G_v.

We denote by $K(X)$ the field of rational fractions of an indeterminate X over K and with $K[X]$ the ring of polynomials of an indeterminate X over K.

Let u be an extension of v to $K(X)$. We say that u is a residual-transcendental extension (*r.t.- extension*) if k_u / k_v is a transcendental extension of fields. If not, but we still have $G_u \subseteq QG_v$, we say that u is a residual-algebraic torsion extension (*r.a.t.- extension*) and when $G_u \not\subset QG_v$, we say that u is a residual-algebraic free extension (*r.a.f.- extension*). More details about this classification may be found in **[9]**.

In paper **[14]** a *symmetric valuation* (with respect to $X_1,\dots,X_n$) was defined as a valuation w on $K(X_1,\dots,X_n)$, $n \geq 2$, such that, given any permutation π of $\{1,2,\dots,n\}$ and any $f \in K(X_1,\dots,X_n)$, we have

$$w(f(X_1, X_2, \dots, X_n)) = w(f(X_{\pi(1)}, X_{\pi(2)}, \dots, X_{\pi(n)})).$$

In this case we denote by $\pi f (X_1, X_2, \ldots, X_n) = f (X_{\pi(1)}, X_{\pi(2)}, \ldots, X_{\pi(n)})$, the automorphism $f \to \pi f$ of $K(X_1,\ldots,X_n)$ that leaves the symmetric fractions of polynomials in $K(X_1,\ldots,X_n)$ unchanged.

Let w be a symmetric valuation on $K(X_1,\ldots,X_n)$. Let $\overline{K(X_1,\ldots,X_n)}$ be an algebraic closure of $K(X_1,\ldots,X_n)$ and $\overline{w}$ an extension of w from $K(X_1,\ldots,X_n)$ to $\overline{K(X_1,\ldots,X_n)}$.

We say that $\overline{w}$ *extends the symmetry* of w if, for any partition of $\{1,2,\ldots,n\} = \{i_1, i_2, \ldots, i_m\} \cup \{j_1, j_2, \ldots, j_{n-m}\}$, with $0 \le m < n$, the restriction of $\overline{w}$ to $\overline{K(X_{i_1},\ldots,X_{i_m})}(X_{j_1},\ldots,X_{j_{n-m}})$ is symmetric with respect to $X_{j_1},\ldots,X_{j_{n-m}}$, where $\overline{K(X_{i_1},\ldots,X_{i_m})}$ is the closure of $K(X_{i_1},\ldots,X_{i_m})$ in $\overline{K(X_1,\ldots,X_n)}$. For such an extension we denote by:

$\delta_a := \overline{w}(X - a)$, for any $a \in \overline{K}$, where X is arbitrarily chosen from $X_1,\ldots,X_n$;

$M_{\overline{w}} := \{\delta_a / a \in \overline{K}\}$;

and for any i, such that $0 \le i \le n$, we denote by:

$K_i := K(X_1,\ldots,X_i)$, with the convention $K_0 = K$;

$u_i :=$ the restriction of w to K_i, with the conventions $u_0 = v$, $u_n = w$;

O_i, G_i, resp. $k_i :=$ the valuation ring, valuation group, resp. residual field of u_i;

$M_i := \{\overline{w}(X_i - \rho) / \rho \in \overline{K(X_1,\ldots,X_{i-1})}\}$, for $i \ge 1$.

We call the *freedom degree* of the extension w (with respect to v) the quantity

$$\text{freedeg } w = \text{card } \{ i \in \{1,\ldots,n\} / G_i \cap \boldsymbol{Q}G_{i-1} \ne G_i \}.$$

and we notice, due to **[9]**, that freedeg w represents the number of intermediate extensions from v on K to w on $K(X_1,\ldots,X_n)$ that are residual-algebraic free and this number is independent on the order the indeterminates $X_1,\ldots,X_n$ are taken into account.

An extension w, of a valuation v from K to $K(X_1,\ldots,X_n)$, symmetric with respect to $X_1,\ldots,X_n$, is called *symmetrically-open* (with respect to $X_1,\ldots,X_n$) if, adding any number of other indeterminates (elements transcendental and algebraically independent over $K(X_1,\ldots,X_n)$), $X_{n+1},\ldots,X_{n+r}$, there exists a symmetric extension of it to $K(X_1,\ldots,X_{n+r})$ with respect to $X_1,\ldots,X_{n+r}$.

3. CHARACTERIZATION OF THE SYMMETRICALLY-OPEN VALUATIONS

In **[15**; §4, §5]** a couple of results were obtained regarding the symmetrically-open extensions, which we will summarize in this chapter.

Observation 3.1: If w is symmetrically-open with respect to $X_1,\ldots,X_n$, with $n \geq 2$, then it is symmetrically-open with respect to $X_1,\ldots,X_i$, for $i < n$. Dually, for any symmetrically-open extension with respect to $X_1,\ldots,X_n$ there exists an extension of it, symmetrically-open with respect to $X_1,\ldots,X_i$, for all $i > n$, with $\mathrm{tr.deg}\,(K(X_1,\ldots,X_i) : K) = i$.

Observation 3.2: A Gaussian extension is symmetrically-open. This means that, if we formally extend the definition above for $n = 0$, we can say that any extension is (trivially) symmetrically-open with respect to the void set.

Observation 3.3: For a chain of symmetrically-open extensions, built using Observation 3.1, there exists a chain of extensions to the algebraic closures (of the fields each of the extensions in the original chain are defined on), such that their symmetry is also extended.

Observation 3.4: A symmetric extension is symmetrically-open if and only if it may be extended to a symmetric valuation on $K(X_1,\ldots,X_{n+1})$ that has an extension further to $\overline{K(X_1,\ldots,X_{n+1})}$ which extends its symmetry.

Observation 3.5: If w is symmetrically-open with respect to $X_1,\ldots,X_n$ then:

$$0 \leq \mathrm{freedeg}\, w \leq 2;$$

$$n - 2 \leq \mathrm{tr.deg}\,(k_w : k_v) \leq n;$$

$$n - 1 \leq \mathrm{freedeg}\, w + \mathrm{tr.deg}\,(k_w : k_v) \leq n.$$

The complete characterization of the symmetrically-open extensions is given through the following result.

Theorem 3.6 [15; Theorem 5.1]:** Let w be a symmetrically-open extension of a valuation v, from K to $K(X_1,\ldots,X_n)$, with $n \geq 2$, a fixed algebraic closure $\overline{K(X_1,\ldots,X_n)}$ and $\overline{w}$ that extends the symmetry of w to $\overline{K(X_1,\ldots,X_n)}$. Then w may be in one of the following possible situations:

(I) freedeg w + tr.deg $(k_w : k_v) = n$ and, in this case, w is defined by a triplet (a, δ, ε), in which we have $a \in \overline{K}$, $\delta \in Z \times QG_v$ and $\varepsilon \in Z \times Z \times QG_v$, $\varepsilon > \delta$ such that, for any $F \in K[X_1,\ldots,X_n]$ written as:

$$F = \sum_{(i_1,\ldots,i_n)\in I} f_{i_1,\ldots,i_n} \cdot g^{i_1}(X_2 - X_1)^{i_2} \cdot \ldots \cdot (X_n - X_1)^{i_n},$$

$$\text{with } f_{i_1,\ldots,i_n} \in K[X_1], \deg f_{i_1,\ldots,i_n} < \deg g$$

where I is a finite set of n-uples of indices and $g \in K[X_1]$ is the minimal monic polynomial of a over K, we get:

$$w(F) = \inf_{(i_1,\ldots,i_n)\in I} \left(\overline{v}(f_{i_1,\ldots,i_n}(a)) + i_1 \cdot \gamma + (i_2 + \ldots + i_n) \cdot \varepsilon \right),$$

$$\text{with } \gamma = \sum_{a' \in \overline{K}, g(a')=0} \inf\left(\delta_a, \overline{v}(a'-a) \right)$$

(II) freedeg w + tr.deg $(k_w : k_v) = n - 1$ and, in this case, w is the limit of an ordered system of extensions of type **(I)**, that have in their definition the same value for ε.

4. SYMMETRICALLY-CLOSED VALUATIONS

We may now move to the *symmetrically-closed* valuations, which are simply those that are symmetric, but not symmetrically-open. We will start by defining a quantity that describes the extent to which an ordinary valuation may be restricted or extended to a symmetric valuation.

Definition 4.1: Let w be an extension of a valuation v on K to $K(X_1,\ldots,X_n)$. We will denote by $\operatorname{symmdeg} w$ and call the *symmetry degree* of w (with respect to $X_1,\ldots,X_n$) the following quantity, case-dependently:

(I) when w is not symmetric with respect to $X_1,\ldots,X_n$, $\operatorname{symmdeg} w$ is the largest k, with $1 \leq k < n$, such that, for any set $\left\{ X_{i_1},\ldots,X_{i_k} \right\} \subset \left\{ X_1,\ldots,X_n \right\}$, we are guaranteed that $w\big|_{K(X_{i_1},\ldots,X_{i_k})}$ is symmetric with respect to $X_{i_1},\ldots,X_{i_k}$;

(II) when w is symmetric with respect to $X_1,\ldots,X_n$, $\operatorname{symmdeg} w$ is either the largest k, with $k \geq n$, such that, for any $X_{n+1},\ldots,X_k$ transcendental and algebraically independent

over $K(X_1,\ldots,X_n)$, there exists ω an extension of w to $K(X_1,\ldots,X_k)$ which is symmetric with respect to $X_1,\ldots,X_k$ or ∞ (infinity), if such largest k doesn't exist.

There are a couple of observations immediately following the definition:

Observation 4.2: $1 \leq \text{symmdeg}\, w \leq \infty$;

Observation 4.3: w is symmetric with respect to $X_1,\ldots,X_n$ if and only if $\text{symmdeg}\, w \geq n$; to be noted that the statement holds also for the trivial case $n = 0$, in which case, given the fact that we may create an arbitrarily long Gaussian chain of extensions further on, we have $\text{symmdeg}\, w = \infty$.

Observation 4.4: w is symmetrically-open if and only if $\text{symmdeg}\, w = \infty$.

We are now interested in comparing the symmetry degrees of two valuations, out of which one is the restriction (or isomorphic with the restriction) of the other one. We will find out that, by extending a valuation to more indeterminates (mutually algebraically independent) this degree decreases or, at most, remain unchanged and this holds both for symmetric and asymmetric valuations.

Proposition 4.5: Let w be an extension of v on K to $K(X_1,\ldots,X_n)$ and w' an extension of it to $K(X_1,\ldots,X_{n+r})$, where $X_{n+1},\ldots,X_{n+r}$ are transcendental and algebraically independent over $K(X_1,\ldots,X_n)$. In this case we get:

$$\text{symmdeg}\, w \geq \text{symmdeg}\, w'$$

PROOF:

Case **(I)**: Suppose, first, that $\text{symmdeg}\, w < n$. This means that $\text{symmdeg}\, w = k$, where k is the largest integer, in range $1 \leq k < n$, such that, for any $\left\{X_{i_1},\ldots,X_{i_k}\right\} \subset \left\{X_1,\ldots,X_n\right\}$ gives that $w\big|_{K(X_{i_1},\ldots,X_{i_k})}$ is symmetric with respect to $X_{i_1},\ldots,X_{i_k}$.

Let's assume, by *reductio ad absurdum*, that $\text{symmdeg}\, w' = l > k$. Then, for any $\left\{X_{j_1},\ldots,X_{j_l}\right\} \subset \left\{X_1,\ldots,X_{n+r}\right\}$ we get that $w'\big|_{K(X_{j_1},\ldots,X_{j_l})}$ is symmetric with respect to $X_{j_1},\ldots,X_{j_l}$ and let $k' = \min(n,\ l)$. Let now $\left\{X_{i_1},\ldots,X_{i_{k'}}\right\} \subset \left\{X_1,\ldots,X_n\right\}$, but, since $\left\{X_{j_1},\ldots,X_{j_{k'}}\right\}$ is a subset also of $\left\{X_1,\ldots,X_{n+r}\right\}$, it follows that w' is symmetric with

respect to $X_{i_1}, \ldots, X_{i_{k'}}$, which means that so it is w, and this holds for any $\{X_{i_1}, \ldots, X_{i_{k'}}\} \subset \{X_1, \ldots, X_n\}$, obviously leading to $k \geq k'$. We have now got a contradiction, as $k < n$ and $k < l$.

Case **(II)**: Let's move on to the second case, where $n \leq$ symmdeg $w < \infty$. According to definition we have symmdeg $w = k$, where k is the largest integer, with $k \geq n$, such that, for any $X_{n+1}, \ldots, X_k$ transcendental and algebraically independent over $K(X_1, \ldots, X_n)$, there exist ω an extension of w to $K(X_1, \ldots, X_k)$ that is symmetric with respect to $X_1, \ldots, X_k$.

Once more we will use *reductio ad absurdum*. More specifically, let's suppose that symmdeg $w' = l > k$ and we notice two different sub-cases here, depending on w' being or not symmetric.

Case **(II.a)**: w' is not symmetric so, for any $\{X_{j_1}, \ldots, X_{j_l}\} \subset \{X_1, \ldots, X_{n+r}\}$ we get that $w'|_{K(X_{j_1}, \ldots, X_{j_l})}$ is symmetric with respect to $X_{j_1}, \ldots, X_{j_l}$. In particular, $\omega = w'|_{K(X_1, \ldots, X_l)}$ is symmetric with respect to $X_1, \ldots, X_l$ and extends w to $K(X_1, \ldots, X_l)$, so the maximality of k is contradicted.

Case **(II.b)**: w' is symmetric hence, for any $X_{n+r+1}, \ldots, X_l$ transcendental and algebraically independent over $K(X_1, \ldots, X_{n+r})$, there exist ω' an extension of w' to $K(X_1, \ldots, X_l)$ that is symmetric with respect to $X_1, \ldots, X_l$, so ω' extends also w, preserving symmetry, but this contradicts again the maximality of k.

Case **(III)**: Finally, in the last case, when symmdeg $w = \infty$, the inequality is obvious.

Q.E.D.

This result allows reducing the study of a symmetrically-closed valuation on $K(X_1, \ldots, X_n)$ to the study of the most relevant restriction of it to $K(X_1, \ldots, X_i)$, namely one of the restrictions u_i, where $i \leq n$.

Definition 4.6: Let w be an extension of v on K to $K(X_1, \ldots, X_n)$. We will call *the most relevant restriction* (symmetrically-wise) of valuation w the following:

$$u_i := w|_{K(X_1, \ldots, X_i)}$$

where i is the smallest index such that $1 \leq i \leq n$ and symmdeg $u_i =$ symmdeg w.

Let's remark the fact that this definition is consistent also with the case when w is not symmetric, since symmdeg w represents the number of indeterminates that, taken in any combination out of $X_1,\ldots,X_n$, give equivalent restrictions. We may now observe a couple of things related to the notion of the most relevant restriction of a valuation.

Observation 4.7: If u_i is the most relevant restriction of w then the most relevant restriction of u_i is, obviously, u_i itself.

Observation 4.8: If u_i is the most relevant restriction of w then $i \leq$ symmdeg w. Indeed, either w is symmetric and, according to Observation 4.3, symmdeg $w \geq n \geq i$ or w is asymmetric and, in this case, symmdeg $u_i =$ symmdeg w is the largest k, with $1 \leq k < n$, such that, for any set $\left\{X_{i_1},\ldots,X_{i_k}\right\} \subset \left\{X_1,\ldots,X_n\right\}$, we are guaranteed that $w\big|_{K(X_{i_1},\ldots,X_{i_k})}$ is symmetric with respect to $X_{i_1},\ldots,X_{i_k}$, which includes the u_i case.

Observation 4.9: When $n \geq 2$ and w is symmetrically-open then the most relevant restriction of w is u_2, since both have the symmetry degree equal to infinity.

5. CLASSES OF SYMMETRICALLY-CLOSED VALUATIONS

In the case of symmetrically-open valuations we discovered 7 classes of such valuations, these being the only possible ones, as a result of Theorem 3.6. We will attempt a similar classification for the symmetrically-closed ones. First, we will discuss a class of valuations that have a minimal most relevant restriction.

Proposition 5.1: Let $K = \mathbf{Q}_p$ the field of p-adic numbers, with p prime and $\mathbf{Q}_p^{\mathrm{nr}}$ the maximal unramified extension of $\mathbf{Q}_p$. The valuation $v = v_p$ on $\mathbf{Q}_p$, extended to v_p^{nr} on $\mathbf{Q}_p^{\mathrm{nr}}$, induces a norm on $\mathbf{Q}_p^{\mathrm{nr}}$ which allows the completion of the latter to the field $L = \widehat{\mathbf{Q}_p^{\mathrm{nr}}}$.

Let $\widehat{v_p^{\mathrm{nr}}}$ be the extension of v_p^{nr} to $\widehat{\mathbf{Q}_p^{\mathrm{nr}}}$. Let E be an Eisenstein polynomial over L of degree n:

$$E = Y^n + a_{n-1}Y^{n-1} + \ldots + a_0$$

where we chose $a_0, a_1, \ldots, a_{n-1} \in L$ that are algebraically independent over $\mathbf{Q}_p$, having the valuations $v_p^{\mathrm{nr}}(a_0) = 1$ and $v_p^{\mathrm{nr}}(a_i) \geq 1$ for $i \geq 1$. Let $X_1, \ldots, X_n$ be the roots of E over L. Let's consider $\widehat{v_p}$ the extension of v_p to $\widehat{\mathbf{Q}_p}$, as depicted in the diagram below:

$$v_p : \mathbf{Q}_p \longrightarrow v_p^{\mathrm{nr}} : \mathbf{Q}_p^{\mathrm{nr}} \longrightarrow \widehat{v_p^{\mathrm{nr}}} : \widehat{\mathbf{Q}_p^{\mathrm{nr}}} \longrightarrow \widehat{w_p^{\mathrm{nr}}} : \widehat{\mathbf{Q}_p^{\mathrm{nr}}}(X_1, \ldots, X_n) \longrightarrow \widehat{\widehat{v_p}} : \widehat{\widehat{\mathbf{Q}_p}} = \mathbf{C}_p$$

$$w : \mathbf{Q}_p(X_1,\ldots,X_n) \longrightarrow \overline{w} : \overline{\mathbf{Q}_p(X_1,\ldots,X_n)}$$
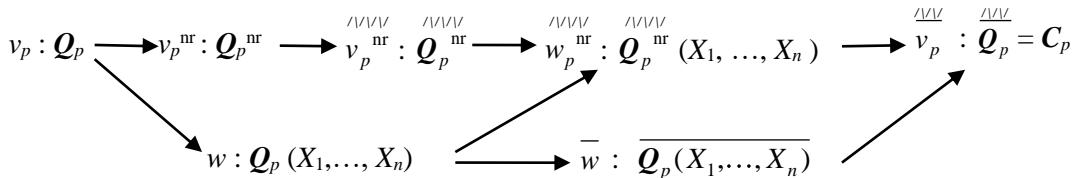
Finally, let $w = w_p^{\;\text{nr}}\Big|_{\mathbf{Q}_p(X_1,X_2)}$ be the restriction of $w_p^{\;\text{nr}}$ to $\mathbf{Q}_p(X_1,\dots,X_n)$.

Then symmdeg $w = 2$, with respect to $X_1, \dots, X_n$, and the most relevant restriction of w is the restriction $u_2 = w\big|_{K(X_1,X_2)}$.

PROOF:

First, to be noted that $L = \mathbf{Q}_p^{\;\text{nr}}$ has an infinite transcendence degree over $\mathbf{Q}_p$ and the extensions $L \to L(X_i)$ are totally ramified extensions. Since the minimal monic polynomial of $X_1, \dots, X_n$ is E, whose coefficients are algebraically independent over $\mathbf{Q}_p$, it follows that $X_1, \dots, X_n$ are transcendental and algebraic independent over $\mathbf{Q}_p$, so they may be considered indeterminates for the extension w over v.

It is easy to see that w is symmetric with respect to $X_1, \dots, X_n$. Indeed, if it weren't, considering the permutation $\pi \in S_n$ and defining πw by

$$\pi w\big(f(X_1,\dots,X_n)\big) = w\big(f(X_{\pi(1)},\dots,X_{\pi(n)})\big)$$

for all f in $\mathbf{Q}_p(X_1, \dots, X_n)$, we get that $\pi w \neq w$ but πw also extends v_p to $\mathbf{Q}_p^{\;\text{nr}}(X_1, \dots, X_n)$, contradicting the uniqueness of v_p la $\mathbf{Q}_p^{\;\text{nr}}(X_1, \dots, X_n)$.

The unique extension of w, say $\overline{w}$, to $\overline{\mathbf{Q}_p(X_1,\dots,X_n)}$ cannot extend the symmetry of w because, if it did, we would have, for any $b \in \overline{\mathbf{Q}}_p$:

$$\overline{w}(X_1 - b) \;=\; \frac{1}{n}\,\overline{w}\big((X_1-b)\cdot\ldots\cdot(X_n-b)\big) \;=$$

$$=\; \frac{1}{n}\,\overline{v}_p\big(b^n + a_{n-1}b^{n-1} + \ldots + a_0\big)$$

therefore, for a sequence $\{b_s\}_s$ in $\overline{\mathbf{Q}}_p$ with $\lim_s b_s = X_2 \in \overline{\mathbf{Q}}_p$, we would get:

$$\overline{w}(X_1 - X_2) \;=\; \lim_s \overline{w}\big(X_1 - b_s\big) \;=\; \infty.$$

According to Observation 3.3, we conclude that w is not symmetrically-open and cannot be extended further to a simple transcendent extension, $Q_p(X_1, \ldots, X_n, X_{n+1})$. Thus, we proved that $\mathrm{symmdeg}\, w = n$ and the most relevant restriction of w is $u_2 = \overline{w}\big|_{K(X_1, X_2)}$ because $u_1 = \overline{w}\big|_{K(X_1)}$ is, trivially, symmetrically-open so it has an infinite symmetry degree.

