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# WHAT CAN TECHNOLOGY DO FOR EDUCATION?

## 1. Introduction

From the stone age, bronze age, iron age, and industrial age to the information age, technology has gone through several major revolutions throughout human history, and now we are entering the age of artificial intelligence. Almost all technologies were invented with a goal in mind, which is, to solve problems. Technology was invented to solve inefficiency problems. For example, automatic machinery from the industrial revolution realized a mass production model and solved the inefficient family business production problem. Technology was also invented to solve effectiveness problems. X-ray machines provided doctors with much better tools for patient diagnosis and solved the ineffective treatment problem; or, computers performed tens and millions of calculations per second to make landing on the moon possible. Indeed, technologies make our everyday life easier, produce goods faster, or perform tasks that are beyond typical human physical or cognitive capacities possible. Thus, it is fair to say that technology is one of the basic drives advancing human development.

According to Spector (2015), "technology changes what people do and what they can do" (p. 5). Thus, a tool's capability in enhancing a user's higher order cognitive abilities has been an important research area in the field of education as learning is a cognitively demanding process. A vast amount of research and development has been devoted to the area of how to use technology to enhance students' performance and learning outcomes (Ge et al., 2019). Surely,

the results of this research have gradually been translated into technological interventions and practiced in classrooms at all levels from higher education to K-12. The technologies used for educational purposes are not homogeneous. They are tools of different types for different educational purposes. Throughout this paper, I will use the term *educational technology* to refer to this concept and actual products.

## 2. Types of Technology

Generally speaking, educational technology can be classified into three types: hard, soft, and process technology. These three types of technology have different functions, characteristics, and instructional affordances. Therefore, they are used to enhance student learning toward different learning goals.

### *Hard Technology*

Hard technology in education refers to the physical and tangible products such as computers, networks, tablets, and interactive whiteboards that are used in and outside of the classroom to make learning more efficient or effective. For example, student learning could be more efficient when students are able to obtain digital resources such as digital journal articles or

e-books, rather than having to physically check out paper books or journal articles from the library. This level and type of learning efficiency is not possible without the hard technology, which is the internet and networks. Moreover, hard technology made some complex scientific concepts easier for students to understand by providing 3D visual illustrations or animations, for example, computer simulations or virtual reality (VR). Combing these technologies with interactive whiteboards, students can have real-time, interactive, and dynamic learning experience (Sung et al., 2016). Hard technology can also help streamline the delivery of educational content and services, making it more accessible and efficient for students.

Hard technology provides educators with the infrastructure and end-user devices that help students learn more efficiently and effectively. However, hard technology is machines, equipment, or devices. These products themselves do not contain subject area content, nor provide specific operational functions for students to engage in domain knowledge acquisition, comprehension, and applications. For efficient and effective learning to occur, we will need other types of technology.

Soft Technology

To help students engage in these learning activities, soft technology is a necessity. Soft technology in education refers to intangible products such as educational software, books, textbooks, journal articles, productivity software, and online resources that support student learning. For example, educational software can provide students with interactive and personalized learning content and experiences. Furthermore, information on the internet as well as databases are part of soft technology that provide rich resources,

data, and knowledge for anyone to further their understanding of any topic they desire to learn.

Process Technology

Process technology is a type of technology that is normally not being perceived as technology. However, it is perhaps the most important type of educational technology when it comes to enhancing the effectiveness of student learning. In education, process technology refers to technologies that help teachers and instructors design effective instructions as well as provide a means for engaging students in higher order learning by reducing the necessity of engaging in lower level of cognitive activities, and thus, enhancing their learning outcomes. Learning theories, instructional design theories, instructional design principles, instructional methods, pedagogies, instructional approaches and strategies, are examples of process technology. They can be used to guide teachers and instructors to systematically design effective instruction for a specific instructional need. There are also certain types of productivity software that can be categorized as process technology. These technologies can be used to help enhance student learning by unloading extraneous cognitive load and enhance germane cognitive load (Sweller, 2020). For example, Excel Spreadsheets can be used to engage students in simulations; or concept mapping tools can be used to help students organize and enhance their mental models of a given subject area under study (Jonassen, 2000).

Hard technology, soft technology, and process technology are the three pillars of educational technology. For a technology-based learning experience to be successful, none of these technologies can be absent. Understanding the differences between these types of technology is

important for educators to effectively utilize and integrate technology into their teaching practices to achieve educational goals (Sung et al., 2016).

## 3. Educational Technology & Educational Functions

According to Spector (2012), "technology changes what people do and what they can do" (p. 5). Similar to the general technological tools throughout human history, educational technology affords two functions to fulfill educational purposes: what students *do* and what students *can do* in achieving better learning outcomes. These two classes of educational technologies are called cognitive tools (Lajoie, 2000), or mindtools (Jonassen, 2000; Jonassen & Carr, 2000). In the following, I will use the phrase "mindtools" to refer to both terms mentioned here.

What exactly are mindtools? They are essentially the educational technologies that enable students to engage in higher order learning during the activities designed to achieve better learning outcomes. Mindtools involve all three types: hard, soft, and process technology.

Type I: Cognitive Tools for "What Students Do"

The function of Type I mindtools is to scaffold students to engage in higher order thinking, and therefore, support students in achieving a higher level of effectiveness in their learning. As we know, humans have limited cognitive processing capacity in holding and processing information in their working memory (Baddeley, 1998, 1999). With the aid of appropriate technology, we can reduce student cognitive load used for processing lower order cognitive activities required in the learning process. For example, in an advanced statistics class, using calculators or statistical analysis software such as SPSS can reduce the demand for long and tedious calculations

processes, which is a lower level cognitive process in this example. This way, the students can focus their learning on determining which statistical analysis method to use or how to analyze and interpret the results. Thus, these types of cognitive tools are to enhance the effectiveness of student learning by unloading lower and unnecessary cognitive processes that students have to exert so that they can focus their cognitive energy on *doing* higher order learning.

Type II: Cognitive Tools for "What Students Can Do"

Type II cognitive tools, on the other hand, are to enable students to do what they cannot do without the aid of the technology. Therefore, the main function of Type II cognitive tools is to remove the barriers that prevent students from engaging in learning. There are a few possible barriers: physical, temporal, or financial barriers in education. In the context of education, one possible physical barrier is distance. For example, in rural areas the distance between the educational institutions and the learners could make attending classes impossible. The availability of internet and video conferencing technology, such as Zoom, removed this physical barrier and democratized education for learners who were marginalized by this physical barrier.

The second possible barrier is temporal. Non-traditional students are increasing in number in the student body profile of higher education institutions. One characteristic of non-traditional students is that the majority of them have full-time jobs, which prevents them from attending classes during regular school hours. The availability of asynchronous online education or the technological capabilities of providing on-demand class recordings removed these temporal barriers. Lastly, some financial barriers

could be removed with technology. For example, actually operating an airplane in pilot student training is a high-cost program. The high cost may deter some students who are not able to afford the total cost of flight hours required.

Incorporating digital flight simulators in conjunction with virtual reality (VR), pilot schools can reduce the cost imposed on the students as well as increase the flight training time for the students. This is not to replace the actual airplane flying time, but to be used as pre-flight training thereby reducing cost. This use of technology not only democratizes education (i.e. making certain high cost education more affordable), but also elevates the efficiency of student learning by providing more opportunities for accessing the learning resources (e.g. VR flight simulators,

AR modules for training nursing students or physicians) and practicing their skills under study.

### *Functions of Mindtools*

David Jonassen (2000) and Susan Lajoie (2000), two leading researchers in the field of learning sciences, educational psychology, and instructional technology, had extensively explored the design and use of technologies to support student higher order learning. Though using slightly different terms (mindtools or cognitive tools), both researchers advocated a fundamental principle of using technology in education. And that is, technology should be used to promote students' engagement in higher order cognitive activities. Therefore, educational technology should function as a cognitive load optimizer, cognitive enhancer, simulator, and reflective enabler. By using appropriate technology to perform lower levels of

cognitive processing (e.g. simple memorization or long and tedious calculations), we can free up students' cognitive capacity to engage in higher order learning (e.g. detecting unusual patterns in the data or looking for correlations between recurring incidents and certain events). Moreover, we also need to acknowledge that no matter how much technology can reduce the cognitive load on lower order thinking tasks, human cognitive processing capacity is limited. Therefore, in addition to reducing lower order cognitive tasks, technology can also be used as a cognition enhancer to augment students' cognition by providing cognitive assistance. These types of cognitive enhancers can help amplify students' cognitive capacity by providing external information storage, for example, visual representations or simulations. Lastly, technology can help students engage in metacognitive activities to reflect on their own learning, and thus, improve and refine their learning outcomes and skills. In the following, I will discuss different types of cognitive tools by their functions.

***Semantic Organization Mindtools***

According to cognitive scientists, human knowledge is organized and stored in the memory (Anderson, 1995; Andre & Phye, 1986, 1986; Baddeley, 1998). Knowledge is organized in a variety of ways, for example, hierarchical, semantical, structural, etc., depending on the nature of the memory schema (Bartlett, 1968; Schallert, 1982). If information received by an individual is not organized in a meaningful or functional way, it is unlikely to be useful for the individual. Therefore, helping students organize their knowledge in a meaningful way can enhance not only the retention of the memory, but also their comprehension and applications of that knowledge. Sematic organization technology can be used for helping students organize

the knowledge that they acquire into a meaningful semantic network. These tools usually involve the use of visual or graphic representations to help learners understand the relationships among concepts and ideas (Jonassen, 2000). By presenting concepts and information in a visually meaningful way by conceptually and visually depicting their interrelationships, semantic organization mindtools help learners identify patterns and connections that might be difficult to discern from text alone (Novak, 1998) or generate new insights. Examples of semantic organization mindtools include concept maps, mind maps, and semantic webs, diagrams, schemes, or databases. They have been used in a variety of educational contexts to support learning and knowledge construction (Dabbagh & Kitsantas, 2012).

***Dynamic Modeling Mindtools***

As mentioned earlier, human cognitive capacity for processing information at a given time is limited. When studying a complex topic, natural phenomenon, or system, the information involved most likely exceeds an individual's cognitive processing capacity. Dynamic modeling cognitive tools are the type of technology useful for enhancing our information processing capacity so that we will be able to conduct these types of tasks or learning (Jonassen, 2000). According to Jonassen (2000) and Jonassen and Carr (2000), dynamic models are visual and interactive representations that allow learners to explore complex systems and analyze the relationships among variables, as well as the behaviors of the system over time by constructing a runnable model. These mindtools can be used to represent a wide range of phenomena, from physical systems like weather patterns to social systems like economic markets. By constructing and modeling a system using dynamic modeling tools, students need to

understand the core variables, the interrelationships, as well as the overall behaviors at a systemic level. Through this construction process, students will develop a deep understanding of the complex systems and the inter-influencing relationships among the variables, and therefore, form a holistic conceptual framework of the system. Modeling mindtools help us visualize effects of certain variables or the complexity of a system through simulations that are beyond our cognitive processing capacity. Jonassen and colleagues (2002) has argued that dynamic modeling mindtools are particularly well-suited to supporting higher-order thinking skills like analysis and synthesis, as well as the development of scientific reasoning (Howland et al., 2011; Jonassen et al., 2002). Examples of dynamic modeling mindtools may include system modeling software, spreadsheets, expert systems.

***Knowledge Construction Mindtools***

Constructivists argue that each individual's knowledge is a result of his or her personal cognition interacting with the socio-cultural and environmental environments, rather than transmitted from one to another (e.g. instructors to students) (Cobb, 1996; Jonassen, 1991; Wilson, 1996). Over time, an individual constructs his or her unique knowledge and epistemological belief system through these interactions and feedback from the surrounding socio-cultural and physical environments. In practice, knowledge construction mindtools provide learners with opportunities to engage in meaningful activities where they construct their own knowledge by completing certain tasks that guide them to exercise and apply such knowledge, for example, constructing a website, authoring a multimedia presentation, or creating a video on a topic (digital storytelling) (Howland et al., 2011). Students construct their own understanding of new concepts and

ideas by actively engaging in the process of knowledge formation. To construct an artifact for a specific purpose, students are required to research, examine, and apply content knowledge. Through engaging in these cognitive activities, students naturally organize their knowledge in a meaningful, coherent, working schema.

***Collaboration & Social Mindtools***

According to Vygotsky (1978, 1986), the cognition development of an individual starts with interaction with others, rather than within the individual. Therefore, social interaction is a fundamental element in an individual's learning and plays a critical role in shaping how we see and understand the world. An individual's learning never occurs in a vacuum, according to constructivists (Jonassen & Reeves, 1996). In the context of education, students gain richer and better understanding about a subject area through social interactions occurred in the learning environment provided. Collaboration and social mindtools support the social aspects of student learning. They are used to facilitate collaboration, cooperation, group work, and communication among learners, such as online discussion forums, wikis, collaborative writing tools, and videoconferencing software (Jonassen & Kwon, 2001). Moreover, social mindtools enable learners to engage in authentic social interactions, such as role-playing simulations, interactive case studies, and digital storytelling.

Furthermore, a lack of sense of community could be a shortfall in online learning environments due to the distance and temporal barrier. Social media and communication technology, such as Zoom, Facebook, WhatsApp, YouTube, etc., provide an efficient platform for social exchanges beyond physical and temporal barriers. By providing learners with opportunities to

engage in collaborative and social activities, these mindtools can help to foster a sense of community. Additionally, these mindtools can also promote the development of important social and emotional skills, such as communication, empathy, and perspective-taking (Jonassen & Kwon, 2001).

**Perception-Enhancing Mindtools**

Humans have limited perceptual capabilities, for example, visual, auditory, or emotional. We are not able to see the structure of a cell, how protons, electrons, and neutrons interact in an atom, or how oxygen circulates in our body. When concepts are imperceivable, learning difficulty is likely to occur (Carey, 1986; Keil & Wilson, 2000). These perception difficulties could hinder students' study of these types of concepts, and thus prevent them from constructing accurate and complete conceptual understanding about the concept. Examples of this type of technology may include VR, AR, simulations, animation videos, or microworld. These technologies remove the perceptual difficulty by either providing realistic 3D visual illustrations of the objects or elements that can not be seen with the naked eye, or animations of how things work at a quantum level. These technologies facilitate student learning by expanding their perceptual capabilities in order to develop and construct deep understanding of the topic under study.

## 4. Conclusion

Technology has changed many times how humans do things, behave, and even view the world throughout and before history. Technology consists of powerful tools that could do great things for humans and education. Yet, we need to ensure these technologies are used in a way that will contribute to enhancing student learning, rather than just for its novelty. They need to

be used to create meaningful learning experiences and meaningful knowledge construction. Also, to use technology for educational purposes, students should be "learning *with* technology" rather than "learning *about* technology." (Jonassen & Reeves, 1996). Lastly, technology should be used to facilitate students' cognitive processes in order to amplify and extend their cognitive capacity and therefore, enhance their learning outcomes.

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# PERSONALIZED E-LEARNING MODELS: A SYSTEMATIC MAPPING STUDY

**Abstract**

*Online learning is a tangible reality today that has a growing trend due to the rapid development of information and communication technologies in education. These systems aim at facilitating the learning process without limiting it in space and time. The adaptation of these systems, taking into account the individual differences of each learner, increases significantly the effectiveness, performance and motivation of the e-learner. This paper presents a summary of the models used to enable personalization for each e-learner including personalization components, data mining models and techniques, and interaction tools between the learner and the content of personalized e-learning.*

**Keywords:** *learner model, personalized e-learning system, personalization components, data mining models, data mining techniques*

## 1. Introduction

Nowadays the trend of learning using electronic devices is on a continuous growth, due to ease of access to information, diversity of information, low-cost, etc. This has led to the traditional classroom teaching being shifted to a virtual environment, without having the limitation of time and place, so to access the necessary information without being in a certain place and time.

One of the biggest gaps in the explanation of a content in the classroom as well as in traditional online courses is the explanation in a particular form or pattern considering that all understand in the same way and with the same effectiveness. The huge amount of information generated by online courses and the need for an explanation of the content according to the level, knowledge and skills of the learner has brought the need for the creation of different models and methods to convey the information in different ways to each learner (Jando, Hidayanto, & Harjanto, 2017).

## 2. Related Work

Rapidly increased data generated from online courses has led to new methods and techniques for creating customized e-learning systems. Some Systematic Mapping Studies (SMS) are realized in this field where the main ones to be mentioned the are the study realized by (C & S, 2007), which has the main objective of Educational Data Mining, also an Learning Models-focused SMS has been realized by (Hlioui, Alioui, & Gargouri, 2016). *Analysis of data mining techniques applied to Learning Management Systems (LMS) for personalized education has been prepared by* (Villegas-Ch & Luján-Mora, Analysis of data mining techniques applied to LMS for

personalized education, 2017), *Integration of Knowledge Management and E-Learning Models* has been prepared by *(Judrups, 2015), a* SMS of data mining of web-based learning systems *has been prepared by* (Villegas-Ch, Luján-Mora, Buenaño-Fernandez, & Román-Cañizares, 2017), comparison of LMS and Adaptive Educational Hypermedia Systems (AEHS) to analyze improvement with the use of Data Mining has been prepared by (Karagiannis & Satratzemi, Comparing LMS and AEHS: Challenges for Improvement with Exploitation of Data Mining, 2014) and a comprehensive classification of collaboration approaches in E-learning has been prepared by (Al-Abri, Jamoussi, Kraiem, & Al-Khanjari, 2016). Most of the SMSs take into consideration one or another aspect of Personalization of e-Learning Environment. Our SMS contribution deals with generalizing and analyzing different aspects of Personalization of e-Learning Environment.

## 3. Research Methodology

This Systematic Mapping Study (SMS) has been conducted based on guidelines provided by (Kitchenham, Budgen, & Brereton, 2015), with the main stages shown in Figure 2. This part summaries the protocol of our SMS, including the research questions used to structure the study; the search strategy, inclusion and exclusion criteria were used; and the rules for extracting data and classifying primary studies.

