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Food Safety and Quality.
The Benefits of Quality Standards Implemented in Agri-food Industry

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ABSTRACT

Food crises are one of the reasons why food quality and food safety are frequently discussed in the media and all over. Very often the terms 'food quality' and 'food safety' are not clearly differentiated. Food safety (FS) refers to any problem related to hygiene and harmlessness of the food that reaches consumers and is a key aspect of food quality. Food quality systems with a focus on products, processes and process management have been and are still being developed for the different stages of the agri-food industry, including feed production, primary production, food processing, storage, transport and retail. Initiators are usually retailers or private and public organizations. Public authorities are leading the food and feed industries into the development of robust QMSs (Quality Management Systems) aiming at improving food safety, restructuring the food inspection system and enhancing the level of information provided to consumers. Quality systems establish the organization and management of processes guaranteeing the quality and the safety of food products brought to markets. Based on requirements of the public sector, private safety and quality standards are emerging and implemented. In the process of change compulsory standards as HACCP are a prerequisite for companies' behavior. The additional standards such GLOBAL GAP are disseminated through the industry as well. The implementation of one (or some) Quality Standards (QS) by the enterprises which carry out all the food supply chain (production, transformation, distribution of foods) goes throw a lot of steps and all these have their costs, but the results give a lot much more benefits for all the parts involved-the business, the consummators and for the welfare in general.

Key Words: food safety, quality, private quality standards, costs and benefits.

1. INTRODUCTION

Various public and private standards have been implemented in the last few years around the globe, as a result of the growing consumers' interest on food safety. While a lot of research on all aspects of food safety has been undertaken, this research has not been specialized to a quite large extent. Some of the most popular standards are the BRC, the IFS, the Dutch HACCP, the SQF 2000 Level 2, and the ISO 22000:2005.

Based on the so-called 'grandparents' of quality control systems [1] the International Organization for Standardization's (ISO) ISO 9000 for quality management and the Hazard Analysis and Critical Control Point (HACCP) approach for risk control - a number of different quality systems with regional, national or global appeal have been developed and introduced worldwide. These may focus on processing or retail enterprises, on farms, on the industry as a whole or on specific food chains. They all differ from traditional product-based food quality control, with their focus on processes, process organization, process control and process improvement [1].
In industrialized countries most companies in food chain comply with basic standards on food safety and quality. For developing countries and emerging economy producers the situation is more difficult [2].

1.1 What is quality?

There is general agreement that quality has an objective and a subjective dimension. Objective quality refers to the physical characteristics built into the product and is typically dealt with by engineers and food technologists. Subjective quality is the quality as perceived by consumers. The relationship between the two is at the core of the economic importance of quality: only when producers can translate consumer wishes into physical product characteristics, and only consumers can then infer desired qualities from the way the product has been built, will quality be a competitive parameter for food producers. In the subjective realm we can, as a gross simplification, distinguish between two schools of thought about quality. In the regard “quality” may refer to:

a) The quality of enterprise management (as exemplified in the term of “total quality management”)
b) The quality of process organization and control
c) The quality of process management exemplified by the ISO 9000 standards on “quality management”
d) The quality of product

Table 1: The attributes of the quality of the product [3]

<table>
<tr><th colspan="2">Attribute Type</th><th>Examples</th></tr>
<tr><td rowspan="4">OF THE PRODUCT</td><td>Security</td><td>-Pathogen elements
- Heavy metals
- Pesticide residues
- Food additives
- Residues of veterinary medicinal products</td></tr>
<tr><td>Nutritional</td><td>- Fat contents
-Calories
- Fibers
-Sodium
-Vitamins
-Minerals</td></tr>
<tr><td>Values of use</td><td>-Dimensions
- Appearance (color etc.)
- Taste and aroma
- Consistency and structure
-Level of product processing (ex. cleaning or pre-cooking)</td></tr>
<tr><td>Presentation and Service</td><td>- Practicality of the package
-Materials of package
- Easy retrieval
- Continuity of the offer during the year
- Characteristics of the label
-Indication of use or cooking</td></tr>
<tr><td colspan="2">METHOD OF PRODUCTION
(techniques and factors)</td><td>-Animal welfare
- Use of certain factors
-Use of certain technical of production (ex. Biotechnologies)
- Environmental impact
- Worker safety
- Compliance with regulations on child labor</td></tr>
<tr><td colspan="2">OF ORIGINE</td><td>- Identification of the company
- Place of production of the raw material
- Place of performing transformation
- From a local tradition</td></tr>
</table>

1.2 The binomial “quality-safety” in agro-food industry

Food quality systems with a focus on products, processes and process management have been and are still being developed for the different stages of the agri-food industry, including feed production, primary production, food processing, storage, transport and retail. Initiators are usually retailers or private and public organizations.

There is in general agreement that quality has an *objective* and *subjective* dimension. Objective quality refers to the physical characteristics built into the product and is typically dealt with by engineer and food technologist. Subjective quality is the quality of perceived by consumers. The relationship between the two is the core of the economic importance of quality: Only when producer can translate consumer wishes into physical product characteristics and only when consumer can then infer desired quality from the way the products has been built, will quality be a competitive parameter for food producer.

Food safety (FS) refers to any problem related to hygiene and harmlessness of the food that reaches consumers and is a key aspect of food quality [4]. FS is a highly relevant public health issue since foodborne illness (either infectious toxic in nature, caused by agents that enter the body through the ingestion of food) are a major source of concern worldwide (WHO 2007):

- In 2005 alone 1.8 million of people from diarrheal diseases with food contamination as major cause (WHO 2007)

- Only in the USA is estimated that an average an annual amount of 76 million cases of foodborne diseases resulting in 325 000 hospitalizations and 5000 deaths [5].

- Foodborne diseases outbreaks can generate huge damage as shown by 1994 outbreak of Salmonellosis due to the contaminated ice cream in the USA affecting more than 200 thousand people [6].

- In addition, food safety problems also generate sever economic losses and increase unemployment and litigation.

There have been several high profile food crises that challenged the credibility of the food industry and raised concerns about the quality and safety. Amongst those are the outbreaks of salmonella or Escherichia coli O157:H7, the mad cow disease crisis (BSE-Bovine Spongiform Encephalopathy) or the use of Genetically Modified (OGM) crops on food. These major incidents resulted in an increased demand from consumers and governments for high quality food and increased accountability and transparency.

These situations prompted Governments to impose new legislations and regulations on food safety systems such as *Codex Alimentarius* standards (FAO/WHO) or the General Food Law (European Union (EU) 2002/178). Large Western retailers also adopted quality certification schemes such as British Retail Consortium (BRC), Global Partnership for Good Agricultural Practices (Global GAP) and Safe Quality Food (SQF) to address not only product quality but also the production and distribution processes.

The Food Safety Systems has evolved greatly and the HACCP approach it is a legal requirement supported by REG. (EC) 852/2004. The HACCP (Hazard Analysis and Critical Control Points) methodology is based on preventive principles and concepts, and a systematic approach and aims to ensure efficient monitoring through assigned "points" where the dangers for consumer health can be controlled.

2. THE QUALITY STANDARDS IN AGRI-FOOD INDUSTRY

Standards can be defined as ''a guide for behavior and for judging behavior'' and in the context of agribusiness, they define the requirements that suppliers have to comply with in order to satisfy their buyers and be accepted in certain markets.

Quality assurance systems are designed to assure customers that contracted product characteristics and/or production processes are consistently delivered. They play an essential role in an exchange because food safety and quality attributes may not be directly observable. Food safety and quality assurance systems can take many forms:

a) private voluntary international quality assurance standards, such as ISO 9000;

b) national farm level assurance systems, such as Farm Assured British Pigs (UK);

c) proprietary quality assurance systems, such as those maintained by the large retail food chains in the U.K (ex. BRC)

Quality assurance systems share two common features:

- a reliance on documentation of production processes and practices,
- third-part auditing and certification. An organization can take advantage of a QMS, especially when critical areas are considered that need to be suitably controlled, to reduce the appearance of defective products but also to improve internal communication, increase customer's satisfaction, and there for the share market and increase the opportunities for expansion in new markets and regions.

Private food safety standards are generally characterized by:

- the description of specific procedures and control points to minimize the penetration of risks into the food production process;
- verification of compliance with the standard through internal documentation;
- mechanisms of internal audit so that firms can self-monitor their compliance;
- external audit by third part certifiers

All standards include requirements on scheme management and governance (for example how auditors should be selected or the accreditation of certification bodies) and good agricultural or manufacturing practices (GAP and GMP respectively). Whereas the section on scheme management and governance tends to vary scheme by scheme, the good practices component is generally very similar across standards as it is based on internationally recognized best practices.

Standards are designed by firms, generally large retailers or business coalitions, but monitoring for compliance is often carried out by independent certifying organizations. Accredited third-party certifiers evaluate production facilities, processes, and documentation and certify that producers comply with a standard. In order to ensure quality and integrity, third party certifiers must be accredited by their domestic accreditation bodies [for example United Kingdom Accreditation Service (UKAS) in the UK and American National Standards Institute (ANSI) and ANAB in the US] which must be in turn members of the International Accreditation Forum (IAF) [7].

Specifically, by adopting private food safety standards, buyers no longer need to carry out audits of their suppliers because they rely on third-party certifiers, which are paid by the audited firms, significantly reducing costs for buyers. The globalization of the agri-food chain has further increased the urgency for instruments that could facilitate trade and global sourcing and promote the coordination of transnational supply chains.

The presence of so many standards depends on the fact that doesn’t exist one single approach for fronting the problem of security and quality management, therefore the indications on these standards can regulate different aspects in accordance to the predetermined objective.