<div align="right">Q.E.D.</div>

We will now move to the other case, of the maximal most relevant restriction of a valuation. This is easy to verify for an extension that is Gaussian up to $K(X_1,\ldots,X_{n-1})$, then having a r.a.f.-extension at the last intermediary extension. In this setup, we get the following result.

Proposition 5.2: Let w be an extension of v on K to $K(X_1,\ldots,X_n)$ such that its restriction to $K(X_1,\ldots,X_{n-1})$ is a Gaussian extension and the extension further to K to $K(X_1,\ldots,X_n)$ is a r.a.f.-extension defined by the minimal pair $(-X_1 - \ldots - X_{n-1}, \lambda)$, with $\lambda \notin G_{n-1}$.

Then $\mathrm{symmdeg}\, w = n$ and the most relevant restriction of w is w itself.

PROOF:

From the hypothesis, for any $F \in K[X_1,\ldots,X_n]$ written as:

$$F = \sum_{(i_1,\ldots,i_n)\in I} a_{i_1,\ldots,i_n} \cdot X_1^{i_1} \cdot \ldots \cdot X_{n-1}^{i_{n-1}} \cdot (X_1 + \ldots + X_n)^{i_n}, \text{ with } a_{i_1,\ldots,i_n} \in K$$

where I is a finite set of n-uples of indices, we have:

$$w(F) = \inf_{(i_1,\ldots,i_n)\in I} \left(v(a_{i_1,\ldots,i_n}) + i_n \cdot \lambda \right).$$

Let's prove, first, that w is symmetric. According to **[15**, Lemma 3.1], in order to prove that w is symmetric it is sufficient to prove that w is symmetric with respect to X_i, X_n for each index i with $1 \le i \le n-1$, in fact it is sufficient to prove only that w is symmetric with respect to the pair X_{n-1}, X_n, the other pairs behaving similarly. Therefore, let $\pi \in S_n$ that inverts n with $n-1$, denote by $S = X_1 + \ldots + X_n$ and rewrite F as:

$$\pi F = \sum_{(i_1,\ldots,i_n)\in I} a_{i_1,\ldots,i_n} \cdot X_1^{i_1} \cdot \ldots \cdot X_{n-2}^{i_{n-2}} \cdot X_n^{i_{n-1}} \cdot (X_1 + \ldots + X_{n-2} + X_n + X_{n-1})^{i_n} =$$

$$= \sum_{(i_1,\dots,i_n)\in I} a_{i_1,\dots,i_n} \cdot X_1^{i_1} \cdot \dots \cdot X_{n-2}^{i_{n-2}} \cdot \left(S - X_1 - \dots - X_{n-1}\right)^{i_{n-1}} \cdot \left(X_1 + \dots + X_n\right)^{i_n} =$$

$$= \sum_{(i_1,\dots,i_n)\in I} \sum_{j=0}^{i_{n-1}} a_{i_1,\dots,i_n} \cdot C_{i_{n-1}}^{j} X_1^{i_1} \cdot \dots \cdot X_{n-2}^{i_{n-2}} \cdot \left(-X_1 - \dots - X_{n-1}\right)^{i_{n-1}-j} \cdot S^{i_n+j}$$

By using an index k as equaling $i_n + j$ in all terms we may continue the expansion (formally considering null extra $a_{i_1,\dots,i_n}$ coefficients that may appear in the expansion):

$$\pi F = \sum_{(i_1,\dots,i_n)\in I} \sum_{j=0}^{i_{n-1}} a_{i_1,\dots,i_n} \cdot C_{i_{n-1}}^{j} X_1^{i_1} \cdot \dots \cdot X_{n-2}^{i_{n-2}} \cdot \left(-X_1 - \dots - X_{n-1}\right)^{i_{n-1}-j} \cdot S^{i_n+j} =$$

$$= \sum_{k \geq 0} \sum_{(i_1,\dots,i_{n-2},\bullet,\bullet)\in I} \sum_{i_1 \geq k} \sum_{i_n=0}^{k} a_{i_1,\dots,i_n} \cdot C_{i_{n-1}}^{k-i_n} X_1^{i_1} \cdot \dots \cdot X_{n-2}^{i_{n-2}} \cdot \left(-X_1 - \dots - X_{n-1}\right)^{i_{n-1}+i_n-k} \cdot S^k$$

For a fixed k, let's put:

$$F_k = \sum_{(i_1,\dots,i_{n-2},\bullet,\bullet)\in I} \sum_{i_{n-1} \geq k} \sum_{i_n=0}^{k} (-1)^{i_{n-1}+i_n-k} \cdot a_{i_1,\dots,i_n} \cdot C_{i_{n-1}}^{k-i_n} X_1^{i_1} \cdot \dots \cdot X_{n-2}^{i_{n-2}} \cdot \left(X_1 + \dots + X_{n-1}\right)^{i_{n-1}+i_n-k}$$

which is a polynomial in $K(X_1,\dots,X_{n-1})$. From **[8]** we know that $(-X_1 - \dots - X_{n-2}, 0)$ is a minimal pair of definition for u_{n-1}, just like $(0, 0)$, since $-X_1 - \dots - X_{n-2}$ has degree 0 over $K(X_1,\dots,X_{n-2})$ and verifies:

$$u_{n-1}(X_{n-1} - (-X_1 - \dots - X_{n-2})) = u_{n-1}(X_{n-1} - 0) = 0$$

By using the infimum formula with this new minimal pair for u_{n-1} we get:

$$w(F_k) = \inf_{\substack{(i_1,\dots,i_{n-2},\bullet,\bullet)\in I \\ i_{n-1} \geq k \\ 0 \leq i_n \leq k}} \left(v(a_{i_1,\dots,i_n}) + v(C_{i_{n-1}}^{k-i_n}) \right)$$

We now remember that k was used instead of $i_n + j$ and write:

$$w(\pi F) = \inf_{\substack{k \geq 0 \\ (i_1,\dots,i_{n-2},\bullet,\bullet)\in I \\ i_{n-1} \geq k \\ 0 \leq i_n \leq k}} \left(v(a_{i_1,\dots,i_n}) + v(C_{i_{n-1}}^{k-i_n}) + k \cdot \lambda \right) =$$

$$= \inf_{\substack{(i_1,\dots,i_n)\in I \\ 0 \leq j \leq i_{n-1}}} \left(v(a_{i_1,\dots,i_n}) + v(C_{i_{n-1}}^{j}) + (i_n + j) \cdot \lambda \right)$$

By noticing that:

$$w(X_n - X_1) = w'(X_1 + \ldots + X_n - 2X_1 - \ldots - X_{n-1}) \geq \inf(\lambda, 0)$$

with $\lambda \notin G_{n-1}$, we get that $\lambda > 0$. This means that, for a fixed $(i_1, \ldots, i_n) \in I$, the smallest quantity using this n-uple must have $j = 0$. Hence, we get:

$$w(\pi F) = \inf_{(i_1, \ldots, i_n) \in I} \left(v(a_{i_1, \ldots, i_n}) + i_n \cdot \lambda \right) = w(F)$$

which proves that w is symmetric.

Now, let's assume that w might be extended to w' on $K(X_1, \ldots, X_{n+1})$, with X_{n+1} transcendental over $K(X_1, \ldots, X_n)$, also symmetric. Then we would have:

$$w'(X_{n+1} - X_n) = w'(X_{n+1} + X_1 + \ldots + X_{n-1} - X_1 - \ldots - X_{n-1} - X_n) \geq$$

$$\geq \inf (w'(X_1 + \ldots + X_{n-1} + X_{n+1}), w(X_1 + \ldots + X_{n-1} + X_n)) =$$

$$= \inf(\lambda, \lambda) > 0 = w(X_1 - X_2)$$

which would contradict the symmetry of w'. This means that symmdeg $= n$ and the most relevant restriction of w is w itself, as u_{n-1} is symmetrically-open, so symmdeg $u_{n-1} = \infty$.

6. Conclusion

We studied the symmetrically-closed extensions through the lens of the freedom degree and the newly defined notions of symmetry degree and the most relevant restriction (symmetrically-wise, i.e. the restriction to the minimal number of indeterminates that preserves the symmetry degree).

We know have a larger classification of symmetric extensions w, of a valuation v on K to $K(X_1, \ldots, X_n)$:

- symmetrically-open extensions, that have symmdeg $w = \infty$ and their most relevant restriction being u_2; these are classified further in two sub-types:
  (I) generalization of a Gauss extension;
  (II) limit of a convergent sequence of extensions of type (I);

- extensions with symmdeg $w \geq n$, symmdeg $w < \infty$, their most relevant restriction being u_2 and freedeg $w = n$;

- extensions with symmdeg $w = n < \infty$ and symmdeg $u_{n-1} = \infty$, hence their most relevant restriction is w itself and freedeg $w \leq 3$; for these, the last intermediary extension closes the chain of symmetrically-open extensions.

Finding the other possible classes of symmetrically-closed extensions would complete the classification of the symmetric extensions in general and would bring us one step closer to closing the chapter of the extensions of valuations to $K(X_1,\ldots,X_n)$.

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EXECUTIVE INFORMATION SYSTEMS' (EIS) STRUCTURE AND THEIR IMPORTANCE IN DECISION-MAKING. A COMPARISON BETWEEN DECISION SUPPORT COMPUTER SYSTEMS

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ABSTRACT

The rise of competitiveness at the economic level due to the acceleration of decisions-taking process as a result of situations occurring within a company led to the creation of information systems that enhance the managers' knowledge of the environment where the organization operates. The abundance of information solutions help the decision makers within a company steer better in the business they belong to.

Due to the fact that the information processed by means of information systems comes from the majority of departments in a company, the management can thus identify the source of problems and take measures to correct the errors encountered.

KEYWORDS*: Executive Information Systems, Decision Support Systems, Management Information Systems, EIS structure, decision making*

1 INTRODUCTION

The ability to use computers as a part of the information systems in business has been put into service since the early 1960s. The first applications mainly targeted the mechanization of existing tasks. Once the computer systems have evolved, applications were designed with a view to support the organization management.

The oldest approach was the introduction of Management Information Systems (MIS). These systems were operated by individuals who had advanced knowledge in the field of information solutions and were used to generate reports containing information about the organization.

Later, for managers to be helped, the Decision Support Systems (DSS) are introduced. They offered assistance to management concerning specific decision-making tasks and provided analytical capabilities to handle large data volumes.

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However, despite the superiority of both systems over non-computerized solutions and the relative success within small and medium enterprises, they failed to supply the necessary assistance to executive management [1].

These systems have contributed to the configuration of the existing technology in the field. Once the Internet became widespread and got developed, research in the field of information technology has intensified and led to the creation of advanced computing solutions that would come to the aid of executive management.

The spread of communications networks has led to the development of databases and tools for analysing them. Therefore, the Executive Information Systems (EIS) appeared, which, according to Applegate, are defined as „a computerized system that allows managers to access information sources, internal and external, which have been restricted to an easily accessible graphical system"[2].

An Executive Information System (EIS) represents a type of Management Information System (MIS) whose purpose is to facilitate access to information and support executive management in the decision-taking process, by offering internal and external information, relevant in reaching the organization strategic objectives.

The EIS targets executive management that needs a rapid evaluation of the company situation or of s company department. These systems are meant for users who urgently need information that helps the decision-making process.

After carrying out an analysis on the EIS operation manner, we have come to the conclusion that the idea behind an EIS is to facilitate comparison and display of information, without subsequent processing. The user can therefore see the situation where the department concerned is to be found, this allowing them to focus on the decision-making process.

Generally speaking, an EIS is created to display data, such as sales receipts, pending orders etc. This information can then be used to make decisions in relation to the development and expansion of the activity or its restriction in order to protect the company from any possible financial issues.

The advantage of an Executive Information System is that it uses data from various sources which can be easily read and interpreted y (Data Sources for the EIS - fig. 1). At the same time, an EIS offers the possibility to the user to obtain detailed results for the information required.
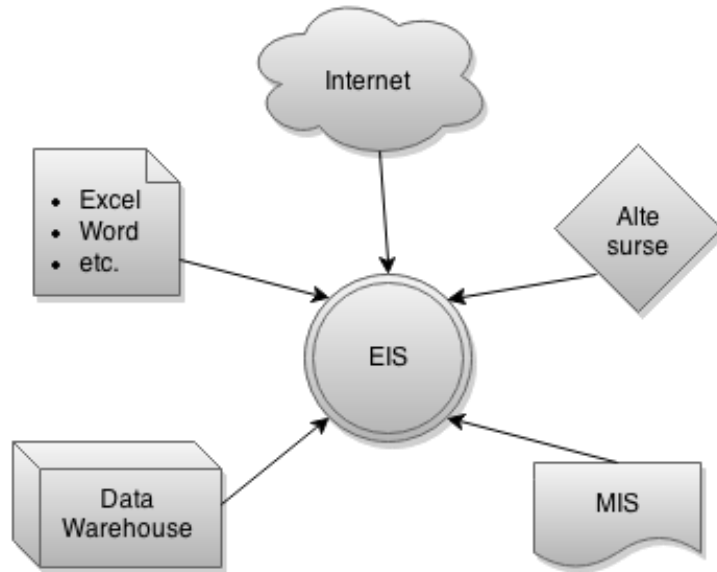
EIS Data Sources – Fig. 1

(Other sources)

The objective of creating an EIS was to develop computer applications that would highlight information aimed at helping top-management. Typically, an EIS provides data that only decision-makers in a company can use.

2 EIS STRUCTURE

The structure of an EIS is made of the following elements:

    a) Hardware

The hardware configuration of a computer solution of the EIS type must meet both the needs of management, that operate the EIS at the executive level, as well as the needs of the aother departments that populate the database with the information that is processed by the system.

For the hardware configuration of an EIS, the following components are to be considered:

- Entry data introduction devices (PC on which employees use to enter data, barcode reader etc.);
- At least one LAN network (allowing the interconnection of all devices that enter data with the database);
- Units that store information (Servers that host the database and process the requirements of the executive body);
- Information display devices (PC or other mobile devices which management use to view the reports that an Executive information System generates).

b) Software

The software is essential in designing an effective EIS. Therefore, the software components and the manner in which they manage to integrate data into a single system, are very important. The basic software needed for an EIS includes three components:

- Basic software – text (documents and data);
- Data Base (where all the data received from external and external sources is collected);
- Graphic software (transforms all the data from the data base into visual diagram-based information);

c) Interface

An EIS must collect the relevant data and submit them to the decision makers. The interface of an Executive Information System is a crucial component and must be designed so that the data presented should be comprehensible and easy to interpret. This represents the element of interaction between the user and the information stored. Its aim is that the person who interacts with the data be able to monitor processes and receive the feedback needed to take a decision.

The user interface concept includes interactive aspects that facilitate system operation and interaction with its components. The design of the interface is logically designed so that the user may be able to grasp the functionality of the controls. In general, interfaces are based on the following mechanism:

- Entry - allows users data introduction and system manipulation;
- Exit-allows users to see the results of their interaction with the system;

In general, the objective of the user-system interaction user system through an interface is to achieve a result by means of the introduction of minimum controls, thus rendering the system capable of distinguishing between useful results and the rest.

Î Lately, due to new technologies, the trend is to create an EIS on online platforms. Thus, access to the application can be done anywhere and the investment in hardware is diminished due to "Cloud Computing" which allows the download of information in an environment where resources are theoretically limitless. Most companies, however, opt for a system that takes all the data and operates by means of data-centers owned by that company or even located in the company premises. This usually happens because they are concerned with the level of information security.

We are tackling the "User Interface" as a distinct element (apart from software) because we consider that it has an equally important role in relation to the other elements.

When the objectives are represented by the creation of an Executive Information System, the factors which should be taken into account are: the configuration of the hardware and the software applications (including user interface). These elements are extremely important in order to obtain the desired results.

The problems that can arise if the hardware configuration does not match the data flow or if the software applications are not well configured and chosen, are likely to lead to a misuse of the system by displaying partial or erroneous results or even to data loss.

3 THE DECISION-TAKING PROCESS IN A COMPANY

According to the *Oxford Dictionary*, decision–taking represents „the action or process of making important decisions"[3]. Therefore, taking a decision involves a process where the problem and its solving are analyzed with a view to ensure that the decisions taken are to be effective. An effective decision, according to Peter F. Drucker, involves five steps: [4]:

a. Clear realization of the fact that the problem is generic and can be solved only by establishing rules or principles;
b. Definition of particularities that problem-solving must satisfy;
c. Thought-processing over what is "to be done", as the solution to meet all the requirements laid down, should be given consideration before the adaptations, compromise and all the necessary concessions for the solution to be acceptable;
d. The creation, on the basis of the decisions, of the necessary steps to be taken for the fulfillment of the objective;
e. The "Feedback" that shows the validity and efficiency of the decisions over the current flow of events;

Therefore, these steps contribute to making the right decisions whose repercussions are important for an analysis.

The first step, as indicated by Drucker, refers to the level of awareness regarding the problem and its implications. Consequently, identifying the problem is the first step in the decision-taking process. It is said that a *well-defined problem is a half-solved one* (quote by Charles F. KETTERING). Relevant information for the problem should be gathered in order to carry out an analysis of the causes and nature of the problem, therefore, making it possible for the problem to be detected.

A clear distinction must be made between the problem and its symptoms, which can many times cover the real causes. Therefore, a manager must seek out the "critical factor" in the workplace. At the same time, the manager must take into account the causes and determine whether they are controllable or not. Thus, they may lay down rules or principles with regard to solving the problem.

The second step concerns the characteristics of the solution offered in solving the problem. To define the characteristics, it is necessary that the problem should be known in detail. The business world is replete with relevant information due to the development of information technology. All available information should be utilized to the full in order to complete an analysis of the problem, clarifying all the aspects of this problem. At the same time, the characteristics of the problem are determined by its nature as well. Thus, at the same time as the establishment of the causes, one is to define the requirements that must be met and which must be taken into account in solving the problem.

The third step, as expressed by Drucker, refers to finding a "crude" solution for solving the problem. This solution should have a single objective, solving the problem. At the same time, we must not take into account the collateral implications of the solution given. The existence of this solution is conditional on fulfilment of the previously established requirements, as a consequence of the analysis made upon the factors that led to the emergence of the problem.

The fourth step involves the definition of the necessary steps to solve the problem. At the same time, it also takes the creation of alternative solutions concerning the action taken. Once the problem has been determined, on the basis of relevant information, the manager must establish alternative actions that can be used in solving the problem. Only realistic alternative solutions should be taken into account. It is equally important to take into account the time and cost constraints and the psychological barriers that will restrict the number of alternative solutions.

After finding alternative solutions, the next step in the decision-making process is to select an alternative that seems to be the most suitable in problem solving. Alternative choice must also be presented to the group that may be affected by its implementation. Acceptance of the decision by the members of the group is always useful and desirable for its implementation to be effective.

After choosing the decision, the next step is to transpose the decision into effective action. Without such action, the decision will remain merely a statement of good intentions. The manager must transform its decision into the employees'decision as well. In order to achieve this, his subordinates should be able to trust this decision. Subsequently, the manager must follow the evolution of the decision.

Feedback is the final step in the decision-making process. At this point, the manager must ensure the existence of channels through which feedback is to be obtained, thus monitoring the progress of the decision. Feedback can come in the form of organised information, reports or observations. The importance of the feedback received is that it affects the course of the decision. Therefore, the original decision may suffer adjustments along the way, whenever feedback is not positive or when more effective solutions can be found along the way.

We consider that the process of decision making at the executive level represents an action which involves the analysis of information, the creation of solutions and their implementation. At the same time, the entire process includes several areas of activity from a company and imposes rules and principles on how to solve the problem encountered.

4 THE ROLE OF INFORMATION SYSTEMS IN THE DECISION-MAKING PROCESS

It is well-known that information plays a crucial role in the success or failure of an organization. "Any information obtained by the decision-makers will have a low impact on the company's performance if it is not taken into account in the decision-making process" [5]. Even if the same information is also available to other companies operating in the same industry, competitive advantages consist in how information is used and its impact.

The organizations that have learned to use the information they possess experience a larger development on the market where they operate. The usage of information helps create higher values and helps identify competitive advantages. Therefore, the actions taken by the organisations who use the information they have helps increase the performance of those organisations.

Executive Information Systems play an important role in the decision-making process within companies. The preliminary results of the research made by George Ditsa show that "there is a high degree of utilization of systems of the EIS type [...], the users considering the information received from an EIS" as satisfactory [6]. Therefore, the

utilization degree of the reports processed through an Executive Information System is quite high. Thus, the information received is used in the decision-making process.

Organizations tend to rely increasingly more on the development of strategies undertaken following the analysis of the information received, both within the firm and outside it. The data analyzed in terms of drawing up a strategy have a very vast content.

For example, for a company that wants to expand and sell its products outside the country borders to be able to do this successfully it takes an analysis of the internal factors (the finance available for the expansion, the production capacity etc.) and the external ones as well (relating more to the country where they wish to operate). Therefore, it is very important for the company to know information related to case-law, taxation, culture, social data etc. which are to be taken into account and included them in its development plans.

It is proven that the companies that have integrated a computer system that retains and processes information related to the activity of the company in question have a higher degree of success. This is the result of the use of information obtained from the information systems and their inclusion in the decision-making process.