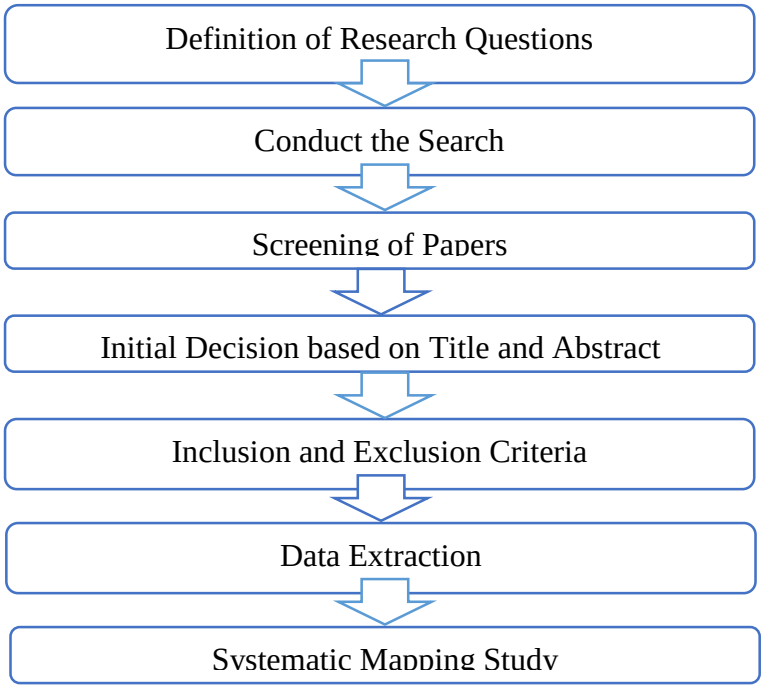


*Figure 1: The Mapping Study Process*

### 3.1. Research Questions

The following research questions and motivations are given to explore the components of personalized e-learning model, tools of interaction between and the content of personalized e-learning, data mining models and techniques used in personalized e-learning, theories behind used to build a personalized learning model, to the effectiveness and success of personalized e-learning learner:

| No. | Research Question | Motivation |
|---|---|---|
| RQ1 | What are main Learning Styles and their components? | To identify most used Learning Styles in e-learning, their main components, advantages and drawbacks of each of them. |

| | | |
|---|---|---|
| RQ2 | What are main personalization components to build a personalized e-learning model? | To identify most commonly used personalization components in order to build adaptive e-learning model and weight of each personalization parameter. |
| RQ3 | What are main data mining models and techniques used in the e-learning domain to make it personalized? | To identify and analyze most commonly used data mining models used in the e-learning domain to make it personalized advantages and drawbacks of each of them in order to increase learner personalization and performance. |
| RQ4 | What tools are generally used to process the interaction between the learner and the content of personalized e-learning? | To identify and analyze most commonly used interaction tools between the learner and the content of personalized e-learning. |

### 3.2. Research Process

The search process should ensure that keyword usage can be relevant to the research question. To conduct this research, we followed the steps described by (Kitchenham, Budgen, & Brereton, 2015) and (Brereton, Kitchenham, Budgen, Turner, & Khalil, 2007) for construction of search strings for all the articles, papers and journals we have retrieved as follow:

1. Identify major terms and synonyms by terms that are used in the research questions.
2. Identify different spellings and synonyms for major terms.
3. Use the Boolean operator "OR" to link alternative spellings and synonyms.

4. Use the Boolean operator "AND" to link major terms.

This resulted in the following keywords used in this search: E-learning OR Distance Learning OR Electronic Learning OR Online Learning AND Component OR Parameter AND Personalized OR Adapted AND Model OR Architecture AND Data Mining OR Knowledge Discovery in Databases OR KDD OR Data Pattern Analysis.

The digital libraries used to conduct this research were the Institute of Electrical and Electronics Engineers (IEEE) Xplore Digital Library, Association for Computing Machinery (ACM) Digital Library, and Elsevier ScienceDirect.

### 3.3. Inclusion and exclusion Criteria

Originally papers are evaluated based on their title if they are to be considered or not. If analyzing the title could not bring to a decision was studied the abstract, even if after studying the abstract we couldn't be able to make a decision then read and conclusions.

For the inclusion or exclusion of a particular study we have implemented the inclusion and exclusion criteria based on (Abuhlfaia & Quincey, 2018) as in the tables below:

| No | Inclusion Criteria |
|---|---|
| 1 | Papers published between January 2014 and February 2019. |
| 2 | Written in the English language. |
| 3 | Peer-reviewed literatures |
| 4 | Paper which includes a description of evaluation about the usability of e-learning and has a clear method. |
| 5 | Papers which contains and describes data mining method and tools |

**Table 1.** Inclusion Criteria

| No | Exclusion Criteria |
|---|---|
| 1 | Duplicate papers from the same study in different databases. |
| 2 | Publications not written in English. |
| 3 | Publications not directly related to our topic. |

**Table 2.** Exclusion Criteria

### 3.4. Data Extraction

The number of papers analyzed at the first stage was 50 papers. Subsequently, based on paper's abstract, conclusions and exclusion and exclusion criteria, 34 papers were selected for analysis where 20 of them are published in different conferences while 14 of them are published in different journals. The results of the selected papers are given in the table below.

| Source Database | Studies Found | Candidate Studies | Selected Studies | References |
|---|---|---|---|---|
| ACM | 22 | 15 | 11 | (Teimzit, Mahnane, & Hafidi, 2018), (Gkontzis, Kotsiantis, Tsoni, & Verykios, 2018), (Chow, Yacef, Koprinska, & Curran, 2017), (Shivanagowda, Goudar, & Kulkarni, 2017), (Wang, Sy, Liu, & Piech, 2017), (Chanaa & El Faddouli, 2018), (Liu, Du, Sun, & Zhai, 2017), (El Fouki, Aknin, & El. Kadiri, 2017), (Shi, Peng, |

| | | | | |
|---|---|---|---|---|
| | | | | & Wang, 2017), (Daud, et al., Companion Proceedings of the 26th International Conference on World Wide Web Companion), (Hu, Zhang, Chu, & Ke, 2016) |
| Elsevier Science Direct | 29 | 21 | 10 | (Tarus, Niua, & Yousif, 2017), (Birjali, Beni-Hssane, & Erritali, 2018), (Kolekar, Pai, & Pai M.M, 2018), (Xie, et al., 2017), (Yi, Zhao-xia, Xiao-huan, Ming-ming, & Wen-tian, 2017), (Sergio, et al., 2017), (Garrido, Morales, & Serina, 2016), (Gulzara, Leema, & Deepak, 2018), (Zhou, Huang, Hu, Zhu, & Tang, 2018), (B.Saleenaa & S.K.Srivatsa, 2015) |
| IEEE | 25 | 17 | 9 | (Herath & Jayaratne, 2017), (Al-Abri, Al-Khanjari, Kraiem, & Jamoussi, 2017), (Karataev & Zadorozhny, 2017), (Karagiannis & |

| | | | | |
|---|---|---|---|---|
| | | | | Satratzemi, Comparing LMS and AEHS Challenges for Improvement with Exploitation of Data Mining, 2014), (Bhatia & Prasad, 2015), (Al-Abri, AlKhanjari, Jamoussi, & Kraiem, 2018), (Samina, Xu, Iftikhar, Zhu, & Misha, 2018), (Halawa, Shehab, & Hamed, 2015), (FeiZhou, QingPan, & Huang, 2017), (Lepouras, Katifori, Vassilakis, Antoniou, & Platis, 2014) |
| **Total** | **76** | **53** | **30** | |

**Table 3.** Summary of Selected Papers

### 3.5. Classification Scheme

Classification scheme is done in accordance to research questions and results of research questions. Firstly, we reviewed all papers' abstract and conclusions and if it wasn't possible to properly classify the paper we read introduction part and in a lot of cases we had to analyze all the paper with details.

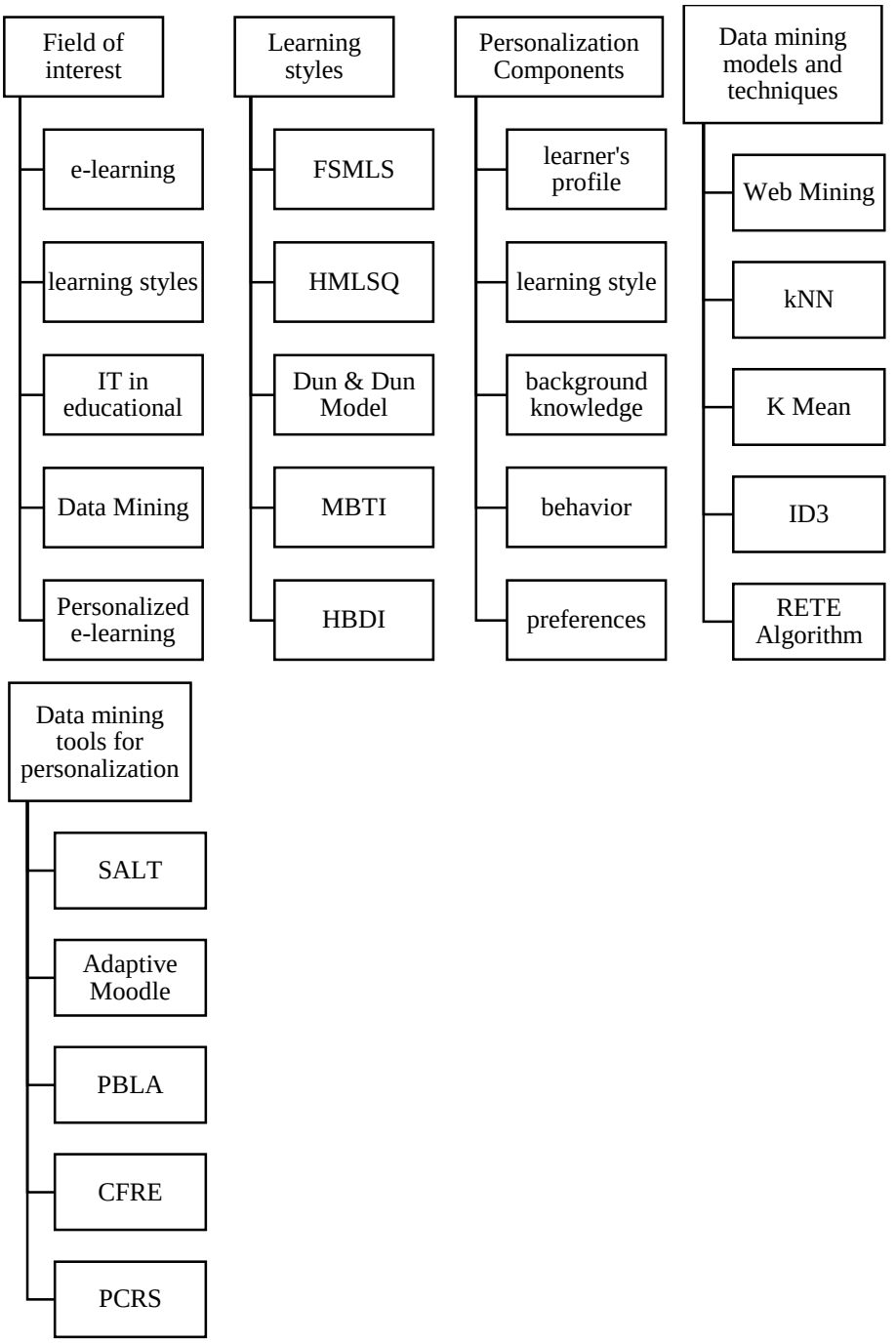


**Figure 2**. Classification Scheme

## 4.Results and Discussions

To answer all research questions, we extracted most relevant information from all papers in accordance with research questions then we analyzed by summarizing, and correlating it to answer research questions. The results are as follow:

### 4.1 What are main Learning Styles and their components?

As it is shown on Table 4, main learning styles extracted from reviewed papers are:

| Theory | Description | No of Papers | References | Percentage |
|---|---|---|---|---|
| FSLM | Felder-Silverman Learning Style Model | 7 | (Teimzit, Mahnane, & Hafidi, 2018), (Chanaa & El Faddouli, 2018), (Kolekar, Pai, & Pai M.M, 2018), (Xie, et al., 2017), (Yi, Zhao-xia, Xiao-huan, Ming-ming, & Wen-tian, 2017), (Al-Abri, Al-Khanjari, Kraiem, & Jamoussi, 2017), (Al-Abri, AlKhanjari, Jamoussi, & Kraiem, 2018), | 23.3% |
| Hybrid | Combination of different components | 4 | (Shivanagowda, Goudar, & Kulkarni, 2017), (Tarus, Niua, & Yousif, 2017), (Gulzara, Leema, & Deepak, 2018), (Karataev & Zadorozhny, 2017), | 13.3% |

| | | | | |
|---|---|---|---|---|
| KLSI | Kolb Learning Style Inventory | 1 | (Shi, Peng, & Wang, 2017) | 3.3% |
| MBTI | Myers-Briggs Type Indicator theory | 1 | (Halawa, Shehab, & Hamed, 2015) | 3.3% |
| Unspecified | There is no clear explanation of theory used | 7 | (Chow, Yacef, Koprinska, & Curran, 2017), (Liu, Du, Sun, & Zhai, 2017), (El Fouki, Aknin, & El. Kadiri, 2017), (Hu, Zhang, Chu, & Ke, 2016) (Sergio, et al., 2017), (Herath & Jayaratne, 2017), (Samina, Xu, Iftikhar, Zhu, & Misha, 2018) | 23.3% |
| LA | Learning Analytics | 3 | (Gkontzis, Kotsiantis, Tsoni, & Verykios, 2018), (Daud, et al., Companion Proceedings of the 26th International Conference on World Wide Web Companion), (Lepouras, Katifori, Vassilakis, Antoniou, & Platis, 2014) | 10% |
| Other | Different approaches | 7 | (Wang, Sy, Liu, & Piech, 2017), (Birjali, Beni-Hssane, & Erritali, 2018), (Garrido, Morales, & Serina, 2016), (Zhou, | 23% |

| | | | | |
|---|---|---|---|---|
| | | | Huang, Hu, Zhu, & Tang, 2018), (B.Saleenaa & S.K.Srivatsa, 2015), (Bhatia & Prasad, 2015), (FeiZhou, QingPan, & Huang, 2017) | |
| **Total** | | **30** | | **100%** |

**Table 4**. Used Learning Styles

- **Felder-Silverman Learning Style Model (FSLM)** with main components of reflection (active, reflected), reasoning (inductive, deductive), Sensory (verbal, visual) and progression (sequential, global).
- **Myers-Briggs Type Indicator (MBTI)** with the main components of thinking/feeling, judgment/perception, introvert/extravert and sensing/intuitive.
- **Kolb Learning Style** with main components of concrete experience (doing, having an experience), reflective observation (reviewing, reflecting on experience), abstract conceptualization (concluding, learning from experience) and active experimentation (planning, trying out what we have learned).
- **Hybrid Models.** Some of hybrid models we have retrieved from our SMS are combination of E-Learning Ontology, Learning Resource Ontology, Learner Model Ontology (Felder-Silverman Model of Learning Style) as described in (Tarus, Niua, & Yousif, 2017), or Domain Model and Question Model, Video Learning Resources, Readable Learning Resources as described in (Shivanagowda, Goudar, & Kulkarni, 2017), or social learning

framework, crowdsourcing, online social networks, and complex adaptive systems as described in (Karataev & Zadorozhny, 2017) or a combination of N-Grams and Domain Ontologies as described in (Gulzara, Leema, & Deepak, 2018).

### 4.1 What are main parameters to build a personalized e-learning model?

Finding the most influential parameters for personalization of e-learning is one of the most difficult processes in building a personalized e-learning model, because human nature itself is very complex. After screening the analyzed research papers some of the personalization components that we can mention are learner personality, learner prior knowledge, learner behavior, learner interests and preferences.

| Component | Description | References | Percentage |
|---|---|---|---|
| Personality | Learner's Profile | (Gkontzis, Kotsiantis, Tsoni, & Verykios, 2018), (Liu, Du, Sun, & Zhai, 2017), (Daud, et al., Companion Proceedings of the 26th International Conference on World Wide Web Companion), (Hu, Zhang, Chu, & Ke, 2016), (Gulzara, Leema, & Deepak, 2018), (B.Saleenaa & S.K.Srivatsa, 2015), (Herath & Jayaratne, 2017), (Samina, Xu, Iftikhar, Zhu, & Misha, 2018), (FeiZhou, QingPan, & Huang, 2017), | 30% |
| | Learning Style | (Gkontzis, Kotsiantis, Tsoni, & Verykios, 2018), | 23% |

| | | | |
|---|---|---|---|
| | | (Chanaa & El Faddouli, 2018), (Kolekar, Pai, & Pai M.M, 2018), (Xie, et al., 2017), (Yi, Zhao-xia, Xiao-huan, Ming-ming, & Wen-tian, 2017), (Al-Abri, AlKhanjari, Jamoussi, & Kraiem, 2018), (Samina, Xu, Iftikhar, Zhu, & Misha, 2018) | |
| Knowledge | Background Knowledge | (Shivanagowda, Goudar, & Kulkarni, 2017), (Wang, Sy, Liu, & Piech, 2017), (Liu, Du, Sun, & Zhai, 2017), (Tarus, Niua, & Yousif, 2017), (Birjali, Beni-Hssane, & Erritali, 2018), (Xie, et al., 2017), (Yi, Zhao-xia, Xiao-huan, Ming-ming, & Wen-tian, 2017), (Garrido, Morales, & Serina, 2016), (Gulzara, Leema, & Deepak, 2018), (Zhou, Huang, Hu, Zhu, & Tang, 2018), (Al-Abri, Al-Khanjari, Kraiem, & Jamoussi, 2017), (Bhatia & Prasad, 2015), (Samina, Xu, Iftikhar, Zhu, & Misha, 2018) | 43% |
| Behavioral | Performance | (Gkontzis, Kotsiantis, Tsoni, & Verykios, 2018), (Yi, Zhao-xia, Xiao-huan, Ming-ming, & Wen-tian, 2017), (Gulzara, Leema, & Deepak, 2018), (Herath & Jayaratne, 2017) | 13% |
| Interests | Attention, Usage | (Liu, Du, Sun, & Zhai, 2017), (Tarus, Niua, & | 20% |

| | | | |
|---|---|---|---|
| | | Yousif, 2017), (Xie, et al., 2017), (Zhou, Huang, Hu, Zhu, & Tang, 2018), (Halawa, Shehab, & Hamed, 2015), (Kolekar, Pai, & Pai M.M, 2018) | |
| Preferences | Like and Dislike | (Xie, et al., 2017), (B.Saleenaa & S.K.Srivatsa, 2015), (Al-Abri, Al-Khanjari, Kraiem, & Jamoussi, 2017), (Al-Abri, AlKhanjari, Jamoussi, & Kraiem, 2018), (Samina, Xu, Iftikhar, Zhu, & Misha, 2018), (FeiZhou, QingPan, & Huang, 2017) | 20% |

**Table 5**. General Personalization Components

Table 5 contains summarization of personalization parameters most commonly used to build a personalized e-learning model. Based on retrieved results we can conclude that most influential personalization parameter is learner's background or prior knowledge then learner's profile with components like personal information (name, gender, date of birth), academic information (major, grade, GPA, learning plan). Another component of personalization is learner's learning style and some other metrics used to to determine the learners learning style are the time spent on videos and other files, the number of times the learner accesses a particular file etc. (Kolekar, Pai, & Pai M.M, 2018) Interests like collaboration, learning time, and preferences like opinion and interactivity level, of e-learner takes an important role in personalization e-learning environment (Xie, et al., 2017), (Al-Abri, Al-Khanjari, Kraiem, & Jamoussi, 2017), (Al-Abri, AlKhanjari, Jamoussi, & Kraiem, 2018). Some other personalization

components retrieved from reviewed papers are E-Learning Ontology, Learning Resource Ontology as described in (Tarus, Niua, & Yousif, 2017), number of submissions to success as described in (Chow, Yacef, Koprinska, & Curran, 2017), Map Reduce-based GA, e-assessment as described in (Birjali, Beni-Hssane, & Erritali, 2018), etc.