From a historical perspective, until the later part of the last century, food product standards primarily focused on the safety issue. They built on the international agreements expressed in the ‘*Codex Alimentarius’* (CA), an initiative jointly supported by the *World Health Organization (WHO)* and the *Food and Agriculture Organization of the United Nations (FAO)*, or were developed within the framework of the *World Trade Organization’s (WTO*) agreement on the application of ‘Sanitary and Phytosanitary Measures’ (SPS). As such, the agreements concentrated on limits of potentially hazardous residues and on the implementation of HACCP concepts for food safety control.

While countries could enforce such agreements in their own food policies, voluntary enterprise-oriented initiatives to communicate production and product reliability via the implementation of quality management systems were increasingly gaining attention, especially those linked to the ISO9000 quality management standards.

2.1 HACCP (Hazard Analysis and Critical Control Points)

HACCP is a science-based system that enables the introduction and maintenance of a cost-effective ongoing food safety program. It also allows food businesses to establish a higher degree of food safety that could not be achieved just by following basic good hygiene practices. Through the implementation of HACCP, all stages involved in food production and preparation are systematically assessed and the stages within production that are critical to the safety of the product are identified and controlled.

HACCP is primarily implemented to determine whether the food operation can consistently manufacture (and/or distribute) safe food and is one of the many approaches toward the wide application of food safety systems that give emphasis on identifying and managing risks in food chains (the “*farm-to-fork*,” or “*plough-to-plate”* approach) [8].

HACCP systems are developed following a 7step procedure that aims to ensure a high level of food safety and facilitates the establishment of a 2-way relationship between consumers and the industry. It also enables companies to effectively identify any legislative problems associated with the internal quality standards of a firm. The fact that the reason behind the assessment of HACCP systems is to ensure the production of safe food, it could be claimed that HACCP could not be easily used to provide a focal point for the conduction of the assessment and that cannot by itself comprise a food safety control system.

A study that recorded the experience of 9 Canadian food manufacturers on HACCP and ISO 9001 concluded that there were different trends associated with the respondents. First of all, all companies interviewed implemented HACCP in combination with other internal controls such as analytical testing and supplier assessment to ensure product quality. Furthermore, all companies considered that internal auditing is an essential element of their quality programs. Finally, companies that used both HACCP and ISO 9000 reported that the main obstacles they faced were resistance to change and documentation requirements [9].

2.2 ISO 22000

ISO 22000:2005 defines the requirements for an effective FSMS and can be used to demonstrate an organization’s ability to control food safety hazards. It can be implemented by organizations of all sizes that are involved in any aspect of the supply chain (ISO 22000:2005). The implementation of ISO 22000 offers a significant advantage to organizations, especially to small–medium sized ones. Another very important reason why companies implement this standard is customer requirements. It has been demonstrated that customer demands are one of the main reasons of why catering firms obtain ISO certification.

Generally, firms consider ISO certification as a tool that offers them a competitive advantage. ISO22000enables organizations to adopt a food chain approach for the development, implementation and improvement of the effectiveness and efficiency of their FSMS. ISO 22000 requires that the organization considers the effects of the food chain both backwards and forwards (ISO/TS22004:2005).ISO 22000 strengthens the HACCP system in numerous ways. It is a management standard and it therefore has a lot of similarities with other management system standards. It includes, for example, requirements for policy, planning, implementation and operation performance assessment, improvement, and management reviews.

ISO 22000 does not require that a preventive action procedure be implemented since HACCP (which is a requirement of ISO 22000) is by itself designed to prevent food safety hazards. It is, however, recognized by ISO 22000 that new hazards emerge, and new control systems and technologies are designed to control them. It therefore encompasses a systems approach (continuous update of the FSMS) toward the prevention of new hazards. Hazard assessment of ISO 22000 is a tool used for the determination of the potential hazards that require specific control measures [10].

ISO 22000 can be implemented in combination with ISO 9001 and its supporting standards. While ISO 9001 focuses on the implementation of an effective QMS required for meeting customer requirements, ISO 22000 is used to ensure that an effective FSMS is also in place to meet customers’ requirements. ISO 22000 allows the alignment or integration of its own FSMS with correlated management systems. There is the potential for an organization to adapt its existing management system(s) to form a FSMS that meets the requirements of ISO 22000 (ISO/TS 22004:2005).

2.3 BRC (British Retail Consortium)

In 1998, the BRC in coordination with major U.K. retailers such as TESCO and Sainsbury defined common criteria to cover the inspection of food suppliers. The inspections are conducted by certified organizations. Before the introduction of BRC, the retailers used to conduct their individual inspections. They quickly realized though that joint inspections are cost-effective. Retailers based in other European countries now also request that their suppliers are audited against BRC and provide the relevant certification reports.

The requirements of HACCP are included in BRC, although in this standard more emphasis is given to documentation, factory and facilities condition, controls on products and processes, and personnel.

Several updates to the BRC standard have been issued to ensure it includes any new requirements and trends in relation to food safety and the standard has now gained worldwide acceptance. BRC provides a framework to assist food manufacturers in ensuring that the products produced are safe, while it also assists them in managing product quality to ensure customers’ requirements are met. The BRC certification is accepted by many retailers, food service businesses, and manufacturers around the globe that need to assess the performance of their suppliers. To respond to this demand, translations of the Global Standard for Food Safety have been made available into many languages (BRC 2015). BRC’s widespread use can strengthen the relation between the retailers and the consumers.

The retail brand name becomes more important for the interpretation of consumer demand, playing the role of a guarantor for the supplied foodstuffs. This trend, which is undoubtedly an important opportunity for retailers, leads unavoidably to the assumption that the retail industry will get more involved in not only the reorganization of the production chain, but also in other functions that were traditionally the responsibility of the producers (such as advertising costs or educating consumers).

2.4 IFS (International Food Standard)

The IFS was introduced by the German and French retail and wholesale associations, as well as their Italian counterparts. IFS’s purpose is the development of a consistent evaluation system for all organizations supplying retailer-branded food products. The SQF Program is owned by the Food Marketing Inst.

This standard offers a combination of food safety and quality management certification for all food producers and processors. The Dutch HACCP was developed by the Dutch Natl. Board of Experts, and aims at specifying the requirements for effective HACCP-based food safety systems. The standard determines the codes of practice that should be incorporated into a management system, and is particularly suitable for the Dutch market suppliers. In the U.K., there has been a high level of concern about food safety, which is a consequence of the rise in the number of incidents of food poisoning over time and the number of Escherichia coli 0157 outbreaks. As a result, a lot of attention has been paid on the regulatory controls implemented by the U.K. government and the efficiency of the systems used by food suppliers for controlling food-related hazards. Specifically, very important are considered to be the level of food safety controls in the form of HACCP controls along the supply chain, and the extent to which regulatory controls lead the manufacturers toward the implementation of such systems.

In general, quality system standards are presented in manuals that include requirements and interpretations, plus checklists for self-control and audits. In some system standards, requirements are structured hierarchically, distinguishing between classifications as ‘high and low priority’ (IKM), ‘critical, not critical and recommendations’ (EurepGAP), ‘basic and high level’ (IFS), or as ‘1, 2, and 3’ (Safe Quality Food (SQF) 1000 and SQF 2000).

Table 2. Examples of private safety and quality standards

		Mandatory public	Voluntary public	Private	
				Collective	Business-to-Business
Focus	National	National legislation	-Food Safety Enhancement program -HACCP Advantage -SQF (until July 2003)	-Dutch HACCP -BRC Global Standard -Assured Food standards -Integrale Keten Beheersing	-Nature’s Choice (Tesco Stores-England) -Field-to-Fork (Marks & Spencer-England) -Filière Qualitè (Carrefour-Francia) -Terrè et Saveur (Casino-Francia)

	International	EU Regulation	-ISO 9000 -ISO 22000	-International Food Standard (IFS) -SQF 1000/2000/3000 -Global GAP	

The different hierarchical levels allow a degree of implementation flexibility in system certification by external auditors. As an example, for the IFS, the fulfilment of 75 percent of the requirements, including all so-called ‘KO-Criteria’, is sufficient to yield a basic level certification. The ‘SQF 1000’ and ‘SQF 2000’ standards on the other hand distinguish between three certification levels which build on the cumulative implementation of different sets of requirements. Level 1 involves fundamental food safety requirements, level 2 extends requirements towards an accredited ‘HACCP Food Safety Plan’, and level 3 incorporates special requirements for quality management. However, the hierarchy principle is not a general one; system standards like the Danish Quality Guarantee (DQG), for instance, ask for a complete fulfilment of all of its requirements.

The European retail chains have assumed a leading role in the formulation of food safety and quality standards. Their international supplier base, especially in developing countries, needs to adapt and comply, if they wish to continue trading with major retailers.

3. BENEFITS FROM IMPLEMENTATION OF PRIVATE QUALITY STANDARDS

Some of the benefits from application of quality standards:

• Access to markets. Increasingly, a quality system certification is a pre-condition for a successful market entry. The barriers are not caused by government regulations, but by pre-conditions set by buyers (wholesalers, retailers, etc.)

• Product liability. As we have already mentioned, product liability has become a critical issue for agri-food enterprises in the EU, especially for retailers. Legal requirements to practice ‘due diligence’ force enterprises to take all necessary steps for assuring the safety of their products.

• Cross Compliance. For the EU market, ‘Cross Compliance’ refers to farms’ adherence to certain EU regulations (for example., in environmental control), some of which are directly interlinked with the implementation of quality systems. Such regulations tend to become standards for suppliers beyond the boundary of the EU.

• Process quality. Process quality refers to the organization and control of internal processes and transactions between firms. Process quality is a core requirement in most quality systems and a means for improvements in product quality and process efficiency.

• Product quality and food safety. Product quality concerns product attributes (taste, shelf-life, etc.) expected by customers. Food safety considers the appropriate control of processes to assure the safety of deliveries prior to any final or external product check.

• Traceability. The EU regulation 178/2002 contains general provisions for traceability, which cover all enterprises in the food and feed sector. Importers and, in consequence, their suppliers all over the world, are similarly affected. Next to the legal requirements quality systems ask for traceability in different ways.