The decision-making process is "complex, involving many variables that cannot be fully understood " [7]. At the same time, this represents an integral part of management and manifests itself at each decision-making level, such as the strategic one (strategic management deals with the development of organizational goals, strategies and policies as an integral part of the process of strategic planning), tactical (develops short and medium-term planning and environmental policies, budgets and drafts the policies that function as guidelines for the running of the company) and operational (short term plans such as the planning production for the week under way). The making of a decision is based on information, and the information is needed to determine the structure of the problem, explore and choose the solutions and to analyse the effects of the solution adopted.

We think that information in the form of reports generated within the "decision making" modules is extremely useful and is included in the decision-making process. In this regard, organizations tend to rely to a high extent on the information provided by the implemented computer systems. Decision makers will no longer be confronted with a variety of uncertainties and decisions are based on accurate data. Therefore, more often than not, the actions of managers will have the estimated result.

5 DECISION SUPPORT SYSTEMS - DSS

Decision Support Systems have been created at the same time with the development of computing systems and their reduction of size. The history of the use of such systems starts in the mid-1960s.

The concept of Decision Support System is perceived differently by various authors, thus, in an article written by K.P. Tripathi, he defines a DSS as being "an interactive computer system, flexible and adaptable using rules and models and which is connected to a database and the decision makers have access to the information that can assist them in solving the problems they encountered. Thus, a DSS supports a complex decision-making process and increases its effectiveness "[8].

A DSS uses synthesized information, exceptions, patterns and trends using analytical models. Decision Support Systems help in the decision-making process, but do not provide a decision per se. Decision-makers take useful information from raw data, documents, personal knowledge etc., to identify and solve problems. Decisions are taken on the basis of this process (The arhitecture of a DSS - Fig. 2).

The characteristics of a Decision Support System are:

- Provides support for decision-makers in semi-structured and structured problems;
- Offers support to managers in various managerial levels;
- Supplies support in design, choice and implementation processes;
- Is adaptable according to the needs and the type of data analysed;
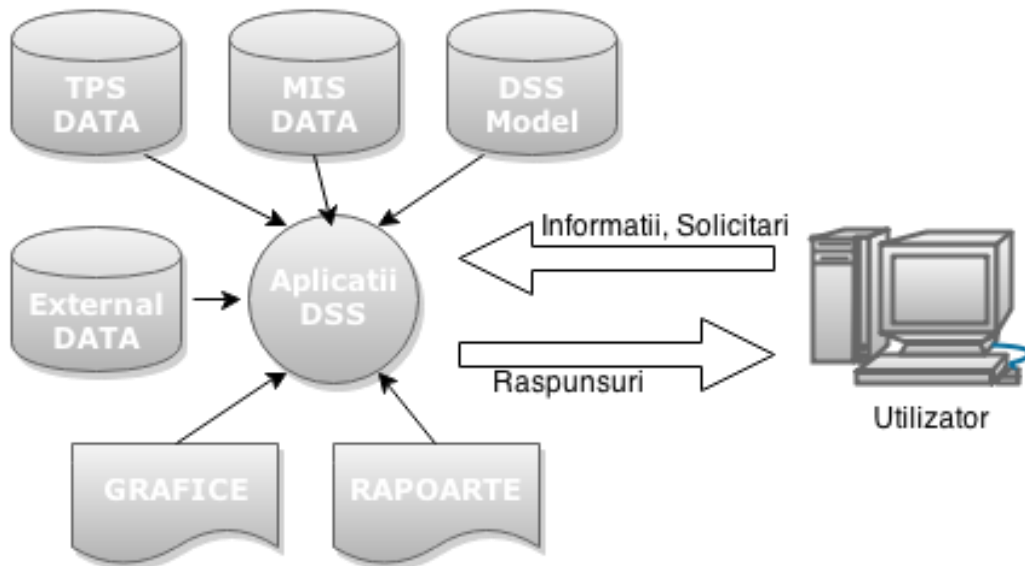
(DSS Applications, Graphs, Reports, Information, Requirements; Answers; User)

Architecture of a DSS - Fig. 2

6 THE MANAGEMENT INFORMATION SYSTEM - MIS

The Management Information System is a system for data collection, storage and dissemination in the form of the information needed to carry out the duties of the management (Arhitecture of an MIS – Fig. 3).

For a manager, the Management Information System represents an implementation of organization systems and procedures. The objectives of such a system are the implementation of the organizational structure and the dynamics of the economic entity in order to lead the organization in an effective way.
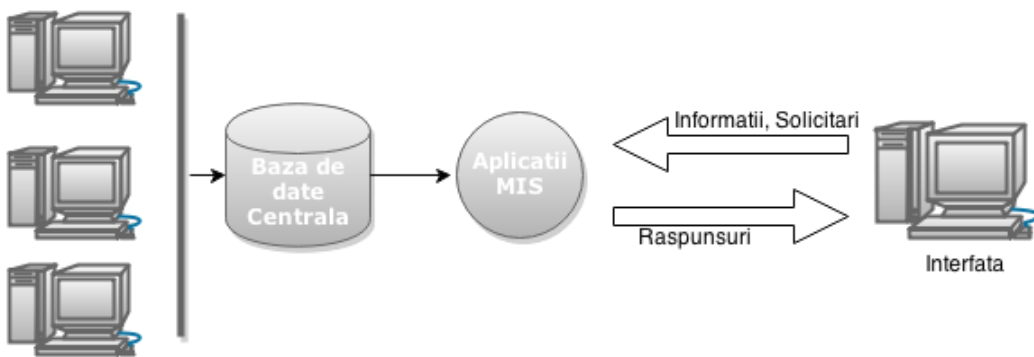
Arhitecture of an MIS – Fig. 3

(Central Data Base, MIS Applications; Information, Requirements; Answers; Interface)

At the same time, through data collection and processing, the use of an MIS aims at maintaining the degree of competitiveness of the company.

The characteristics of a Management Information System are the following:

- It is based on long-term planning;
- Offers an all-encompassing view of the organization structure and dynamics;
- It relies upon strategic, strategic and operational information;
- Notifies the management about exceptional situations;
- Generates advanced information, thus providing a competitive advantage;
- Creates links between all the sub-systems in the organization, supplying the management a clear picture on problems;
- Uses a central data base.

7 COMPARISON BETWEEN EIS, DSS AND MIS

In the book *Executive Information Systems*, Ion Lungu and Adela Bâra highlight the following remarkable differences between a Decision Support System and an Executive Information System[9]:

a) *The volume of information and flexibility.* An EIS is able to collect information from both internal and external sources, processing these data through a set of tools that allow it to adapt to the needs of the user;

b) *The degree of specialization.* Most of the solutions of DSS type are functionally specialized, so they can meet the needs of a specific group within the organization's management. On the other hand, an Executive Information System caters for all the needs of the executive management of the company;

c) *Interface.* The interface of a Decision Support System is complex and requires time and advanced knowledge in computer use. The EIS has a "user-friendly" interface and is geared for persons who do not have the time available to get familiar with complex interfaces and advanced data-mining processes;

d) *The speed of response*. Executive Information Systems are optimized in order to get replies as rapidly as possible, unlike DSS which works with large volumes of data and whose interface requires additional resources.

We can notice that Management Information Systems, unlike the Executive Information Systems, are more complex regarding the reporting process and are built on systems for processing transactions. They are often used to support structured decisions, described in detail.

MIS supports the strategic level of management, but they are usually used at other decision-making levels.

As it can be seen in the figure below, the three information systems operate at different levels of decision-making. The Executive Information Systems (EIS) are designed to provide essential information to top management in an organization (Levels of decision-fig. 4). Here you can see the type of data taken from the organization by an EIS: i.e. it retrieves data which both MIS and DSS process and work with.
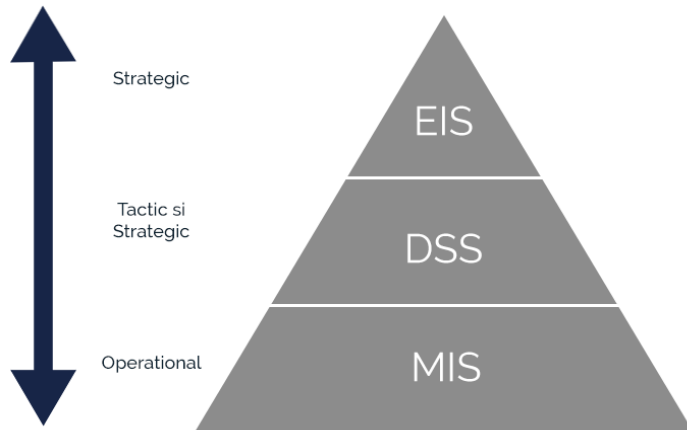
Decision Levels – Fig. 4

(Strategic, Tactical and Strategic, Operational)

8 CONCLUSIONS

The use of information systems in the framework of organizations represent a key element for the activity of the ecomomic entity and, at the same time, for the management of that entity. Information systems support the organizing, planning and rendering efficient of the whole decision-making process, but they also constitute a good aid in knowing the organization situation and capacity to develop.

According to the needs of the company, there exist several information systems that are capable of organizing and synthesizing the information so as for every department to be monitored. The differences between the three types of information systems analyzed above provide a clear vision of the manner of information reporting. Consequently, according to the decision level, the degree of usage of these systems is varied because their efficiency from one level to the other is different. For the top-management to succeed in making strategic decisions, the level of information they analyze must be structured so as to supply a large perspective over the entire activity undertaken.

The projected information systems must be capable of presenting the information in a clear manner, easy to understand and use for them to prove their efficiency and the level of usage to be high.

More often than once, the management from the strategic level of companies who do not operate abroad are reluctant in using an information system that would provide a view of

the activity of the organization they coordinate. This is due to the fact that the operation of most information systems require advanced skills in the field.

Executive Information Systems are thus designed so as to require a low level of operation skills for the usage degree to rise. As a consequence, the efficiency of such an implemented system increases.

As for the usage of a Decision Support System, it is capable of providing structured data on the organization which can be subsequently used in the decision-making process. The synthesis capacity of such a system is high, but the level of information skills needed to operate it is higher than in the case of an Executive Information System.

The role of Management Information Systems is to supply information from all the departments of the company. Therefore, the information quantity is high, but its usage in the decision-making process is not efficient.

The management of strategic level requires synthesized information that target the development opportunities of the company or the problems existing there. Consequently, economic information play a crucial role for the top-management, as what happens in the administrative departments is only relevant to the manangement of the operational level.

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AUTOMATICALLY ADJUSTING THE COLOR PERCEPTION:
A QUALITATIVE ANALYSIS

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ABSTRACT

Image processing is an old concept, being a key issue in high quality pictures. The high quality of pictures can be affected by lightness, weather, time of day when the picture was captured, camera photo, shadows. This paper presents a literature review of some techniques of images processing such as: Autolevels, Contrast stretching, Histogram equalization, Multiscale Retinex with color restoration, Luminance based on Multiscale Retinex. All comparisons are aimed at finding a combination of the techniques such that the output image will be more accurate.

KEYWORDS: Retinex, Histogram, Image enhancements, Autolevels, Luminance

1. INTRODUCTION

The purpose of this paper is to describe the most common problem with the perception of images - that is the imperfect correspondence of the colors and dynamic range seen through viewfinder versus the digital image.

Usually, before being processed, the digital images suffer many types of distortions such as poor contrast, color casts, noise, motion blur. Such being this case, sometimes, the image does not correctly represent the reality, because the color and lightness are not the same with what a human would perceive. Taking this into account, we will analyze different methods for addressing the stated problems and provide a qualitative comparison, identifying the situations in which every method is most suitable in.

2. PROBLEM DEFINITION

Starting from this idea, Land and McCann introduced the "Retinex" model in 1971, as a model for human vision constancy. The human eye adapts to light conditions, such as low light (darkness) or powerful light (sunny), but an image could not adapt to these conditions. In many cases, the images are black or white. For example, the constancy of human vision is that the human eyes perceives a color as being the same color any time of day, even if at sunset the illumination is red and at afternoon the illumination is white. The Retinex algorithms enhance the image using the constancy of human vision, dynamic range compression and color rendition [5].

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The "Retinex" word comes from "retina" and "cortex"; retina is the innermost coat of the eyeball that receives the image produces by the lens and the cortex is the part of human brain that processes information, including visual data. The name of this model tells us the basic assumption of this theory: the human visual system operates with retinal-cortical systems [6].

3. AVAILABLE METHODS

A. Traditional algorithms for the image processing

A.1 Autolevels

The most common algorithm used for image processing is Autolevels, which became popular because of some qualities such as fastness and good results. Many tools have already implemented this algorithm (Adobe Photoshop, JASC PaintshopPro, GNU GIMP) [1].

The Autolevels algorithm uses histogram clipping. The histogram is a graph showing the pixel distribution over the range of possible pixel values, more than 1 and less than 255. For every pixel value (from minimum to maximum), the histogram tells us how many pixels with that value exist in the image. Basically, Autolevels algorithms expand the range of the image, by mapping the smallest value (from the histogram) to min (0), and highest value to max (255). The net effect is increased contrast for most images because they tend to have less dynamic range.

A.2 Contrast stretch

The only difference between Autolevels and contrast stretch is that contrast stretching techniques typically do not clip the histogram [1]. Contrast stretching applies only a linear scaling function to the image pixels. Each pixel P is scaled using the following function:

$$Pout = (Pin - c)(\frac{b - a}{d - c} + a)$$

Where:

- a – minimum pixel value that the image type concerned allows [usually, $a = 0$]

- b – maximum pixel value that the image type concerned allows [usually, $b = 255$]

- c – minimum pixel value from input image

- d – maximum pixel value from input image

- Pin – the current value of pixel

- Pout – the final value of pixel

This technique has good results if the input image does not contain significant numbers of dark or white pixels simultaneously.

A.3 Histogram equalization

Histogram equalization is used for maximizing the entropy of an image. The scope of this algorithm is to make the darker regions brighter. The algorithm follows the steps:

1. Calculate the histogram for the initial image, with the values from the minimum pixel to maximum pixel from current image.

2. The cumulative distribution function should be calculated. The cumulative distribution function for the current pixel, px, is defined as:

$$cdfx(i) = \sum_{j=0}^{i} px(j)$$

3. The histogram equalization should be calculated, using the following formula:

$$h(v) = round \left(\frac{cdf(v) - cdf_{\min}}{(MxN) - cdf_{\min}} * (L-1) \right)$$

Where:

- cdf(v) – is the cumulative distribution function calculated in step 2

- cdfmin – is the minimum cumulative distribution function calculated in step 2

- M, N – dimension of the image, where M is width and N is height

- L – number of gray levels used (usually 256)

- 4. Create a new image with the histogram equalization calculated in step 2.

B. Retinex theory

B.1 Multiscale Retinex with color restoration

Single scale Retinex (SSR) is a Retinex algorithm developed by Jobson for image processing where the output is determined by the correspondence between the pixel value (center, input value) and Gaussian function (surround, neighborhood) [2]. SSR is defined as:

$$R(x1, x2) = \alpha * \{\log I(x1, x2) - \log[I(x1, x2) * F(x1, x2)]\} - \beta$$

Where:

- R is the output of Retinex algortihm, the output image

- I is the input image

- α is a gain constant,

- β is a offset parameter

- "*" is the convolution operator

- Log is logarithm natural

- F(x,y) is the surround function defined as:

  - $Fk(x1, x2) = k * e^{\frac{-(x1^2 + x2^2)}{\sigma^2}}$

  - Where:

    - σ is standard deviation

    - k – is a normalization factor, defined as:

      - $k = \frac{1}{\sum_{x1} \sum_{x2} F(x1, x2)}$

The SSR algorithm is not consistent when the initial image has regional and global gray-world violations. Observing this, Jobson has developed a new algorithm: Multiscale Retinex algorithm (MSR), using a color restoration function, which is defined as:

$$Ci(x, y) = \beta \{\log[\alpha * Ii(x - y)] - \log[\sum_{i=}^{S} Ii(x, y)]\}$$

At this algorithm, Jobson added improvements, obtaining the final version of MSRCR [3]:

$$R(x, y) = G * [Ci(x, y)\{logIi(x, y) - \log[Ii(x, y) * Fn(x, y)]\} + b]$$

B.2 Luminance based multiscale Retinex

Multiscale Retinex with color restoration processing enhances image contrast very well, but it often has an undesirable desaturating effect on the image color [3]. The 'Luminance based multiscale Retinex' algorithm applies to MSRCR algorithms a color balance for

calibrating the image chromatic [2]. There are 3 channels (red, green, blue) used for getting the input intensity:

$$Ii = \sum_{j=1}^{3} Ij = Ired + Igreen + Iblue$$

$$I(x, y) = R \, x \, \frac{R}{R + G + B} + G \, x \, \frac{G}{R + G + B} + B \, x \, \frac{B}{R + G + B}$$

The output of the image is the sum between the output intensity for the all three channel (red, green, blue) as below:

$$Ri = \sum_{j=1}^{3} Rj = Rred + Rgreen + Rblue$$

$$R(x, y) = \frac{1}{3} \, x \, [\log \frac{I(x, y)}{I(x, y) * F1(x, y)} + \log \frac{I(x, y)}{I(x, y) * F2(x, y)} + \log \frac{I(x, y)}{I(x, y) * F3(x, y)}]$$

4. RESULTS AND DISCUSSIONS

We present in Table 1, the comparison between all image processing techniques, described above. Any technique has advantages and disadvantages, so it is very difficult to estimate the best technique [4]. For choosing the best processing image technique, we should account the input image and the expected image output.

Image processing technique	Advantages	Disadvantages
Autolevels	It is a fast and simple method; It uses histogram clipping; Provides good output images for the input images with low dynamic range.	Provides inaccurate output images for input images that have high dynamic range.
Contrast stretching	The visual scene is represented with success.	It does not use clipping, so the image can lose details.

Image processing technique	Advantages	Disadvantages
Histogram equalization	It is a simple and fast technique; The output image is an uniform image.	Preserves the brightness of the input image; It is indiscriminate, increases the background noise contrast, but decreases the usable signal; Produces unrealistic effects in images.
Multiscale Retinex with color restoration	Provides mixed results between dynamic range compression and color constancy; Preserve most of the detail.	Gray level violation problem. Could not get consistently good color results.
Luminance based multiscale Retinex	Improves colors fidelity; Provides the contrast enhancement benefits.	It is a slow and complex method.

Table 1. A comparison including advantages and disadvantages of different methods of image color adjustment

There are activity domains in which an algorithm is better than others. For example, in the medical domain, for enhancing the radiographs of bones, a widely used method is 'Histogram equalization', because it is a technique useful in images with bright or dark foregrounds and backgrounds and the usable data of the image has close contrast values.

Autolevels and contrast stretching are good techniques if the images do not contain many dark and bright pixels in the same time. In this case, the output image is identically with the input image.

Retinex algorithms are more accurate than histogram algorithms, but they lose many information and details, having difficulty with keeping the visual quality of colors. For this, it was observed that using an algorithm with histogram technique (Autolevels, Contrast stretching, Histogram equalization) before the Retinex algorithm can lead to more accurate output images, when speaking about terms of visual quality.

Another advantage for using a combination between Histogram methods and Retinex methods is when processing images that are situated at the limits of the test scenarios, when using a single method has failed. For this, if one method fails and the other succeeds, the output image is more accurate than the output image obtained when using only one algorithm.

5. CONCLUSIONS

External factors, such as weather, light and camera are very important for picture accuracy, as they can distort the reality and the pictures can lose information about real image data.

Over the time, various methods for processing unclear images were developed, some of them analyzing image histograms, while others analyzing human vision constancy and dynamic range compression. All techniques are good on specific test scenarios, but all of them may fail when the input is not the expected one.

According to the analysis described above, if we want to enhance the image quality, firstly, you should stabilize some input criteria. For example, if the image does not have many dark and bright pixels simultaneously, Autolevel or contrast stretching methods can be used. There are currently no methods to performing good result regardless of the type of input images.

6. SUGGESTIONS FOR FUTURE WORK

The next step after this qualitative comparison is to perform a quantitative analysis of the presented method. The metrics can include both image-related parameters (noise, color distribution etc.) and parameters that indicate runtime performance (complexity, CPU and memory usage). Also, for processing very large images (for example, satellite maps), we can research the potential for transforming the algorithms into parallel ones.

The advances in color perception analysis may well contribute in other research domains which rely in color perception and correction, like: sense substitution [7], specular highlight removal [8], image color reduction [9], binarization [10] and image segmentation [11].

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ON IMAGE RECOLORING – PART 1: CORRECT GRAYSCALE CONVERSION

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ABSTRACT

This paper aims to analyze and develop the algorithm of the grayscale conversion by performing a reduction of the three dimensional input color set into a single dimension with a minimal loss of information. In the meantime, the results obtained are desired to be as perceptually plausible as possible. The related software application uses as input a colored image, three varying parameters and outputs a greyed-out image.

KEYWORDS: color conversion, greyscale to color, color to greyscale

1. INTRODUCTION

The focus of this paper is to develop an algorithm for obtaining greyscale images [1]. For bringing into focus the usefulness of this algorithm, we can mention the situation where a color document undergoes printing on a grayscale device and how indecipherable it can become after doing so. This is the main problem with greyscale transformation: reproducing as accurately as possible the intent, the contrasts and the salience of the original colored image. As most processing operations on images are done in single channel mode, ex: [27] [29], a channel that contains logical information from all colors is useful.

This paper presents part of the work done in the license thesis presented at the faculty of Automatics and Computers from the "Politehnica" University of Bucharest by the author of the paper [28].