**4.2 What are main data mining models and techniques used in the e-learning domain to make it personalized?**

| 5. Data Mining Techniques | Data Mining Models and Algorithms | References | Percentage |
|---|---|---|---|
| Classification | K Nearest Neighbor | (Chow, Yacef, Koprinska, & Curran, 2017), (Shivanagowda, Goudar, & Kulkarni, 2017), (Tarus, Niua, & Yousif, 2017) | 27% |
| | ID3 decision tree | (Herath & Jayaratne, 2017), (FeiZhou, QingPan, & Huang, 2017) | |
| | C4.5 | (Daud, et al., Companion Proceedings of the 26th International Conference on World Wide Web Companion) | |
| | Classification and Regression Tree (CART) | (Daud, et al., Companion Proceedings of the 26th International Conference on World Wide Web Companion) | |
| | Bayesian | (Shi, Peng, & Wang, 2017), (Al-Abri, AlKhanjari, Jamoussi, & Kraiem, 2018) | |
| | Naive Bayesian | (Daud, et al., Companion Proceedings of the 26th International Conference on World Wide Web Companion) | |

| | | | |
|---|---|---|---|
| | Support Vector Machines | (Daud, et al., Companion Proceedings of the 26th International Conference on World Wide Web Companion) | |
| Clustering | Fuzzy C Means | (Kolekar, Pai, & Pai M.M, 2018) | 17% |
| | Fast Search and Finding of Density Peaks via Heat Diffusion | (Zhou, Huang, Hu, Zhu, & Tang, 2018) | |
| | k-Means | (Teimzit, Mahnane, & Hafidi, 2018), (Chow, Yacef, Koprinska, & Curran, 2017), (Shi, Peng, & Wang, 2017) | |
| Pattern Mining | Frequent Pattern Growth (FP-Growth) | (Hu, Zhang, Chu, & Ke, 2016) | 7% |
| | Sequential Pattern Mining | (Shivanagowda, Goudar, & Kulkarni, 2017) | |
| Web mining | Web content mining | (Shivanagowda, Goudar, & Kulkarni, 2017), (Wang, Sy, Liu, & Piech, 2017), (Herath & Jayaratne, 2017) | 13% |
| | Web structure mining | (Sergio, et al., 2017) | |
| | Web usage mining | (Herath & Jayaratne, 2017) | |
| Recurrent Neural Network | Long Short Term Memory (LSTM) | (Liu, Du, Sun, & Zhai, 2017), (Al-Abri, Al-Khanjari, Kraiem, & Jamoussi, 2017) | 13% |
| | Deep Neural Network | (Chanaa & El Faddouli, 2018), (El Fouki, Aknin, & El. Kadiri, 2017) | |

**Table 6**. Main data mining models and techniques

Main data mining techniques used in the e-learning domain to personalize it are Classification Techniques with percentage of 27 from reviewed papers and main data mining algorithms for classification are K Nearest Neighbor, ID3 decision tree, Bayesian and Naive Bayesian. Second most commonly used technique for personalization is Clustering Technique with k-Means algorithm used most. Web Mining with its components of web content mining, web structure mining and web usage mining is also very used. Machine Learning Recurrent Neural Network technique with its main algorithms of Long Short Term Memory (LSTM) Deep Neural Network is the new trend used in personalizing e-learning environment.

### 4.4 What tools are generally used to process the interaction between the learner and the content of personalized e-learning?

Some of the tools that are generally used to process the interaction between the learner and the content of personalized e-learning are Collaborative Filtering Recommendation Engine (Shivanagowda, Goudar, & Kulkarni, 2017), (Herath & Jayaratne, 2017), Orange Software, a Python datamining library (Gkontzis, Kotsiantis, Tsoni, & Verykios, 2018), GATE text mining tool (Wang, Sy, Liu, & Piech, 2017), and GATE (TwitIE) adapted for Twitter (Al-Abri, AlKhanjari, Jamoussi, & Kraiem, 2018), adaptive User Interface for Moodle (Kolekar, Pai, & Pai M.M, 2018), CRETAL (Compiler of Resources in Engineering & Technology to Aid Learning) (Birjali, Beni-Hssane, & Erritali, 2018), myTutor implemented in Moodle, provides a mixed-initiative architecture that allows teachers and students to work together during the learning cycle (Xie, et al., 2017), on-line course applicability assessment (OCAA) (Gulzara, Leema, & Deepak, 2018), WordNet (Bhatia & Prasad, 2015), and WordNet or MeSH (B.Saleenaa & S.K.Srivatsa, 2015) Ontology Dictionaries, SALT (Self-

Adaptive Learning through Teaching) (Karataev & Zadorozhny, 2017), Reading Battle and Rapid Miner toolkit (Hu, Zhang, Chu, & Ke, 2016), etc.

## 5. Conclusions

As it is mentioned above one of the most difficult challenges that encounter personalized e-learning models is the unique and at the same time extremely complex human nature. Another problem that arises in personalized e-learning models is the highly variable nature of learner, so a pattern of e-learning that may be suitable for one learner at a time or for a particular content may not be any more suitable to the same learner at a different time or content.

## 6. Limitation and Future Research

Among the main limitations of this systematic mapping study are the number of digital libraries in which the search is made, the number of selected papers and our subjectivism in the way we understand and select a particular paper.

As a future research we think that finding most important personalization components in Personalized e-learning Model based on experimental studies with broad learner diversity and contents would meet one of the current gaps of Personalized e-learning Model. Also it will be interesting in analyzing the ways and techniques how to integrate personalized e-learning model into the emerging global communication architecture of Internet of Everything

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# ARTIFICIAL INTELLIGENCE IN THE HEALTHCARE INDUSTRY. ADDRESSING CHALLENGES IN THE IMPLEMENTATION PROCESS OF ROBOTIC SURGERY AS A POTENTIAL ALTERNATIVE TO TRADITIONAL SURGERY.

**Abstract**

*The rapid rise of robotic surgery has allowed artificial intelligence (AI) to reach where natural intelligence could not reach. Nowadays, Artificial Intelligence (AI) is the biggest assistant of every healthcare provider with various algorithms, machine learning systems and skilled robots. AI can provide higher accuracy estimates than surgeons for certain situations by designing a 3D model of the bone and providing millimetric and perfect cuts. Obviously, this will improve patient*

*outcomes. A report by Markets and Markets forecasts that the global digital transformation market will grow from $469.8 billion in 2020 to $1,009.8 billion by 2025, at a CAGR of 16.5% during the forecast period. However, the implementation of Artificial Intelligence in healthcare can be more complicated in the real world in terms of dealing with issues that go beyond designing an AI model in theory. Digital transformation remains a concern and needs attention in terms of addressing the challenges in the proper way. This study tries to address the current gaps in supervision/oversight of AI challenges and robotic surgery practices in order to leverage the use of AI and robotic surgery and increase the accuracy of patients' outcomes. The two main challenges in terms of AI and robotic surgery implementation are the high costs and lack of training for surgeons. This study tries to address the current gaps in supervision/oversight of AI challenges and robotic surgery practices to leverage the use of AI and robotic surgery and increase the accuracy of patients' outcomes.*

***Keywords:*** *Artificial Intelligence (AI), robot-assisted surgery, healthcare, supervision team, cost, training.*

## 1. Introduction

With digital technologies reshaping every industry, it is safe to say that digital transformation has become a marketplace itself, generating billions in value. In fact, a report by Markets and Markets forecasts that the global digital transformation market will grow from $469.8 billion in 2020 to $1,009.8 billion by 2025, at a CAGR of 16.5% during the forecast period. The end-users for such solutions vary, and healthcare is not exempt. Amid the COVID-19 pandemic, organizations started relying largely on digital technologies to keep up with their daily operations in a changing setting. Even more so, healthcare industry players were pushed to accelerate the adoption of new technologies within their environment to keep up with the growing number of patients. Every kind of transformation in the workplace is hard, which is especially the case with digital transformation. The healthcare industry, in the process of digital transformation, has been facing changes in improving patients' journeys and outcomes, structuring employee workflow, storing and sharing patient records, and ensuring compliance with changing regulations, among others.

Nowadays, Artificial Intelligence (AI) is the biggest assistant of every healthcare provider with various algorithms, machine learning systems and skilled robots. AI can provide higher accuracy estimates than surgeons for certain situations by designing a 3D model of the bone and providing millimetric and perfect cuts. This will improve patient outcomes. In addition, AI promises to revolutionize the healthcare industry and reduce healthcare costs. Computers can work 24 hours a day, 7 days a week, without getting bored, distracted, and tired. In addition, AI systems think faster than humans and perform multiple tasks simultaneously to achieve the best results. AI can

process millions of data and map a pattern between them. AI-based algorithms can provide higher accuracy in their analysis.

The main uses of AI applications in healthcare can be grouped into four categories. The first is Digital Consulting. AI consultants provide remote consultations to patients. Furthermore, patients can learn what to do after the treatment, get information about how to use their medications, and find logical answers to their questions.

The second area of use is Smart Disease Diagnosis. Artificial intelligence receives the patient's data, evaluates the data, and presents the doctor with a list of possible outcomes. Smart Disease Diagnosis can predict diseases at a very early stage so that they can be prevented.

The third area of use is the Virtual Tracking System. Chatbots can monitor the patient's recovery process and send the data to the doctor. Moreover, notifications such as medication reminders, and exercise reminders, facilitate the recovery process.

Fourth, robot-assisted surgery (robotic surgery) is the most important use of AI in healthcare. The rapid rise of robotic surgery has allowed artificial intelligence to reach where natural intelligence could not reach.

AI applications can make independent decisions based on the algorithms which memorize the input data and then draw conclusions based on the received information. Smart Disease Diagnosis and Virtual Tracking Systems collect data from the patients, observe and draw conclusions through different algorithms. However, this is not the case with a robot-assisted surgery. “A surgical robot is a self-powered, computer-controlled manipulator that can be programmed to aid in positioning and manipulating

surgical instruments. The robotic manipulator acts as a remote arm extension governed by the surgeon's movement" (BenMessaoud, Ch., et al., 2011). Robots that assist the surgeons in the operating room are controlled and directed by well-trained surgeons. Therefore, we cannot think of robot-assisted surgery as a method that can perform independent tasks.

The implementation of Artificial Intelligence in healthcare can be more complicated in the real world in terms of dealing with issues that go beyond designing an AI model in theory.

This paper tries to address the current gaps in supervision/oversight of AI and robotic surgery practices to leverage the use of AI and robotic surgery and increase the accuracy of patients' outcomes. The two main challenges in terms of AI and robotic surgery implementation are the high costs and lack of training for surgeons.

## 2. Literature Review

John McCarthy was the first to use the term artificial intelligence (AI) in 1956. AI is used to evaluate the technical skills of healthcare practitioners. "AI can be incorporated into surgical training and education to provide an objective method for assessment of surgical skills of a trainee, through its application in robotic surgery, virtual reality-based surgical training and post-op analysis of surgical videos" (Azhar, H., Waseem, T., & Ashraf, H., pp.58, 2021).

AI plays a crucial role in preoperative planning, intraoperative guidance and robotics. Traditional surgical methods seem not to be preferred anymore. AI is expected to play a greater role in the diagnostics of several diseases. The authors argue that AI is still in its primitive stages, but the education and training of medical professionals are essential to address the

gap in terms of AI implementation (Azhar, H., Waseem, T., & Ashraf, H., 2021).

Robotic surgery was first used in 1985 in neurosurgery. Da Vinci surgical system was first launched in 1999 and in 2000 the FDA approved the use of this robotic system in laparoscopic surgery. Uses of robotic surgery have increased. Robotic surgery is considered to be successful in terms of shortening recovery time and reducing pain compared to traditional open surgery. Based on the model used, Da Vinci robots require an investment of about $0.5 to $2.5 million. Also, service contracts and other annual costs are added to this investment. Regarding the system of surgical robots, it can be stated that the more cases there are the better. Perez & Schwaitzberg (2019) in their study consider the characteristics and costs of other robotic systems in surgery. Perez & Schwaitzberg (2019) claim that the costs of robotic- assisted surgery are higher compared to traditional laparoscopy.

In light of their research, Perez & Schwaitzberg (2019) argue that the increase in the volume of robotic - assisted surgery cases would make robotic - assisted surgery cost-effective. Market competition is another key element in terms of lowering the costs of robotic - assisted surgery. Robotic - assisted surgery is considered to be a system in development and it may take a while to prove its value and increase the volume of robotic surgery and competition in order to lower the costs of Da Vinci robots (Perez, R. & Schwaitzberg, S., 2019**).**

Furthermore, AI has the ability to process the diagnosis quickly and in an effective way. In the long term, AI will help healthcare providers to address the challenges and will contribute to a deeper relationship between

patients and healthcare providers. It is important to develop a medical school curriculum together with the medical staff of hospitals and other healthcare providers. A highly - trained professional team can provide learning opportunities and can contribute to the consumer - oriented healthcare market. The application of AI in healthcare requires the cooperation of different specialists in the healthcare area. So, it is important to provide a collaborative environment with the participation of professionals in the development and implementation stage of AI in healthcare (Lee, D., & Yoon, S. N., 2021).

Robotic surgery has become the most preferred alternative and has gradually replaced laparoscopic surgery methods in the US. By 2015, robotic surgery was widely used in hospitals. Hospitals try to provide the most advanced technology to their patients in order to improve the quality of service. Although robotic surgery has become a strong competitor to traditional surgery, it seems to have some implications such as cost. Robotic surgery procedures resulted in being associated with longer operating times and higher costs. Surgeons should perform 100 to 150 cases annually to meet the costs of purchasing the robotic system in Radical Nephrectomy. The cost of robotic surgery results in increasing the hospital costs by 15% compared to laparoscopic procedures. Furthermore, robotic surgery is associated with increasing the cost of the operating room as a result of longer operating time (Jeong, I. G., Khandwala, Y. S. Kim, J. H., Han, D. H., Li, S., Wang, Y., ... & Chung, B. I., 2017).

In the US, Da Vinci robots are priced from $1.5 to $2.5 million, accessories cost $700 to $3,200 per case and the robots' annual contract costs $100,000 to $170,000. At this point, increasing the volume of robot - assisted surgeries can decrease the cost of robotic surgical systems. Although

hospitals purchase robot - assisted surgery procedures they keep case volumes low, leading to several drawbacks. It becomes challenging for hospitals and administrators to attract patients to utilize the new technology. Furthermore, some hospitals face challenges in terms of training surgeons to gain the necessary skills within a certain frame of time. Untrained surgeons would lead to insecurity, thus lower-case volumes (Shih, Y. C. T., Shen, C., & Hu, J. C., 2017).

AI and robotic - assisted surgical procedures are used worldwide and compared to non - robotic practices such as colorectal surgery the robotic - assisted surgery results in being more expensive. In a 28-month study conducted in Australia, the authors concluded that the cost of implementing RAS was $4,433,186 including the purchase of the robot, sterilization and theater refurbishment. The overall median episode cost was estimated to be $19, 269. The average consumable cost of robotic - assisted surgery was considered to be $1848 per case and the average specific cost of this technology was considered to be $8828 per case. In light of their research, McBride et al. argue that the overall cost of the implementation of robotic - assisted surgery depends on the volume and specialty of surgery. Furthermore, it is important that administrators consider the costs of this new technology before the implementation and incorporation of robotic - assisted surgical procedures (McBride, K., Steffens, D., Stanislaus, C., Solomon, M., Anderson, T., Thanigasalam, R., ... & Bannon, P. G., 2021).

AI and robotic surgery procedures are widely used in several fields of healthcare such as urologic operations (e.g., prostatectomy and cystectomy). Da Vinci’s system is considered to have significant advantages compared to traditional surgical methods. The technical limitations and operational difficulties of conventional laparoscopy in surgeries have been

significantly resolved with robotic - assisted surgery procedures. While considering the advantages of these procedures, it is important to analyze the high cost, which remains the most important disadvantage of this procedure. In current studies, it has been observed that robotic surgery has much higher costs than both laparoscopy and traditional open surgical procedures for many operations (Erbin, A., Özgör, F., & Binbay, M., 2016).

Robotic - assisted laparoscopic prostatectomy is $1726 greater as compared to open retropubic prostatectomy due to instrument costs and long operating time. High fixed costs should be analyzed in order to reduce fixed high costs of robotic surgery procedures in urology. Therefore, it is important that hospitals reduce disposable costs and higher-cost equipment. Healthcare practitioners need to find new reasons to justify robotic-assisted surgery. (Dobbs, R. W., Magnan, B. P., Abhyankar, N., Hemal, A. K., Challacombe, B., Hu, J., ... & Crivellaro, S., 2016)

The cost of robotic-assisted surgery can be reduced by 40% by using cheaper materials such as a hem-o-lok clip applicator instead of expensive equipment such as LigaSure technology. The role of healthcare professionals is crucial. Considering the fact that robotic surgery is a new technology, it causes an increase in expenses such as equipment and training of surgeons (Arslan, D.T., Esatoğlu, A.E. & Süer, E.,2020). With the spread of new-generation models, the costs of first-generation models will decrease. If hospitals manage to eliminate the cost problem in the future, then robotic surgery will be the gold standard in pyeloplasty, radical prostatectomy and radical cystectomy (Erbin, A., Özgör, F., & Binbay, M. (2016).