• Trust. Trust in food quality and safety is a key element in food markets for transactions between enterprises and the acceptance by consumers. It has been documented that trust could further reduce transaction costs and be supported by quality standards and quality labels.

• Environment. There are specific management systems for environmental control. However, quality systems do increasingly include environmental aspects as well. Apart from the fulfilment of legal requirements, they constitute benefits for the environment and might support sustainability for the enterprise.

• Transaction support. Transactions between enterprises generate costs. They encompass all aspects of the contractual relationship including informational search costs, negotiation costs and the costs of monitoring and enforcement. The implementation of quality systems and the communication of its implementation reduce information asymmetry, support transactions and, in consequence, reduce costs.

Table 3. Approaches for the estimation of costs, benefits and cost-benefits relationships in different application scenarios [5]

Level	Cost/Benefits analysis methods
Enterprise	Engineering analysis method, accounting method, econometric estimation approach, cost utility analysis, cost- benefits analysis
Chain	Accounting method, econometric estimation approach, cost utility analysis
Market	Willingness-to-pay approach, cost estimation approach
Public	Cost-of-illness, cost-utility approach, cost estimation approach

Private food safety standards play a pivotal role in food safety governance. Most food products commercialized in supermarkets must comply with strict private standards that retailers and manufacturers impose on their suppliers.1 Global GAP, Safe Quality Food (SQF), and the British Retail Consortium Global Standards for Food Safety (BRC) are just some examples of such private standards.

Private standards have different scopes: some cover the production of agricultural products (Global GAP) while others apply to the manufacturing phase (BRC). They include scheme management and governance requirements (for example on record-keeping and certification) as well as Good Agricultural Practice (GAP) or Good Manufacturing Practice (GMP) depending on the scope. Companies that choose to become certified have a choice among different private standards, hence a regime of competition exists among standards.

A voluntary instrument designed within the agri-food industry to coordinate complex food value chains, standards impose specific safety and quality requirements on food producers. Standards are developed and maintained often by industry associations and are used by thousands of producers and manufacturers worldwide. The enforcement of standards relies on third-party certification bodies that conduct on site audits and certify producers who are in compliance [11].

The limits of public regulation are particularly evident if we look at import safety. The safety of imported foods is in fact determined by the regulations in place in the producing countries, as well as the regulations of countries where the food is consumed. If we consider producing countries, some may have weak regulatory capacity, different requirements or limited enforcement systems, hence producers may more easily sell contaminated or adulterated foods [12].

Given that it is impossible to inspect every imported food and that the jurisdiction of regulators does not extend across borders, regulatory bodies have the option to enter into agreements with their counterparts in exporting countries in order to build their capacities and to carry out inspections in foreign facilities. Building the regulatory infrastructure of exporting countries is an appropriate response but also a long term endeavor because rules and skills are not built overnight. In the meantime, private standards fill this regulatory gap by focusing directly on producers and ensuring that their products are in compliance with buyers' demands. In doing so, private standards build the capacity of the producers, irrespective of the food safety regulations in vigor in the producing countries [13]. At a time when governments are still grappling with the best way to ensure food import safety, private transnational regulatory systems have emerged as a more efficient solution to ensure safety across complex and global markets.

4. DISCUSSION

It should be noted that for the utilization of the multi-criteria decision approach one needs first to define an initial set of conditions - the so-called 'calculation base'. Enterprises or chains with already high quality standards, for instance, are less likely to be affected by the requirements of a new quality system. They are also less likely to reach higher levels of benefits.

Conversely, enterprises or chains that are lagging behind in quality system adoptions may incur in higher adoption costs, but may stand to benefit the most from the additional costs. As such, the decision analysis calls for a consideration of marginal costs and benefits. Moreover, the generalization of results from enterprise to enterprise or chain to chain will not always be viable, as the initial sets of conditions are not necessarily heterogeneous.

Yet, the consideration of cost and benefits is by no means a simple matter. Enterprises are increasingly faced with the necessity to consider multiple alternatives represented by the quality demands of different markets, different buyers within a given market and different legal environments.

To remain in business, enterprises might have to either comply with many different quality systems or to restrict themselves to one or few market alternatives. Enterprises in developing countries are particularly affected by these developments in quality systems. The increasingly stricter requirements of quality systems established by enterprises from the end of the chain, especially from retail groups from the northern hemisphere, force them to adapt to quality demands determined by one or several quality systems.

5. CONCLUSION

Private standards can be negotiated and amended relatively quickly, providing timely and flexible solutions to respond to new risks more promptly than through traditional public regulation.

Enterprise decisions on the adoption of quality and safety standards might focus on the implementation of individual requirements or of comprehensive systems. Policy decisions by public or private agencies might on the other hand focus on the provision of support for sector developments in quality and safety improvements, beyond legal regulations. In both cases, decisions will have to deal with the feasibility of implementation and on an analysis of its consequences, involving those related to costs and benefits

The standards become stricter and additional requirements are included, the manufacturers invest in meeting the new demands.

There are significant differences though between different countries that depend on local and international factors such as well as regulations and exporting opportunities.

While GFSI, ISO, and HACCP standards become more and more popular in Europe and the U.S., emerging economies also follow the trends although in many cases the implementation of standards and controls seems to be problematic.

Although standards are private and voluntary, they are so widespread to have become *de facto* mandatory for the various actors in the food value chain and, in parallel to public regulation, they play a critical role in ensuring the safety of the foods we consume.

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The Issue of Architectural Design Creativity and Computer Technique: Standards & Rules

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ABSTRACT

Creativity, newness, invention and innovation are major topics that taking up enough space of researchers and other specialists thinking. Skills of Communication are the basic issue of program learning for each disciplinary, that affecting education and learning output. Creativity is of high impact on the process, according to its conceptions and how to make students of high ability to produce and make newness through his/her creation. The research problem appears through finding the relation between human thinking's (cognition) and how to simulate imagination depending on the impact of computer techniques, to produce a creative product, as essential component and standards of architectural design process. Normally creativity depends on human thinking and his / her brain to catch something new as original topic. Architectural creativity extends between human thinking skills and computer techniques, and the product varies from composer to other according to his / her skills and learning. Questionnaires included many students and specialists of architecture selected as sample of the case study and application. Many standards and rules govern skills of communication affect creativity according to fluency, flexibility, originality, elaboration and metaphorical factors, corresponding with cognition, personality and environmental variables. Those variables include, intelligence, knowledge, technical skills, special talents, internal motivation, confidence, creativity traits, non – conformity, political – religious factors, cultural factors, socioeconomic factors and educational factors, as the research findings.

Key Words: creativity, architectural design process, computer techniques

1. INTRODUCTION

Mumford and Mackinnon [1] mentioned that creativity is one of major topics that taking space of many specialists. Creativity represents highly complex and diffuses contrast, it concerns with the production of ideas. Creativity is a form of problem solving ability. The question is which conceptions affect creativity, and how they impact the process for all epistemological fields? In architecture according to William and Askland [2], it considered to be a cornerstone, while Plucker and Beghetto [2] described creativity as the interaction among aptitude, process and environment by which individual or group produces perceptible product that is both novel and useful as defined with in social context. For example, traditionally students, and architects depend on studying, knowledge and their realm of imagination. In contemporary level of science development, computer technologies and the internet allow us to study the achievement of contemporary science newly. The question appears that: Do those technologies affect design, design process and creativity in architecture. How computer techniques and software assist them to produce creative architectural forms? .The research will concentrate on the issue of creativity in architecture process design through the basic variables of cognition , personality, environment ,and the impact of human thinking indicators on that in one side , the trace of computer techniques and software on the other side .The research depends theoretical framework in order to reach the major variables that affect creativity through many indicators and characteristics .Questionnaire survey will be depended, through selecting two groups of architecture students , and architects whom involve in design process to reach the impact of computer techniques on the major variables of creativity.

1.1 Research problem

The research problem appears through the shortage of literatures that take the relation between human thinking's standards (cognition) and how to simulate imagination according to the impact of computer techniques on creativity as essential component of architectural design processes.

1.2 Research goal

The research aims to find the most important conceptions, standards and rules that affect creativity as important skills of communication implications of learning program. The impact of computer techniques, and software programs on thinking and cognition abilities through the characteristics of fluency, flexibility, originality and elaboration to produce creative ideas in architectural design.

1.3 Research importance

The research importance extends through displaying many literatures in order to find the importance of creativity in learning program and its impact on the outcome as standards for any epistemological field. The role of computer (CAD) and other software that affect the process of architectural design creativity as case study.

1.4 Research hypothesis

The research assumes that the relation between creativity, thinking standards, computer techniques and architectural design are of three approaches:
- There are many standards of thinking conceptions play as roles in architectural process.
- Computer techniques are of great importance in design thinking process according to the traits of fluency to discover new and original ideas.
- Computer techniques play major role in architectural cognition according to the issue of flexibility in thinking to produce the new creative forms.

2. THEORTICAL FRAME WORK

Theoretical frame work will introduce literature about creativity, the conceptions of creativity as standards, the way of creativity and the most important indicators affect cognition and thinking according to:

2.1 Creativity and literatures

In the middle decades of the 20th century Creativity studying be fundamental issue for scientists [3]. Creativity and the evaluation of it have been widely studied and subjected to critiques by researchers. All creativity researches involve multiple epistemological, theoretical and methodological ties that may make comparison impossible.
In our Islamic theory, creativity is of great sacred word for it relates with ALLAH. Creativity is one of ALLAH properties, for our universe is of his creation. He is the first reason of our existence. The all are of his creativity. So, person must look for creativity in any epistemological field. The term of creativity or imagination can be found in writing of ancient Greece and Rome. In the mid of 20th century educators and psychologists have usually taught to have its root. J.P. Guilford provided the foundation, that has influenced more five decades of theory and practice [4]. Many indicators put about creativity, but because of its complexity and has multi-faceted, so no single universally accepted [5]. According to Reid and Petocz [6] creativity is viewed in different ways depending on different disciplines, in education is called (innovation), in business, it is (entrepreneurship), in mathematics it is performance or composition, and everyone is of its private roles.
Chen [7] declared that creativity is one of the five human instincts. there is no way but getting the correct creativity and creative thinking as different interpretations in different field of education, as object of learning and teaching. Innovation has been the main purpose as, Kowaltowski [8] mentioned. The importance of creativity appears for that there is no field of discipliners never miss

or neglect the meaning of creativity. in the era of today modern economy, technological factors, knowledge, creativity and measurement of creative industry become the focus of attention of various countries in the world today [9]. Vernon and Eysenck [1] define creativity with referring to a person's capacity to produce new or original ides, insights, inventions, or artistic products, that are accepted by experts of scientific, aesthetics, social, technical value.
Many specialists declare multi definitions of creativity as shown in Table 1.