2. RELATED WORK

Greyscale conversion

Algorithms that decrease the dimensional color components (ex: 24 bit color images to 8 bit greyscale) are referred to in the specialty books as dimensional reduction algorithms [12]. The main challenge is to optimally preserve and make use of the chrominance component of the image so that the initial appearance of the image is transferred to the resultant picture as accurately as possible. The focus lies on making use of the color differences of the initial image in order to retain feature discriminability in the grayscale appearance of the output.

The conversion methods that regard achromatizing an image can obtain their desired results by using either a local mapping or global mapping. The main difference between the two mentioned types of mapping is that the global mapping preserves a more homogenous feel on the output image, as it ensures that same pixels values will get

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mapped to the same value every time and everywhere. Meanwhile, the locally mapping algorithms can be more accurate in preserving local characteristics of the image but can produce inhomogeneous results as the mapping function changes. Moreover, the latter ones are slower.

It is a wide known fact that color is represented by a three-dimensional concept, the RGB color space, which basically refers to the three main attributes of color: lightness, hue (tone), Chroma (pigment, coloration). In the converted image the one attribute that is preserved is the luminance, the other two (i.e. Chroma and hue) are discarded. The lightness (i.e. luminance) is the achromatic reaction to a color incentive. This is exactly what the challenge is, to find an algorithm that better combines the initial 3D information into a 1D information to optimally reflect initial appearance and dynamism.

A much discussed local mapping approach was introduced by [12]. The authors described a method of infiltrating the chrominance information into the luminance component of the output image by applying a high-pass filter onto the chrominance information based on the spatial information of the pixels. They aim to prove that by making use of the location of the pixels, the problem of different pixels having similar luminance values would be greatly improved.

Another local mapping algorithm [13] developed a linearly complex technique of preserving the chromatic contrasts based on a research of the Coloroid color system observations, which is a tool to express the relational phenomena and psychometric characteristics that relate each color to another. In addition to this tool, the authors [13] also present their extension to the Color2Gray [1] method. They introduce a new function for computing the delta gray difference which greatly reduces computational cost and also achieves better results.
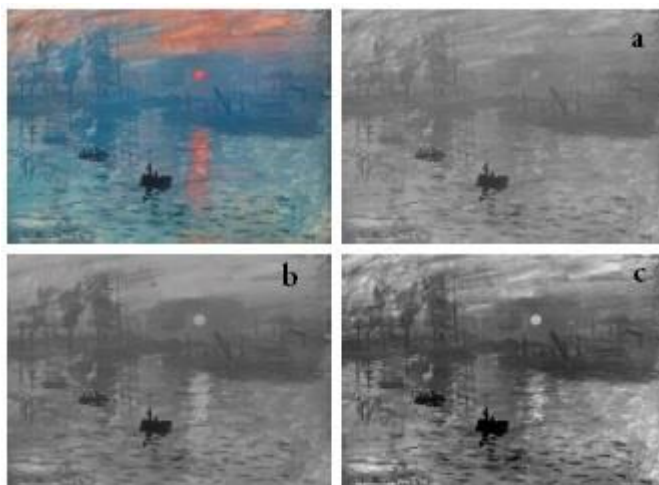
Figure 1. Comparison of simple CIE Y method (a), Gooch et al. method (b), Neumann (c) et al. method (image taken from [13])

One interesting greyscale transformation technique is that of Smith et al. [14]. Their work proposes the development of an algorithm that combines global as well as local concepts. The mapping of the pixels takes into account in a globally way the lightness and it is based on the Helmholtz-Kohlrausch (HK) Effect [15]. This is a technique which, in very simple terms, predicts the differences between colors with the same luminance values. The latter mentioned effect causes a more colorful stimulus to appear brighter (i.e. as if he had a greater luminance value) than another stimulus less colorful and with the same luminance value. The other half of the algorithm in discussion implements a contrast enhancement which behaves locally. The method proposed has linear complexity and Smith et al. [14] also bring into focus the applicability of their algorithm on videos. Figure 2 shows the consequences of the HK effect. Figure 2.a presents the original picture which is made up entirely of isoluminant colors (i.e. colors that have the same luminance value). Figure 2.b of the shows basic CIE XYZ transformation, the HK effect is not incorporated, the chrominance differences are omitted. The last picture reflects the mapping proposed by Smith et al. [14] which uniquely and correctly matches ordered grey scale values.
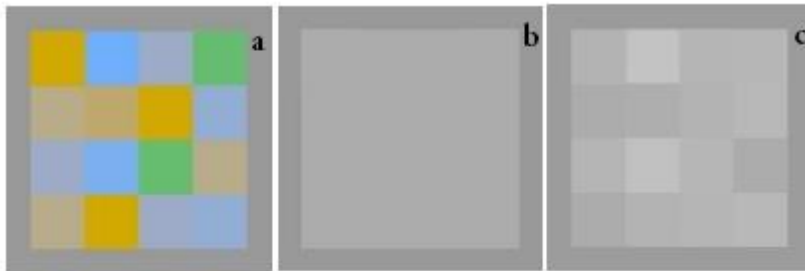
Figure 2. The HelmHoltz-Kohlrausch Effect (image taken from Smith [14])

The global mapping techniques can be further classified into non-linear and linear.

Several global mapping algorithms were proposed by Rasche and others researchers in the field. For example in [15], a linear global function is used. The preservation of contrast is thus done by defining a quadratic objective function, after that they apply constraints in order to make sure of the consistency of the luminance. Some unique feature of their method is that they are able to extend it so that it can recolor images for the color-deficient viewers.
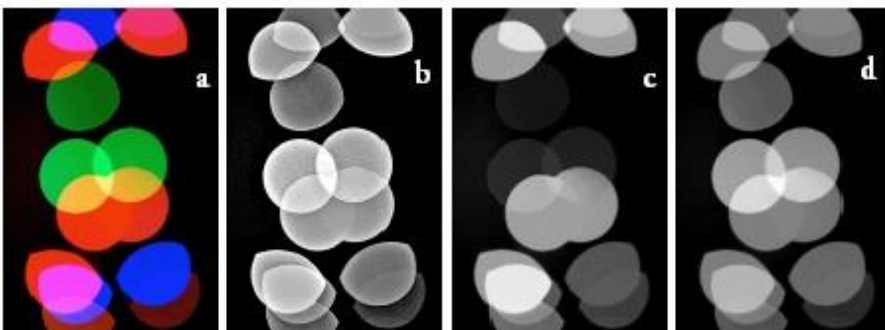
Figure 3. Comparison between Color-to-Gray conversions (image taken from [16])

Another approach was taken by [16]. The authors present a very interesting comparison between different types of mapping approaches (local, linearly global mapping, non-linear global mapping). As far as their experiments, it seems like their method is the one that better reflect the original lightness of color values. Figure 3a is the input. Figure 3b represents the result of the greyscale conversion of the local mapping algorithm of Smith et al. mentioned above [14]. Figure 3c is the result of global linear mapping [19] and figure 3d is their [16] non-linear global method.

The work developed is based on [1] and the results, as well as the theoretical portrayal of the algorithm, will be presented in a later chapter. Figure 4a represents the input image, 4b is an example of applying Photoshop grayscale method, 4c is the better result from a qualitative point of view obtained with Color2Gray algorithm.

Figure 4. Comparison between Color-to-Gray conversions in Gooch et al. [1]

Also there exist iterative methods that start with a best looking assumption (in this case the grayscale conversion using the weights the eye sees at a global level) and with each iteration the differences in contrast between the color image and grayscale image are minimized [24].

3. GREYSCALE CONVERSIONS – THEORETICAL PORTRAYAL

Challenges in greyscale conversions

A very obvious and already discussed issue is the problem with the isoluminant colors: how to make them visually perceptible and distinguishable after the greyscale processing, on what criteria an isoluminant component should be brighter or darker. The common approaches are to let the user manipulate this issue through some parameters. For example Figure 5 shows how the colorful blue circle from the input image could be very well mapped to a brighter luminance value (right) or to a darker one (left) than the isoluminant background color (grey).
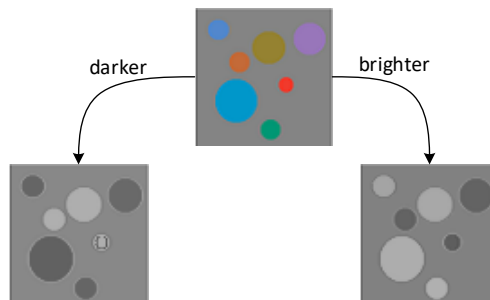
Figure 5. Challenge1: Mapping to darker or brighter values the isoluminant colors

Another second challenge when it comes to converting color images to greyscale ones, especially when a local mapping algorithm comes into discussion, is how to optimally and carefully select the size (radius) of the neighborhood. The importance of the locality size is described here: [26].

A less obvious and more sophisticated challenge is the mapping of the chrominance changes into luminance values. It is necessary to take into account that the chrominance values for most of the color spaces usually have a larger spectrum of values than the luminance. For example, the CIE Lαβ color space chrominance (i.e. α and β components) range is from -128 to 127. For the CIE LUV color space, the U range is [-134…220] and the V's range is [-140…220]. The luminance spectrum is only from 0 to 100. The problem that could appear if we make a sloppy decision and/or a silly mistake is to obtain a completely saturated image from a luminance point of view.

Latest paragraph brought into discussion the existence of multiple color spaces and how their main characteristics can vary in a definite way. The two color spaces already mentioned, CIE LUV and CIE Lαβ, are referred to in the specialty books as uniform color models. One of the most significant characteristics of the CIE Lαβ color space in discussion is the fact that its axes tend to have little correlation. The uniformity of a color space is the property by which the difference between any two colors from a perceptually human visual system point of view varies in a proportional way with the Euclidean difference measured inside the specific color space [17]. The choice of color space is important and thus it can also represent a challenge. In [18] Reinhard et al. performed a comparison between using different color spaces in color transfer techniques (see Figure 6) and came to the conclusion that color spaces Lαβ and CIE LAB (with illuminants E) perform the best. The MD, IN, MN and ND from the legend refer to different environmental settings (i.e. manmade day, indoors, manmade night and natural day respectively).
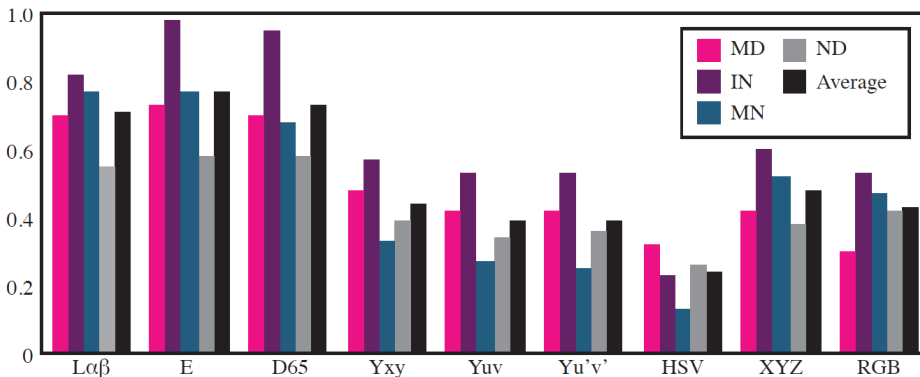
Figure 6. Percentage of successful color transfer for different context images (image taken from [18])

Because CIE Lab (E illuminant) was shown to perform well in most of the cases as per analysis [18], this uncorrelated color space is also the choice of the algorithm implemented in the available framework.

4. ALGORITHM DESCRIPTION AND IMPLEMENTATION

The algorithm on which the presented framework was built upon is based on the theoretical portrayal given by Gooch et al. in [1]. The first step as per the later chapter of this paper is to convert the data of the input color image from RGB space to CIE La*b* space. The function which does this performs a RGB to CIE XYZ space conversion and then from there the CIE XYZ values are transformed to CIE Lab illuminant using illuminant D65.

After acquiring the L*a*b* values, the next phase of the algorithm proposed is the computation of the deltas (i.e. differences) between pixels. This differences will be calculated based on the luminance (L* component) and chrominance values (a* and b* components) from the uncorrelated L*a*b* color space. In the third phase, the array of differences of all pixels will be used to obtain the final greyscale image. This is done by using an iterative process in which the final image is computed out of the deltas from previous step. The goal of this iteration process is to obtain some data output which is as similar to the deltas computed as possible.

In this section the challenges of greyscale conversion were exposed. In the presented algorithm, the course of decisions regarding the mentioned challenges are solved by requiring the user to give input. Upon running the software program the user will be asked to input three parameters which will be further discussed.

Parameters

The three parameters that the framework requires when running Color2Gray implementation are:

- Θ – This is the parameter that solves the decision regarding Challenge1 (see 3.1). It basically controls the direction in which the isoluminant colors are being made distinguishable, either by increasing in brightness or in darkness.

- α – This parameter relates to Challenge2. It must be found a way to scale the chrominance values of a* which are in the range [-200 and 200] and those of b* - [-500,500] to the range [0,100] which corresponds to the L* channel. The α parameter sets a limit to how much of an impact the chrominance difference between two arbitrary pixels can have on the final computed luminance. It is obvious that this limit is equal to [-α, α].

- μ - the framework gives the possibility to the user to control whether or not the algorithm should have a local behavior or a global one. Thus, by providing a third parameter with a value that is greater than 0, the algorithm will try to preserve local changes and will take decisions based on a neighborhood size equal to μ. If the value of the μ is 0 the algorithm will perform globally (Challenge3).

Notations

Throughout the description of the algorithm there will be used some notations that are worth describing and that will be used in the pseudo code of the algorithm. The luminance of one specific pixel i will be denoted as L_i. The difference between the luminance, a* and b* values of two arbitrary pixels i and j are δL_{ij}, δA_{ij} and δB_{ij} respectively. It suffices to consider that the luminance difference between two pair of pixels is exactly δL_{ij} but when it comes to chromatic difference between pixels i and j we introduce a new notation $\vec{\delta C}_{ij}$ which, in contrast to the scalar δL_{ij}, is a vector. Another notation worth mentioning is $\vec{v}_\theta$ which is a vector calculated based on the Θ parameter in order to decide the way the luminance should oscillate (see Challenge1 from 3.1). All the above notations lead to one goal, obtaining the output delta of some pair of pixels: δ_{ij}.

Pseudo code

```
ConvertRGBtoXYZ
ConvertXYZtoLab
if NeighborSize > 0 then
        for i := 0…AllPixels do
                for j in NeighbourPixels do
                        Delta = ComputeDeltas(i,j)
                        Deltas[i] += Delta
                        Deltas[j] -= Delta
                done
        done
else
for i := 0…AllPixels
        for j := i…AllPixels
Delta = ComputeDeltas(i,j)
                Deltas[i] += Delta
                Deltas[j] -= Delta
        done //for j
done //for i
if NeighborSize > 0 then
        for Iteration = MAX_ITERATIONS;
                Iteration > 0;
                Iteration := Iteration - 1
                for i : 0…AllPixels do
Sum := 0
Neighbors := 0
                        for j in NeighbourPixels do
                                Sum += Greyscale[j]
                                Neighbors++
                        done
Greyscale[i] = (Sum + Deltas[i]) / Neighbors
                done
```

```
        done
else
        for i := 1…AllPixels do
Greyscale[i] = (Deltas[i] – Deltas [i-1]) /
AllPixels + Greyscale [i-1]
        done
ConvertLabToXYZ
ConvertXYZtoRGB
```

Computing the deltas

The most intensively computational part of the algorithm, approximately 95% of the total processing time, is the one that deals with the calculation of the deltas, as per the pseudo-code above, the 'computeDelta' function. This function receives as input the position of two pixels, let's denote them i and j, and it outputs δ_{ij}. The first decision that the logic of this function has to take is to compare the difference in luminance δL_{ij} and the difference in chrominance $\delta \vec{C}_{ij}$. In order to compute the difference in chrominance, the [1] defines a function named 'crunch' which has the main goal to limit the much bigger spectrum of values of the chrominance to a smaller one which is [-α, α] in order to fit the luminance's specific range of [0,100]. This 'crunch' function receives as input the Euclidian distance between the two chrominance points, the a* coordinate and the b* coordinate, and outputs its adjusted value. The value gets adjusted as per [1] by applying the equation on the Euclidian distance and by making use of the inputted α parameter.

$$crunch(x) = \alpha * \tanh(\frac{x}{\alpha}) \tag{1}$$

The equation (1) ensures that all possible values are least than α and bigger than -α.

After having obtained also the chrominance difference the logic looks at testing whether or not the luminance difference is bigger than the chrominance. If this is true than there is no point in going to the next step and so the function simply returns δL_{ij}. But if the chrominance difference happens to be bigger than the luminance, it means that there is the possibility at looking at two isoluminant color values, and so the Challenge1 comes into focus. As per an earlier chapter, the Challenge1 is solved by making use of the θ parameter. Equation (2) basically is a way of separating the color space in negative and positive parts and based on that to make isoluminant colors brighter or darker. The output in this case is decided by $\vec{v}_\theta$ itself: if its sign is equal to that of the 'crunched' chrominance than the 'crunched' chrominance itself is returned, otherwise it is returned the negative value of the 'crunched' chrominance.

$$\vec{v}_\theta = \left(\cos\theta * \delta A_{ij} + \sin\theta * \delta B_{ij}\right) \tag{2}$$

Complexity and Performance

One first aspect that greatly influences the complexity and, implicitly, the performance of the algorithm is by the total number of pixels of the image to be processed. In the framework proposed, if the user does not specify a value for the input parameter μ (i.e. the number of neighbor pixel), then the algorithm will perform in a globally way, thus generating every pixel pair possible. Let's suppose that the input image is a NxN square image. Then the complexity for generating every pixel pair for the complete case (full neighborhood) is $O(N^2 * N^2)$ and for the partial case is $O(\mu^2 * N^2)$. Apart from this complexity, there is also the complexity for transforming the RGB color space to Lab color space and at the end back to RGB space, which brings an additional complexity of $O(N^2)$, but which is insignificant compared to that of $O(N^4)$ which is necessary to compute the deltas needed. As a result the computation for a 128x128 image takes 30 seconds on an i5 processor. Limiting μ to 16 the time drops to 7 seconds.

Results and Discussion

Figure 7 shows the impact that the varying of the parameter θ has on the outputted greyscale picture. As a reminder, this is the parameter which controls whether the difference for isoluminant colors should increase or decrease in brightness. It can be easily noticed how the green colors appear darker on the right side of the trigonometric circle and how they are lighter on the left side (especially in the second quadrant). The picture in discussion shows a very simple way of understanding how the θ influences the lightness variance. It is interesting to notice that the a* and b* components of the L*a*b* color space have been drawn with very suggestive colors. Large a* values indicate red, small values indicate green. In a similar way, small b* values point towards yellow and large ones are for blue.
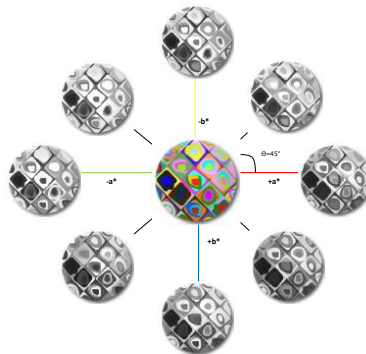
Figure 7. Influence of θ parameter on greyscale image

The next interesting phase of testing the proposed algorithm was that of varying the α parameter. This one is the one that is in charge with how much of an impact the difference between the chrominance between two pixels should have on the outputted greyscale image. The 'crunch' function limits the possible values of the deltas to [-α, α]. Figure 8

shows the results of running the tests with different alpha parameters. It is worth noticing that while the alpha increases, the chromatic variance between the images also gets more obvious. The images were obtained with full case neighborhood and θ=45°. The picture elements that best reflect this phenomenon is the sun and its reflection in the water. In the top most pictures (α=25 and α=30) they are more strident.
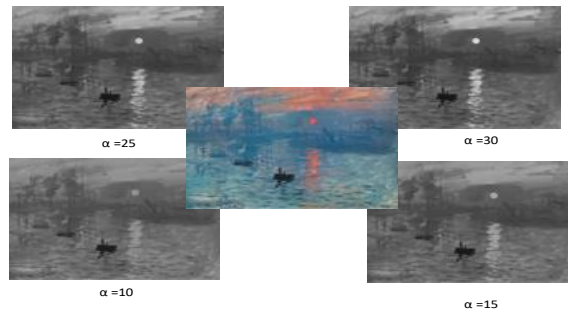
Figure 8. Influence of α parameter on greyscale image (image taken from [1])

The last parameter left to be exercised and whose influence is to be noticed is the radius of pixels (neighborhood size). It can be seen from test scenario Figure 9, that when taking into account a smaller number of surrounding pixels the color progression is more obvious because of the image gradients that do not correspond to the initial colorful picture (eq. the grass in bottom pictures from Figure 9). Also it is possible for two pixels that are not in each other's radius and which have same luminance but different chrominance to be mapped to the same final value, which is not necessary correct.
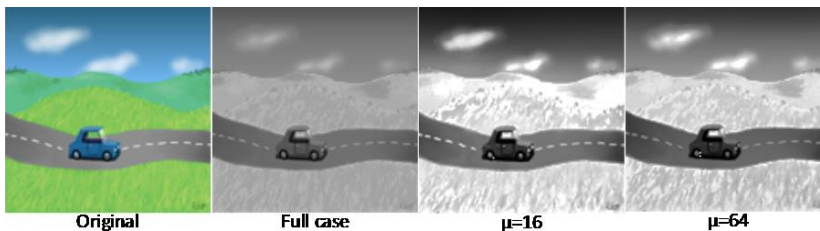
Figure 9. Influence of μ parameter on greyscale image (source image taken from [1])

5.   CONCLUSIONS AND FUTURE WORK

The framework developed through this paper has several advantages. Firstly, it is very easy to use. The User Interface implemented in MATLAB through which the user interacts with the executable is very intuitive and friendly. This is what makes the effort of the user to be as low as possible.