Moreover, despite the increasing costs of robotic surgery, the number of studies evaluating alternative surgical methods in terms of cost is few. At

this point, economic evaluation studies examining new technologies such as robotic radical prostatectomy are needed in order to utilize these resources efficiently.

By supporting R&D studies, these medical technologies can be developed and produced domestically. Thus, the costs of surgical methods can be reduced in the long run. Also, hospitals should monitor their service quality on a regular basis. Also, hospitals should observe the preoperative and postoperative quality of life systematically. Therefore, the economic evaluation of new technologies can be carried out without missing data, and it can be argued that hospitals can regularly monitor their own service quality in different areas (Arslan, D.T., Esatoğlu, A.E. & Süer, E., 2020).

Furthermore, AI robotic-assisted surgery is also used in sleeve gastrectomy. The advantages of robotic - assisted surgery are obvious compared to traditional surgery, but the costs of this technology were twice as high and the total hospital costs were higher when robots were used. Robotic - surgery methods resulted in increased length of operation, longer hospital stays and an increase in terms of overall costs. Adair et al. (2019) analyzed the results of minimally invasive sleeve gastrectomy and four studies out of five studies conducted for hospitals, which resulted in higher costs for robotic-surgery procedures. It is important for surgeons to be trained before undertaking complex operations such as robotic roux-en-y gastric bypass. As experience increases, a decrease in the development time of robotic operations is noticed (Adair, M. J., Alharthi, S., Ortiz, J., Qu, W., Baldawi, M., Nazzal, M., & Baskara, A., 2019).

Most of the surgeons complete their specialization training without receiving robotic surgery training during this process. This is a big challenge

for surgeons who perform robotic surgery in their field of specialization. For instance, in most US hospitals obstetrician specialists who do not have the necessary robotic surgery experience, are required to complete the manufacturer's robotic surgery authorization training before using the robotic surgical system. It is the responsibility of hospitals to determine their own structured training program for surgeons and the minimum criteria that must be completed according to each surgical procedure. Surgeons go through a learning curve while learning new technologies. In the meantime, the lack of education and experience will generate several problems. Special attention should be given to the supervision of surgeons in order to work in a way that they feel safe. (Usluoğulları, F. H., Tıplamaz, S., & Yaycı, N., 2017).

Nurses also play a very important role in the use of AI and robotic assisted surgery in hospitals, as the main support of surgeons and they have direct contact with patients. There are not enough training programs for nurses in terms of robotic surgery. Robotic surgery nurses experience limitations regarding current information, training programs and learning opportunities. By meeting educational needs, nurses can contribute to improving patient safety and quality of care. The role of hospital administrators is to develop training programs on robotic surgery for nurses as well as provide evidence-based information and equal opportunities. In order to provide quality care and ensure patient safety, nurses should be encouraged to understand the system used and be informed about its applications (Alcan, A. O., Soyer, Ö., Giersbergen, M. Y. V., Solak, M., & Yoltay, H. E., 2019).

Lee & Yoon (2021) argue that except cost and training there are also some administrative challenges that should be taken into account while

implementing AI in the healthcare industry. AI causes loss of managerial control since the traditional bureaucratic governance systems do not function anymore in modern healthcare. AI applications are being integrated in different aspects of life. As AI continues to develop, healthcare providers will have the tendency to rely on the knowledge and skills of AI experts. Administrators may lose some kind of managerial control over professional staff (Lee, D., & Yoon, S. N., 2021).

This argument is supported by Spatharou et al. (2020), arguing that as the need for new experts emerges, the organizational culture may change and be replaced by decentralization. The top management of the HSOs will have to delegate the decision - making responsibilities to teams specialized in medical and technical knowledge in adopting and implementing AI in healthcare. Spatharou et al. state that:

"The biggest leap of all will be the need to embed digital and AI skills within healthcare organizations – not only for doctors to change the nature of consultations but for all staff to integrate AI into their workflow. This is a significant change in organizational culture and capabilities. The final effect on the workforce will be the introduction of new professionals. Multiple roles will emerge at the intersection of medical and data-science expertise" (Spatharou, A., et.al., 2020).

In addition, there are also accountability issues, privacy and security issues that may hang in the balance if the implementation of AI techniques is not controlled, as well as ethical issues (Lee, D., & Yoon, S. N., 2021). Eriksson and Djoweini (2020) support this argument by stating that ethical dilemmas that AI raises should be considered. The authors wonder whether AI will be able to consider all the stakeholders involved in the process

equally or not. In addition, they emphasize the decision - making challenge within organizations. This happens because organizations have values, and an organizational culture and decisions cannot be made only on the basis of raw data. Also, the training data should not be generalized, instead they should be specified according to the organization's culture and values. At the moment of speaking, these can be considered as challenges in the implementation of AI (Eriksson, M., & Djoweini, C., 2020).

## 3. A SWOT Analysis of Robotic Surgery

### Strengths

Since the first-day robotic surgery had been widely used. Robotic surgery has more advantages than traditional surgery, and this makes it an important competitor in the market. Moreover, robotic surgery promises a less painful procedure, with less blood loss and taking into account the fact that the robot arms can often be sterilized during surgery. Also, robotic surgery shortens the healing time of the patient due to the minimally invasive methods used and as a result, shortens the time period of hospital stay. All of these contribute to better outcomes for patients.

### Weaknesses

In addition to the advantages, robotic surgery also brings some disadvantages, which should be considered before implementing this technology. In terms of weaknesses of AI and more specifically robotic surgery, cost constitutes a major problem. In fact, in literature cost is considered to be the most important challenge in the widespread use of robotic surgery. The purchase of the Da Vinci device, the installation cost of the system, the annual maintenance cost and the costs of the extra tools of the robots make the use of robots very difficult. The cost of the Da Vinci

robot is about 2.5 - 3 million dollars. Moreover, the robot's instruments cost between $700 to $3,200 per surgery. The annual maintenance cost varies between $100,000 to $170,000. In addition, it takes a long time to set up and remove the robot before and after surgery.

Training is one of the main weaknesses of robotic surgery and the reason why surgeons refuse to use this new technology. Robotic surgery should always be performed by an experienced surgeon. Surgeons who will use this technology should receive long-term training. The success of robotic surgery is proportional to the skill of the surgeon. Moreover, surgeons who participate in training programs abroad have to cover the expenses themselves. Lack of training and experience also has a great impact in terms of increasing the risk rate.

**Opportunities**

An important opportunity of robotic surgery is the possibility for the scope of expansion if the administrative team of the hospital manages to successfully manage all the challenges and weaknesses. Moreover, in the future, with the spread of new-generation models, the costs of first-generation models may decrease.

**Threats**

Extensive training of surgeons can result in a loss of interest in what they are learning. Moreover, extensive training emphasizes theory more than practice. Many surgeons are more successful with hands-on experience. Furthermore, the malfunction of the device poses a threat considering the challenges of robotic surgery. In addition, taking into consideration the fact that robotic surgery is a new practice the lack of a development plan poses a challenge in terms of high costs and low case volumes.

### 3.1.Discussion

This qualitative study seeks to convey why AI and robotic surgery are not widely used and how can the supervision team and the administrators of the hospitals address the challenges in the implementation process of robotic surgery as a potential alternative to traditional surgery.

Taking into consideration the fact that this new technology seems to be very promising for the future, we can argue that there is some extent of enthusiasm. Obviously, robot-assisted surgery, when used properly, improves patient outcomes. Minimally invasive interventions are more beneficial for the patient because they cause less pain, less blood loss, and accelerate the overall recovery after surgery.

Robot-assisted surgery methods can be considered as halfway or add-on technologies and have a great impact in improving the physician's ability to diagnose and treat several diseases. This technology does not aim to replace the traditional surgery methods, but to improve the existing ones and as a result improve the accuracy of patients' outcomes.

The Da Vinci robotic system has proven to be successful in many fields and achieved to get where human intelligence could not. However, it deserves special attention to overcome the potential challenges. Purchasing and introducing a new technology is a considerable investment for a healthcare provider and the return on investment (ROI) should be easily earned in different ways.

Cost is a matter of debate for AI in robotic surgery. This new emerging technology brings the cost burden. In addition, the healthcare provider should consider the costs to train employees e.g., surgeons.

Insufficiently trained employees can result in mistakes. What if an AI-related accident occurs in the operating room? Who would be held accountable for this error? The hospital who made the decision for the technology purchase or surgeons who were not experienced in using it. These kinds of mistakes can bear major consequences for the institution. Insufficient training and skilling of end-users may cause bias, and malfunctions, have negative impacts on patients' outcomes, and even generate discrimination between different levels in the hospital.

Mistakes can lead to not only a loss in productivity but major hiccups in providing services. Thus, resulting in not only major losses in unrestricted revenue but the overall return on investment from the technology. Well-trained surgeons can master new skills, increase overall production efficiency, and cut costs. Well-trained surgeons have the tendency to be more productive at work by performing at higher levels. Maintaining a well-trained workforce may bear cost upfront, including reduced productivity, but result in a better return on investment and a valuable team.

Most of the time staff feels resistant to the change and this leads to more abrasive behavior. To alleviate this problem, the healthcare provider should always be available to train clinicians. In fact, if this problem can be eliminated, the healthcare provider will get rid of the disadvantages of robotic surgery.

It is crucial to adopt a credentialing system together with the establishment of a supervision team. The credentialing process will identify the necessary qualifications, experience, and professional attributes of the surgeons who have the competence to provide safe use of robot-assisted surgery. Therefore, before performing robotic surgery, the surgeons should

be able to attend an accredited training program and show a certificate of completion of a training program. The training program should be focused on demonstrating the necessary information and skills to use the Da Vinci robotic system. Moreover, upon successful completion of the required courses, surgeons should be involved in a direct practical program and interactive experience in terms of using the robot. The surgeon should demonstrate a certification of practical experience to the responsible team in the hospital. Also, surgeons should be monitored by more specialized surgeons for a certain period and after the completion of the training program. It is the responsibility of the supervisory team to assign working groups between senior surgeons and inexperienced ones. Also, an annual quota that would determine the number of cases that should be performed by the surgeons should be set.

In addition, training is crucial in terms of determining access to this new technology. Will AI be able to involve the stakeholders in the implementation process? Does access of patients to AI applications depend on the doctor? The answer to this would be it depends on the training that the doctor received and on the advantages the doctor benefited from.

While some doctors can embrace technology easily, some others are reluctant to do so because of a lack of training they will not adapt to change. At this point, training is crucial. If doctors are all trained in AI and know all the ins and outs of it, they will definitely see that AI will be more beneficial in different aspects and will be able to pass it to the patients in the right way. It is important that doctors benefit first from the advantages of AI to be able to let their patients know.

It is important that the hospital covers the cost of this training program. Also, the supervisory team is responsible for continuous monitoring and reporting to the administrators of the hospital on a regular basis. In relevance with the literature review, it is important that in the long term, courses related to technology in healthcare and mainly AI-related courses should be accepted as fully a part of the medical school curriculum in undergraduate studies, just like laparoscopic courses that have become part of the undergraduate curriculum in universities. As robot-assisted surgery becomes widespread and surgeons' experience with technology increases, the volume of cases will also increase. Moreover, the import of medical devices and materials used in robot-assisted surgeries generally increases the cost of this technology. Therefore, by supporting R&D activities, these medical technologies can be innovated and developed domestically. Thus, the cost of robot-assisted surgery can be reduced in the long run.

Supervision teams or as well-known as robotic teams would play an important role in addressing potential challenges, paving the way for solving them as well as increasing the engagement, confidence, and effectiveness of AI implementation. "Administrative systems need to be established in order to monitor the AI systems before and after implementation to determine whether the performance of the AI in the real world meets the expectations" (Silcox C., 2020). The supervision team will play an important role in the process of problem-solving, and decision-making and will also consider the quality assessment of pre-and post-operative reports in terms of AI. While deciding upon the implementation of robotic surgery, the supervision team (robotic team) should reflect the values of the organization and establish a moral framework in line with the mission, vision, and culture of the hospital.

## 4. Conclusion

In the rapidly globalizing world, telesurgery will be part of the agenda much more in the coming years. While considering the advantages of AI and especially robotic surgery, it is important to emphasize the potential challenges that set the implementation of these technologies back.

As this technology continues to grow, it is important to deploy AI around the world in an ethical, comprehensive and transparent way in order to ensure efficiency. Administrators need to evaluate the strengths, emphasize the weaknesses and obtain the maximum benefit. In addition, they need to develop the necessary strategies to adopt AI applications and the right plans in order to facilitate the process of implementation in order to benefit from this new technology. If the administrators could overcome the potential challenges during the implementation process of robotic surgery, it can definitely be considered as a potential alternative to traditional surgery.

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# AN EVALUATION OF CUSTOMER LOYALTY PROGRAMS

**Abstract**

*Loyalty programs became a global trend in the last 30 years, time when, the economic growth, technology and expansion of the companies were booming. Due to this reason, it became object of studying and analysis and was considered as a key element in establishing the future of company with regards to its brand, incomes and reputation. Loyalty programs have an indispensable role in customer relationship management programs, but not all programs are successful. Companies should realize not only what is beneficiary for the customers in a LP, but also how they want to be treated as a loyal member. The purpose of this article is to evaluate some of the successful LP pertinent to the current situation for both companies and customers.*

**Keywords:** *loyalty program; customer loyalty; evaluation of loyalty programs*

## 1. Introduction

The main principle that governs the application of loyalty programs (LPs) is manly based on the grounds that it is less expensive to keep an existing customer than to gain new ones. This is one of the main reasons why companies are competing to implement different schemes of LPs. Evidentially, LP's applications have been extended in all kinds of businesses including service, retailing, production even to mid and small size enterprises.

Generally, there is not a general definition for the loyalty programs. A loyalty program can be defined as a marketing process that generates rewards for customers on the basis of their repeat purchases (Reinartz, 2006). Different authors have given other definitions for the LPs based on the main purpose that a LP has in connection with the target that a certain company aims to achieve. In plain language a LP is nothing more than a rewarding program which aims to increase the benefits of the company by keeping the current customers and simultaneously using them to attract others. This is the reason that the LPs have become a strategic tool used by companies to identify, reward and retain their customers.

Despite the fact that LPs are not a new entry in marketing strategy, their importance is strengthening day by day and have become part of the competition between companies and at the same time a tool of cooperation between companies of different nature. In this sense, it is very common for a telecommunications company to reward its customers by extra points, gifts but also to offer touristic trips by cooperating with a travel company. To continue with the same example, other service companies may offer gift cards or discounts applied in a supermarket, and so on. As a consequence,

LPs have become a global trend in a globalized market, fuelled by the use and speed of technology.

Due to this reason, the LPs management have set up "their own market", sometimes outside the very business which applied and implements them. The loyalty management market has expanded, evolved and created new strategies of implementation of the LPs. According to Markets and Markets, the global loyalty management market size will grow from USD 8.6 billion in 2021 to USD 18.2 billion by 2026. In this survey, conducted by the prestigious portal in its 245-page report, the data collected and processed in North America, Europe, APAC, Latin America and MEA, shows that the LPs now are an integral part of almost all segments of business such as; software, consulting, support and maintenance, web mobile, aviation, automotive, media and entertainment, retail and consumer goods, hospitality etc.

As we are living in a new era of technology and specialised LPs management companies, the main question that businesses should answer and take into consideration would be; the evaluation of customer loyalty programs and if their LPs meet the new required standards.

## 2. Considering the Application of Loyalty Programs.

Demand and supply, forms of businesses and market strategies are not rigid and are prone to adopt according to changes introduced by various factors such as; new forms of production, services, technology and so on. The latter one, namely technology, has made accessing of goods and services more reachable. In this particular point, the implementation of LPs is becoming indispensable in order to help companies to establish strong

relationships with the existing customers and create new ones in order to increase the incomes.

Nowadays the use of technology, especially social networks, communication platforms and mobile phone applications have almost replaced the old marketing adverts and even traditional loyalty programs. The former actors are changing roles and currently are the customers who are adverting the company, the product and the service. Over 70% of consumers are more likely to recommend a brand if it has a good loyalty program (Bondbrandloyalty.com, 2018).

Certainly, this is connected with the LPs itself which has a crucial role in offering to the customer a satisfying reward. One of the biggest credit card companies in the world, American Express has concluded that satisfied customers are more likely to share their positive experiences with others, resulting in a referral rate of approximately 11 people (American Express, 2017).

People tend to share their experiences within the closed circle such as family and friends. A satisfying, easy accessed LP, can significantly increase the number of customers simply by suggesting, sharing the product/service or by chatting about the quality of the product and the benefits of the loyalty program. 81% of customers trust recommendations from family and friends over those from companies (Redbord, 2018). It seems that one of the best strategies in using the LPs is also to engage the customer and making her/him part of the process without forgetting to give the due share.

## 3. Using Loyalty Programs to Boost the Customer Engagement

What the customer wants and needs from the company is the quality of the product, affordable price, rewards and motivation thus making them respectable and appreciated by the company. By offering these, a company can connect the customer to the product thus creating a brand that customers like and trust and most probably to recommend it to the others.

Customers engaged in a brand's loyalty program will spend 12-18% more each year (Shepherd, 2019). A crucial element which must not be neglected by the companies in implementing the LPs is the emotional connection between the company and the customer. Setting up a group of fans or "fanatics" of the brand or product is considered the best advertisement a company can have. When companies transform the ordinary into the extraordinary, those experiences deepen the client relationship, and that translates to sales, with 53% of customers saying that they feel an emotional connection to the brands they buy most often (Pouw, 2021).

It is understandable that this emotional connection requires strong dedication by the company to interact and answer the demands of the customers almost in real time. The use of technology has its negative sides with regard to challenge the rapid response of the company. Salesforce's recent "State of the Connected Customer" report found that 70% of consumers now report that technology has made it easier than ever to take their business elsewhere — switching from brand to brand to find an experience that matches their expectations (Afshar, 2022). That is why 64% of consumers said they expect companies to respond and interact with them in real-time (Johnson, 2017). Considering that the use of technology is extremely fast, the response by the company should have almost the same intensity and if the business is not doing enough to keep the customer

connected and engaged, the company has a 54% chance to lose customer to another competitor (Shepherd, 2019). The risk of losing the customer has been amplified even by the expansion of the marketing services company which hold a vast information of personal data and can put under disposition of the companies that subscribe for marketing and LP services. The key element of a modern LP seems to be the customer satisfaction experience.