Table 1 Declares sample definitions of creativity and their implications assessment [5]

Sample definitions	Emphasis in definitions	Primary focus	Implications for assessment identify by creativity
Fromm khatena makinnon	person	Characteristics of highly creative people	Assessment creative personal traits
Gordon Guiford Mednick Torrance Treffingeret	Cognitive process or operations	Skills involved in creative thinking or in solving complex problems	Testing for special creative thinking and problem-solving skills.
Maslow Rogers	Life style or personal development	Self-confidence, personal health and growth, creative context	Assessing personal adjustments, self imagine
Garder Khatena	product	Results, outcome, or creative accomplishments	Evaluating products or demonstrated accomplishment
Amabile Rhods	Interactions among person, process, situation and outcome	Multiple factors with in specific contexts	Assessing multiple dimensions in profile with various tools

Table 2 Declares the multi effective definitions of creativity

creativity	statements
creativity	Imagination Innovation Human instincts Creative thinking's Capacity to produce new ideas Capacity to produce original ideas Insights Inventions Artistic products

2.2 Learning program & Skills of communication

Higher education plays a key role of learning programs in order to foster professional development in upper level of students [10]. Akbari [11] mentioned that learning is one of the cornerstones of the human society. It is one of the domains that has been mainly affected by advances in information and communication technologies.
Reudenberg [12] declared that there are a number of terms which have been used to describe generic skills, such as graduate, professional, transferable, work and employability. skills of communication can be defined as a set of skills that have potential broad application to the range of disciplines or circumstance.
Jones mentioned that there are many debates about generic skills including practical constraints in its teaching. the appropriate of generic skills, technical skills and the integration into curriculum are very important.
So generic skills and the focusing on them in higher education authorities is the core to reach the output of the program, and the nature of the goal [1].

2.3 Innovation, Intelligence, problem solving & cognition

Cirel [4] declared that creativity in organization is presented as a phase of innovation and is a crucial issue of the core of the economic system. Augor [4] observes overlapping between the concept of creativity and innovation, for creativity is a founding stage of innovation. Intelligence, according to spearman [4] is not a sufficient condition for creativity with his neo-genetic process, as being capable of generating new mental content and the final act of creativity must be assigned to the 3rd novel genetic process which of displacing a relation from the ideas. It was its original fundamentals to another idea, and generating the 4th idea, which may be novel. creativity is oriented toward discovering new rules, creative actions occupy a position in experience and action.
Asborn and Isaksen [4] concentrated on problem – solving and, the creative problem-solving model identifies various stages of divergent actions, which describing the creative process, that can use to facilitate it. the divergent and convergent process incorporated in pedagogy of problem-based learning, which provides students with complex real-life situation.
Quaitadamo and Faiola [2] considered that Cognition is closed to critical thinking that drives problem solving and decision making. the cognitive and creative skills to develop and evaluate a design concept that demonstrates the exercise of theoretical reflection, critical choice, imagination and professional responsibility, through the exploration, testing and refinement of different technical and aesthetic alternative. the technical and creative skills to produce a design that demonstrates an appreciation of economic factors, environment issues, social and cultural issues, building systems and materials. the technical and communication skills to generate design and contractual to both specialist and non- specialist audience and enable architectural design to realize.

2.4 Aspects of creativity, standards and cognition indicators

Creativity associates with novelty which is of two meaning [1]:
Private one, that discovers new one.
The other is public which is new to everyone.
The distinction between private and public novelty is associates with two major’s definitions of creativity and conceptions which can classify:
1-Trait which can person lead himself to produce acts, items, and instances of private novelty.
2-Achievement which is shown by productivity, by actually production that is novel in public sense.
Otto Rank [2] suggested a classificatory scale of creativity as personal trait with three recognizable features:
Adapting to the social norms.
Rebelling against the social norms.
Moving beyond the social norms to satisfy an innate drive.
Lehrer [10] argued that neuroses being the driver to create thought. it is the ability to form unexpected neural links to connect hither to unconnected stored data.
The creativity as trait involves four components:
-There is the creative process for the production of novel of original content, and this process is repeated regularly by the same person, gives rise to the notion of trait.
The creative product may involve the trait of creativity, but also much more.
The creative situation as defined to produce creative people and products than other.
Spearman asserted that fluency is the development of the idea, that verbal imaginative fluency was basic for creativity and could be measured. Fluency tests have been found to correlate with intelligence and to contain something in common over and above intelligence, possibly creativity.
Mumford and Custafson [1] referred to creativity as achievement for represents highly complex and diffuse construct.
Achievement measures of three kinds:
Overt production criteria.
Professional recognition criteria-
Social recognition criteria. the judgments of knowledgeable others.
Creativity as trait measured by TD tests, the number of products and contributions, but the creativity of achievement can be measured by, personality, environment and cognition variables as in table 4.

Table 3 Historical evaluation of architectural education and its efficiency from learning theory [8]

Type of architectural education	Date	Learning theory
Master –pupil system	1800	Functionalism (Relying on factors outside individual)
Disciple and leader system (beaux-art)	1800-1950	Behaviorism (Relying on behavioural objects)
The immersion system (Bauhaus)	1950-1960	Cognitivism (Emphasis on problem solving)
Creative problem –solving system	1960-1970	Ultra-cognitivism (depending on their individual recognition)

Thinking is of two levels, consisting of sensory perception, divided into sense, perception and representation, as abstract of thinking, constructs as notion, statement and inference [13]. The representation stage was start operating with images to subject abstracting from subject itself.
Donald [5] declared that many key-characteristics and indicators of creativity, generating ideas, according to, fluency, flexibility, Elaboration, Metaphorical thinking, and originality. Each of that indicators are of many values as declare in Table 5.

Table 4 Declares the major variable of affecting creativity [1]

variables	factors	Creativity as achievement
Cognitive variables	Intelligence Knowledge Technical skills Special talents	Creativity As achievement
Environmental variables	Political – religious factors Cultural factors Socioeconomic factors Educational factors	
Personality variables	Internal motivation Confidence Non- conformity Creativity (trait)	

3. ARCHITECTURE AND CREATIVITY

Generally, creativity in engineering is the effectiveness of producing ideas as products. according to, shah and Vargas [3] this field broadly address the production of ideas, products and process the effectiveness of idea generation can be linked to the method of used by engineers to generate concepts.
UNESCO declared that creativity is a kind of hope for communities in a detailed view and in architecture to use variety to enrich the design studio environment, based on cultural framework for each nation [14].
Chen [7] declared that creativity, is the core in every field of design, can't be taught in a traditional sense, anything taught to be learned by students would be just practical technique. the true creativity must be inspired instead of instructed.
Donald [5] declared that the generating ideas category includes the cognitive characteristics referred as divergent thinking abilities and metaphorical thinking. It is digging deeper into ideas. It includes the following:
-Analyzing
-Synthesizing
-Re-organizationing or redefining
-Seeing relationships
-Desiring to resolve ambiguity or bringing order to disorder
-Producing complexity or understanding complexity.
-Openness and courage to explore ideas includes some personal traits that relates to one interests, experiences, attitudes and self-confidence. the characteristics in that category includes:

-Problem solving
-Aesthetics sensitivity
-Sense of humor
-Playfulness
-Fantasy
-Imagination
-Risk taking tolerance for ambiguity
-Openness to unwillingness to accept authoritarian assertions without critical examinations and integrated to opposite.

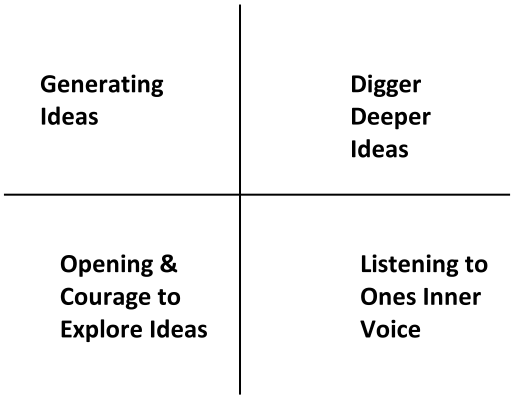

Figure 1: Showing categories of personal creativity characteristics [5]

3.1 Creative process, computer software programs techniques and architecture

Creativity is generally acknowledged as an essential element of design process, to create aspects of architecture, as remaining of contentious issue. Mackinnonin [2] his study compared three samples of architects:
-Consisted of highly creative issue, whom actualized their creative potential, and have progressed to operating beyond social / professional norms. They are always imaginative.
-Architects with at least two years of work experience by associate with highly creative architects, whom displayed an overlapping of both the two samples. They are in transitional stage and their conscientiousness is the opposite of imagination.
-Architects who had never work with highly creative architects, whom restored to more conventional standards of society and their profession, and adopted to social professional norms. They are always checking the adjective conscientious.
-Mackinnon, mentioned that creative man, the artist as one of large measure creates his own reality and 98%of creative architects are imaginative. He described the conflicted neurotic type, rank observed, as many others also have the relation of neurosis to realization. His study focused on a person rather than the process of product.
Wiggins and Metighs [4] concentrated on meta cognitive thinking – exploration, interrelations, applications, perspectives, empathy, and self knowledge, that have been commanded to asses creative products. The contemporary level of science development, computer technologies and the internet allow us to study the achievement of contemporary sciences as newly and speak of excellence of abstract knowledge. Thinking is of two levels, consisting of sensory perception, divided into senses, perception and representation, as abstract of thinking, constructs as notion, statement and inference. Every information of development fixed by drawing, as a process of information. people learned to fix their tough in time and in space. The issue of cognitive thinking will be depended in this research in order to declare the relation between creativity and human thinking and the impact of computer techniques in the all process [13].