Secondly, the framework offers some level of manipulation of the outputted images. The greyscale conversion gives the possibility to the user to vary its input parameters (theta, alpha angles and also the neighborhood size).

One limitation of the current developed framework is the fact that the output of the format image cannot be controlled. The output image will always be of PNG format, regardless of what format the input picture may be.

Another disadvantage may refer to performance issues. The algorithm for greyscale conversion has a complexity of $O(n^4)$ which means this is not one of the fastest algorithms that there can be for coloring in gray a colorful image.

Future work will be focused on finding a way to reduce the costly computation of the target differences; perhaps a method of storing the difference in luminance values for every pair of pixels in a table so that to avoid the overhead of computing them every time they are needed. Another solution to the performance issue is to try to parallelize the code as the logic of the algorithm seems very permissive as the values of the currently computed output pixels depend only on the initial values in the input image.

Maybe it could also be interesting investigating the behavior of the greyscale algorithm when applied in RGB space and what kind of adjustments are necessary in order to eliminate the problem of strong correlation of axes. Another interesting continuation of the greyscale conversion would be to recolor the obtained grayed out image back to a colored one by using the luminance values obtained through the algorithm and keeping the chrominance features from the initial image.

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DESIGNING A FLEXIBLE DOCUMENT IMAGE ANALYSIS SYSTEM – PART 1: THE ARCHITECTURE

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ABSTRACT:

Archives of manuscripts, old printed books, papers and so on, are only available on paper support. Making them easily accessible to a wider public involves not only scanning them, but also processing them using OCR applications to extract the actual contents and make it searchable.

KEYWORDS: OCR, Digitization, Document Image Analysis, Document Export, Retroconversion

1. INTRODUCTION

The aim of this project is to evaluate the possibility of designing a modular OCR system, made of independent components, which could be dynamically configured at runtime. Most modern systems have a monolithic design, leaving the user little to no possibility of interfering with the configuration of intermediary processing steps. At best, the user has the possibility of choosing the format of the end file (PDF, Doc or text file), and in some cases selecting the document areas that would undergo content extraction. Another configurable component of modern systems is the dictionary which might be used to improve the word matching rate. Sometimes, more than one dictionary may be specified, but this is nothing more than a convenience feature, as all the contents could be part of a single file.

This paper is the result of the 2 year's work done for the master thesis of the author [30]. Other papers published during this period, which are connected to the presented subject and can add relevant information, which was omitted here for the sake of consistency, are [26] and [27]. They go into the details of preprocessing and contain detailed related work.

2. DOMAIN OVERVIEW

History of OCR Systems

Developing automated systems for character recognition has attracted the attention and imagination of scientists for a very long time. However, the technology to achieve it only became available around the end of the 19th century and the beginning of the 20th century, with the invention of scanning devices. In the interbellum period, a couple of patents were awarded for OCR machines, one to Gustav Tauschek in Germany in 1929 and another to Paul Handel in the US in 1933 [10]. And although these never materialized

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in actual machines at the time, due to technological limitations, the idea behind them, of matching characters to templates, would form the basis of many OCR systems to come.

Eventually, technology did catch up, thanks to the innovations brought about by the Second World War, so when a commercial opportunity arose in the 1950s in the domain of character recognition, financing and research in this domain took off. The opportunity itself came in the form of a challenge launched by the finance sector, which was looking for a unified mechanism for automatically processing checks - an activity that after the war had become the most wide-spread printed document processing activity. Eventually, the winning solution was Magnetic Ink Recognition (MIR), but there were also some proposals that relied on OCR [8].

In 1955 Reader's Digest bought the first commercial OCR[12], which was used for processing printed sale reports and generating punched cards, which would then be used as input for the computer that handled the delivery of 15 to 20 million books every year. The system itself had been developed by David S. Shepard, based on a patent obtained in 1953, in his company, Intelligent Machines Research Corporation.

Another system was sold to Standard Oil, for reading data from credit cards, so as to ease the bill generation procedure. Among the systems sold by IMRC till the end of the 1950s, there were also a bill reading system for Ohio Bell Telephone Company and a system for scanning pages used by the US Air Force. In the following years, IBM and other companies obtained the right to create systems based on Shepards's patents.

By the mid-1960s, Reader's Digest and Radio Communication of America were collaborating on developing an OCR system for identifying series numbers on Reader's Digest advertisement coupons. To do that, the text was printed with an RCA Drum printer, using the OCR-A, a special kind of font specifically designed to simplify the OCR process. The system itself was composed of a reader connected directly to an RCA 301 computer, followed by a specialized document reader that could process up to 1500 documents a minute. The documents would be either fully processed or rejected. Eventually, the system became part of product line offered by RCA, which could be used for processing bills.

Perhaps the company with the longest tradition and highest impact in OCR usage is the post system. In the USA, the postal service has been using an automated system since 1965. The receiver's address is identified by OCR analysis, and then a bar code is printed on the envelope, which is a lot simpler to read and interpret by subsequent classifiers in the chain [22].

Related Technologies

Because character detection is not 100 percent accurate and it can be relatively expensive computationally speaking, alternative systems have been designed to deal with interpreting printed information. In the following sections, an overview of these systems is presented, along with their advantages and disadvantages.

ICR Systems

Intelligent Character Recognition (ICR) systems process non-cursive hand written characters, which are then converted into digital characters. These systems mainly focus on digit recognition, which has a far greater success rate than letter recognition. The accuracy of this solution is lower than that of OMR and it requires additional editing and checks [12].

OMR Systems

An OMR (Optical Mark Recognition) detects the existence of a mark, not its shape. The technology is usually used for automatically processing forms that contain check-boxes that the respondent has to fill in. Although such a system is incapable of recognizing actual characters, limiting to some extent its flexibility, it displays the greatest processing speed of all file processing technologies. These systems are most often used for standardized testing, so they have to be able to differentiate between various grayscale intensities, which might mean the difference between a checked check-box and one whose content has been erased [12].

MICR Systems

Magnetic Ink Character Recognition is a special technology for identifying characters used by the financial industry to facilitate the processing of checks. Most US and UK checks include an MICR identification code that uses a special font E-138. Supported for recognizing this font is included in most modern OCR systems, without making use of the magnetic ink. However, sometimes, the background of check can have rather complicated designs that would interfere with the recognition mechanism, so there is a need to use the magnetic component of the ink to guarantee high recognition rates [9].

OCR Today

The main area of interest for using OCR systems nowadays is represented by the digitization of paper archives, which are of interest to the public due to their historic importance. The aim is indexing the contents of all the papers and allowing the public to search the contents by key words.

To evaluate the performances of an OCR system, two measurements are used: confidence and accuracy. Confidence indicates to what extent a system can rely on an identification it has performed and consists of assigning a (confidence) score to the proposed identification. Confidence starts from character level, then it can be aggregated over all characters within a page, a document or a set of documents. The accuracy score, regardless of its value, cannot indicate if the identification was correct or not. This can only be done by a human supervisor, who can manually determine the accuracy of the identification: how many characters (or possibly) words were correctly identified within the analyzed sample.

Following tests performed on a set of papers dating from the 19th and 20th centuries as part of a big digitization project, the accuracy for letters ranged between 71 and 98 percent [9]. According to this analysis, for some documents, approximately 30% of all characters are misclassified. If they were to be uniformly spread among all words, searching the document for keywords would become basically impossible. It is therefore quite likely that for older sources, as the quality of the documents drops, the number of recognition errors increases.

Apart from the accuracy of character identification, papers also pose the problem of segmenting and grouping text into logical units. By correctly determining the reading order of the contents of a paper page, titles and subtitles could be identified and provide an extra indexing mechanism.

The problems that appear in the final steps of document processing may have various causes, each of which can be dealt with by applying the appropriate correction technique. The most important factor is the quality of the physical document in itself, thus, while scanning the image it is important to use a resolution that allows to capture the relevant information without using too much storage space - usually, 300dpi is a good enough resolution. The image format is just as important, because it would be a shame to lose part of the information by storing the image using a lossy format.

What follows is a preprocessing step, which attempts to improve various features of the image, of which, one of the most important is foreground-background contrast enhancement [15]. Most often, this simply consists of binarization, but there are also other approaches which would rather use the image in its grayscale version. The next step attempts to determine the element positioning within the page, with a possible skew correction, if the document was not correctly aligned. Then comes the edge detection, process which might suffer due to a potential skew correction that might have interrupted existing edges. The edges or more precisely features of the edges are now used for character detection, with various degrees of accuracy. Characters are grouped into words based on closeness, confidence and matches in existing dictionaries [15]. Depending on the used OCR, the performance of this step may be improved by adding additional dictionaries or perhaps completing an existing one with toponyms or technical terms relevant to the contents of being analyzed. A step that is not actually part of the document analysis is training the OCR system itself [11]. Although it does not produce results directly, the impact it has on creating a database of relevant features for future documents might greatly improve the performance of the OCR system.

Unfortunately, despite all the advancements in the domain and the increasing processing power of modern computers, automatic processing cannot equal human performance; the intervention of human users is sometimes critical for correcting the output of such processing systems. Human intervention ranges from correcting the final text - most frequently - to setting custom parameters for various steps in order to respond to the features of the image being processed.

3. PROPOSED SYSTEM DESCRIPTION

The proposed solution has the main purpose of serving both as a functional (and good quality) Document Image Analysis System, and as an educational tool for students researching this field.

Application Structure

The system has a modular structure, each functionality being implemented by a standalone Executable.
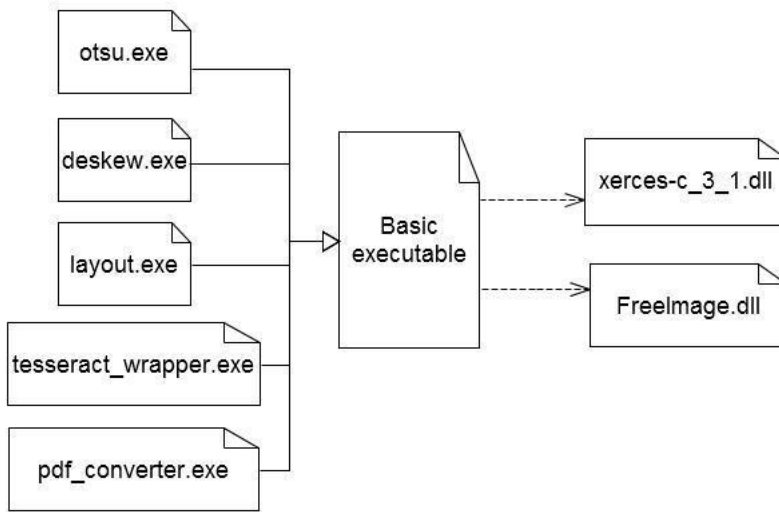
Figure 10. Component Diagram

All executables that compose the system interact more or less with images, so they need access to the FreeImage library. For example, while otsu.exe creates a new bitonal image based on the initial image, pdf_converter.exe on the other hand will use the library to make interrogations related to image features.

Another aspect common to all these executables is communication through XML files. XML files are used both for setting configuration and input parameters as well as reporting the results of the processing. Therefore, all executables must have the capacity to parse XML files.

Development

Typical Code Structure

All executables have as unique input argument the name of an xml file, which contains the parameters with which the program will run. The XML format is standard, and imposed by an XML Schema specially defined for this purpose. After the file is parsed,

application specific structures are built and initialized, storing the parameters that are to be used in the processing.

When the processing of the XML file is done, the initially populated structures are checked, to guard against invalid parameters. Aside from the processing result itself, whether it is a modified image or another file type, an auxiliary xml file will also be generated specifying if the processing was successful or not.
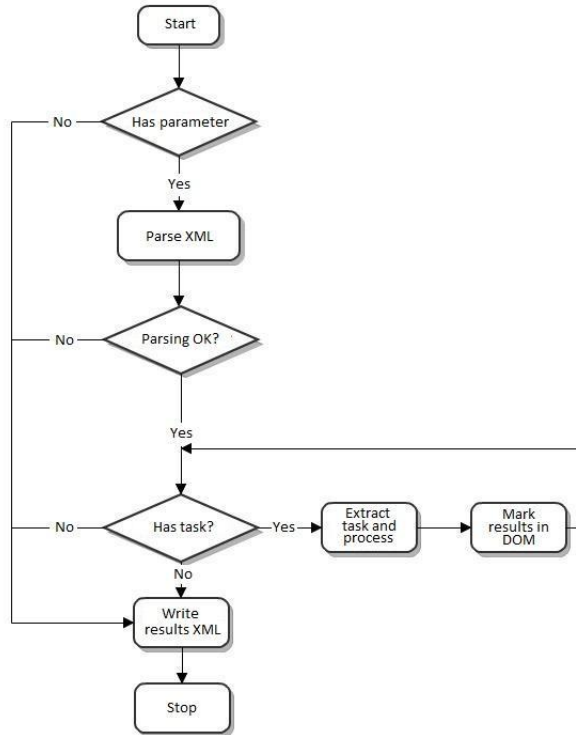
Figure 11. Code Execution Diagram

External Dependencies

Because some of the aspects of the system were auxiliary to the project, external libraries were used to solve the difficulties that arise.

FreeImage is a library developed under the GNU GPL license which offers support for the most popular image formats. The library offers minimal support for pixel manipulations, which reduces the memory costs of using it.

Xerces is an Apache library for manipulating XML files. The parsers included in the library are XML API compliant. The Xerces project was initially developed at IBM, both the Java and the C++ implementation. Eventually, Perl was added to the two languages, and due to attention it received, it ended up being top level Apache Foundation project.

As mentioned earlier, for the OCR processing itself, the system uses Tesseract. As it deals with images itself, Tesseract also uses a third party image processing library, and in this case it is ImageMagick; this library has a more generous interface, with more functionality, most of which however are not necessary to Tesseract.

Also, conversion from the METS/ALTO format to PDF is done through a third party binary, which also needs to access images. Luckily, it too uses ImageMagick, so there is no need for an additional library.

4. COMPARISON TO OTHER SYSTEMS

Ideally, a single software package should be able to extract the information from any type of document it is presented, but the truth is that most times highly specialized software is used to solve a specific problem. For optimum results, analysis systems, as well as their components, tend to have a limited applicability. This may involve a limited series of processing than can be performed, imposing a restriction on the quality of the documents, limited language support, or specific document layout, for archives of documents whose format repeats over and over again [14][4]. Yet, even when the input material is limited from the point of view of the contents, the required processing might be very complex, due to high variety of other parameters such as paper color, non-standard text layout, and wide ranging handwriting styles as is the case of [19].

Document image analysis systems may be limited in scope to things such as extracting names from documents [18], or processing only tables, graphs and images [16]. These simplifications rely on the assumption that only certain information is worth being used for document indexing.

The system described in [7] circumvents character recognition altogether, extracting "word images" that are then matched with user inputted keywords through word-to-word matching.

Some systems simply cannot compensate for the low quality of the documents that are processed, so the designers developed systems that rely on user feedback. As stated in [11], without human intervention, the results tend to degrade significantly, so human intervention is compulsory for good results. The systems proposed in [6][14] use initial human input to create templates that are afterwards used to extract information for similarly constructed documents, with no other user intervention expected. More common, though, is allowing human users to review the proposed results of the analysis and correct them accordingly [14][24].

Other systems allow the user to gain full control of their capabilities [17], which could be useful whenever the batch mode processing does not yield the expected results. A more radical approach is to leave the entire document analysis to the end user [25], taking advantage of a large community of scientists that are interested in those documents and can collaborate on enhancing them. Some degree of automated processing could be integrated nonetheless, having been tried in [24]. However, in order to eliminate the effort

of duplication, a single shared model of the documents should be used [21]. Crowd sourcing is also used for [13], in order to review the results of the automated processing and improve the quality of the end documents.

There are currently several large scale projects for digitization of national archives in countries such as Australia, Finland and the USA. Apart from the hardware support for scanning the documents, these also enjoy performant software dedicated to information extraction. In the following sections, a couple of these systems are described, and their architectural choices are compared to those made for the current project.

OCRopus

OCRopus is an open source software distributed under the Apache 2.0 license for document analysis and OCR processing. The last version of the system is 1.0, launched in April 2014.

Apart from the critical components that are written in C++, the system also has scripting support in languages such as python and LUA. As a result, the OCRopus components can be accessed either by linking the C++ dynamic libraries or through scripts [1].

The functionality of the system may also be extended by writing classes that implement existing interfaces or extend classes. Any class that implements one of these interfaces can afterwards be used in OCRopus as if it were a native component. Among the interfaces, there are some dedicated to image enhancement, page segmentation and classification interfaces [1].

Like the system that was presented up until now, OCRopus is also easily extensible; however, adding new components is conditioned here by implementing the interfaces, which are not I/O XML files, but C++ ones. OCR opus can be configured for either performance or flexibility, which is not possible in our proposed system, which was mainly designed having flexibility in mind.

OCRopus enjoys relative success, and the developers, once they become accustomed to the components, which are quite numerous, may create fast and relatively well performing image processing components. The disadvantage though is the fact that it requires getting accustomed with the components, which may be too big of a hurdle for developers that are not fully committed to this solution. On the other hand, using XML files to communicate with other components is a lot easier, as the technology is relatively familiar, and the developers may choose to implement their solutions using any library they find useful.

METAe

METAe was a research project founded by the European Commission that took place between 2000 and 2003. The aim was to create a software that would allow the conversion and archival of historic documents such as books, scientific publications, magazines and newspapers.

The METAe system simplifies the digitization of documents because it detects structural elements in printed documents without prior training. One of the more advanced processing that the system performs is the hierarchical analysis of the components, which leads to cataloguing the text zones as titles, subtitles, articles etc. and their grouping into logic sequences [2].

The results of the image processing may be saved in different formats typical for archives of digital documents. METS and PDF are some of the most popular in that respect [2]. The current system only outputs PDF as its final format, but given that the METS/ALTO is generated as an intermediary format, the possibilities of expressing the end result are basically limitless.

The developers of the system were aware that the implemented algorithms are not perfect and would not be able to cover all cases. As a result, the system allows humans to make low level modifications. This is also possible in the proposed system, through some of the graphical interfaces or by directly modifying the intermediary files.

METAe is hardly flexible, with all components being compiled into the final system; although the components can be configured through the use of carefully selected parameters, developing a new component implies recompiling the entire project.

5. CONCLUSION

The world of Document Image Analysis Systems is getting larger and larger. Unfortunately most of the proposed applications lack a full configuration for the processing flow and for the components involved. The system presented in this paper may be a solution which is easy to configure, fully customizable while also providing both robust everyday usage and good quality results.

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OCR QUALITY IMPROVEMENT USING IMAGE PREPROCESSING

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ABSTRACT:

Optical character recognition (OCR) remains a difficult problem for noisy documents or documents scanned at low resolution. Many current approaches rely on stored font models that are vulnerable to cases in which the document is noisy or is written in a font dissimilar to the stored fonts.

In this paper we test two approaches for preprocessing, or correcting the input images. The focus is on noise reduction, lightness correction and binarization, all relative to found letters with a slow but more accurate method and a fast and less accurate method. We then compare the results and see if the extra time spent in developing more complex letter deduction technique offers significant improvements.

KEYWORDS: OCR preprocessing, image correction, noise reduction, binarization

1. INTRODUCTION

One important problem in the field of image processing is data extraction from documents. We are trying to convert as much information as possible from paper to digital form for preservation purposes. Due to the quantity of data to be converted, manual processing is not an option for cost and time issues. OCR [4] helps with the automation of the process. However especially important historical documents are degraded and they can't be detected by the OCR without prior processing. Here are some of the more common techniques applied before actual interpretation of the text:

- Equipment Calibration and Data Acquisition [7]

- Noise Reduction

- Binarization [8]

- Deskew [9]

- De-speckle

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● Classification

● Layout analysis

● OCR preprocessing (the step we're interested in this paper)

● OCR [10]

● Optional step: OCR postprocessing [11]

In this paper we test two approaches at preprocessing and compare the results.

Related work

Noise reduction is an important problem today with a very wide field of applications, from artistic photography to medical diagnosis. In the domain of optical text recognition, noise can affect profoundly the performance of the text recognition and reconstruction software, having a cascade effect on the processing pipeline.

Various methods were employed to be able to reduce the noise without damaging the useful signal in the image. In their work on medical X-ray images enhancement, Hensel et al [1] use a transform called Laplace pyramids. Multiple layers of pyramidal transformations of the image are generated and the processed image is reconstructed by combining these layers in a different way that gives a bigger weight to the useful signal and a smaller weight to the noise. This work is the main inspiration for the presented application.

Usually referred to as "salt and pepper" noise, or impulse noise, the type of noise given by extreme values for some of the pixels is the subject of Chan et al. [2]. This type of noise can appear in binary images after different other noise cleaning methods are applied. In their work, they apply adaptive median filtering to neutralize this kind of noise from images.

In 1998, Winkler et al [3] did an extensive work on edge preserving noise removal methods. They analyze some of the current methods and approach M-estimators and nonlinear filters to obtain similar performance.

Aside the correction of the image, a slightly modified version of the Adaptive thresholding using integral images [6] will be used, in order to work with degraded images.

2. PROPOSED APPROACH

We will compare two different approaches, both very similar, but with different implementation approaches for achieving the purposes (ex: the first approach actually encapsulates letters in bounding boxes, while the second considers letters the regions of

high contrast in the image). At the end we will see if the extra time spent on precision processing offers significant improvements or none at all.