## 4. The New Trend of Loyalty Programs

The new inquiries show that by offering customers personalized content which are related to them, a business can considerably improve customer satisfaction and experience. If you know what a customer likes the chances that she/he will spend more are higher. This particular element of the LP requires that companies must treat the customer not like a number but like e human.

Seventy-two percent of consumers and 89% of business buyers say they expect companies to understand their unique needs and expectations, while 66% of consumers say they're likely to switch brands if they feel treated like a number, not an individual (Johnson, 2017). The companies that are able to create and use more human feeling LPs, the rewards are higher. Personalised experience certainly influences the loyalty of the customers and keeps them connected to the company.

This is an indicator that the customers are eager "to sacrifice" even some of the personal data in order to receive a satisfying LP which meets their needs. The inquires show that the customers are spending more on brands that they are loyal, despite the fact that they could find better quality alternatives because of trust. In USA, a country that has pioneered the LPs and has further developed them, 87% of Americans will gladly give up some

form of privacy in exchange for an excellent customer experience or reward (Bulao, 2022). On the other hand, it also true that a customer will abandon a company that does not share their beliefs or "betrays" them in one way or the other. This kind of betrayal mostly occurs when the company does not respect the terms and conditions offered in the LP which mostly is accompanied with poor quality and poor rewards.

On the contrary, a good LP, well implemented and customised to the needs of the customers, adds value to the business. In order to meet those criteria, a contemporary LP, according to KPMG annual report 2019, should consider four key elements;

1. The LP should be easier to use. In this context many customers find difficulties in long registrations procedures, complex mobile phone applications and difficult ways to claim their reward.
2. Keeping the customer updated. Many customers, forget they are part of a LP or even if they do, sometimes they forget about the accumulated points or events when those rewards are going to be distributed.
3. In this case, customers may not believe in LP so the company should raise awareness about the seriousness of the rewards that they offer to the loyal customers by promoting and advertising the reward as much as possible.
4. Update and upgrade. Nowadays an appreciated LP is defined not only by its value but even by the feeling of empathy and emotionality that it creates. It seems a good strategy to update an LP for example from a simple personal reward to a donation for charity or an exclusive experience.

In this context it is worthy to mention that one of the most successful LPs is implemented by Sephora company. Sephora has relied less on transactional loyalty and started leaning into emotional perks. Think personalized birthday picks and even a Brow House Call with Jared Bailey—the brand's resident brow pro—plus a Francis Ford Coppola Winery tour with a special collection of Sephora products. Today, 17 million members subscribe to Sephora's loyalty program, and this group is responsible for 80 percent of the company's sales. (Definition6, 2022).

## 5. The Final Aim of LPs is to Increase the Incomes.

The purpose of a business is to create a customer (Drucker, 1954) and also to keep that customer and add more. There is no need to explain that LPs have been established to increase the company's revenue but still there is a clash of opinions between "old and new school" of marketing consisting of the idea of not investing much in a LP or considering them seriously.

As a matter of fact, a well implemented LP will significantly increase the revenues of the company. According to Reicheld (2001), 80% of the company's future revenue will come from just 20% of the existing customers. Also, an increase in customer retention relates with a good increase in profit for the company. The research shows that loyalty leaders—companies at the top of their industries in Net Promoter Scores or satisfaction rankings for three or more years—grow revenues roughly 2.5 times as fast as their industry peers and deliver two to five times the shareholder returns over the next 10 years (Markey, 2020).

Leveraging data from 322 publicly-traded firms that introduced an LP between 2000 and 2015, the authors demonstrate that introducing an LP can increase sales and gross profits in the short-term (within the first year) and

these positive effects are sustained long-term (for at least three years) (Chaudhuri et al., 2019).

In modern times of technology, the usage of LPs, its implementation, number of customers, revenues and other analytical data can be easily gathered and processed. Recent analysis has shown that after implementing a loyalty program, the average order quantity of a business can rise by 319% (Kreitner, 2019).

In particular, the implementation of technologically advanced LPs has transformed even the commerce itself leading to the so called "E-commerce". Nowadays not only multinational companies but even small size enterprises tend to involve the customers in their mobile applications thus including all information in one "piece of icon", which is easy to be used and controlled at the same time.

In this way, online trade not only lowered their serving costs but it implemented better the LPs which resulted in a better customer experience, enabling the company to more quickly and efficiently process orders and increase revenue.

In fact, contrary to what sceptical opinions, it seems that online customers are *more* loyal, since they rely totally on trust. Since a customer trusts a webpage or application of a business to insert personal data and receives the goods of the quality it is expecting and receives the rewards included in the LPs, the bond between the customer and the company becomes more solid.

## 6. Conclusions

LPs are widely used to retain the existing customers and making new ones thus becoming one of the main marketing tools of the business. They are marketing investments designed to encourage behavioural loyalty among a company's best customers and consequently increase company's performance and incomes.

Creating a brand name is the ultimate goal of every business, in this respect the implementation of LPs is crucial in establishing a pool of loyal customers who will serve as the best "marketing agents" of the company within the public. In this regard the customer's engagement is decisive for a successful loyalty program.

As forms of business evolve, keeping pace with rapid developments in trade and technology, the same should be done in designation, application and implementation of the LPs. Modern forms of LPs require that they should be personalised and customized according to the customers' needs and certainly introducing new rewarding methods and prizes.

Studies and researches have demonstrated that introducing an LP can increase sales and gross profits in the short and long term significantly. This article demonstrates that introducing strategically designed LPs can significantly increase firm performance and revenue.

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# URBAN TRAFFIC ASSESSMENT:

# A CASE STUDY IN TIRANA USING THE VISSIM SIMULATOR

***Abstract***

*Nowadays urban traffic is one of the problems we face every day in daily life. Based on this key problem, how we can solve it, the idea of this paper was born. This paper aims to study and analyze urban traffic in Tirana for a specific area of the city. The theoretical part deals with the methods of estimating and forecasting urban traffic. The number of intersections controlled by traffic signals has increased in Tirana, but efforts to study the traffic performance of the strategies used are still lacking. This part of the paper aims to give a general idea about:*

*- Urban Traffic Signal Control Strategies;*

*- Methods for measuring the impact of Urban Traffic Signal Control strategies.*

*For the realization of the practical part, the area at the Lana bridge was chosen, which includes two consecutive intersections. This whole area will be examined as a single node which is simulated with the traffic simulator called PTV VISSIM. This simulator will serve to realize several different scenarios and to evaluate urban traffic in different situations, such as. at different peak hours where the flow of cars is variable and for different traffic cycle programming cycle times. The method for the operation of traffic lights is fixed time and their programming was done by*

*means of logistics. Detectors, delay meters, queue counters and total travel time meters were installed for each line.*

*According to the simulation results it was noticed that when the traffic cycle time of the traffic lights would be reduced, the cars do not wait long in line, but the chances of accidents occurring are very high. Also, according to the simulations made in the peak hours, both in the morning and in the afternoon, there was a significant increase in traffic and high chances for accidents, due to the high number of vehicles, despite the fact that the traffic cycle time was chosen longer.*

**Keywords:** *Urban traffic, Traffic light, VISSIM*

## 1. Introduction

For the realization of this scientific paper, we encountered many problems. One of the main problems concerns traffic data, as most urban traffic data is privately owned and many researchers obtain very little traffic data. Data produces heterogeneity, which makes the complexity of data processing very high. The time interval between data collection is 5-10 min. The shorter the data update time, the more accurate the forecast can be. As more data collection points are concentrated on the highway, this leads to more research on highway traffic conditions. Practically, the collection of data or their availability for internal areas, such as the case we have considered, is very difficult. The difficulty deepens further for the study area that we have taken in the city of Tirana since there are no detectors or data collection sensors.

## 2. Methodology

### 2.1 Map of the Case Study Area

The area under study starts from the end of Elbasani street, continues to the Lana bridge and ends up to the ninth floor, in the city of Tirana, which includes two intersections in a row as shown in figure 1. One of the hottest areas of urban traffic in Tirana, which includes 'Bajram Curri' and 'Zhan D'Ark' boulevards, 'Elbasanit' street and 'George W. Bush' street.


**Fig. 1.** Map of the study area in Tirana

The provision of the map is made possible by the Vissim simulator which provides easy use of the entire world map. The type of map used for simulations is Bing Maps (Aerial View). The reason why this specific area was chosen to analyze and evaluate in detail by means of the simulator is the high flow of vehicles at peak hours and the heavy traffic. Figure 2 shows the construction of two intersections in Vissim using the obtained map as a research tool.

**Fig. 2.** Construction of two intersections in VISSIM

## 2.3 Scenarios

**Fig.3.**

## 3. Introduction

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# 4. Methodology

## 4.1 Map of the case study area

The area under study starts from the end of Elbasani street, continues to the Lana bridge and ends up to the ninth floor, in the city of Tirana, which includes two intersections in a row as shown in figure 4. One of the hottest areas of urban traffic in Tirana, which includes 'Bajram Curri' and 'Zhan D'Ark' boulevards, 'Elbasanit' street and 'George W. Bush' street.

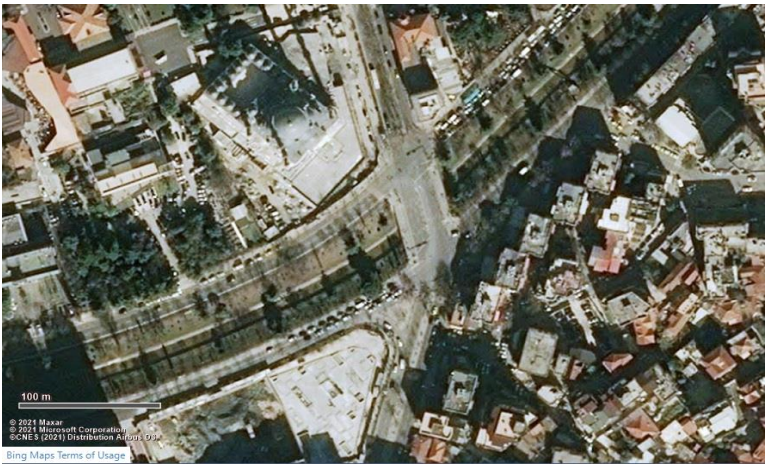


**Fig. 4.** Map of the study area in Tirana

The provision of the map is made possible by the Vissim simulator which provides easy use of the entire world map. The type of map used for simulations is Bing Maps (Aerial View). The reason why this specific area was chosen to analyze and evaluate in detail by means of the simulator is the high flow of vehicles at peak hours and the heavy traffic. Figure 5 shows the construction of two intersections in Vissim using the obtained map as a research tool.

**Fig. 5.** Construction of two intersections in VISSIM

## 2.3 Scenarios

**Fig. 6**. Basic simulation scheme

### 2.3.1 Scenario 1

**Basic simulation scenario**

The goal is as long as possible the duration of the green light so as not to block traffic. Traffic lights are placed in such a way that vehicles do not collide with each other and vehicles do not collide with pedestrians. Traffic light cycle time is 160 seconds. We have a single program signal for

all types of traffic lights. Traffic lights for vehicles are: signal group 1, 2, 4, 5, 6, 7, 8, 9 and 10. While for pedestrians they are K1, K2, K3, K4, K5, K6, K7, K8 and K9. The flow of cars in the incoming links is 1500. This value is set based on the data received from the relevant directorate of the municipality of Tirana. The semaphore for pedestrians was selected with two colors red and green, while red, green and orange were chosen for vehicles. Their duration was decided on the basis of logistics such that there is no collision between the two intersections for a traffic that is as heavy as possible.

### 2.3.2 Scenario 2

In the second scenario, the cycle time of traffic lights was changed. Cycle time of traffic lights was reduced from 160 seconds, 120 seconds were set. The flow of cars on the incoming links is 1500, the same as in the first scenario. This value is set on the basis of data obtained from the relevant directorate of the municipality of Tirana. A cycle time of 120 seconds is insufficient for the operation of eighteen traffic lights (pedestrians' vehicles). Traffic lights for pedestrians K1, K3, K5, K6, K7 and K8 have been left green for a very long time. Thus, pedestrians are given more priority and cars will wait longer. This causes a huge queue for vehicles.

### 2.3.3 Scenario 3

In the third scenario, the traffic light operation cycle time is the same as in the first scenario, i.e. 160 seconds. All traffic lights for pedestrians and vehicles are programmed with the same program signal. The difference with the first scenario is only in the set flow of vehicles for the entrance lanes. So the value of the number of vehicle entries has changed. The difference from the second scenario is exactly the programming cycle time of the lights and

the input values for the vehicles. In this scenario, the number of cars entering the entrance lanes has increased. The flow has doubled compared to the first and second scenario. From the value of 1500 vehicles in the peak hour for each entrance lane, 3000 vehicles/peak hour has been set.

## 3. Results of Simulations

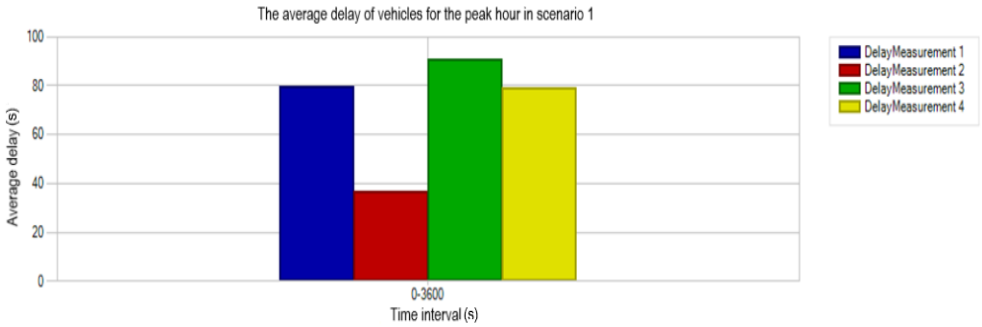


**Fig. 7.** The average delay of vehicles for the peak hour in scenario 1

From the graphs, it appears that Elbasanit street, Bajram Curri boulevard and Jean d'Arc boulevard have the highest average travel time of around 100 seconds. While George W. Bush Street has the lowest average vehicle travel time at about 50 seconds. Time interval is selected 1 hour [3600s].

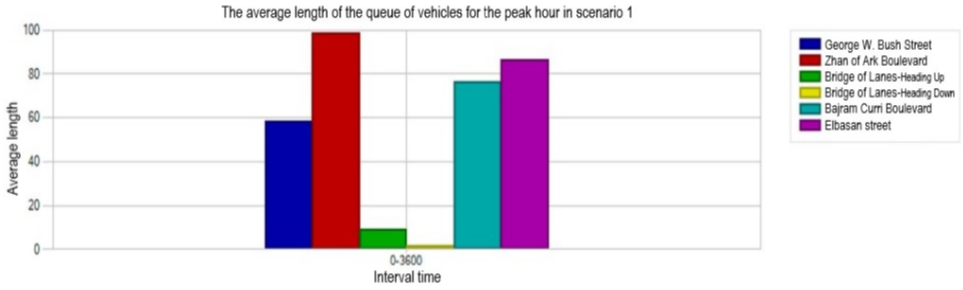


**Fig. 8.** The average length of the queue of vehicles for the peak hour in scenario 1

In scenario 1 the cycle time of 160 seconds is sufficient for all traffic lights placed. It was observed that during the simulations there was no collision between vehicles and vehicle-pedestrian. Sufficient time to clear the queue of vehicles and pedestrians performs better than the other two scenarios. In the first scenario, 20 simulations were carried out for the peak hour which was chosen at 4 pm to 5 pm.

Figure 8 shows the average length of the vehicle queue for this peak hour. As it seems from the graphs, Jean d'Arc boulevard has the longest traffic queue of about 100 m, after it comes Elbasani street, which has about 90 m. Bajram Curri Boulevard has the average length of about 70 m. The length of the Lana bridge is the lowest in both directions.

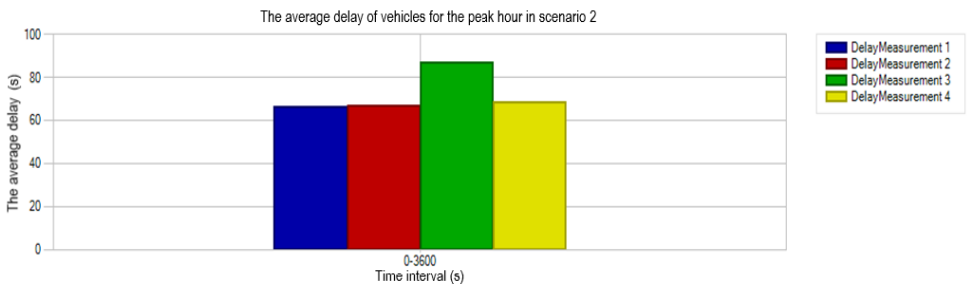


**Fig. 9.** The average delay of vehicles for the peak hour in scenario 2

The longest average delay for the Elbasan road is 90 seconds. This is because the average queuing time was also higher for this route. Followed by Bajram Curri and Jean d'Arc boulevards, George W. Bush street has an average vehicle delay of about 70 seconds. These values were expected to be so since the traffic was less heavy.

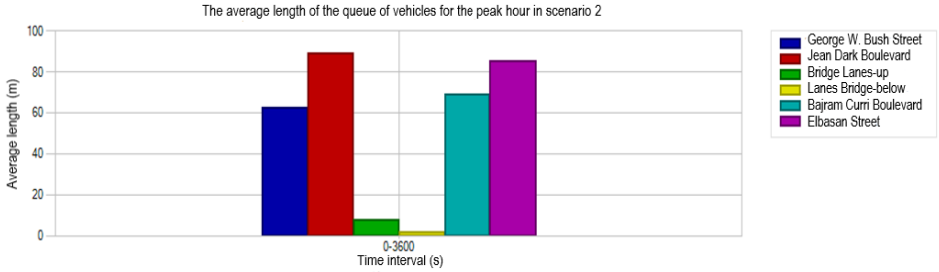


**Fig.10.** The average length of the queue of vehicles for the peak hour in scenario 2

For scenario 2 a traffic light programming cycle time of 120 seconds is insufficient to clear the queue. It was noticed that during the simulations there were vehicle-pedestrian collisions. When the network is considered as a single node we have a total delay of vehicles at the network level greater than scenario 1 has lower performance.

Figure 10 shows the average maximum vehicle queue length for rush hour in the second scenario. The maximum values are obtained on both Bajram Curri and Jean d'Arc boulevards, about 180 m and 170 m. While the lowest maximum value that is obtained is on the bridge of Lana, the direction is down for 25 seconds. The maximum value of the Elbasan road is about 125 m.