3.2 Design process and architecture

The architectural design process is based on s creative phase, where creativity is highly valued, creativity is rich to simulate the decision – making process, and that rarely present in building design process as tool [6]. According to Chen [7] the value of design changed from aristocratic monopolism to more liberal, so the paradigm of design methodology itself has been changed.
Architectural education had left four systems which quite different. before the modern movement, and before the academic education on architecture, master – pupil system with the community – oriented view, that was responsible for data transition with little creativity. The opening of architectural schools and their head school of fine – arts in Paris (1795-1950), the traditional method had continued in a form of academic. Bauhaus school opening in Germany (1922-1933), was the pioneer of modern movement, their applied new approaches, including a reconciliation of art and craft in solving problems.
In the last half century – coinciding with post- modern movement developed. it is the time of pluralism of new system, emphasis on learning and motivation, apply models, such as team work. Creative teachers started with their creative process in a motivated and creative environment, that make learners thinking of creativity, high performance training experience, further professional of needing award of complexity and rapid changes [8]. Sternberg [4] provided general instructor guidelines in order to promote creative process in class room, including project-based learning and facilitation of student inquiry, and suggest an encouragement of idea generation, risk – taking, and tolerance of ambiguity.

Table 5 Declares the major indicators and characteristics of creativity [5]

indicators	characteristics
Fluency	Ability to generate a large number of ideas in response to open ended questions, or thinking process
Flexibility	Ability to shift the direction of ones thinking or to change one's point of view
Elaboration	Ability to add details and to expend ideas, and for making ideas richer, more interesting
Metaphorical thinking	Ability to use comparison or analogy to make new connections. To make the strange familiar or to make the familiar strange.
Originality	The ability to generate new and unusual ideas, to generate options statically in frequent

4. APPLICATION

The research application includes the following steps according to survey form questionnaire, and the method of selecting a group of (24) questionnaire subscribers, as bellow:
A- Many questions will be selected on three statements, depending on, cognitive variables, environmental variables, and personality variables, with relations of the cognition factors of creativity to test the impact of computer software programs as variables of computer techniques. The questionnaire depends on the variables of table (4, 5), as shown in table 6.
B- 12 members of architecture engineering students at the last stage (5th years), and 12 others of architects have been selected as sample. Form of (60) questions will deliver to see their replying of computer software techniques (CAD, 3DMAX, REVIT) on their thinking abilities of architectural design to generate forms.

Table 6 Declares the most important indicators, will depends in the investigation of the questionnaire, sources: the author depending on [1,5]

	variables	factors	Cognition factors	

Creativity	Cognitive variables	Intelligence Knowledge Technical skills Special talents	Fluency Flexibility Originality Elaboration Metaphorical thinking	Computer techniques and software programs
	Environmental variables	Political – religious factors Cultural factors Socioeconomic factors Educational factors		
	Personality variables	Internal motivation Confidence Non- conformity Creativity (trait)		

5. DISCUSSION & ANALYZING

By analyzing the results of the questionnaire that applied on the selected sample, the research reached the following according to the two groups:
-Fluency is of different impact on creativity according to the issue of intelligence, knowledge, technical skills, special talents by depending computer techniques according to architects, which extend to (41.6%,75%,83.3%,66.6%) percentage, and be (66.6%,58.3%,66.6%,50%) of students, as a matter of cognitive variables.
The results for architects was (75%,58.3%,66.6%,41.6%,), and for students was (75%,75%,75%, 58.3%) for the same items, as a matter of personality variables.
The result for architects was (16.6%,66%,75%, 91.7%), and for students was (16.6%,66%,75%,58.3%) as a matter of environmental variables for the same items. (Figure 2).
The impact of computer techniques and fluency descended in the item of intelligence as a matter of cognitive variables according to students’ questionnaire results, as a matter of cognition variables, and the same character in the issue of political –religious factors, as a matter of environmental variables.
-Flexibility is of different impact on creativity according to the issue of intelligence, knowledge, technical skills, special talents by depending computer techniques according to architects, which extend to (33.3%,50%,75%,66%) percentage, and be (91.7%,58%,58%,41.6%) of students, as a matter of cognitive variables.
The results for architects was (58%,50%,75%,41.6%,), and for students was (66.6%,50%,66.6%, 41.6%) for the same items, as a matter of personality variables.
The result for architects was (33.3%,66.6%,83%, 75%), and for students was (58%,75%,58%,83%) as a matter of environmental variables for the same items. (Figure 3).
The impact of computer techniques and flexibility descended in the item of intelligence as a matter of cognitive variables according to architects’ questionnaire results, and in special talents of students’ questionnaire as a matter of cognition variables. The same character in the issue of non-conformity factors, as a matter of personality variables, for both architects and students .it also descended in the item of political-religious factors for architects as a matter of environmental factors.

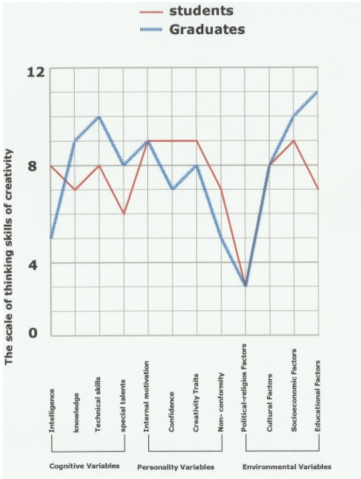

Figure 2: The Impact of Fluency

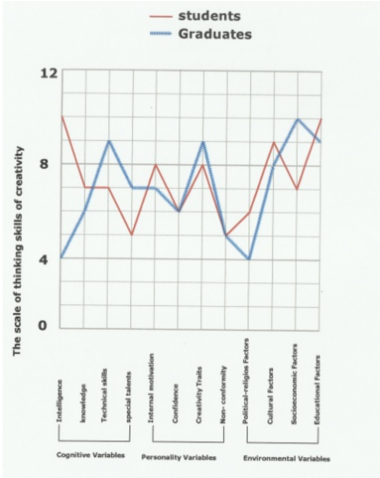

Figure 3: The Impact of Flexibility

Originality is of different impact on creativity according to the issue of intelligence, knowledge, technical skills, special talents by depending computer techniques according to architects, which extend to (58.3%, 75%, 50%, 58.3%) percentage, and be (75%, 58.3%, 50%, 41.6%) of students, as a matter of cognitive variables. The results for architects was (58.3%, 75%, 75%, 50%), and for students was (58.3%, 66.6%, 50%, 41.6%) for the same items, as a matter of personality variables. The result for architects was (16.6%, 75%, 75%, 75%), and for students was (50%, 100%, 41.6%, 58.3%) as a matter of environmental variables for the same items. (Figure 4).

The impact of computer techniques and originality descended in the item of political- religious factors as a matter of environmental variables according to architects’ questionnaire results. The same character in the issue of special talents factors, as a matter of cognitive variables, and non-conformity in the matter of personality variables for students.

-Elaboration is of different impact on creativity according to the issue of intelligence, knowledge, technical skills, special talents by depending computer techniques according to architects, which extend to (58.3%,75%,66.6%,50%) percentage, and be (58.3%,75%,58.3%,50%) of students, as a matter of cognitive variables.

The results for architects was (41.6%, 50%, 66.6%, 50%,), and for students was (50%, 75%,100%, 50%) for the same items, as a matter of personality variables.

The result for architects was (33.3%, 83%, 83%, 66.6%), and for students was (66.6%, 83%, 66.6%, 66.6%) as a matter of environmental variables for the same items. (Figure 5).

The impact of computer techniques and elaboration descended in the item of special talents as a matter of cognitive variables, and in political-religious factors according to architects’ questionnaire results as a matter of environmental factors.

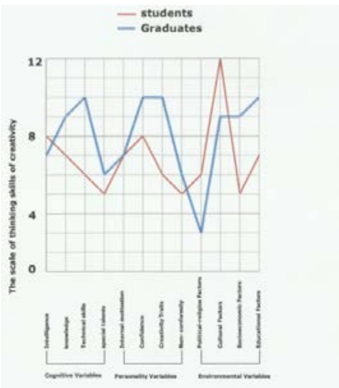

Figure 4: The Impact of Originality

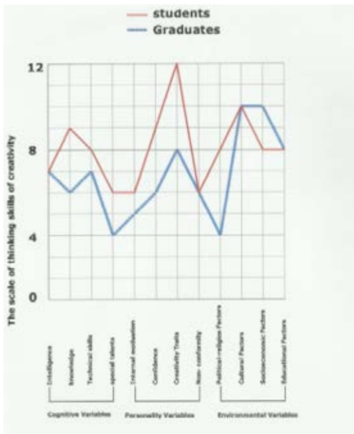

Figure 5: The Impact of Elaboration

- Metaphorical thinking is of different impact on creativity according to the issue of intelligence, knowledge, technical skills, special talents by depending computer techniques according to architects, which extend to (50%, 58.3%, 58.3%, 41.6%) percentage, and be (66.6%, 83.3%, 66.6%, 75%) of students, as a matter of cognitive variables.
The results for architects was (83.3%, 50%, 58.3%, 41.6%,), and for students was (75%, 58.3%, 58.3%, 66.6%) for the same items, as a matter of personality variables.
The result for architects was (33.3%, 75%, 75%, 83.3%), and for students was (50%, 58.3%, 83.3%, 66.6%) as a matter of environmental variables for the same items (Figure 6).
The impact of computer techniques and metaphorical thinking descended in the item of special talents as a matter of cognitive variables, in confidence and non- conformity as a matter of personality, and in the item of political- religious factors as a matter of environment variables according to architect’s questionnaire results.