3. THE FIRST PREPROCESSING ALGORITHM

- Grayscale transformation of the image

- Histogram equalization

- Adaptive binarization with window dimension 12

- Identification of the potential letters using the WordHeight function on the binarized image

- After the letters are saved, the noise level is measured by counting the potential letters with height less than a certain value

- If the noise level is above a threshold, we apply noise reduction using a Gaussian pyramid on the post-histogram equalization image from above. Otherwise, we skip to the next step

- We apply adaptive binarization using a size 12 window to determine the average letter height (a potential letter is a set of interconnected black pixels)

- We re-apply the adaptive binarization using the average letter height as the window size. The letters are saved in an array

- Each rectangle containing what is present in the original image inside its limits is saved in an OpenCV matrix which in turn is saved in an array

- On each of these matrices we apply histogram equalization and adaptive thresholding. We create a new white image the same size of the original. The new image is populated by the rectangles. We apply a simple median filter

- We save the final image

3.1. Histogram equalization

This method is mostly used for contrast adjustment using the image's histogram to modify the pixel intensities. [5]
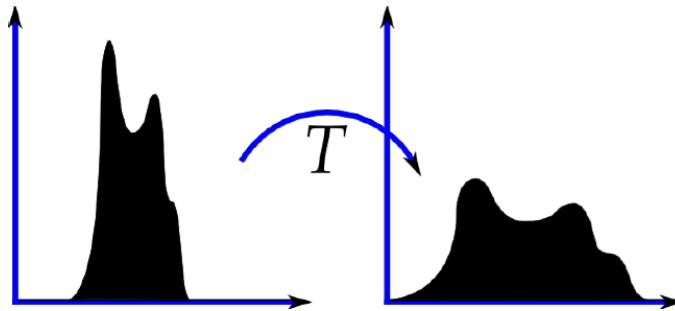
Figure 12. An example of histogram equalization

In this implementation, the color space used is YCbCr. For each intensity, the probability that a pixel has that intensity is calculated and added to the sum of the probabilities of all the intensities smaller than the current one. Having arrived at this value, the algorithm tries to find an i for which i/255 is closest to the current value. After finding it, all pixels with the current intensity will be converted to intensity i.

3.2. The WordHeight function

The idea is that after a basic binarization with a small window, most letters will be present more or less correctly. The crucial aspect is their heights. Making the presumption that the binarization will only ruin a small number of letters, we will be left with a meaningful amount of letters from which we can approximate their average height.

The algorithm works by visiting each fairground pixel: for each unvisited black pixel, the following steps are executed:

- The pixel is marked as visited in the visited pixels array and a new letter instance is created

- The immediate neighbors of the pixel are checked and added to the letter

- This iterations ends when reaching the last pixel in the array

- After forming a letter, it is added to the letter array and its height is added to the height array.

- After finding all of the letters, the heights are sorted in a separate array and eliminate the ones below a certain value.

- The median height is considered as the height used in the future steps of the algorithm.

- Finally, letters with height lower than the average will be eliminated.

- During these operations, each letter structure will also contain the encompassing rectangles.

Figure 13. An encompassing rectangle around a binarized letter b

3.3. Noise reduction with Gaussian pyramid

This method consists of reducing the image to half of its dimensions and then expanding it to its original size. In doing this, a sizeable amount of noise will be removed. The reduce operation consists of isolating a 5x5 matrix with the current pixel as its center and calculating 4 values by multiplying the middle row, middle column and diagonals with vectors and then performing a mean average. These vectors are:

- [0.1, 0.25, 0.3, 0.25, 0.1] for the column and row

- [0.075, 0.225, 0.4, 0.225, 0.075] for the diagonals; the pixels are chosen intermittently on the columns and rows. The expand operation is the inverse of the first one, interpolating the pixel values to find the missing pixel values.

3.4. Final steps

The image is re-binarized according to the medium computed letter height. Thus, we can establish an encompassing rectangle for each letter and local operations can be performed, ignoring the potential large contrast differences from other parts of the image. Also, to eliminate the noise which will be saved as letters, only letters over certain heights will be passed along to the next step.

4. SECOND APPROACH FOR IMAGE PREPROCESSING

- Substract Laplacian Operator

- Non Local Means Denoising

- Noise removal from non-text regions

- Automatically choose binarization parameters based on noise measurements

- Automatically choose binarization parameters based on result observations

4.1 Discrete Laplacian Operator

This is the first important algorithm applied over the image, of course after the image was transformed to grayscale. This step is done to detect the edges of letter. Of course to see the result, scaling to absolute is required.
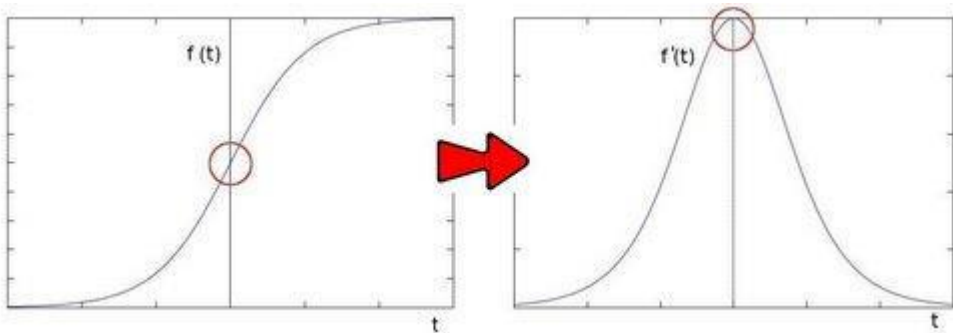
Figure 14. Edge is characterized by a maximum. First Derivative[1]
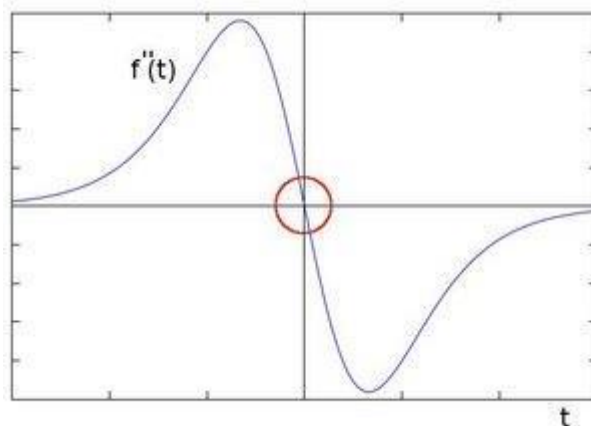
Figure 15. Second derivative is 0. Used in edge detecion[1]

4.2 Store difference between Laplace and normal image

Now subtracting the result obtained from the Laplace transform from the original image, the algorithm will increase letters thickness. Parameters can be change by increasing the contrast of the Laplace image.
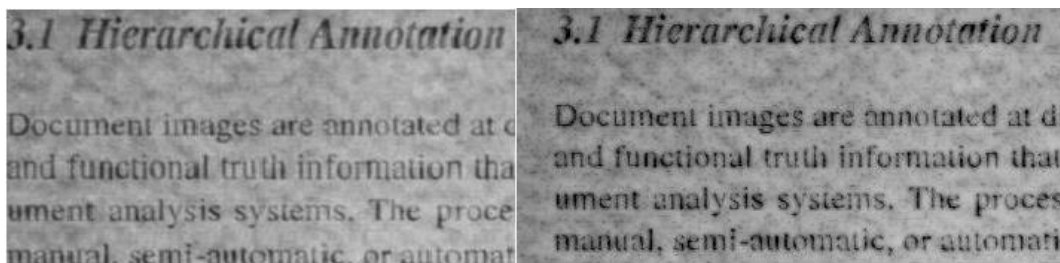
Figure 16. Applying Laplace and subtraction from original: left=original, right=processed.

4.3 Denoising

Denoising is applied over the image obtained in the second step. There are a few algorithms used in image processing. For this experiment Non Local Means Denoising was used. The algorithm searches for similar pixels in the image and can classify a pixel as a good value or noise. To compute similarities in a window a weight function can be applied.

There are a few factors that should be considered when implementing this algorithm. The size of the window (gives the processing time), the similarity window which must be smaller than the process window (usually it's somewhere about 7X7 pixels and the weight function. This is the most time consuming part of the algorithm.

4.4 Speckle removal

The noise removal stage affects only the binary noise that occurs in non-text areas.

The noise removal algorithm is obtained by applying the following steps:

- Compute the binary gradient map by applying the Sobel operator (Figure 6);

- Binarize the gradient map (Figure 7);

- Apply a morphological dilation to the binary gradient map. This step is necessary in order to make sure that we don't remove any of the text regions (Figure 8).

- Remove small contours from the image obtained in the previous step (Figure 9).

- Apply a bitwise and operator between the image obtained in step 4 and the binary image selected by the adaptive thresholding algorithm (Figure 10).
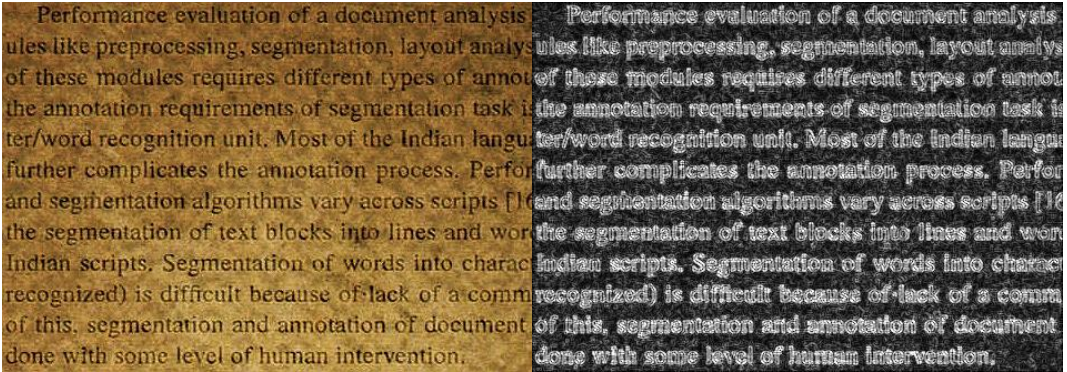
Figure 17. The results after applying the Sobel operator: left - edge enhanced image, right - gradient map
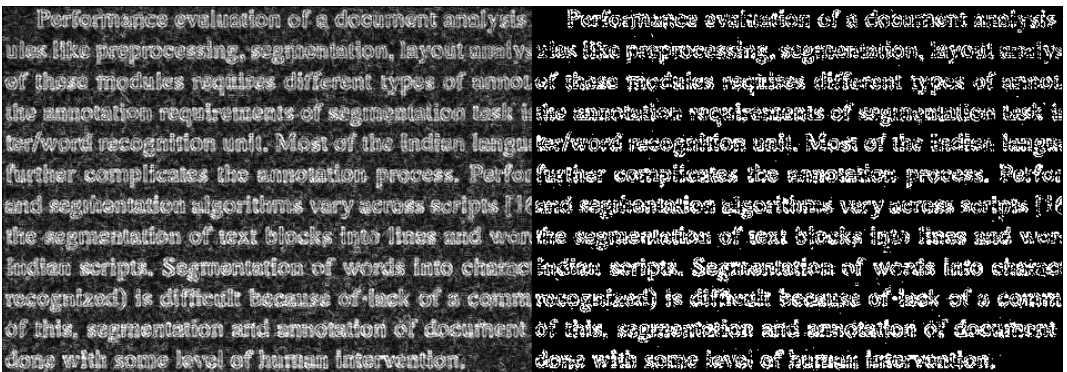
Figure 18. The results after applying a threshold binarization to the gradient map: left - gradient map, right - binary gradient map
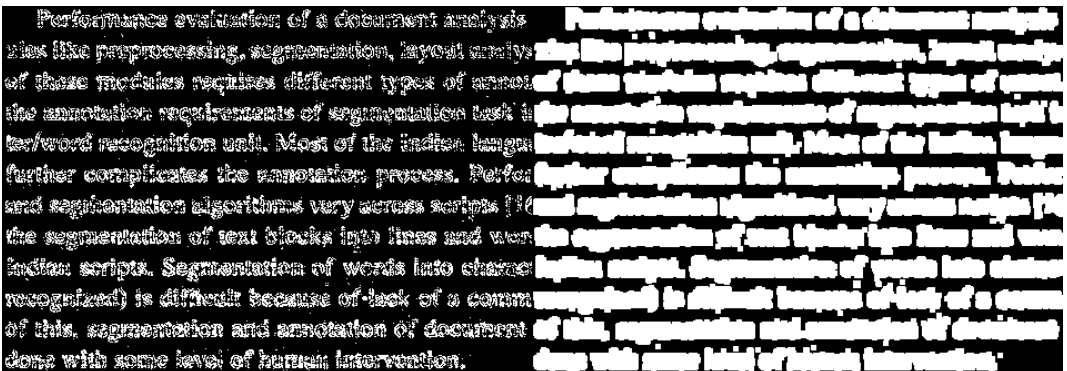
Figure 19. The results after applying the dilation morphological operator: left - binary gradient map, right - dilated binary gradient map

Figure 20. The results after removing small contours from the dilated gradient map: left - original image, right - processed image

Figure 21. The final result (right) obtained after combining the binary image (left) with the dilated gradient map (center).

4.5 Compute Noise Ratio

The noise ratio can be estimated based on the difference between the denoised image and the original image. The noise estimation helps in deciding upon which threshold algorithm to choose from. The adaptive thresholding is applied only if the noise ratio is above the threshold. The final image is binarized based on an adaptive thresholding method. The method is comparing if a pixel has a smaller or bigger value than the average pixels. If the pixel value is smaller only with a percent then the value is turned to black otherwise is white. This algorithm is super robust and can perform well on lighting variations. The only problem to be consider it the dimension of the window which can be chose based on the width of the image.

4.6 Binarization algorithm improvements

For this project we have used a binarization algorithm described in the article "Adaptive thresholding using the integral image" [6]. This is a simple and easy to implement algorithm, and provides good results in cases where the illumination is not uniform.

The adaptive thresholding algorithm depends on two parameters: S - a fixed window size and T - a percentage threshold.

In short terms, the main steps of the binarization algorithm are:

- For every pixel I(x; y) in the input image I, compute the mean intensity of the pixels in the window S centered in (x; y);

- If the intensity of the pixel in the center of S is lower with T percent than the mean intensity set its correspondent pixel in the binary image to 0, else set the correspondent pixel to 1.

For speed optimization, the integral image is computed at the beginning. Every pixel in this image is represented by the sum of all pixels with lower position indexes (in a top to bottom, left to right order).

In order to determine the optimal size of the window (parameter S) we have applied the following steps (results are shown in Figure 11):

- Compute multiple binary images with various sizes (for example from 2 to 20)

- Select the image that has the biggest difference in terms of the number of white pixels compared to the previous size
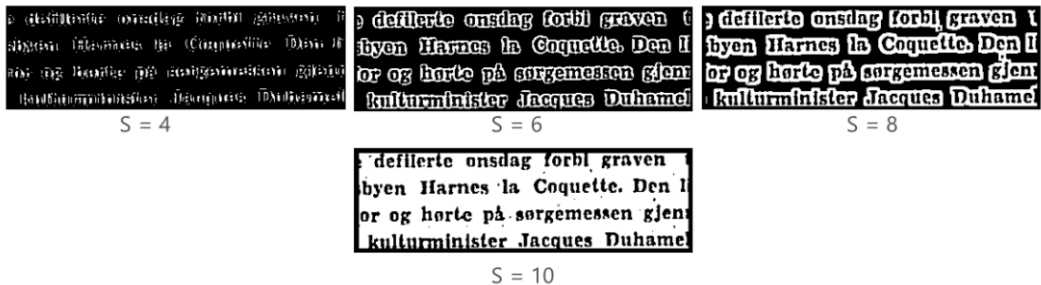
Figure 22. Binary images computed by varying the window size. In this case, the last image is selected as the best candidate.

5. RESULTS
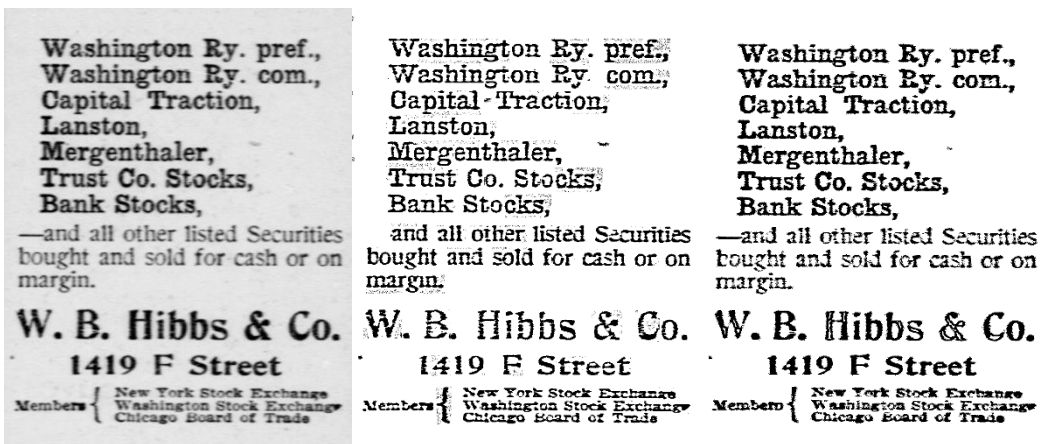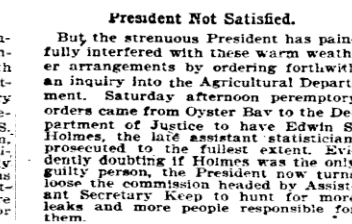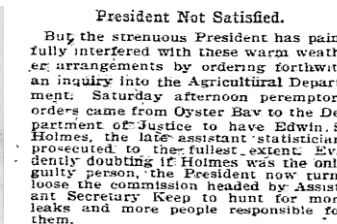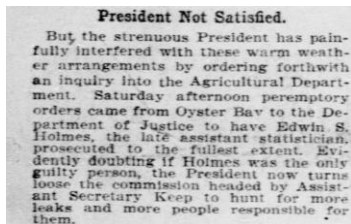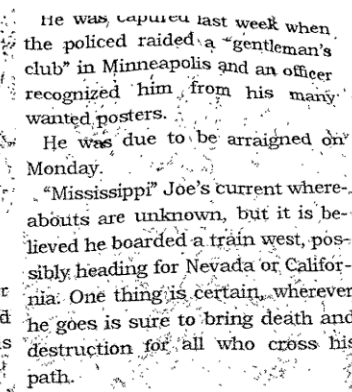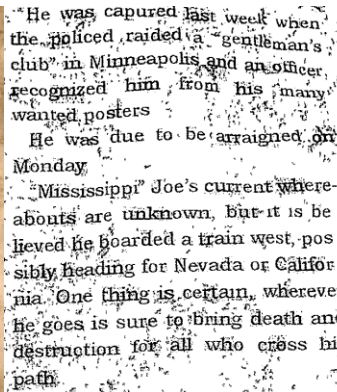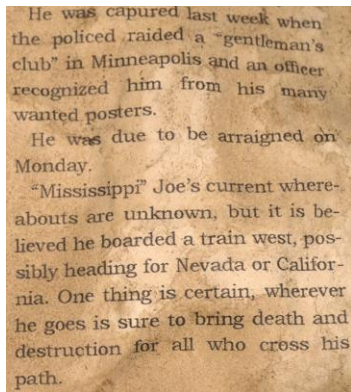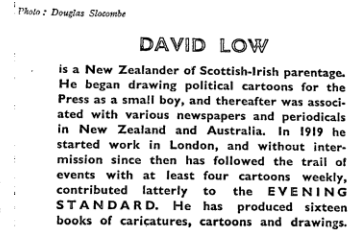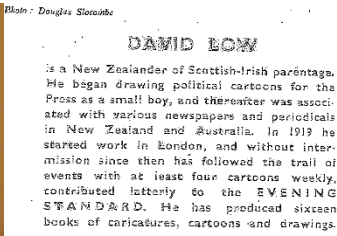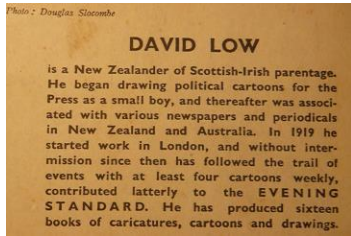
Figure 23. Results of the two approaches: first column - original image, second column - first approach, third column - second approach

From the results of different images we can see that even if the ideas are similar, the actual implementation approaches offer slightly different results. The first algorithm tends to induce noise around letters because of the binarization around each letter, but the letters are connected, whilst the second approach tends to find edges around large letters because of the edge detection approach in finding letters.

6. CONCLUSION

Because the range of the possible input images in the task of text recognition is very wide it is important to be able to bring different types of document scans to a common format that is easy to process by an OCR software. This involves an adaptive preprocessing that can correct the deteriorated document images without breaking the clean ones.

The list of dimensions of variability is very long, with just a few mentions being: contrast, skew, warping, text color, size and type-face, page layout and formatting, shadows /

specular highlights, background color, noise level, blur level. The current work aims to add invariance for contrast and noise differences.

Noise is particularly important, because it is almost omnipresent in the domain of scanned documents and it very often interferes with the textual content. A full range of factors can add noise to an image, from camera sensor aberrations, print bleeding through the page, to dirt and printer defects.