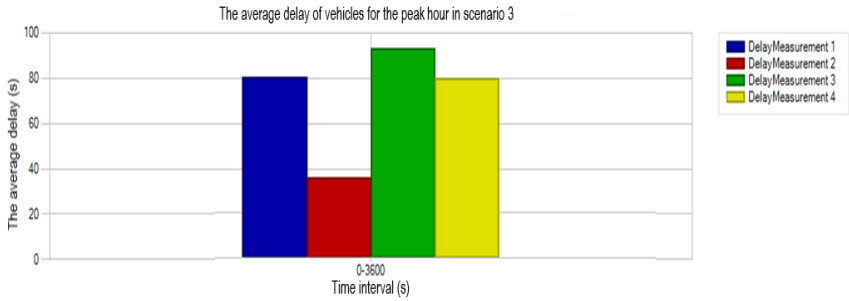


**Fig. 11.** The average delay of vehicles for the peak hour in scenario 3

Figure 11 shows that Elbasanit street, Bajram Curri boulevard and Jean d'Arc boulevard have the highest average travel time of around 110

seconds. While George W. Bush Street has the lowest average vehicle travel time at about 50 seconds.

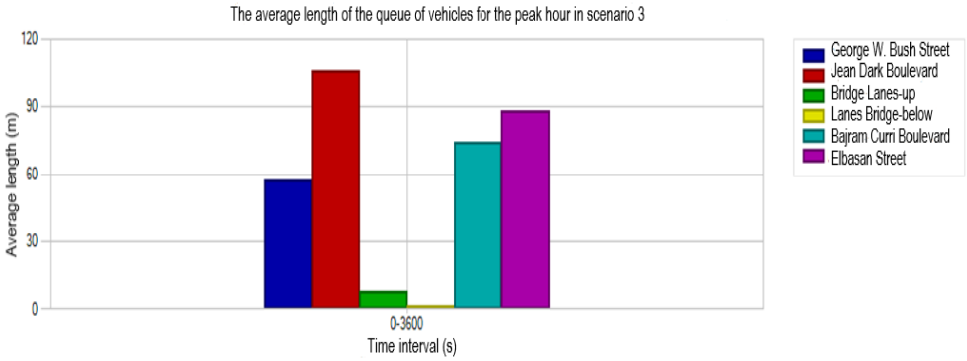


**Fig. 12.** The average length of the queue of vehicles for the peak hour in scenario 3

For scenario 3 a traffic light programming cycle time of 160 seconds is insufficient for such a high flow of vehicles. It was noticed that during the simulations there were collisions between vehicles. Insufficient time leads to long queues of vehicles. This scenario has lower performance than the other two scenarios.

Figure 12 shows the average length of the vehicle queue for this peak hour. As it seems from the graphs, Jean d'Arc boulevard has the longest traffic queue of about 110 m, followed by Elbasani street, which has about 90 m. Bajram Curri Boulevard has the average length of about 80 m. The length of the Lana bridge is the lowest in both directions.

## 4.Conclusions and Recommendations

### Scenario 1

In this scenario, the cycle time of traffic lights, which was chosen to be 160 seconds, was sufficient for the 18 traffic lights installed (pedestrian and vehicular). It was observed that there were no vehicle-vehicle and vehicle-pedestrian collisions during the simulations. The next highest average queue length was for Jean d'Arc Boulevard at 100 seconds. The highest average travel time was 110 seconds for the Elbasan road.

The longest average delay was 110 seconds for the Elbasan road. At the network level, the average total latency was 99 seconds. While the total delay of the entire network was 300,000 seconds on average and 650,000 seconds as a maximum. The number of vehicles that are in the network when the simulation ends is 250, while the number of vehicles that have left the network is 2300. The difference between these values shows the capacity of the intersection network, which has a value of 2050 cars.

### Scenario 2

In the second scenario the cycle time was reduced by 40 seconds. A traffic light programming cycle time of 120 seconds is insufficient to clear the queue of vehicles and pedestrians. Regardless of the average length of the vehicle queue for the peak hour, the graphs show that Jean d'Arc boulevard has the longest traffic queue of about 90 m, i.e. less than in scenario 1 by about 10 seconds.

Average travel time to the top around 90-110 seconds. This does not mean that it performs better than scenario 2. Based on the analysis performed, this is because the operating cycle time is lower and the vehicles do not have to wait long in the queue and the simulator generates charts based

on this action. But during the simulation it was noticed that there are collisions between vehicles and pedestrians. So we conclude that a low and insufficient cycle time for a given network is a source of accidents even though vehicle delays may be lower than in the first scenario.

At the network level, the average total delay is 800,000 seconds, i.e. higher than in the first scenario. Both junctions are considered as a single node and when the total average network delay is obtained it is higher for the second scenario. So when we compare scenario 1 and 2, this second one has lower performance at the network level since it also takes into account the accidents that occur.

**Scenario 3**

In the third scenario, the traffic light programming cycle time is the same as the first scenario, 160 seconds. The change was made in the number of vehicle inputs, which was doubled. Jean d'Arc boulevard has the longest traffic queue, about 90 m, followed by Elbasani street, which is about 90 m long. While the average time of the highest journey is around 110 seconds. The longest average delay is for the Elbasan road, about 95 seconds. So, based on the graphs that were generated, the third scenario is better than the first.

This conclusion is rejected for two reasons: the first because during the simulation there were long queues for pedestrians and accidents between vehicles; the second because the total average delay of vehicles at the network level is 8000000 seconds, more than in the first scenario. The number of vehicles that are in the network is 250, while the number of vehicles that have left the network is 4000. The difference between these values shows the capacity of the intersection network of 3750 vehicles.

At the network level, the average total delay of the entire network has an average value of 800,000 seconds. We conclude that the third scenario has the lowest performance than the other two scenarios, the value above shows this best.

For the future, it is important to study the method chosen for the operation of traffic lights. Nowadays in Tirana the traffic lights work with fixed time, which means that the time of the traffic lights is predetermined regardless of the traffic flow. For the future, it would be ideal to operate traffic lights with an adaptive method that adapts to traffic changes in real time. This thing has a great cost for Tirana, but it is the ideal that is used in the most developed countries of the world.

Noticing every day more and more heavy traffic in the capital, this cost is worth spending to improve the traffic in the country. The adaptive method for operating traffic lights causes their lights to change depending on real-time traffic flow and environmental conditions such as humidity. It adapts in real time to the traffic bringing an immediate relief to it and also avoiding accidents that may occur.For the future, it is essential to increase traffic experts in Tirana.

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# GOOGLE TRANSLATION, THE CASE OF ALBANIAN

**Abstract:**

*Artificial intelligence has radically influenced translation, shortened the time, and transformed the translation process itself, even that of learning a language. In the meantime, Google, Microsoft, Facebook, and Amazon are becoming the top investors helping the results we benefit from today. But is the translation process helped in this regard and how?*

*The translator uses every means to make the translation process as lively and challenging as possible (to escape the routine) but at the same time to respond to the translation as quickly as possible. If we talk about translation with google, since 28th of April 2006, when presented and designed by Franz Josef Och as the main architect, it translates multiple forms of texts and media such as words, phrases, and webpages, but this in peripheral languages like Albanian has not found genuine application possibilities, even partial ones. We recall here the translation experiences offered by Umberto Eco in his well-known book "Dire Cuasi la Stessa Cosa".*

*However, we will come to 2016, when translation has progressed qualitatively by being conceived as a neural machine translation engine - Google Neural Machine Translation (GNMT), for this reason in this paper we concretely follow the progress of Albanian translation, from English and vice versa via google translation study on the progress of translation and the construction of semantic units, or equivalent in Albanian translation.*

**Keywords**: *equivalence, semantic units, expression, target language, semantic sentence*

## 1. Introduction

If until a few years ago the results produced by various automatic translation systems were often questionable and even made translators smile, with the advent of neural systems in 2016, the situation has changed a lot. In fact, these systems are an application of artificial intelligence (AI) based on neural networks made up of thousands of artificial units that resemble - as the name indicates to our neurons (Forcada, 2017, p. 292).Their strength lies in the fact that they are able to successfully deal with completely new situations, based on what they have previously "learned". The most recent evolution of AT is the so-called Neural Machine Translation (NMT) introduced in 2016 by Google, Systran, Microsoft and Facebook, followed by Amazon and more recently by the promising DeepL. (Riediger, 2018, p. 3) Whenever a user requests a translation into one of the aforementioned languages, these systems appeal to neural networks, following a dynamic logical path that varies according to the context of the sentence and the meaning that is given to it. (Forcada, 2020, p. 4).

### 1.1 Aim

In this paper we concretely follow the progress of Albanian version in translation, from English and *vice versa* via google translation on the progress of translation and the construction of semantic units, or equivalent in Albanian translation.

### 1.2 Importance of the Study

While translation from structurally related languages or with great daily use is increasingly perfected thanks to the use and specialization of

various software, translation from a peripheral language, or *minor languages* (See: Forcada, 2020, p. 3) such as Albanian and with a small number of its users compared to English or Spanish and with considerable grammatical and expressive complexity is always a challenge and consequently in this regard to study how effective GNMT is for Albanian, is also important for testing this level of machine translation.

### 1.3 Problem Statements & Hypotheses

The use of google translation is possible and realized in texts of a medium complexity and always needs to be taken as first-hand version after which always comes a complete post-editing process.

Following the progress and development and improvement of machine translation from the beginning until 2016, when the google translation system was programmed according to the neural system, in this paper we have focused not only on the data provided by Umberto Eco's book: *Dire quasi la stessa cosa*, although he problematises and analyses automatic translation, from a period of its beginnings, the year 2003 with the work done with *google translate* by Franz Josef Och and the group he led. (Chan, 2015, p. 385)This is to be clear about the nature of the translation offered by the computer program in Altavista. (Eco, Të thuash të njëjtën gjë : përvoja përkthimi, 2006); (Eco, Dire quasi la stessa cosa: esperienze di traduzione, 2013, p. 21), to bring attention to the issue of computer translation, at the beginning of this process.

In this context, the comparison with the examples brought to attention by google translation, during these days, with those versions offered by Eco in this book and the results of the translation in real time, while they continue to show relevant problems related to the syntax or the

very nature of the translation and the variant offered from the morpho structural point of view, however, present improvements in relation to the quality of the translation, especially in the well spread languages as English, French, Spanish, German and Italian.

In the case of google translate for the Albanian language, there is no data on its operation of 2003, nor a database of computer translation variants of this year, to correlate and be compared with that of given languages in Umberto Eco's book.

The only reliable material in machine translation is what we can develop ourselves right now in real time. To follow and distinguish the changes or improvements in the translation, we would have to develop this work at two different times, with a stretch of 4-5 years between them. Therefore, to illustrate this translation in its beginnings, we have taken references from the translation data of Umberto Eco, in his book, *Dire quasi la stessa cosa*. In his study Eco documents the translation quality of Altavista, for the main European languages, including Italian.

Examples brought by Eco:

1. The Works of Shakespeare = Gli impianti di Shakespeare = The systems of Shakespeare

2. Harcourt Brace (nome di una casa editrice americana) = Sostegno di Harcourt = Support of
Harcourt

3. Speaker of the chamber of deputies = Altoparlante dell'alloggiamento dei delegati = Loudspeaker of the lodging of the delegates

4. Studies in the logic of Charles Sanders Peirce = Studi nella logica delle sabbiatrici Peirce del Charles = Studien in der Logik der Charless and papier schleifmaschinen Peirce = Studies in the logic of the Charles of sanders paper

grinding machines Peirce. (Eco, Dire quasi la stessa cosa: esperienze di traduzione, 2013, p. 23)

Eco's analysis for machine translation with Altavista continues to address not only the problems arising from the translation to find the equivalent of the words, groups of words, in languages (English, German, Spanish, Italian, French), but also goes further into the more specific elements of the linguistic system of equivalence (translation) from the original language to the target language(s).

In this analysis, the process of human translation (Eco's translation analysis) confronts the automatic one, focusing on the cultural approach, the problems of translating expressions, the narrative aspects of the translated text, and facing not only a structurally different language, but also with a different worldview. Of course, the machine translation, which in its programming has a database of direct equivalents with a limited number of meaning nuances, does not respond to a correct translation, or more precisely, the process of transition / construction of meaning and linguistic construction from the source language to the target language fails.

The example given above by Eco (Eco, Dire quasi la stessa cosa: esperienze di traduzione, 2013, f. 23) is one of the simplest.

Eco 2003, the 2003 Babel Fish translation from English to Italian is a grammatically programmed translation with a database of dictionaries of all languages. But compared to the human translation, the selection of the word "Implant" as the equivalent of the English word "works" shows that the program selects an equivalent word, even though the English word marks or names a completely different concept in the cultural context of the source language.

In the second case, the program has chosen to translate a proper name of the Hartcourt Brace publishing house, finding the corresponding English word in Italian: Brace = sostento. While it is clear from the examples given by Eco, for the translation from English to Italian for the year 2003, that the translation process even in a language with many speakers and users such as Italian, we can also guess the unmatched quality of the translation from English in the Albanian language and vice versa, either in the quality of syntactically simple texts or the most complicated ones.

We are trying today to look at the translation of the same English phrases once considered by Eco, into Italian and Spanish, adding the Albanian variant to them. The following text was generated by google translate at 11:23 PM on 9/6/2022

| **English** | **Google translate Albanian** | **Italian** | **Spanish** |
|---|---|---|---|
| The works of Shakespeare | Veprat e Shekspirit | Le opere di Shakespeare | Las obras de Shakespeare |
| Hartcourt Brace | Hartcourt Brace | Tutore Hartcourt | Tirante de Hartcourt |
| Speaker of chamber of deputies | Kryetar i dhomës së deputetëve | Presidente della Camera dei Deputati | Presidente de la cámera de diputatos |
| Studies in the logic of Charles Sanders Pierce | Studime në logjikën e Charles Sanders Pierce | Studi sulla Logica di Charles Sanders Pierce | Estudios en la lógica de Charles Sanders Pierce |

and for comparison we have also brought that of the revision of the paper,

before the publication of 10.09.2022 8:22:28 M.D.

| **English** | **Google translation, Albanian** | **Italian** | **Spanish** |
|---|---|---|---|
| The Works of Shakespeare | Veprat e Shekspirit | le opere di Shakespeare | Las obras de Shakespeare |
| Hartcourt Brace | Harcourt Brace | Tutore Harcourt | Brazalete de Harcourt |
| Speaker of the Chamber of Deputies | Kryetar i Dhomës së Deputetëve | Presidente della Camera dei Deputati | Presidenta de la cámara de diputados (feminine) Presidente de la cámara de diputados (masculine) |
| Studies in the logic of Charles Sanders Peirce | Studime në logjikën e Charles Sanders Peirce | Studi sulla logica di Charles Sanders Peirce | Estudios en la lógica de Charles Sanders Peirce |

While in the example of Eco, 2003, it is noted that translations from English as a source language into Italian and Spanish present problems in the reconstruction of the meaning in the respective languages, Albanian, at this level, does not present problems, because, unlike the translation into Italian and in Spanish it was not generated by google translator in 2003, but nowadays, when the computer translation program has processed in time a series of variants and algorithms that generate an accurate translation of the proposed structures.

## 1. Comparative Analysis of Translations

At this point, to evaluate the quality and reliability of the translation with google translation a comparative analysis of translations occurred by comparing previous translations with today's ones and assessing the quality of construction of meaning in the target language—Google translation of different texts by style and genre (prose and poetry).

### 3.1 Two Authors of Literature for Each Language, Albanian and English

Paul Muldoon (prose), Michael Hofmann (poetry)
Faik Konica (prose), Frederik Rreshpja (poetry)

### 3.2 Methods for Evaluating Machine Translation or Google Translation

Different metrics (criteria) are used for the evaluation of the TA: evaluations carried out subjectively by human evaluators, evaluation of whether the message passes, evaluations of the size post-editing required to optimize the text, automatic evaluation metrics.

Among the various other models, the most functional (usable) by users is that of Arnold (1994). Considering only intelligibility, this proposes a four-point scale, that is, a sentence can be completely understandable (1), for the most part understandable (2), only after a thorough analysis (3), or completely incomprehensible.

Thus, the criteria of intelligibility = acceptability are as follows:

3 - perfectly acceptable translation. It does not require revision.

2 - understandable translation but requires stylistic revision.

1 - understandable translation, but with grammatical, linguistic errors, and stylistic

0 - incomprehensible translation. Requires rewriting.

| **English version: Paul Muldoon (1951 -)** | **Albanian with Google translation** |
|---|---|
| It's a beautiful part of the world. It's still the place that's 'burned into the retina', and although I haven't been back there since I left for university 30 years ago, it's the place I consider to be my home. We were a fairly non-political household; my parents were nationalists, of course, but it was not something, as I recall, that was a major area of discussion. But there were patrols; an army presence; movements of troops; a sectarian divide. And that particular area was a nationalist enclave, while next door was the parish where the Orange Order was founded; we'd hear the drums on summer evenings. But I think my mother, in particular, may have tried to shelter us from it all. Besides, we didn't really socialize a great deal. We were 'blow-ins' – arrivistes – new to the area and didn't have a lot of connections. (Potts, 2001)<br><br>(The Guardian Profile The poet at play, 12 May 2001. Retrieved 27 February 2010.) | Është një pjesë e bukur e botës. Është ende vendi që 'është djegur në retinë' dhe megjithëse nuk jam kthyer më që kur u largova për në universitet 30 vjet më parë, është vendi që unë e konsideroj si shtëpinë time. Ne ishim një familje mjaft jopolitike; prindërit e mi ishin nacionalistë, sigurisht, por nuk ishte diçka, siç më kujtohet, që ishte një fushë kryesore e diskutimit. Por kishte patrulla; prania e ushtrisë; lëvizjet e trupave; një ndarje sektare. Dhe ajo zonë e veçantë ishte një enklavë nacionaliste, ndërsa ngjitur ishte famullia ku u themelua Urdhri i Portokallisë; do të dëgjonim daullet në mbrëmjet e verës. Por unë mendoj se nëna ime, në veçanti, mund të jetë përpjekur të na strehojë nga e gjithë kjo. Për më tepër, ne nuk u socializuam shumë. Ne ishim 'goditës' - të ardhur - të rinj në zonë dhe nuk kishim shumë lidhje.[6]<br><br>*Translation generated by google: 09.06.2022, 10.17 PM* |

The text is taken from an interview of Seamus Heaney, where the poet through an emotional and personal narrative returns to the time of his childhood. What is noticed in the text generated in Albanian as a translation, is the absence or dimming of this personal rhythm of the narrator which breathes in English through the corresponding phrases: *to be my home, fairly non-political household, as I recall, a nationalist enclave, to shelter us from*

*it all, 'blow-ins', to the area and didn't have a lot of connections...* that gives way to the flow of thinking and meaning built-in language and, precisely in these words, the computer translation encounters difficulties in building meaning, and of course in building the rhythm of the narration by the author in the original language. From the point of view of the general meaning, we have an understandable text, but with small grammatical and linguistic errors, which of course put a lot in the style of the text that is generated in Albanian, which needs to be revised. Therefore, our assessment according to the criterion of meaningfulness and acceptability is: 2 - understandable translation but requires stylistic revision.