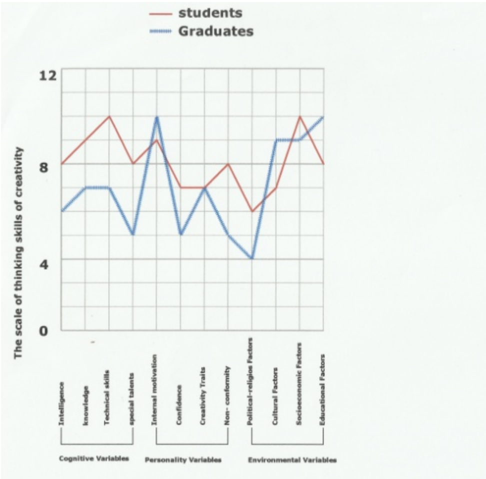

Figure 6: The Impact of Metaphorical Thinking

6. CONCLUSIONS

-Creativity importance increased according to the world shift of economic knowledge age, so creativity and its evaluation have been widely studied and subjected to critique by researchers and specialists for its importance and involvement of multiple epistemological, theoretical and methodological ties. The last phase of transformation depends on the creative problem – solving system. That phase depends ultra – cognitivism relates with individual recognition.
-Creativity and its conceptions are essential as standards to be part of skills communication for learning program, and the issue of creativity figurate the major role of quality assurance.
-There are two levels of creativity: first, as private one, that discovers new one called traits, which can lead person to produce novelty, and second; public one which is new to everyone, under the definition of achievements as novel in public sense.
-There are many major’s variables as standards and rules affecting creativity according to cognitive variables of (intelligence, knowledge, technical skills, special talents), personality variables of (motivation, confidence, non- formality, creativity of traits) and environmental variables of (political – religious factors, socioeconomic factors, cultural factors, educational factors).
-Computer techniques and software simulate brain neurosis of cognition factors through (fluency, flexibility, originality, elaboration and metaphorical factors) to produce creative design product.
-The impact of computer technique and software differ through design process. It increased in the issue of knowledge, technical skills, internal motivation, confidence, non- conformity, cultural factors but it decreased in the issue of intelligence, special talents, political-religious factors, special talents and traits according to fluency, flexibility, originality, elaboration, and metaphorical factors, according to the results of survey questionnaire.

-There is no matching between students and architects in the result of the questionnaire survey, according to the factors of intelligence, special talents, non-conformity, political – religious and socioeconomic factors according to their skills and training.

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Methodology for Determination of the Class of a Medical Device and the Common Requirements it Should Apply According to Regulation 2017/745

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ABSTRACT

The aim of the current publication is to address several important problems that the manufacturers of medical devices and conformity assessment bodies (notified bodies) face. Manufacturers of medical device are obliged by the current legislation: Council Directive 93/42 and will be by the upcoming regulation 2017/745 to assess the conformity of their products according to the mentioned normative acts. This is done by choosing the right conformity assessment procedures. The choice is determined by defining the class of the medical device, which is done by means of the classification rules. Practice shows that those rules are found to be in a way too abstract, so the manufacturer cannot understand their application in an adequate way. The same could be stated for the official manual guides, so classification of medical device is considered an important issue. Similar issues occur when determining the adequate application of common requirements to a particular medical device A solution to these problems is provided by developing a methodology for determining the class of the medical product and the common requirements that it should satisfy. With this methodology, the necessary initial information is obtained in a clear and certain confident way, so the collection of the documentation necessary for the establishment of the content of a technical file follows clear rules. For establishing this methodology, medical devices are divided into three domains: groups, types and sorts. The relationships between them is described in a logical model that finds its expression in a block diagram following certain algorithm, which can be manifested in practice incorporated in a relational data base system. This endeavor sets the foundation for the developing of a comprehensive system for complete normative providing of medical device products.

Key Words: medical device, regulation 2017/745, classification, methodology.

1. INTRODUCTION

The human body is the most complex system of organs, and processes in them that is known. The latter are characterized by exceptional variety. Modern medicine studies physiological processes (both in normal and diseased) and the ways in which they can be treated. Engineering scientists, on the other hand, aim to help by designing products that make such an impact possible. Assuming that any medical device used in practice - whether single or serial - is a unit, then, according to data from [1] to 2018, the sum of all medical devices placed on the market is nearly 500,000. This is a huge amount that needs detailed systematization to be covered by the regulatory requirements of European technical legislation whose primary purpose is to ensure safety in achieving the intended purpose. Because of the extreme variety of the different medical devices (due to the above-mentioned complexity of the human organism) their systematization on this criterion is not only difficult, but also inexplicable from a practical point of view. Achieving a high level of safety is obtained by controlling the means the target of the product is achieved. It is this criterion that distinguishes the characteristics according to which the medical devices are classified into groups, types and types.

2. ESTABLISHING DOMAINS OF MEDICAL DEVICES

2.1 Establishing a domain of groups medical devices

In the classification rules of normative acts [2], [3] as well as in explanatory documents such as [4], 5 groups of medical devices are described. Their systematization is shown in [5]. The criterion by which they fall into these groups is the way to achieve the goal of the product. In Figure 1 is a schematic view of how the set of the group is formed. All medical devices from 1 to n (which may be thousands or tens of thousands) that can be said to not penetrate the human body fall into the group of Group 1. The finding in this statement does not require any in-depth knowledge of medicine, nor specific technical competence. Similarly, the other four groups are formed. Determining where a particular medical device belongs to depends on the truth of the following statements relevant to it:

- • The product penetrates the human body non-surgically;
- • The product penetrates the human body surgically;
- • The product is active (uses electricity);
- • The product is specially designed (combines the above statements).

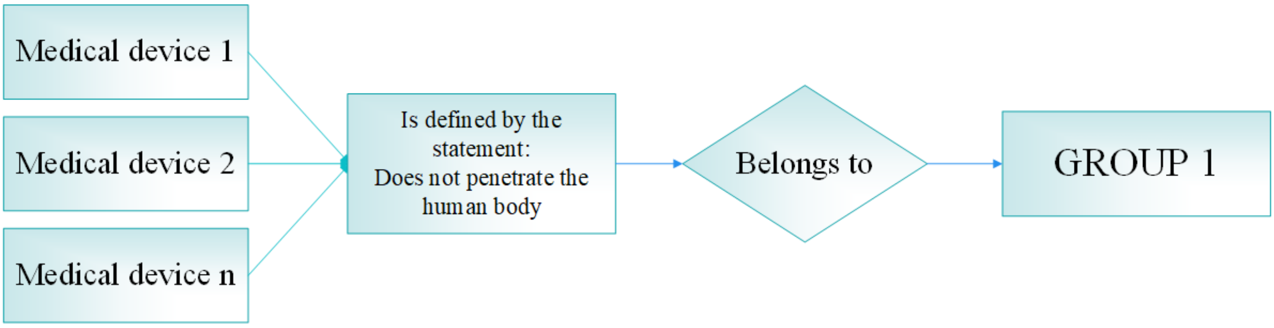

Figure 1: Determination principle of forming the content of a group of medical devices

2.2 Establishing a domain of types of medical devices

Classification rules whose general description and attitude to the groups is presented in [5]. In the table 1, there are five medical devices falling within the scope of [3] and divided into three classes: IIa, IIb and I. By their very nature, both as a purpose and as a technical device, they differ significantly. However, the rule generates a generalized statement, which covers all of these items: "Carries or stores parts of the human body - liquids, organs, tissues, etc.“. This statement is the criterion of belonging to the rule. For each of the 22 rules of [3] there is an affirmative statement. An exhaustive list of all 22 statements is presented in [5]. The authentication of each of them also does not require any particular technical competence. In conclusion, each rule forms a plurality of medical devices that are designated as type and are numbered 1 through 22. In Figure 2 is a schematic view of how a type of medical device is formed (the approach is analogous to the one for determining the groups).

Table 1 Medical device, classification rule and class

Medical device	Rule	Class
Devices intended to be used as channels in active drug delivery systems, e.g. tubing intended for use with an infusion pump)	2	IIa
Devices that provide a simple channeling function, with gravity providing the force to transport the liquid, *e.g.* administration sets for infusion	2	I
Devices intended to be used for a temporary containment or storage function, *e.g.* cups and spoons specifically intended for administering medicines	2	I
Syringes without needles	2	I
Blood bags	2	IIb

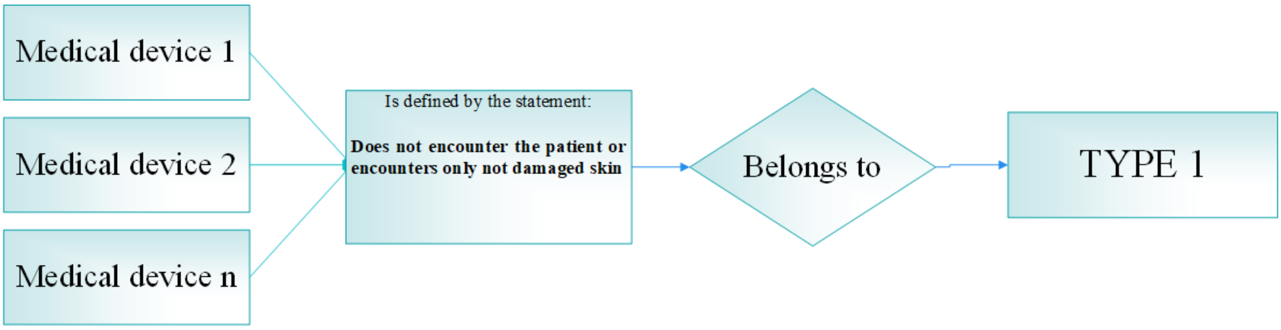

Figure 2: Determination principle of forming the content of a type of medical devices

2.3 Establishing a domain of sorts of medical devices

Any sub rule within a classification rule indicates an attribute identifying the membership of multiple medical devices falling within a particular class as specified in [6]. It puts this statement on certain medical devices, thus defining a new set called "Type of medical device". In Figure 3 is a schematic representation of the species designation and an example of medical devices complying with the requirements of sub rule 3.1. The sum of these sets is equal to the set of the type that is determined by the rule itself. The way of identifying the types of medical devices is analogous to the above mentioned, acting in the formation of the groups and types.