By using an adaptive contrast adjustment followed by a noise reduction algorithm, this work aims to improve the readability of documents, both for human readers and for OCR software. Noise reduction is obtained by decomposing the image in a Laplacian pyramid and recomposing this back into a gray-scale image with giving less visibility to the noisy layers. This algorithm chaining can give bad result on images with different type and sizes of fonts and good results on images with few variations for size.

The second algorithm is based on a series of smaller algorithms put together to create a good image which in the end is passed to an OCR algorithm. On a medium PC, the algorithm can take up to a few minutes, depending on the size of the input image. For future work parallelization can be implemented to speed up the whole process. The denoising algorithm is already parallelized using OMP.

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UNIVERSITY STUDENT ATTENDANCE MANAGEMENT SYSTEM

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ABSTRACT

This article describes the problem of managing the number of attendances or absences in the academic environment, as well as proposing a system of record and control of these data. The article supports the idea of an automated system over the day-to-day handwritten attendance registries, in order to facilitates the process. The system comprises a timekeeping system that will register every student or teacher in a database. The database itself will be managed by the University, so that reports, either individual or collective, can be issued whenever they are needed on both physical and electronic format. Also, these reports would be used to create statistics and further help the growth of the academic process correlated with students' interest or attendance rate on certain classes. The timekeeping machines offer a quick alternative of counting the attendances and the process to do so is very much simplified.

KEYWORDS: *Attendance, registry, electronic, online.*

1. INTRODUCTION

The process of monitoring attendances in any institution is an important part in determining the efficiency of the services offered by the institution and the general interest of those who benefit from the institution's services, in our case, the students. This process is a pain staking routine, and as such, this article proposes a new way of dealing with the old system, which implies handwritten attendance registries, which had to be filled in after wrote every course, seminar or laboratory, for each student individually. These registries would later be sent to the school's secretariat where all the attendances or absences would be counted manually for each student. This method is both time consuming and prone to errors, either by marking a student as absent by mistake or counting the wrong number of attendances when reports or statistics are to be delivered.

The present article proposes an automated system that is able to count the number of attendances, store the data for a long time in both physical and/or electronic format, and

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create reports and statistics to show the accurate number of attendances, the general interest for a specific course as well as statistics concerning the attendance rate for each student. Our new proposed system consists in a timekeeping mechanism placed in every class room, and a set of software programs to run the solution. The most important part of our solution is a database containing all the information about students, faculty and timetables.

2. SOFTWARE IN THE ACADEMIC ENVIRONMENT AND TIMEKEEPING SYSTEM

The need for accurate and fast registration of attendance or absences can be satisfied by implementing a software driven method. Software solutions are already a part of educational institutions and they have evolved from providing basic student information to „blending learning environments, supporting data-driven practice, and running their organizations more efficiently"[1], according to Clayton Christensen Institute. If most aspects of a learning institution can and have been improved by software usage, managing the attendances is one of the steps in building a more efficient institution. According to Linnea Boden „in the vast majority of Swedish schools, computer software is used for the registration of the absences and presences of students"[2].

Our system would have, as stated before, timekeeping machines placed in every class room of an institution and a set of software programs specifically designed to handle such data. Each student would receive a card with their information on it such as first and last name, faculty and year of studies. Each card would have a unique code inscribed on it, which is entered in the data base holding all student and professor information, either by hand or using a card reader. The code on the card becomes primary key corresponding to the according table in the database, so that with each swipe of the card through the timekeeping machine, the code would be recognized and the student can be marked as „present" for a certain time slot, as defined inside the software solution.

3. BIO-MATRIX SYSTEM

As a proposed solution we have chosen the BIO-Matrix machines[3] - available commercially on the Romanian market - which allow data registration by means of using an electronic card, a code or even a fingerprint. These systems have a memory that can register at least 2000 cards, codes or fingerprints and as much as 50000 registrations

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[1] „Schools and software: what's now and what's next" – Julia Freeland, Alex Hernandez and Alyon Samouha

[2] "The Presence of School Absenteeism: Exploring Methodologies for Researching the Material-Discursive Practice of School Absence Registration" - Linnea Bodén, Department of Social and Welfare Studies, Linköping

[3] http://www.pontaje.ro/

before the data has to be collected and transferred in order to make room for further usage. The data can be saved on a computer, memory flash drive, external hard drives or online by using cloud technology through internet access. The BIO-Matrix timekeeping systems can be connected into a network and the access to the database can be granted from one computer or multiple ones by installing the BIO-Matrix MICRO MANAGER or BIO-Matrix PROFESSIONAL software programs. To download the data from the machines, all that is needed is a VPN or internet connection. The data can be processed as requested, being made available into some of the most widely used and accessible electronic formats of today: Microsoft Word or Excel and the omnipresent PDF.

Fig.1 BIO-1-A clocking machine, with card, code or fingerprint registration options[1]

To avoid the unfortunate complications due to losing an electronic card for example, presence can be signaled by the student also in an alternative way - with a four digit code. In order to do so, the student must first enter the identification code, for which we propose the use of the personal identification number (CNP), and then, once they are recognized by the system, they enter the four digit code, like a password. Should the card be somehow lost, the student must report this to the institution management so that the old code inscribed on the lost card can be erased from the database and a new one can be issued as a replacement. The student will then receive a new card, with a new code.

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[1] Image and information available from: http://www.pontaje.ro/pontaj-cu-amprenta-pontaj-cu-card-bio1a-biomatrix

Fig.2 Electronic card management software[1]

As an added bonus, the electronic cards used for our proposed system can not only be individualized with pictures/logos and any other relevant information (eg. School, group, series, major etc.) – they can also be integrated with other campus features.

The same cards can be programed and used, by either students or faculty/staff – according to institution policies, to operate, for example, different restricted access devices (copiers, elevators, lab equipment etc.), to open different doors, to gain access to parking spaces, to issue different printed materials etc,

4. MODIFYING EXISTING SOFTWARE OR CREATING A NEW ONE TO MEET ACADEMIC REQUIREMENTS

Our system needs software to fulfill the goal for which it was designed. The BIO-Matrix timekeeping machines come with their own predesigned software that shows clocking options for two distinct moments: „Arrival" and „Departure" or „Check-in" and „Check-out". These options are somehow appropriate not exactly for students, but for the staff of the institution and the faculty. This system is intended to be used by all members of the institution, as it can monitor faculty and staff attendance as well.

Absence among professors has been shown to decrease the productivity of the institution they work for, as well as affect students by reducing their achievements. This is done through several mechanisms, two of them being the radical reduction of instructional intensity and creating discontinuities of instruction. „On average, public school teachers in the United States are absent 5% to 6% of the days schools are in session", also „within the United States, teacher absence rates are nearly 3 times those of managerial and

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[1] Image and information available from: http://www.pontaje.ro/card-design-pontaj-gratuit-soft-pontaj-gratis-pentru-firme-mici-biomatrix-micro

professional employees" [1]. Our system can track the attendance of all staff members and issue reports concerning them as well.

As far as students are concerned, having only two moments of clocking is not enough, as students usually have more than one course, seminar or laboratory in one day. The BIO-Matrix software give the user the ability to modify the predefined intervals and appoint more than two of them for students by altering the database and the hour intervals so that each interval can be broken down into two or more, according to the number of courses, seminars or laboratories the student has to attend for each specific day. To mend with the dissensions regarding the set hour intervals, the database has to be created containing a timetable that exactly specifies the courses and their interval (the time the courses start and the time they end). The timetable has to be created in such a way that there are no overlapped seminars or laboratories for students that share the same school and group. For example, group „A" cannot have in its timetable two distinct seminars at the same time and also no two distinct groups can have the same seminar or laboratory with the same professor, at the same time. As far as courses are concerned, more groups can have the same course, at the same time, with the same professor, even though they are separated in groups and series. An example of setting different time intervals is: the moment of „Arrival" corresponds to Course 1, by setting the appropriate time interval, and „Departure" would correspond to Course 2, setting a new hour interval. Each student has to clock only once per course, seminar or laboratory.

Starting from the configuration of the BIO-Matrix software, a new add-on program can be made to work with the database in order to fulfill the needs of the faculty. Upon entering their personal code, the database would recognize the user as a professor and show on the clocking machine's screen the timetable. Then, the professor can choose the day of the week, hour interval and discipline and then clock.

5. POSSIBLE CONFIGURATION FOR THE DATA BASE

Our basic database proposal contains 4 data tables, each of them being connected to the others directly or through another link table.

• STUDENT table: has the id of *CNP* and contains information about every student, including the code of the clocking card.

• ATTENDANCE table: has the id *registration_code* and registers if someone has clocked in or not in a certain hour interval tracking the registration code from the clocking cards or the personal codes of the students or professors.

• ACTIVITY table: has the id *name_of_course* and contains every discipline, the hour interval for the specific discipline and the number of attendances for each student pulled from the ATTENDANCE table.

• TIMETABLE table: contains information about each discipline and their hour intervals so that there will be no overlapping when clocking.

This configuration is simple, yet efficient and has a simple principle of use, as described before: with each clocking in a set hour interval, the registration code on the card is recognized, the attendance is confirmed, the data base is modified so that the student is marked as „Attending". Should no clocking be registered for a student in a set time interval, the respective student will be marked as „Absent". Results from this timekeeping activity are kept in the machine's memory and can be accessed in real time by the personnel granted with access rights to the database.
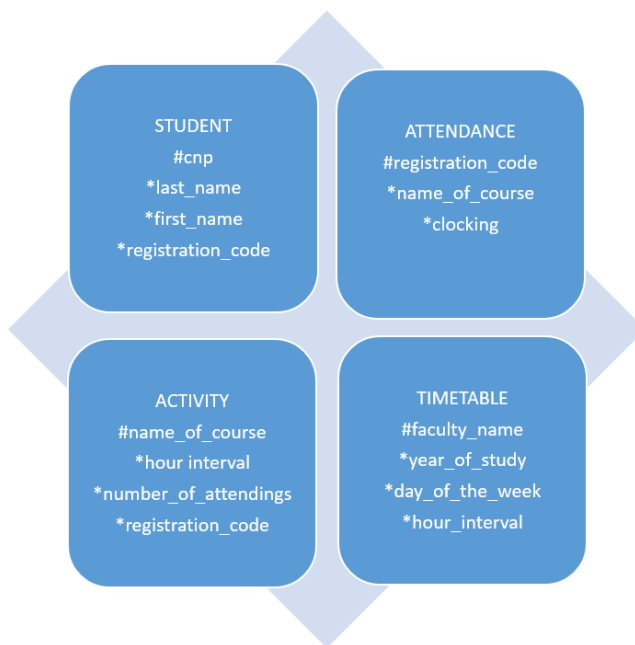
Fig.3 Basic proposal of the clocking system database

6. CONNECTING THE DATA BASE TO A STUDENT ORIENTED ONLINE PLATFORM

In the best interest of the students, the information in the database related to their attendance/absence records should be posted on their personal page on the University platform in real time (http://paginamea.rau.ro). This involves connecting the database to

the public website. A web browser cannot connect directly to a MySQL server to retrieve information from the database. In order to achieve this, we will use PHP code that can connect, extract query results from the database and display them in an HTML compatible browser, in a much more aesthetic manner than simple tables. The operating principle is as follows: the browser wants to display a web page containing database information, it connects to the web server and asks for that specific page that was being written in PHP, then the result is sent to be handled by the PHP module installed in the browser. This module analyses the code and upon figuring that information from the database are being asked, it connects to a MySQL server, extracts the specific information through predefined queries and generates HTML code to display the results in the browser.

Of course, for a better security approach, the data that is being exposed to the internet would be protected by use of different techniques. And, as simple and most effective solution to avoid long-term serious problems due to any hacking attempt on the respective data, the data used by the MySQL server for answering queries is only a mirror of the main database repository.
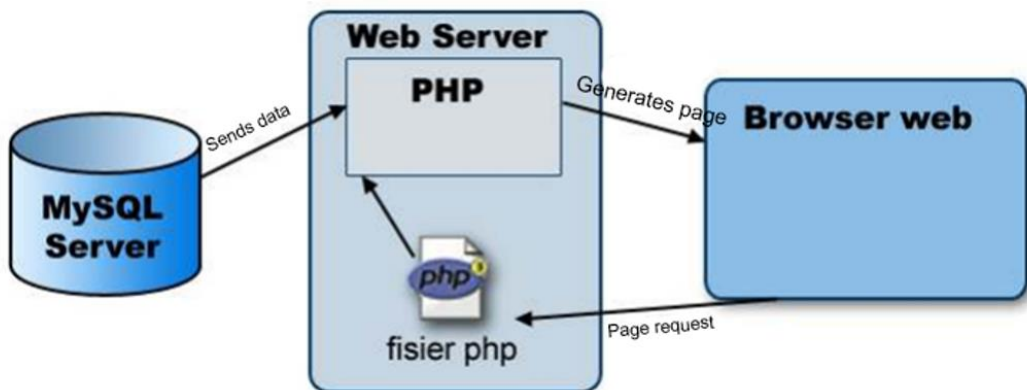
Fig.4 Data transfer between student personal webpage and BIO-Matrix system database

7. REPORTS, STATISTICS AND USAGE

Centralized data can be exported, as mentioned previously, in widely recognized electronic formats, such as: Microsoft Word, Microsoft Excel or PDF formats. The data can be stored either electronically and/or in physical format (printed). These reports can be multiple, depending on what is needed at a certain point in time:

- Daily reports;
- Weekly reports;
- Monthly reports;
- Half-yearly reports;

- Yearly reports;
- Single person report: contains information for a single student or teacher;
- Multiple person report: contains information for groups of students or teachers, separated by faculty, year of study, group or the discipline they teach if the report is about a professor.

Of course, at any time any report or statistics based on the system's input data (attendance clocking) can be designed and presented. For example, a very individualized report for a certain IONESCU I. ION student during the timeframe of January 18 to February 9, every Tuesday between 10:00 am and 13:00 pm.

A similar system has already been implemented in several schools in Brasov, as well as in over 60 schools in Bucharest's second district, where over 40000 magnetic cards have been handed to students. The main difference between our proposal and these working systems is the fact that, for the latter, clocking is regarded mainly as a security measure, allowing access into the institution only for those that are carrying such a card. The only data verification is done regarding the confirmation of student's attendance at the beginning of the day (check-in time). In order to leave the institution, the student must clock again, therefore, this system measures only the time interval the students were (supposedly) inside the institution as a whole. These systems are not designed to show actual data related to real participation in any of the specific classes a student has to attend.

Pros and Cons of the proposed system.

Pros:

- Increased efficiency in presence/absence management
- Can help reduce absenteeism, by listing each student's attending/absent status online, at any given time
- New approach that can augment the image of the institution it is implemented in, at least from the parents' point of view

CONS:

- Psychological effect that induces a sense of constraint among students who might feel as if they are going to work rather than school
- Price of timekeeping machines and software
- Additional working hours/employees needed by the institution in order to supervise/maintain the system

8. CONCLUSIONS

Our proposed system offers a change in the process of monitoring and counting (overall, management) of the attendances or absences as well as keeping track of the activity in the university environment and provides information based on the data it collects, being able to create personalized or batch reports. In the same time, the system gives the opportunity to easily create statistics and to show the general interest for a specific course, the general rate of attendance as well as helping the institutional calculations for faculty and staff, based on their own number of attendances or absences during the school year. Our system also makes storing the data easier as it can be kept on electronic format as well as printed on paper and it is of help for both the staff of the institution where it is installed and the students who benefit from it by using their personal webpages, should their university have an online platform, or through their institutionalized e-mail addresses if these are provided.

Even though our solution requires a relatively high amount of resources, be them financial or human, as a software program needs competent people to run/maintain/develop it, it offers compensating results that will benefit the institution in the future.

From another perspective, the proposed system can be further extended, as a second step in developing and implementing such a solution. As part of the Romanian university mandatory curricula we find the "internship" period (of at least two weeks, depending on study program and/or profile or major). In order to accurately keep track of the students' presence and time spent with their internship institution we propose a further development of the system.

The institution should buy or rent mobile clocking devices, compatible with the designed and implemented solution. Each internship base – which has to have a previous agreement with the university, as requested by the regulations – will receive such a device. The device will be connected to the internet and the internees will have to cloak by using the same electronic card or code as they would usually use inside the school.

A specifically designed module of the software platform will correlate their cloaking with the information of each specific internship program. At the end of the internship program, the module will generate an automated timesheet with the presence/absence data of each student. This report will go to both the university and to the internship base.

The system would also increase the effectiveness of the internship system. If we just check the clocking data at the end of the internship period, we might find out that a certain student has only 30% attendance and, as a result, it will fail to pass for this task. But, if attendance data is provided online and in real-time, the faculty can intervene very

fast and check and the situation. In most cases the situation will be straightened very fast and the final results will be better. Instead of just "punishing" the student for not fulfilling his internship task, the institution has the possibility to intervene, to check on the actual situation, find out why/how come that the student was not clocked present. The faculty can talk to both the student and the internship supervisor and solve any possible issues as fast as possible, starting just from the point the problem started.

This type of pro-active and pro-student approach we think might provide an advantage to the institution, in comparison with the standard obsolete approach of just verifying a number of attendances/absences, calculating a percentage and providing a pass/failed status (speaking only from the point of view of attendance now).

- Ceasul de pontaj TAP+ este foarte usor si foarte mic, oferind astfel portabilitarea necesara echipelor de lucru ce nu au un loc de munca fix.

- Aparatul este proiectat pentru a fi utilizat in exterior, in santiere de constructii, dar poate fi utilizat si in interior, in hale industriale, birouri sau orice locatie unde nu exista infrastructura de comunicatii in retea.

- Procesul de pontare nu necesita cabluri iar bateriile interne asigura functionarea aparatului pe o perioada de 1 an.

- Poate stoca in memorie 12.000 de pontari. Dupa descarcarea pontarilor cu ajutorul cablului USB, memoria se elibereaza si poate fi refolosita pentru stocarea pontarilor viitoare.

- Fiecare aparat poate fi folosit simultan de pana la 2000 de angajati. Pentru mai multi angajati puteti folosi mai multe astfel de aparate.

- Softul BIO-matrix MICRO, ce se livreaza impreuna cu acest aparat, poate fi folosit pentru un numar nelimitat de angajati si poate gestiona un numari nelimitat de ceasuri de pontaj.

IN TEREN...

Aparatul, dotat cu baterii interne, poate fi purtat de catre seful de echipa: in buzunar, in geanta sau in masina.

Pentru pontare angajatii vor folosi cheia de pontare iButton individuala.

LA BIROU...

Aparatul se poate folosi conectat la calculator sau chiar neconectat.

Procesul de pontare este extrem de simplu si nu dureaza mai mult decat o secunda.

Fig.5 Example of mobile clocking device[1]

The only downside of this further system extension, besides the obvious cost increase, is the necessity to have internet connection for the cloaking device (for online real-time data). But, nowadays, when internet connection is almost taken for granted - at least by the younger generations – and there are countries that have already legalized mandatory

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[1] Image and information available from: http://www.pontaje.ro/pontaj-portabil-tap-biomatrix

internet access for their citizens, with Finland being the first country to do it [2], we do not consider this to be a very important issue. There are available at least 3 types of cloaking devices that offer not only cabled network connection (through RJ45 couples) but also wireless connection capabilities. As a more robust, but also pricier solution, there are several types of clocking devices which comprise not only the possibility to "externally" connect to a wired or Wi-Fi network (and by this mean to the internet) – they have a special slot for a sim card in order to have the possibility to connect through a data sim card, directly to the internet from wherever we have mobile phone coverage actually. And, of course, there is always the basic solution (without real-time online data available) of keeping the clocking records inside the machine up to the moment the device returns to the institution, where the data is collected and later interpreted.

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THE VIRTUAL UNIVERSITY - A CONCEPT NEEDED IN A SUSTAINABLE DEVELOPMENT

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ABSTRACT

Taking into consideration the fact that the system management is in a continuous development, the help, based on technological means, is lead to the organizational domain. The lack of a proportioned system, organizationally speaking, leads, in most cases, to the decrease of the students' performance. This is how we intervene in this process: we come up with new ideas to improve the current plethora of technological means.

The gap between students and their professors could be removed with only a click or at the push of a button. The platform is intended to come in handy to the needs of the students, as well as the professors' needs, through building a bridge that assures the communication between those two parties in real time. Using the user's location, the application would facilitate his access to the rooms in which he has to study, providing input of the current location and the finish location. Such an application should be introduced in any organization whose activities are happening in an internal space.

This would ensure that the human circuit is going smoothly without any stops, because it would reduce the response time. The time, taken as a reaction time, is the most important measuring unit in the area of technology, and therefore, if we can shorten it through this application, it would be innovative.

KEYWORDS*: virtual university; maps; university application;*

1. INTRODUCTION

In the past, smartphones were a bit less used than they are nowadays. They have been improved with time and their functions developed according to the users' needs. Statista website showed the connected device usage rate in Romania as of March 2014 :

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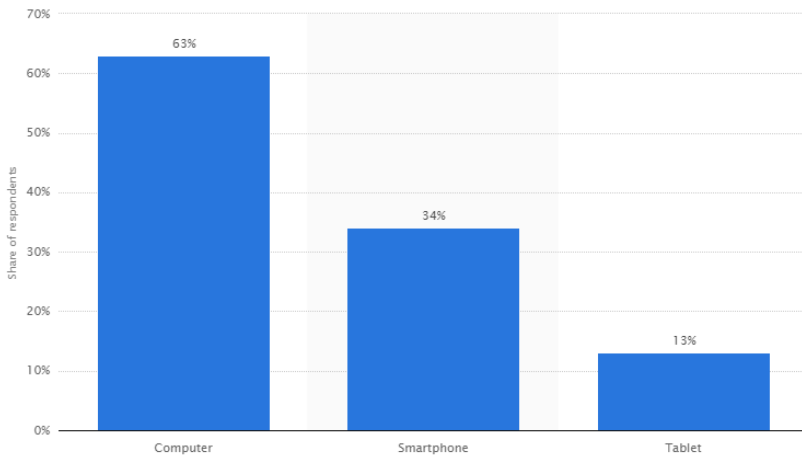[2] PhD Student, Academy of Economic Studies, Bucharest, Romania; pop.dragos.paul@profesor.rau.ro

Figure 1 [1]

This graphic shows that the use of smartphones in 2014 was almost doubled by the use of computers, whereas tablets play an insignificant role compared to the other two. Undoubtedly, smartphones developed rapidly and became a breakthrough in this day and age.