However, it does not appear as completely like this in the version generated as a translation by google translation, of the most complex poetic text by the author Michael Hofmann, where intertextuality and suggestive language and poetic syntax give to computer translation an almost impossible task.

| **Michael Hofmann (1957 -)** | **Google translation** |
|---|---|
| **Ostsee**<br>– The water deepens to iodine from brown.<br><br>What is there to wait for? The gulls to get bored of their bouncy slick offshore.<br>The sun to break through the qwerty clouds. The entire coast to make more hagstones, amber, jellyfish.<br>The sand martins to file themselves away in their cliffside tenements.<br>Or the cropped blonde to come back along the beach with her mystery rucksack and impenetrable wraparounds, | Ostsee<br>– Uji thellohet në jod nga kafe.<br><br>Çfarë ka për të pritur? Pulëbardhat për t'u mërzitur nga kërcitja e tyre shkëlqejnë në det të hapur.<br>Dielli për të thyer retë qwerty.<br>I gjithë bregdeti për të bërë më shumë gurë hagstone, qelibar, kandil deti.<br>Martinat e rërës nisen për t'u grumbulluar në banesat e tyre buzë shkëmbinjve.<br>Ose biondja e prerë që të kthehet përgjatë plazhit me çantën e saj misterioze dhe mbështjellësin e padepërtueshëm, deltoidet e saj të |

| | |
|---|---|
| her superbly articulated deltoids under the black wife-beater.<br><br>– to iodine from brown (Hofmann, 2018, f. 56) | artikuluara në mënyrë të shkëlqyer nën rrahësin e zi të gruas.<br><br>– në jod nga kafe<br>*Generated: 10. 31PM, 09.06.2022* |

The above translation is problematic from the point of view of constructing a poetic syntax: by focusing on the translation of a meaningful unit such as a sentence, it fails to construct the same meaningful unit (sentence) in the translated text. The untranslatability is conditioned by the suggestive language full of second and third meanings of the poem in the original. In addition, the text also presents difficulties at the lexical level. Words: *qwerty, hagstones, deltoids*, the google translation has not found their semantic equivalent, therefore we also have what is called zero translation in translation terminology. However, the computer has not transformed the sentence in general, but has determined a function of the unknown word in the sentence and has continued to construct the meaning in the corresponding sentence. The meaning in general lines is built in the computer translation, however, grammatically, and stylistically, corrective work is needed with the text. Consequently, our assessment according to the criterion of meaningfulness and acceptability is: 1 - understandable translation, but with grammatical, linguistic errors, and stylistic, it required an accurate stylistic review.

| **Faik Konica Malli i atdheut** | |
|---|---|
| MALLI I ATDHEUT<br>Kur vete njeriu, i lirë e i vetëm, larg atdheut – viset e reja, ndryshimi i zakoneve, ëmbëlsia e udhëtimit e një mijë gjëra që vihen re ndër popuj të huaj, të gjitha këto ta përgëzojnë zemrën e të bëjnë jo të harrosh Shqipërinë, po të mos | MALI I ATDHEUT<br>When the man himself, free and alone, far from the homeland - new places, change of habits, sweetness of travel and a thousand things that are noticed among foreign peoples, all these congratulate the heart and |

| | |
|---|---|
| të vejë tek ajo aq dendur mendja. Më tutje, si ngopen sytë së pari ndryshime, gazi shuhet pak nga pak. S`di ç`të mungon, s`di se ç`të duhet. ... Ah, malli i Shqipërisë, malli i atdheut të dashur, i shenjtë mall e dashuri e shenjtë, kush është ai shqiptar që s`e ka pasur në dhe të huaj! Duhet të jeshë jashtë Shqipërisë, e të jesh larg, për të kuptuar se ç`forcë e ç`bukuri të ëmbël ka për veshët kjo fjalë: Shqipëri! Ajo më e zbrazura letër, ajo fjala më e vogël, na sjell, kur vjen nga Shqipëria, një gaz të parrëfyeshëm, se na sjell si një copë të atdheut… (Konica, 1995, f. 38) | make you not forget Albania, yes not to come to her so densely minded. Further, as the eyes first saturate changes, the gas is gradually extinguished. I do not know what is missing, I do not know what is needed. ... Ah, the longing of Albania, the longing of the beloved homeland, the holy longing, and the holy love, who is the Albanian who has not had it in foreign lands! You have to be outside Albania, and be far away, to understand what strength and what sweet beauty this word has for the ears: Albania! The most empty letter, that smallest word, brings us, when it comes from Albania, an indescribable gas, that it brings us like a piece of the homeland…<br>*Generated: 10. 40 PM, 09.06.2022* |

The problem of computer translation from Albanian to English is presented in the same way, with selected texts in prose and poetry. While there is also a problem regarding finding the lexical equivalent of the words: *vete* (in the sense I go) and *gaz* (in the sense of joy) which are mistranslated due to homonymy: *vete* (v. f. go) with *vete* (pron, *vetë*/ *self*) and, *gaz* (n. *joy*) with gas (*gas*, a substance or matter in a state in which it will expand freely to fill the whole of a container, having no fixed shape (unlike a solid) and no fixed volume (unlike a liquid), the generated text is generally dry in terms of the second and third meanings and stylistically does not offer the expressiveness of the text in the Albanian language. Rrjedhimisht, vlerësimi ynë sipas kriterit të kuptimshmërisë dhe pranueshmërisë është: 2 - understandable translation but requires stylistic revision.

| **Frederik Rreshpja (1940-2006)** | **Google translation English** |
|---|---|
| Ul Kokën i Lodhur<br><br>Më thërret një mjegull ulur diku<br>Mbi korijen e fjetur që premton mars<br>Dhe pikëllimi i dëborës me gjunj te burimi.<br>Mbrëmja rend drejt qiellit'<br>Hëna rend drejt një shtëpie reshë.<br>O akuarel i lëvizshëm! Ti mua më thërret<br>Por me erdhi tepër vonë thirrja jote.<br>Koka ime e pabindur tek një alarm gjethesh<br>Që hedh përsipër dy grushta nate!<br>(Rreshpja, 1995) | Lower the Tired Head<br><br>A fog is calling to me sitting somewhere<br>Over the dormant grove that promises March<br>And the grief of snow with knees at the fountain.<br>The evening rushes to the sky '<br>The moon runs towards a cloudy house.<br>O portable watercolor! You call me.<br>But your call came too late.<br>My disobedient head to a leaf alarm<br>Throwing over two night punches!<br>*Generated: 11. 20. PM, 09.06.2022* |

The poetic text generated from Rreshpje's poetry is presented in a complicated way. In addition to the "faithful" tendency of the text to translate each unit of meaning, which to some extent has built the corresponding poetic rhythm of the poem in the original, the style, the meanings, the angle of the poet's gaze do not come completely in their form in English. Therefore, if a translator, in translating Rreshpja's poem into English, sought the help of Google's computer-generated translation, he would need to review each line at the level of poetic expression. Consequently, our assessment according to the criterion of meaningfulness and acceptability is: 2 - understandable translation but requires stylistic revision.

## 2. Conclusions

Due to the analysis of the translations, generated by google translation in the considered texts of prose and poetry, from Albanian to English and vice versa, for texts of considerable complexity, we come to the conclusion that even for the google translation between the Albanian language and Englishat the level of construction of meaning, and its

grammatical accuracy, improvements have been observed. In general, the total construction of the semantic equivalence of the text, in syntax and expression, is done correctly. However, small errors are noted in finding lexical equivalence due to homonymy - the case of Faik Konica's poetic prose text from Albanian to English. According to the translation evaluation scheme, the criteria of intelligibility = acceptability, we evaluated the translation of the texts with mainly two points, but there are cases when the text generated as a translation had grammatical inaccuracies and language errors, therefore we evaluated it with 1 point. So, the texts generated by google translation are:

2 - understandable translation but requires stylistic revision.

1 - understandable translation, but with grammatical, linguistic errors, and stylistic revision.

What the texts generated by google translation lack is the style and an organization of the translated text, therefore the texts require a careful stylistic revision or human postediting process.

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# CYBER SECURITY IN EU AND ALBANIAN LAW. IDENTIFYING CHALLENGES OF IMPLEMENTATION IN ALBANIA

***Abstract***

*The transition to a new era of digitization of public services, in addition to private ones in Albania, has directed attention and stimulated the debate, not only towards improving and increasing citizen's access to the use of information technology, but has also brought with it the need for cyber security. Technological developments in the field of computers and the Internet, in addition to the positive impact, also carry the risk of misuse of communication networks and information systems, turning into a serious threat to the freedoms and rights of citizens, businesses and governments. In fact, the security of communication networks and information systems until a few years ago was seen as a matter of technical and organizational nature of public institutions or private entities. Under the effects of the technological revolution, the concept of legal protection in the field of cyber security has undergone a speedy revolution. Now, the legal regime of cyber protection is focused, more than just on aspects such as what is cybercrime, what are the figures of cybercrime, how international cooperation should be addressed, and the harmonization of criminal and criminal procedural legislation to fight these legal phenomena. However, the legal regime of cyber protection already includes*

*all the legal, organizational, technical and educational tools that aim to protect the functionality and operation of communication systems and information networks.*

*This paper aims to examine the legal model of cyber security in community and domestic law. The paper analyzes the concepts, instruments and technical and organizational measures in the legal documents of the European law and in the positions of the EU institutions. The paper also examines the Albanian legal framework in the field of cyber security and the measures that have been taken regarding the protection of communication systems and information networks. The main purpose of this paper is to see the level of harmonization of this legislation and to highlight the differences and problems in this field. The paper supports the hypothesis that, despite the legal framework and protection mechanisms set up to guarantee the security of networks and information systems, Albania still does not have the necessary technical, operational and financial capacities and resources to face cyber threats. The recent cyberattacks by Iranian hackers against the communication systems and information networks in Albania showed the weakness and lack of effectiveness of the mechanisms set up by law. The paper concludes that Albania should improve cyber security instruments and measures according to the requirements of the NIS 2 Directive(Network and Information Security 2 Directive ("NIS 2"), for a more efficient response to cyber threats. The paper recommends that cyber security should become a priority, giving it the necessary support in terms of special specialized centers that have the human, technical and financial resources for the support and proper functioning of networks and information systems.*

**Keywords:** *cybersecurity, directives, legislation, communication systems and information networks.*

## 1. The Concept of Cyber Security Between Doctrine and Law

Rapid technological developments in the field of electronic communications have made cyber security a very dynamic and constantly evolving notion. This is reflected in the different definitions given by different dictionaries on the notion of cybersecurity, as well as in a large number of standings and attitudes held by researchers and experts in this field. (CEN/CENELEC CSCG, 2016, p.12) Also, this fact is confirmed by the need for frequent changes in the legal framework on cyber security on a European level, where the need for amendments has arisen in the span of 5 years. The rapid pace of digitization in various sectors has made it necessary to modernize the existing legal framework through a new Directive to efficiently respond to cyber security threats. (Directive (EU) 2022/2555, December 2022)

If we refer to different dictionaries we will see that Merriam-Webster defines "cybersecurity" as *"measures taken to protect a computer or computer system against unauthorized access or attack"* (Merriam-Webster Dictionary, 2022). The Cambridge Dictionary considers it as "*things that are done to protect a person, organization, or country and their computer information against crime or attacks carried out using the internet" (Cambridge Dictionary, 2022, while that of Oxford as "the state of being protected against the criminal or unauthorized use of electronic data, or the measures taken to achieve this". (Dictionary.com Oxford University Press, 2022). Wikipedia considers the terms "cybersecurity", "computer security" and "information technology security" as synonyms and defines them as "the protection of computer systems from the theft of or damage to their*

*hardware, software, or electronic data, as well as from the disruption or misdirection of the services they provide"*. (Wikipedia, December 2022).

Conceptual differences on the notion of cyber security are also observed in the attitudes of different authors and experts in this field. According to Schatz etc. cybersecurity is defined as *"the approach and actions associated with security risk management processes followed by organizations and states to protect confidentiality, integrity and availability of data and assets used in cyber space. The concept includes guidelines, policies and collections of safeguards, technologies, tools and training to provide the best protection for the state of the cyber environment and its users.*". (Schatz D, Bashroush R, Wall J, p.66) As for Fuster and Jasmontaite "the term "cybersecurity", from an EU perspective, entails a combination of cyber resilience, cybercrime, cyber defense, (strictly) cybersecurity and global cyberspace issues. (Fuster G, 2022) Whereas, the group of experts established for the drafting of the strategy in the field of cyber security at the European level (CSCG) states that *"European Commission should not limit its clarification to definition of cyber security…"*. (CEN/CENELEC CSCG, "Recommendation nr.2).

Despite the fact that cyber security represents a term in continuous evolution, European law has given a formal definition to this concept in the European act on cyber security. (EU Regulation No 881/2019) This is due to the fact that without a clear definition of cybersecurity and its key terms, it is difficult for the EU to establish a comprehensive vision. (Odermatt J, 2018) According to EU Cybersecurity Act: "*cybersecurity means the activities necessary to protect a) network and information systems, b) the*

*users of such systems, and c) other persons affected by cyber threats*". (EU Regulation No 881/2019, art. 2.1). According to this provision, cyber protection extends to 3 categories. The first category of protection includes "security of network and information systems" and means *"the ability of network and information systems to resist, at a given level of confidence, any event that may compromise the availability, authenticity, integrity or confidentiality of stored, transmitted or processed data or of the services offered by, or accessible via, those network and information systems.*". (Directive (EU) 2022/2555, December 2022, Art.6/2) Whereas, the other two categories have the quality of a natural or legal person, and are specifically included as users of networks and information systems, as well as the category of persons affected by cyber threats.

Meanwhile, Albanian law defines the concept of cyber security, "*as a set of legal, organizational, technical and educational tools that are necessary to be created and implemented in order to protect the users of the wide cyberspace.*". (Law No. 2/2017, art 3/13) According to the law, cyberspace represents the digital environment capable of creating, processing and exchanging information created by systems, services of the information society, as well as electronic communication networks. As noted, the Albanian law provides a different definition than the one found in the European cyber security act, which defines cyber security as: "*the activities necessary to protect a) network and information systems, b) the users of such systems, and c) other persons affected by cyber threats*". (Art. 2.1) If we make a comparison between these definitions, we will notice that the Albanian law has broken down the notion of "necessary activity" used by the directive, articulating these activities in a more concrete way as "the

totality of measures of a legal, organizational, technical and educational nature that must be created and be implemented" in order to protect cyberspace users. So, as it results in the defining approach, the legislator has made a concretization of the nature of protective activities, but has not specifically given the object of protection divided into three categories, as it results in the European act.

### 1.1 The Object of Cyber Protection

If the definition provided by the European Act on cybersecurity helps us to clearly identify the subjects of cyber protection, the same cannot be said for the object or fields of cyber protection. Their identification is a difficult and dynamic process. However, ENISA(European Network and Information Security Agency), as the European institution specialized in the field of cyber protection, has identified 5 main areas that may be subject to cyber threats. According to her, the security of networks and information systems (cyber security) includes the fields of communication, operations, information, physical and public or national security. (ENISA, Definition of Cybersecurity, 2015, p.11) *Communication security* means protection against a threat to the technical infrastructure of a cyber system which may lead to an alteration of its characteristics in order to carry out activities which were not intended by its owners, designers or users. Meanwhile, *operation security* means protection against the intended corruption of procedures or workflows which will have results that were unintended by its owners, designers or users.

*Information security* is another scope of cyber protection seen as protection against the threat of theft, deletion or alteration of stored or transmitted data within a cyber system. (ENISA, Definition of

Cybersecurity, 2015, p.10) *Physical Security* is considered as protection against physical threats that can influence or affect the well-being of a cyber system. Examples could be physical access to servers, insertion of malicious hardware into a network, or coercion of users or their families, while *Public/National Security* is protection against a threat whose origin is from within cyberspace, but may threaten either physical or cyber assets in a way which will have a political, military or strategic gain for the attacker. Examples could be 'Stuxnet' or wide-scale DOS attacks on utilities, communications financial system or other critical public or industrial infrastructures. (ENISA, Definition of Cybersecurity, 2015, p.11).

Despite the significant influence of views of authors and experts on cyber security, the main contribution in this direction at the European level is played by community law. The European Law states that cyber incidents "can impede the pursuit of economic activities in the internal market, generate financial loss, undermine user confidence and cause major damage to the Union's economy and society.". (DIRECTIVE (EU) 2022/2555, December 2022, p.3) EU considers "cybersecurity preparedness and effectiveness now more essential than ever to the proper functioning of the internal market. Moreover, cybersecurity is a key enabler for many critical sectors to successfully embrace the digital transformation and to fully grasp the economic, social and sustainable benefits of digitalization.".

## 2. The Legal Regime of Cybersecurity in Community Law

Technology, communication networks and information systems represent an important instrument of economic and social interaction and contribute to the realization of rights and freedoms on a European level. The role of communication networks and information systems in the rights of the European citizens and in the proper functioning of the common market has caused them to be a frequent object of the activity of the EU institutions through a large number of legal acts that have addressed various issues. The increasing reliance on communication networks and information systems has brought with it the possibility and risk of their misuse, causing them to become a serious risk for the rights of citizens and businesses and the functioning of the European market. European law, as in any field, has played the role of a main driving agent of development for member states also in the field of security of communication networks and information systems through a significant number of acts. (Directive 2011/93/EU, Directive 2013/40/EU, Directive 2018/1972/EU, Regulation (EU) 2019/881, Directive (EU) 2015/1535 Regulation (EU) No 910/2014, Directive 2005/29 /EC, Regulation (EU) 2019/1150, Directive 829/2020/EU) etc.)