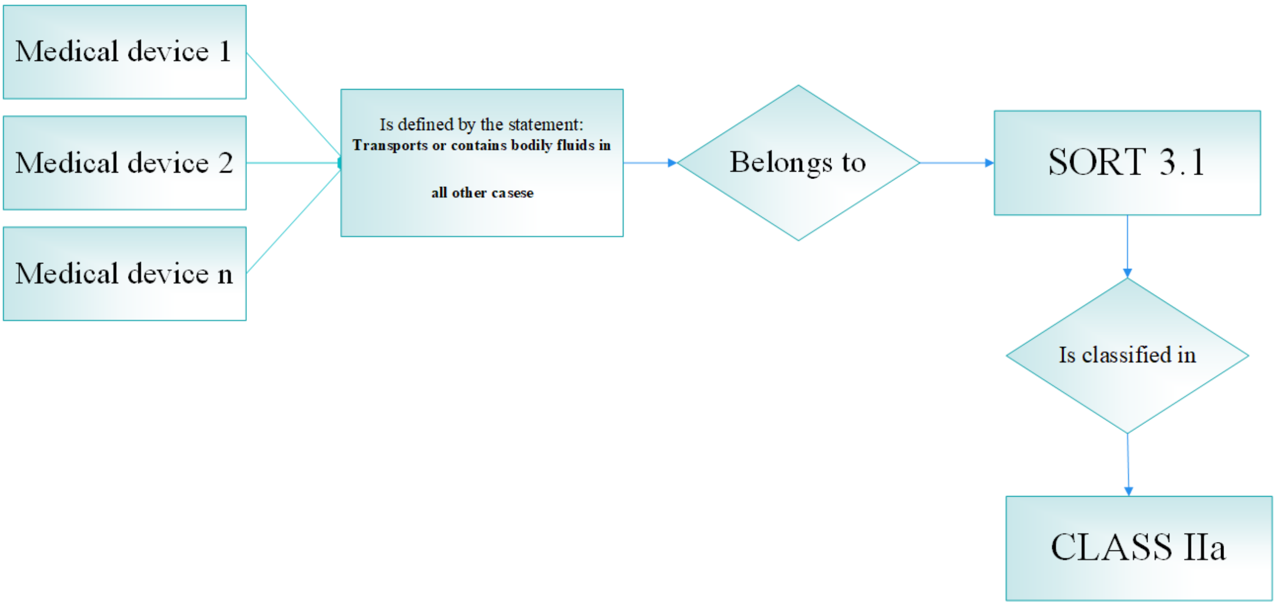

Figure 3: Determination principle of forming the content of sorts of medical devices

2.4 Establishing a domain model from groups, types and sorts of medical devices

After the analysis of the formed groups, types and sorts of medical devices it is considered that, the number of groups is the largest, followed by the number of types and sorts. The criteria for belonging to the groups is the most common, and the one for the sorts - the most specific. Also, the content of a group of medical devices completely contains the content of several types of articles, and a type of article contains several sorts of articles. In Figure 4, this relation is plotted, for example, Group 1 is used. Its set consists of the sum of the sets of Type 1, Type 2, Type 3 and Type 4. Each of the types contains the sets of the sorts that make it up. For example, the Type 2 set is composed of the sum of sets of sort 2.1, sort 2.2, sort 2.3, sort 2.4, and sort 2.5. The other 4 groups are structured in a similar way.

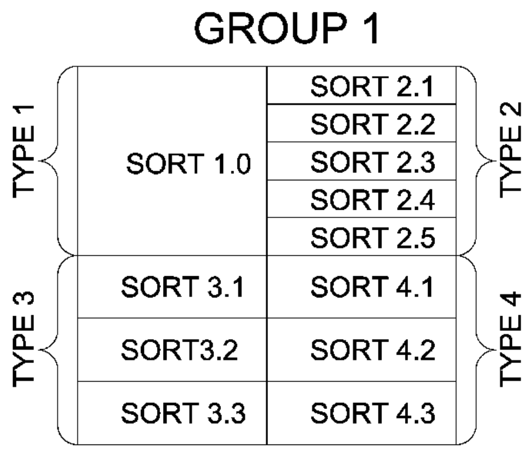

Figure 4: Content of the domain of Group 1

Any medical device the conformity of which has to be assessed has a purpose and one or more ways to achieve that purpose. For example, the purpose of the body thermometer is to measure the temperature of the body. The ways of achieving this goal, which depend on the technical layout of the particular device (the thermometers may be several types depending on the location in the human body where the measurement is performed) are placement on the patient's skin without penetration into the body or in oral cavity. The latter creates a greater risk of fracture and malfunction. This example shows that to achieve the safety of the products it is not so much their purpose as the way of its achievement.

Based on similar examples and the studied relationships between the sets of groups, types and sorts of medical devices, a domain model is described, as a block diagram, for determining the belonging of a medical device to a group, type and sort. The model is shown in Figure 5.

3. DESCRIPTION OF A METHODOLOGY FOR CLASSIFICATION OF MEDICAL DEVICES AND DETERMINATION OF THE COMMON REQUIREMENTS THEY SHOULD APLY

The methodology is a follow-up of the steps of the domain model depicted in Figure 5. For example, the following medical device is taken: wound patch. For ease of reference and traceability, claims to which the product positively responds are presented on the scheme in purple blocks; the group, the type and the sort in which they fall - in green; the class is in orange and the general requirements to be met in beige.

The steps are as follows:

- First step - the 5 statements as specified are used to identify the group. Only the claim to Group 1 happens to be the truth about this medical device.
- The second step - the type of the article is determined by the four statements, of which only that "contact with injured skin" corresponds to the truth.
- The third step - the sort of the article is determined by the statement of the 3 presented, which corresponds to the truth, therefore the product is of sort 4.3.
- Step Four - Determine the class of the product. All products that happen to be determined by sort 4.3 products are of Class I.
- Step 5 - Define the general requirements of [3] that the product should meet. The relationship between type and general requirements is described in [6]. For the specific product, these are paragraphs: 10 (Chemical, Physical and Biological Properties) and 11 (Contamination and Microbial Pollution). After passing the five steps, all the information necessary for the complete regulatory provision of the medical device is determined. The scheme shown in Figure 5 is incomplete due to the multiple branches that have to be depicted for each type and sort. Nonetheless, following the above steps makes it possible to easily determine the belonging of each medical device to the respective group, type and sort.

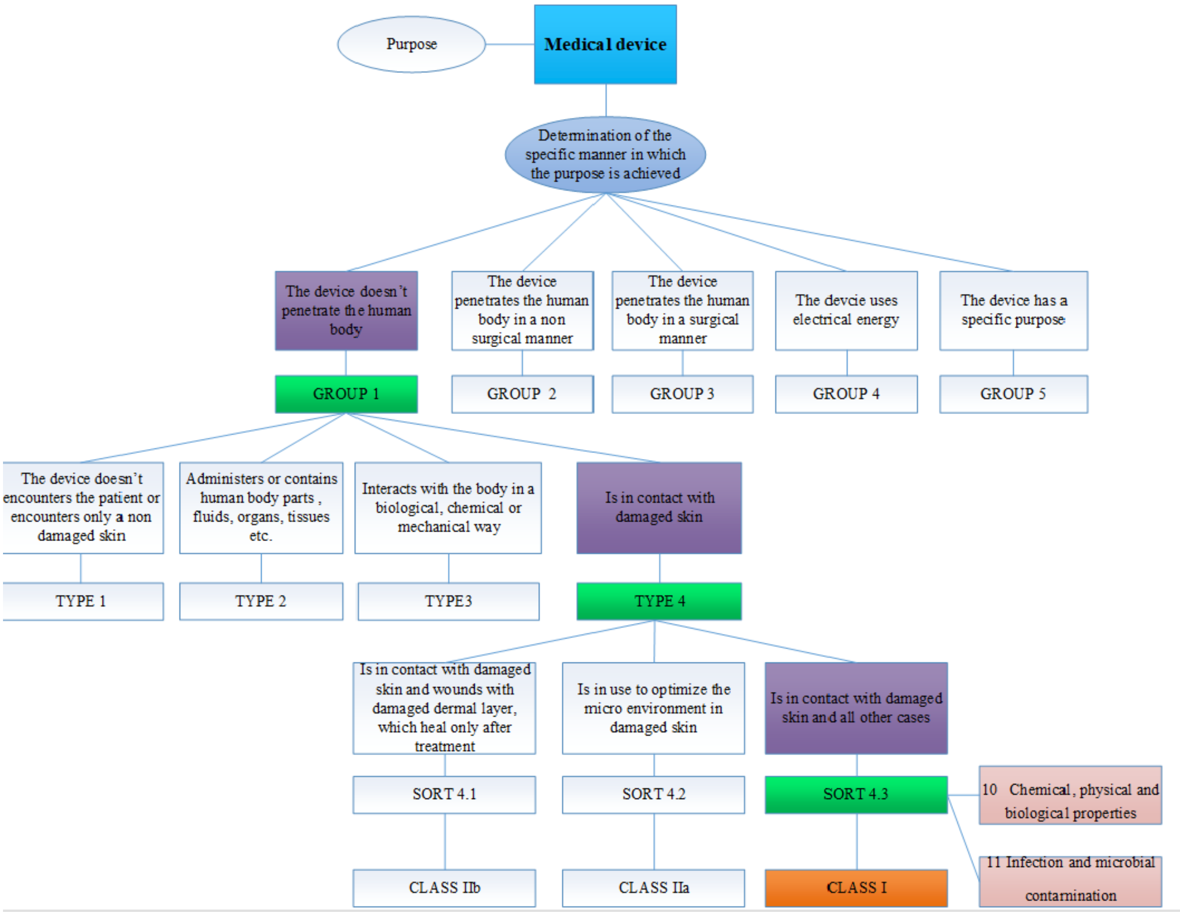

Figure 5: Methodology for classification of medical devices and determination of the common requirements they should apply

4. CONCLUSIONS

Systematizing in groups, types and sorts of medical devices together with the domain model developed through their relationships and following its steps creates a methodology for determining the class of each individual product and the general requirements that it should apply. The methodology is to help:

• Manufacturers of medical devices, laying clear steps to follow the mandatory regulatory provision of their product;

• notified bodies - does not require the use of specialized knowledge and skills, thus allowing an auditor to assess the conformity of a considerably wider range of products than those for which it has technical competence.