Moreover, the graphic shown below reveals the evolution and predictions made until 2019 of the number of smartphone users from the United States:
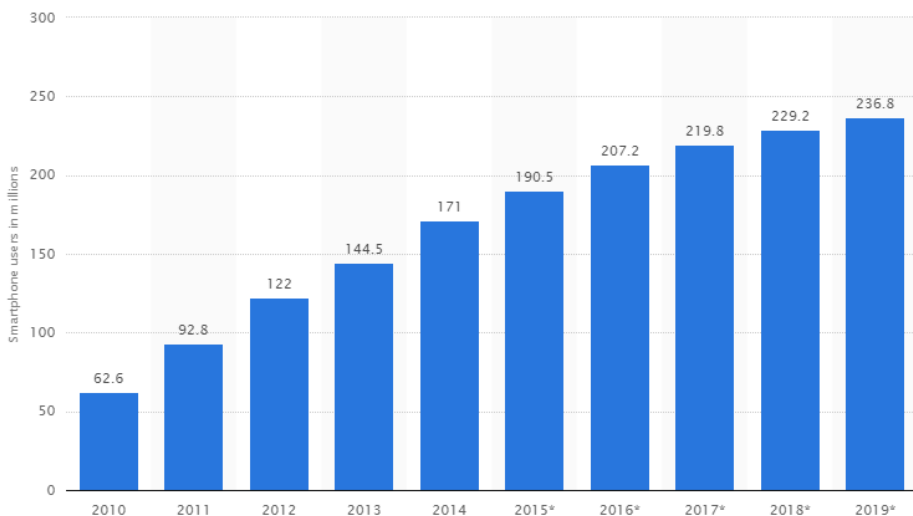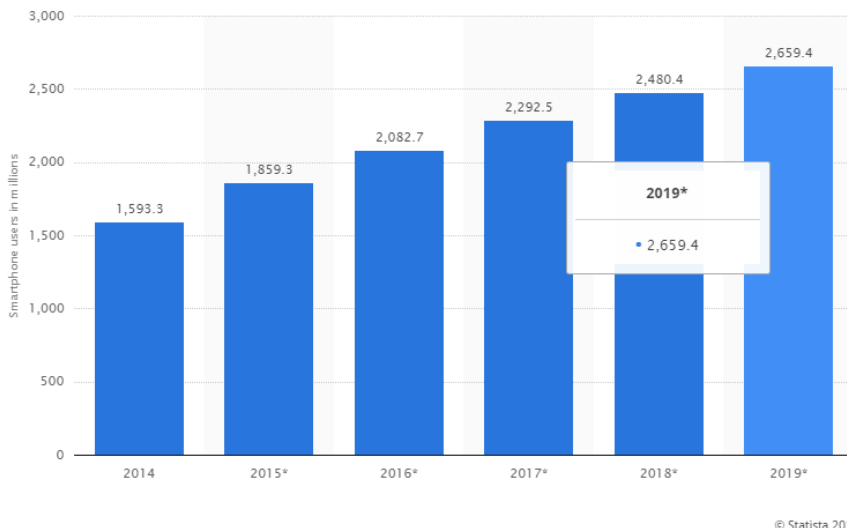

Figure 2 [2]

This indicates that the number of smartphone users is having a sharp increase, estimated to reach 236.8 millions of users in 2019 only in US.

Regarding the number of users worldwide, it could be pointed out that the number of smartphone users all over the globe could even reach 2,659.4 millions in 2019.

Graphic no.3 [3]

To add more, the most significant uses of a mobile phone have changed with time. Users' needs have become somehow different compared to a couple of years ago. A powerful example would be The Cisco® Visual Networking Index (VNI) Global Mobile Data Traffic Forecast Update's [3.1] study on major global mobile data traffic. For example, users need more mobile data nowadays than they needed even one year ago.
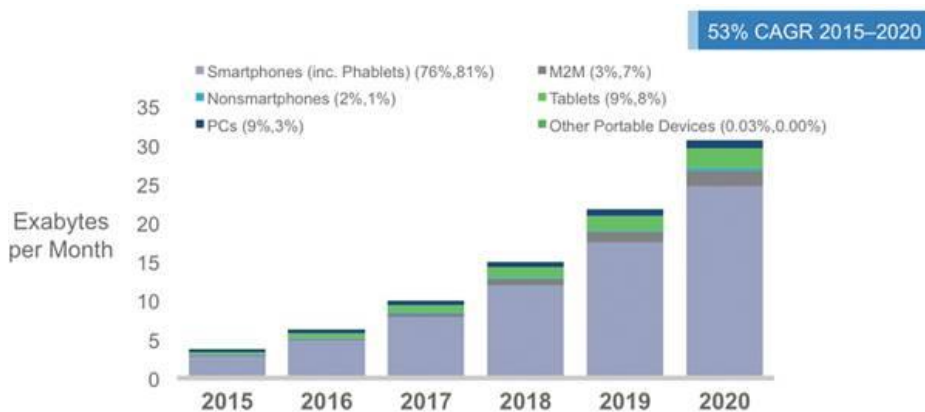
Figure 3 [3]

According to the figure above, the number of Exabytes ($=10^{18}$ Bytes) consumed per month has almost doubled in one year, until 2016. The predictions are that the data consumed in 2020 will be equal to five times the data consumed in 2015.

Thus being said, since smartphones took over the market, they have developed and adapted to the users' needs, trying to cover up all of the features needed by the users.
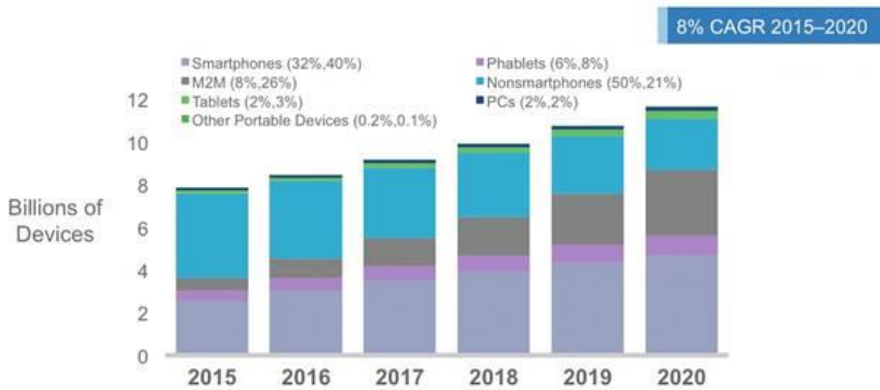
Figure 3.2 [3.2]

In the past, phones were usually used to make calls and send text messages. Nowadays, with all of this techonolgy available, they have developed more functions to ease users' lives. Compared to 2014, when calls were no longer in top 5 uses of the mobile phones [3.3], a new application is needed. Maps play an important role in everyone's lives, as they shorten the time on route. Moreover, mirror.com revealed that "one in six claimed they would be unable to get around an unknown city without a navigation app on their smartphone".

A relevant example that has developed rapidly would be Google's or IOS's Maps application.
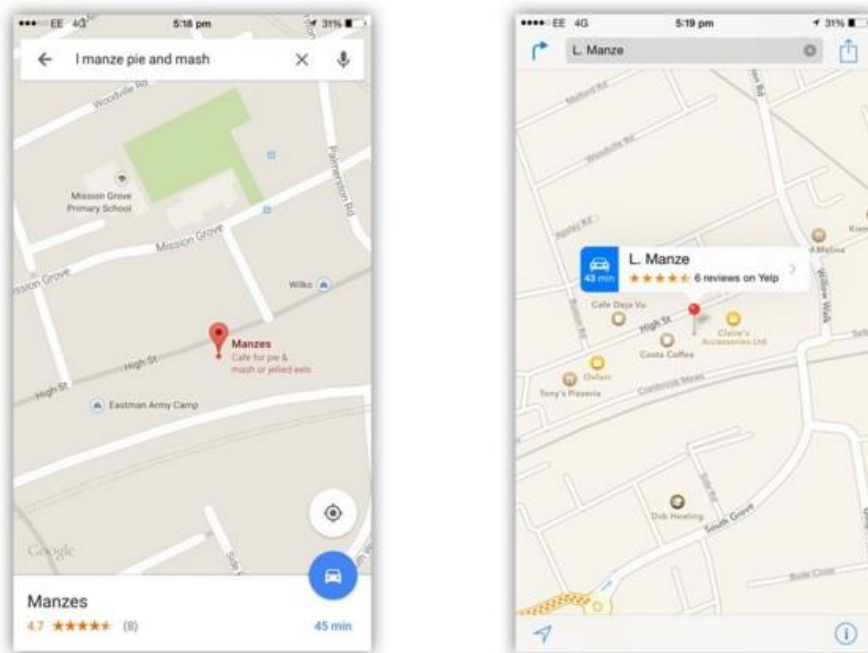
Google Maps   iOS maps

Figure 4 [4]

However, although very useful in their complexity, those applications do not provide input for the interior of the buildings, be it a school, university or even a corporation. The most efficient way to make this possible would be to create an internal map for each of the buildings listed before.

As an interconnection between those maps would be useful, all of them can be linked to a mother-map. This can lead to a complete map of an area, of a town, a map that includes interiors. This map will be available to all of the users and, by connecting to this application, they will not need to find out the interior's whereabouts.

The concept is relevant as it brings a new response time, shorter than the time spent on finding one room without any technological means. The amount of time one will arrive in a certain place will diminish significantly. Also, everything will become more practical, because one will not need to talk directly to a person. Instead, one will only have to open your application. It comes as a helping hand to those who need a better time management, those who are always late or even those who want to discover new things.

The application would mix numerous currently existing concepts, such as messaging and e-mail, the map itself, the user's profile that should contain mandatory data (name, university) and optional data. The application collects data based on the user's routes which are saved in a history and it offers them as "Favorites" or "Recommended" in the next sessions. It should be connected to the user's phonebook to synchronize the data collected from both parts. That being said, the application can be used as whatever the user wants and needs.

The only downside that could create problems would be the high level of internet data consumed. This level can be reduced by the use of wi-fi signal instead of mobile data. The graphic below shows fixed and mobile data consumption and GDP (Gross Domestic Product) per capita in eight geographical regions and Romania in 2013 :
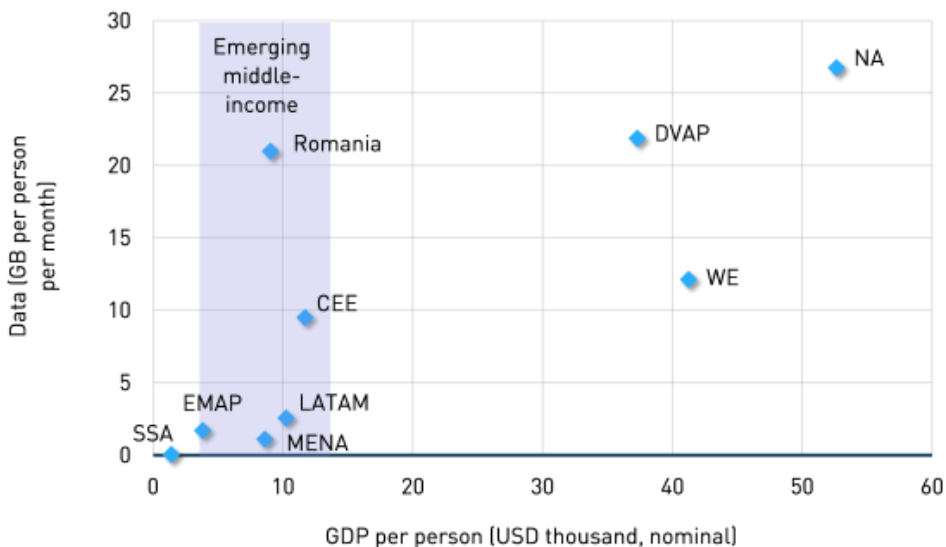

Figure 5 [5]

According to the same website, analysysmason.com, in Romania, where 1Gbps access can cost as little as USD15 per month and GDP per capita is USD9000, this rises to 21GB per month. Although the price for mobile data may not be that affordable for students, offering students a wireless internet connection to facilitate work and study in today's increasingly mobile world should be mandatory.

An unexpected result would be to lose potential or current clients, loss caused by bugs or too much network data lost. The application, collecting data and asking for permission to capture the screen, can be easily corrected. If it is the case of an unaccesible button, the application would show an error message and then would close. This screenshot would be sent through anonymus means to those who created it and, afterwards, they would solve the problem. Updates will be possible and they can be made even by the users, but will be acquiescented only by the university's staff before it comes online. Thusly, the worst case scenario would be to lose a large number of users. If this is likely to happen, then the application would regulate potential errors to renew the number of users and will stimulate users' attention by creating a bridge between them and their teachers.

2. MATHERIALS AND METHODS

After analyzing the market and students' daily life, we can say approximately what things are the most useful to them. The majority of smartphone owners has an application for socializing and most of them use "facebook". The use of "facebook" for getting information about the schedule or rooms will not be necessary anymore because of this new application on the market.

A recent study shows that the "facebook" application is browsed the most in schools, according to alexa.com :
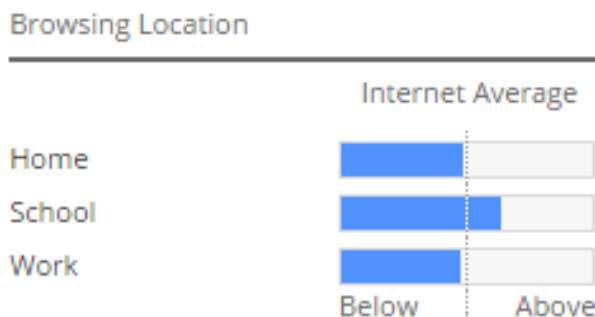
Graphic no.6 [6]

Maybe its use is not entirely due to the misunderstandings regarding the schedule or the rooms, but what is for sure is that the traffic on this application, "facebook", will decrease when the users are not to open it and memorize the schedule and rooms. They, instead, will access the application through which they can access all the information needed for a day in the university.

Because the main aim is to minimize the response time and the action time of one student, every second matters. Through the application, accordingly, we can get the data we need

without opening an internet browser. Opening a browser can cause delays if the browser is inaccessible or its interface is not known to the user or is complicated to understand.

The same website shows a study on the amount of time that is used by "facebook" to be loaded.

How fast does facebook.com load?

⌛ Very Slow (2.96 Seconds), 82% of sites are faster.

Figure 7 [7]

Because of the fact that facebook.com is very slow and 82% of sites are faster than it, users choose, by all means, to use the application instead of the browser. This fact will happen step by step with most of the top websites to optimize the traffic.

The most efficient way through which we can monitor and structure the changes undergone in such environment is to create an interactive platform. The platform, which has data update possibilities made by professors and also students, offers access to a database that can be accessed by all of the members in the university's personnel.

The application will be made of numerous parts: the messaging part, that resembles to an e-mail application, the map part and the schedule part, that can be even integrated in the map. To benefit from all of these, users will have to create an account. One will log in with his/her telephone number whereas the application has access to its phonebook. Another significant detail would be the mandatory field "University", where the user has to write the university where he/she studies. The name, the university and the telephone number will have to be public fields that can be viewed by all of the other users and also by the professors.

After taking a survey among colleagues in our university, this application is wanted to be used daily and must be accessible from all the mobile devices. This can elude the simultaneous use of an internet browser, messages and an e-mail application. The platform would harmoniously combine those three technologies, along with other numerous possibilities of communication, facilitating the user's access to the schedule information, rooms and so on.

The application's interface should be easily intelligible to offer the user easy access to all that one wants. At the same time, those parts that form the application will also exist separately, as tiles or any other way of arranging that is easy to access. Simultaneously, they will be interconnected.

The application will be practical and accessible. It will look like a 3D-map, like a space where users wander. Each user can choose how its character is represented on the map : they can choose an arrow pointing up in front of him/her or can choose to see the whole image, where the others are pointed with arrows above their heads. Each arrow which is above a student or a professor allows the user to click on it. When one presses click, listed

next to his/her head will be a display showing name, university and phone number. This display would allow a direct phone call, adding him/her as a friend and not only. They will walk and wander through the 3D space of the university. They can see the names and numbers of the rooms they come across, the restrooms and so on. They can choose to search for locations or people only by introducing data in the search bar. As a whole, the application will bring the real life on an online platform.

There will be some main body parts that should play the most important roles : messaging, maps, schedules and the search bar. They will be available both in Romanian and English.

- *Messaging:* this will work through the default messaging application that is already in the phone or through the messages tile in the application. The user can send a message to other user or users, message that can be displayed as a push notification on the recipient's phone. The conversations can take place with the possibility of saving the conversation, of seeing the time and date of the sent, received or seen message.

In addition, the application will synchronize with the user's e-mail address and can send e-mail messages, under his demand, even through the existing e-mailing app, although it would be easier if users were to send messages only through this application connected to the internet.

- *The map:* the way this map works will bear a resemblance to the Google's Maps. But, instead of streets, we will have aisles. Buildings will be replaced by amphitheatres and study rooms. The map could also calculate the best routing to reach the point B from a given point A. The routes can be saved to favorites. There will be an option to share your current location through this application or an external application. To access the map while offline, the user can download the map, which will contain the study rooms and the schedule which was updated when downloaded. Afterwards, at every update, the application will ask for permission to download its newer version and will be downloaded through wi-fi by default. The user can change this setting in the settings menu. If the user does not want to be seen on the map, he will switch off the location and all of the data displayed will be the one that was updated the last time the device was connected to the internet.
- *The Schedule:* the schedule will be available as a table, but not only. Choosing the university and the specialization you will see the updated schedule. While the user moves in space, moving forward towards the rooms, the display bubble will show him the current study class, the next class and the group that should attend it. It would be useful if there exists a way to download the schedule with the possibility of adding notes on the subjects (such as exam dates or projects). Through this section an event calendar can be created, where all of the optional subjects and workshops will be centralized. Professors will update the holiday days, the exam days and the days when students should be more prepared for a test than usual.

Along with the subjects' list, we can find the professors' list and their subjects. Additionally, their phone numbers will be displayed.

- *The Search Bar :* the search bar will be one of the most accessed areas on the interface. If the student searches for a professor's name or a room number, the application will always return the name or number as a first result, and then the results which contain the words that were introduced in the search bar. Professors can upload files on the calendar notes and every user can make use of these files, personalizing them.

To add more, there will exist a filter search. We can search for people depending on their university, number of certain classes per week, sex, age, nationality and so on.

The search bar can be used to search for a word or a character string through the conversations.

- *The user's profile page:* through this profile, the users could communicate because it shows important pieces of information. Professors could rate students and could comment on their profiles. The students can select which of the comments they would like to be posted on their page.

A "Favorites" button will be always available if the user wants to add something to his/her favorites, be it a route, a room or a person. That would allow him/her to access favorite routes/users even when they are offline, without an internet connection.

When the user is walking on the aisle, the application would display an extra red border if the chosen route is an emergency exit. It always displays red borders on the routes that lead to the emergency exit so that, by seeing it regularly, users would become aware of the ways they can rescue themselves in case of emergency.

The emergency button will be always available, but a security measure will be taken so as to not press the button if there is no emergency. For example, if the button is pressed a single time, nothing happens. If the button is pressed twice, at a two seconds distance, the emergency call will be activated.

3. DISCUSSION

This application can become, in a short while, the most used by students application when they are in the university, along with the socializing application. It allows them to make something both entertaining and useful – it uses their phone numbers, it gets students in contact with other students or their professors, it calculates optimal routes and it can raise the awareness level of emergency exists in case of fire or other dangers.

Especially when the university year starts, the application should be promoted because, through the application, each and every university will be promoted. The first months of university will be filled with people using this application to find out where they are in the building. If they should reach a place in a couple of seconds or minutes and there is no person to offer them information around them, the application will be more than useful to them. They will get in touch with the professors, with whom they will talk later on the application's chat.

Even after a couple of months of use, the application will still be useful. Its usage values will, most probably, be measured by a Gaussian function : the peak, with the highest usage (aside from the start of the year), will be when the students are to sit exams and have to have access to the calendar, the exam dates and the files uploaded by the professors. Another semester comes along, but, at its start, the level of usage will sharply decrease (because students got used to the surroundings). This will not be a problem, since the application is used as a bridge linking the students to their professors and letting them talk freely through the platform.

4. CONCLUSION

The application, in its simplicity, but also complexity, has, at the basis of it, a simple concept: shortened estimated time of arrival and communication between students in an easier way. If this application is to be implemented when the university year starts, even if it requires ampleness, there will come feedback. The more opinions (be them good or bad) on the potential improvements, the faster characteristics are to be improved.

The application will be necessary at one moment at a large scale. Chances are that everything will be framed in such an application to give access to anyone who wants to get information on a building, no matter what nationality, sex, level of education and so on.

5. ACKNOWLEDGEMENTS

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