The legal basis for these acts is Article 114 of the Treaty on the Functioning of the European Union (TFEU), the objective of which is the establishment and functioning of the internal market by enhancing measures for the approximation of national rules. (Treaty of Lisbon, 2009, art.114) For the EU, the improvement of cyber security is a matter of primary importance because it directly implies guarantee of fundamental rights and freedoms, specifically the rights to privacy and protection of personal data, as well as

freedom of expression and information. (European Commission and the High Representative of the Union for Foreign Affairs and Security Policy Citation 2020, p.4)

European law put the legal regulation of cybersecurity at its center, addressing legal concepts, instruments and measures in this field such as: cyber security, cyber threat and its types, as well as enforcing the establishment of a series of institutional, technical and operational mechanisms on a European, national level and for any public or private entity. This right has sanctioned their rights and duties, the way of their cooperation and reporting and the concrete measures that must be taken to ensure cyber protection or to respond effectively to various attacks.

Community law in the field of cyber security during these last 15 years has evolved rapidly from a law that addressed technical and organizational measures to a more comprehensive horizontal regulatory approach (Papakonstantinou, V, 2022, p.8). Undoubtedly, the main function of community law is to address within the framework of the common market the issue of the security of electronic communications in general, and the security of networks and information systems, in particular. This is due to the fact that the heterogeneous implementation of cyber security instruments can reduce efficiency and create obstacles for the internal market. Therefore, the main goal of community law in this area is to achieve a common high level of cyber security in all member states in order to respond to threats arising from digitization and cyberattacks (Directive (EU) 2022/ 2555, p.1).

In the legal framework of the EU of cyber security, there are several regulatory legal instruments, specifically the European Act on Cyber Security (Regulation EU No 881/2019), Directive 2008/114/EC, “On critical

infrastructure networks and measures for their protection", Directive 2013/40/EU, "On attacks against information systems and communication networks", as well as the NIS 1 Directive (Directive (EU) 2016/1148), now replaced by the NIS 2 Directive newly adopted in December 2022 (Directive ( EU) 2022/2555, 2022).

### 2.1 EU Regulation No 881/2019

EU Regulation No 881/2019 represents the main EU Act of cybersecurity. Through this act, the notion of cybersecurity is defined for the first time in EU law, as *"the activities necessary to protect a) network and information systems, b) the users of such systems, and c) other persons affected by cyber threats*". This conception is completely different from the one held by EU before, in 2013 in the Cyber Security Strategy. In this document, cyber security was seen through a narrow perspective, addressing it only within the framework of the guarantee of the three main principles, confidentiality, integrity and availability of networks and information systems (CIA triangle, EUCSS, 2013). The perspective of this act left out of the scope of coverage the persons and their basic rights that may be affected by cyberattacks. This act along with the directive NIS 2 enhance relying on information systems and networks in order to benefit from innovation, interoperability in networks and automation, by at the same time guaranteeing a higher level of cyber security. (European Commission and the High Representative of the Union for Foreign Affairs and Security Policy, 2020).

The Cyber Security Act consists of two main parts. The provisions that make up the first part strengthen the competences of ENISA, giving it a permanent mandate, more financial resources and human capital, holding it

responsible for the protection of the digital environment in the EU. These provisions sanction the active role of ENISA as a point of reference for advice and expertise on cyber security for institutions, bodies, offices and agencies of the Union, as well as for interested parties. (EU Regulation No 881/2019, art.3-45) The second part defines the European legal framework of cyber security certification. The main purpose of these provisions is to increase confidence in ICT products, services and processes that are certified under European cybersecurity certification schemes and, avoiding conflicts in cybersecurity certification schemes, thereby reducing costs for enterprises operating in the digital market. (EU Regulation No 881/2019, art.46-65) According to this act, the certification mechanism represents a tool to increase consumer confidence through a conformity test in accordance with the "basic", "substantial" or "high" levels" of cyber security, (Mantelero et al, 2021) The Cyber Security Act provides a legal basis for the approximation and harmonization of the mandatory requirements in EU cyber security legislation.

**2.2 NIS Directives, Directive (EU) 2016/114 and Directive (EU) 2022/2555**.

In addition to the European Cyber Security Act, the issue of cybersecurity is addressed more specifically through the NIS Directives, which include Directive (EU) 2016/1148 and Directive (EU) 2022/2555. The NIS-1 Directive of 2016 represents a technical regulatory instrument aiming at protecting the functioning of network and information systems in order to improve internal market conditions within Europe. (Directive (EU) 2016/1148, p.5) The directive defines measures with the aim of achieving a high common level of security of networks and information systems. The Directive, for cyber security purposes, classifies operators of network and

information systems into two categories, operators of essential services (OES) and digital service providers (DSP). They operate across vital sectors for the European economy and society, such as energy, transport, water, banking, financial market infrastructures, health care. According to this act, member states have the obligation to identify which entities, public or private, are included in the definition of OES. (Directive (EU) 2016/1148, art.5/2)

Also, the Directive subclassifies digital service providers (DSP) into three types: online marketplaces, online search engines and cloud computer services. (Directive (EU) 2016/1148, Annex III) According to this act, every subject that belongs to these subcategories is included here, and the member states do not play any role in their determination. The directive defines the security and notification requirements for OES (Directive (EU) 2016/1148, art 14) and DSP. (Directive (EU) 2016/1148, art. 16) The Directive does not give any further indication on the type, adequacy and proportionality of the technical and organizational measures that operators OES will take. The directive recognizes the right of operators to assess the measures they need to take following an approach based on the level of the cyber threat. As can be deduced, the European legislator chose a model based on a framework of principles and rules allowing discretion to operators, instead of applying mandatory rules uniformly applied to all operators. Also, this Directive establishes the obligation for the member states to create a national strategy for the security of the network and information systems, for the establishment of new mechanisms to develop trust and confidentiality (the NIS Cooperation Group and the CSIRTs network). In this Directive are sanctioned obligations both for Essential Service Operators and for Digital Service Providers, as well as obligations for Member States to assign

national competent authorities, having single points of contact and CSIRTs defined.

Directive NIS-2/2022, which replaces the above-mentioned directive, was issued as a necessity to respond to technological developments and the potential threats they carry with them. It came as an urgent need for a more harmonized, expanded and improved framework in the field of cyber security and critical infrastructure protection. The NIS 2 directive seeks to improve the response and interaction capabilities to cyber security incidents that may come to public and private entities, and to responsible relevant authorities in Europe. Inclusion in the cyber defense framework of new sectors such as critical infrastructure operators (energy; transport; banking; financial markets infrastructure; health; drinking water and wastewater; digital infrastructure; public administration; space) as well as those of important infrastructure represent one of its main goals(postal and courier services; waste management; the manufacture, production and distribution of chemicals; food production, processing and distribution; manufacturing; digital providers (such as providers of online marketplaces, online search engines and social networking services platforms). (Directive (EU) 2022/2555, art.3).

This Directive removes the distinction made between operators of essential services (OES) and digital service providers (DSP), and makes a more appropriate categorization of the latter, dividing them into three categories: online marketplaces, search engines and cloud service providers. (Directive (EU) 2022/2555, art.6, p.28,29,30).

This Directive imposes obligations on governing bodies regarding the implementation and supervision of compliance with the legislation of cyber security measures and standards in their organization, leading to fines and temporary suspensions from performing managerial functions, including at the C-Suite level. The directive sanctions the obligation for IT specialists of different institutions to attend specific trainings, on a regular basis, to acquire sufficient knowledge and skills to capture and assess cyber security risks and for governing bodies to adopt management practices and measure their impact on the entity's operations. The directive also gives the competent authorities broad supervisory access and auditing powers for entities falling under the scope of the Directive. According to it, entities have the obligation to implement cyber risk management measures that are appropriate and proportionate, they should adopt technical and organizational measures to manage the risks that come to the security of the network and information systems.

The directive provides a catalog of measures to be taken by entities, such as security policies, incident handling, business continuity and crisis management, supply chain security, policies and procedures to test the effectiveness of risk management procedures, cyber risk and the use of cryptography and encryption. It imposes the obligation to report cyber incidents in stages, including an initial notification within 24 hours of becoming aware of any incident that has a significant impact on the provision of company services or any significant cyber threat that these entities identify that may result in a significant incident followed by "interim" and "final" reporting obligations. The previous directive sanctioned incident reporting only without "undue delays," leaving unclear response and reporting times for the cyber incident.

The directive also sanctions the necessity of the continuous review of the national strategies of the member states in the field of cyber security, beside requiring all medium and large entities (in the sectors covered by the NIS2 framework) to automatically comply with the cyber security rules, removing the possibility for member states to adapt the requirements in certain cases. Other significant changes include: addressing ICT supply chain cyber security for the first time; the creation of a special mechanism called the EU-Cyber Crisis Liaison Organization Network (EU-CyCLONE) to support the coordinated management of EU-wide cyber security incidents and crises at the operational level, as well as increasing responsibilities of ENISA within its mandate. This directive stipulates that member states have the obligation to transpose into domestic legislation and enter into force the measures sanctioned in this directive by October 17, 2024.

As a conclusion, it must be said that community law, through the instruments it creates and the technical and organizational measures it requires to be taken, constitutes the backbone in the field of cyber protection on a European level. It represents the basis for the stability of the European common market and the protection of the fundamental rights of European citizens. It represents an important tool to build cyber security in the EU, to mitigate threats to network and information systems used in essential services in key sectors and to ensure the continuity of such services in the face of incidents, thus contributing to the security of the Union and the effective functioning of the European economy and society.

## 3. The Legal Regime of Cybersecurity in Domestic Law

In Albanian law, the issue of cyber security, in addition to the provisions that sanction criminal legal protection in the Criminal Code of the Republic of Albania (Law no. 7895, 1995), has been the subject of a number of other legal acts, such as for electronic communications ( Law no. 9918, 2008), for the protection of personal data (Law no. 9887, 2008), for classified information (Law 8457, dated 1999), for electronic signature (Law 9880, 2008), for electronic identification and trusted services (Law no. 107, 2015)" and recently, the one for cyber security (Law no. 2, 2017). Initially, aspects of cyber security requirements were addressed in the Law no. 9918, dated 19. 05. 2008 "On Electronic Communications in the Republic of Albania", which assigned to AKEP as the responsible institution in this field ,the role of drafting, coordinating and supervising the implementation of measures for the provision of electronic communications, networks and services, associated facilities and other services. (Law no. 9918, 2008, art. 7, p. 3) A special provision in this law is dedicated to protective measures to be adopted in the field of cyber security for entrepreneurs of networks and services of public electronic communications. (Law no. 9918, 2008, art. 122). The regulatory role of AKEP as an institution in charge of drafting cyber security policies and measures was manifested with the approval of Regulation no. 37/2015 "On technical and organizational measures on security in networks and information systems". This act represents the first step into providing and elaborating a detailed framework of technical and organizational measures that must be implemented by information systems operators. This act regulates concepts such as: infrastructure assets, compromised information systems, security incidents, denial of service, malicious

software, electronic data manipulation, as well as the obligation of operators to guarantee network security and incident reporting. (AKEP Regulation, 2015, art 4-15).

For the first time, the issue of cyber security instruments and measures was raised on a legal level in Albania in 2017 with the approval of Law No. 2/2017, "On Cybersecurity". The law, just like the NIS Directive, categorizes communication networks and information systems and consequently the entities that use them into two categories: critical infrastructure, which includes the entirety of networks and information systems, the violation or destruction of which would have an impact serious to the health, safety and/or economic well-being of citizens and/or the effective functioning of the economy of Albania, and important infrastructure, which includes the totality of networks and information systems owned by a public authority, which is not part of the critical information infrastructure, but which may endanger or limit the work of the public administration in the event of a breach of information security. (Law No. 2/2017, art 3/5,6) According to the law, the list of critical information infrastructures and important information infrastructures is approved by decision of the Council of Ministers and updated at least once every two years. (Law No. 2/2017, art.6) According to this decision, the critical infrastructure includes sectors such as energy (electricity, gas, oil), some health, financial services (banks, microfinance, taxes), transport, public government services (defense, etc.), as well as a part of the digital infrastructure (AKEP). While the important infrastructure network includes some health, financial, transport services, some government and digital services. (VKM no. 553/2020, p. 2-10)

The law sanctions the establishment of entities responsible for cyber security, which include the role of a state authority, alongside operators of critical and important information infrastructure. The law stipulates that in every critical infrastructure operator it is mandatory to set up computer security incident response teams (CSIRT), while for operators of important information infrastructures they must have at least one person responsible for computer security incidents. (Law No. 2/2017, art.7) The law relegates to the state authority in the field of cyber security the responsibility to act as a central point of contact at the national level for all operators, to define cyber security measures, to administer incident reports and their storage and registration, as well as to provide methodical help and support to responsible operators in the field of cyber security. It has the obligation to act in the capacity of the national CSIRT and to carry out analyzes of identified weaknesses in the field of Internet security and awareness and education activities in the field of cyber security. (Law No. 2/2017, art.5).

The law sanctions cyber security measures, dividing them into organizational and technical ones, and recognizes the right of the state authority in this field to determine in more detail the content and manner of their documentation. (Law No. 2/2017, art.9) Authority through the Order no. 22/2018 has approved what exactly the security measures should contain and how they should be documented by the respective operators. (AKCESK, no.22/2018) The law defines what is considered a cyber security incident, what are their forms, how they are reported, the measures to be taken in the event of an incident, the state of the cyber crisis, as well as administrative offenses in the field of cyber security and relevant sanctions. In fact, the law on cyber security is a great achievement in terms of addressing: a) standards and capacities of security technical and organizational measures to be taken

by private and public operators that provide essential or important services, b) monitoring mechanisms and setting specific sanctions, c) potential risks and incidents and measures to be taken.

Albania, in accordance with the NIS Directive, has drawn up the National Strategy for Cyber Security and the corresponding action plan. (VKM no. 1034/2020) This act makes a general analysis of the cyber security framework in the country and identifies policies, sectors, infrastructures, tools and necessary measures to be adopted in certain sectors to guarantee cyber security. The Act requires the establishment and operation of institutional cooperative mechanisms: legal and technical instruments, as a critical element of protection in cyberspace, for digital infrastructures, transactions and electronic communications. The act emphasizes the necessity of raising professional capacities, increasing nationwide awareness and strengthening national and international cooperation for a safe digital environment. (VKM no. 1034/2020, p. 3/1)

### 3.1 Discussion

Despite the great importance of the existence of a complete legal framework, in societies with a low level of rule of law such as the Albanian one, the main concern remains its implementation in practice. The lack of implementation of cyber security measures in specific operators, makes the law to be seen more as a vision than as set targets to be achieved. Despite the creation of mechanisms and measures to protect against cyber threats in accordance with the Directive, the recent cyberattacks by Iranian hackers against networks and information systems in Albania showed the weakness and lack of professionalism and effectiveness of the mechanisms set up in Albania to deal with them. This case put the Albanian cyber defense system

to the test, bringing it to its knees and having a very serious impact on national security and the basic rights of citizens. However, the attack showed that the legal framework is insufficient if it is not implemented with the necessary seriousness. The attack highlighted the necessity to support the state agency in the field of cyber security and the operators of the field with financial, technical, operational means and ongoing trainings and instructions.

The Albanian law regarding the establishment of the state agency in the field of cyber security follows the European model, concentrating the competence in this field on AKCESK(National Agency for Eletronic Certification and Cyber Security), which actually has a wide range of responsibilities. The question that arises is whether this agency has the technical, financial and qualified human resources to face the challenges of cyber security, in addition to the other tasks it performs? The establishment of a special center for cyber security, in the form of a coordination, treatment, support mechanism, will serve as a more efficient instrument for the prevention, management and solution of cyber threat issues.

Most important challenges to address are: the extent to which these operators of critical and important infrastructure have managed to implement the requirements and cyber security measures, through specific technological and organizational tools, human resources in this area and through the allocation of operating costs. Thus, for example, the law requires critical infrastructure operators to set up teams for cyber incidents, whereas important infrastructure operators must have at least one dedicated person on their staff. So, these measures increase costs for these operators. The issue of the technical, operational and human resource potentials of public agencies to assess new potential risks and to design safeguards remains the

biggest cyber security concern. Bypassing cyber security measures, untimely updating network security technology and information systems by operators, making them vulnerable to potential risks, improper and responsible non-auditing of security measures by public authorities are a serious concern especially for countries with lower standards of rule of law. Therefore, public and private operators, subjects of law need to improve their procedures, develop strategic plans for cyber protection against cyberattacks or cyber-crime, elaborate risk management plans in cases where these attacks occur. The importance of implementing these measures should be part not only of managing the activity of these operators, but should become part of the organizational and individual culture. Improving the regulatory framework for cyber security harmonized with sectorial laws, to accurately address issues and resolve them, including, but not limited to: Cloud computing, IoT, 5G technology and Artificial Intelligence.

Lastly, but not least, Albanian law has a new obligation: the improvement of cyber security instruments and measures according to the requirements of the NIS 2 Directive, for a more efficient response to cyber threats.

## 4. Conclusions

The purpose of cyber law, above all, is to protect the rights of users of networks and information systems. On the one hand, this is achieved by preventing the misuse of networks and information systems, considering such a category of actions as illegal activities and imposing criminal legal sanctions on them. On the other hand, another duty of law is to build a system of norms that address the totality of organizational, technical and educational tools that aim to protect the functionality and services of information systems and communication networks.

European law, through the instruments it creates and the technical and organizational measures it requires to be taken, constitutes the backbone and a major drive of development in the field of cyber defense on a European level. It represents the basis for the stability of the European common market and the protection of the fundamental rights of European citizens.

Albania has actually addressed cyber security instruments and measures by law immediately after the release of the main European acts. In Albania, as it happens in other areas, the main problem is not the existence or non-existence of norms, but the rigorous culture of law enforcement. Albania still does not have the necessary technical, operational and financial capacities and resources to face cyber threats. Cyber security requires professionally capable human resources to suggest technical and organizational measures to prevent cyberattacks. It requires serious investments in technology and equipment to maintain communication networks and information systems in all infrastructures. Cyber security requires the strengthening of control measures, reporting and training to every critical and important infrastructure operator.

The paper concludes that Albania should improve cyber security instruments and measures according to the requirements of the NIS 2 Directive for a more efficient response to cyber threats. The paper recommends that cyber security should be a priority, in terms of a setting up a specialized center that has the human, technical and financial resources necessary for the support and proper functioning of networks and information systems.

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