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Education about Standardization in Developing Countries within the Framework of the National Quality Infrastructure and its Implementation

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ABSTRACT

In this era of rapid regional integration, growing international trade and increasing expectations of consumers, market entry requires conformity with technical legislation and evidence of such compliance through an internationally recognized accreditation system of conformity assessment bodies. That necessitates the strengthening and, where needed, the establishment of internationally accepted infrastructure for standardization, technical regulations, SPS measures, accreditation, conformity assessment and metrology. That is why, all countries, strive to share the benefits emanating from the opportunities offered by the implementation of common markets (EU, ECOWAS, EAC, ASEAN, CARICOM, etc.).

In our paper, we will try to describe how the developing countries are seeking to increase the level of knowledge in their countries and have been promoting the development of standardization despite the fact that are facing difficulties in achieving the goal. Most of the developing countries are facing significant challenges in securing qualified human and financial resources to be dedicated to the National Quality Infrastructure - NQI. In order, for companies in those countries, to export, products, and services, producers must meet the demands of the target markets regarding quality, safety, reliability, environmental compatibility and hygiene and they must be able to provide credible proof of this. A prerequisite is thus the existence of a national quality infrastructure that meets international standards and that monitors the production chains and furnishes the proof required. We will describe the importance of implementation of the NQI and the significant role of standardization.

The challenges for developing countries in the implementation of the NQI and the education on standardization are language barriers, lack of proper facilities and educators, Emigration and the Military and conflict (i.e. in Africa, according to UNESCO, is the most significant threat to education). ISO and its national standards bodies (NSBs) are, therefore, keen to support academic institutions in their efforts to enhance the role of standardization and the education about standardization in the developing countries.

Key Words: Education about Standardization, National quality Infrastructure, Developing countries.

1. INTRODUCTION

Standardization is a naturally occurring activity that predates human history. In his theory of evolution, Darwin described the cycle of biological evolution as the result of two contradictory forces: random mutations that diversify the living species and natural selection wherein only those mutations that are best adapted to their environment survive. Therefore, standardization is nothing more than a “selection” activity, the act of simplifying a phenomenon that would otherwise grow more complex if left to its own devices [1].

Protypation as a creation of standardized products, actions and services in all sciences should be human centred. We shouldn’t although remain only in the human, we shouldn’t forget, that next to human, is a NATURE as an object of standardization and Protypation because nature also creates protypes/standards like for example the shape of human (two eyes, ears etc.) and others.

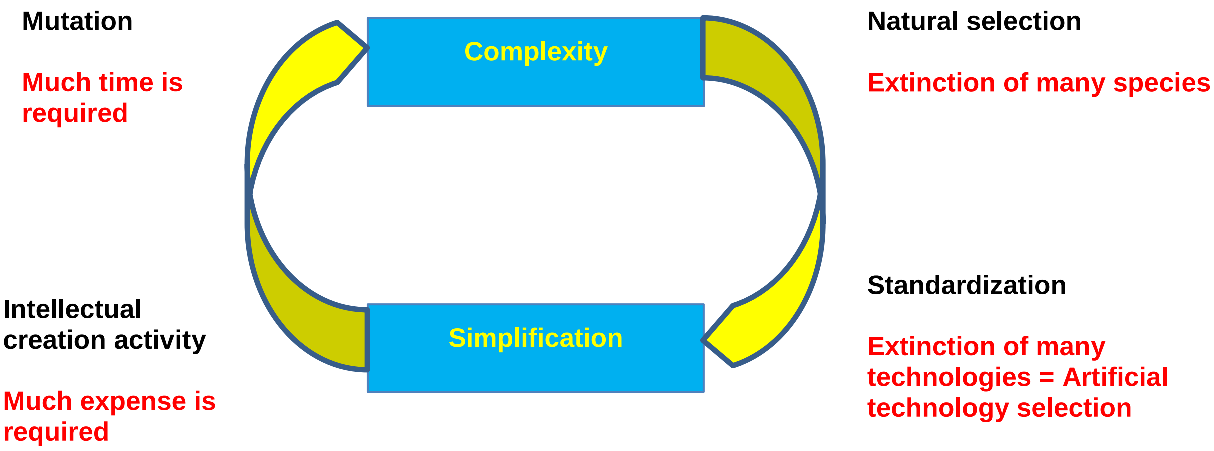

Figure 1: The role of Standardization [1]

If we take under consideration the given definition of protype/standard we will see that the observed and repeated natural procedures and objects, practically have been standardized by Nature without the participation of human and society but are open for study and comprehension/understanding.

There are numerous examples of naturally occurring standardization in human history: language, writing, many forms of tools and implements, and ceremonies and other social rituals. Through countless iterations and experiences, these aspects of life were gradually standardized and spread from person to person across broad geographical areas. “Language” is a salient example, illustrating both the benefits and limits of standardization. While languages have attained a very sophisticated level of standardization within certain well-defined areas, several hundred languages are still in use in the world today [1].

We are surrounded by protypes/standards and have grown so accustomed to their existence that we do not observe them and do not think of their significance and their value. This way, for example, our attitude in relation to our fellow human submits to the conventions. Our language is a combination of symbols and notes which reflect the sequence of thought.

We should mention that the furthermore technologenic development of our society should take under consideration the need for process of approaches and environment protection methods and the reservation of human safety. Safety which will derive from the quality of life [2].

With human society growing more sophisticated, humans began to make use of standardization deliberately to build the underpinnings of their societies and cultures — counting systems, weights and measures (units of length, volume, and mass), and currency systems were needed to negotiate the trade of goods. When we speak of “standardization” today, we generally refer to this type of man-made activity. Manmade standardization has a direct connection to the establishment of civilizations and rise of state power [1].

With the methods of Protypation, reservation of the quality of life is proposed for the following four fields:

- For the environment,
- For humans,
- For the resources and
- For Production.

A standard is a reference document approved by a recognized standardization organization (ISO, IEC, CEN, CENELEC ...). It stems from voluntary elaboration by consensus between all stakeholders in a market or a business sector, grouping for example producers, users and consumers. In particular, a standard makes it possible to clarify and harmonize practices as well as to determine the level of quality, safety, compatibility, performance, environmental impact for products, services, methods and processes. Other types of reference documents are also developed by recognized standardization organizations and consortia or joint ventures may solve some special cases. This form of cooperation results in standards aimed at asserting and establishing a company's own technology among the competition on the market. Knowing and being able to apply the standards is a requirement for all professions. These are tools for the regulation, but also an expression of the state of the art. Standards facilitate commercial exchanges and make daily life easier. For companies, standards are therefore strategic tools that can open, develop, regulate or close the access to a market. The benefits of participating in standardization committees are numerous, such as for example [3]:

- Influence the contents of a standard
- Enhance and protect companies' activities and products
- Acquire a better understanding of the actors of the market (competitors, partners, customers, users, authorities, laboratories, …)
- Anticipate and develop future requirements for the market
- Encourage innovation

The need for education and training in Standardization is a strategic asset for companies, industry sectors, countries and regions. All level of decision-makers in public administration and private business need to understand the economic benefits of standardization. Standardization should be perceived as strategic tool to strengthen professional performance and to drive the economy, innovation and thus the competitive positioning of each enterprise. Employees of public and private organizations should be trained to use standards as means to strive for performance excellence [3]. These opportunities are not seized because of a lack of awareness of the importance of standards. A next reason is insufficient ability to transform awareness into relevant actions. Education is the solution to both of these. This applies both to formal education at different levels (from secondary schools up to universities), continuing professional development and in-training (life-long learning). We observe a growing awareness of the need for standardization education.

As we said, standardization is simplification. The foundation of standardization is simplifying certain things that would otherwise grow complex if left alone, thereby raising the degree of interoperability among tilings. Simplification brings about cost efficiencies and increased convenience. Looking at it another way, standardization means taking the middle way. Standardization is the act of finding the mean or average of competing ideas and consolidating them into one to simplify two things or several things [1].

A standard is defined by the WTO TBT Agreement as a:

Document approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for products or related processes and production methods, with which compliance is not mandatory. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method

The nature of standards is voluntary, and therefore it is essential to ensure support from the farmers and industry for the use of them.

Standards to be drafted by parties of interest, engaging the experts in the areas concerned (farmers, producers, users, consumers, traders, laboratories, inspectorates, etc.). If there are divergent views on the contents of the standard a consensus should be reached with balanced and effective approach, not undermining the objectives of the introduction of a new standard. An important step in developing standard is in relation to validation, which includes consultation at national and international level to ensure that the draft standard conforms to the general interest, judging comments and finalizing the text. As defined by the TBT Agreement, only recognised body can approve standards, so approval of the text for publication as a standard is another step, however, not final in the life cycle of a standard development, as it must be reviewed periodically to detect if there is a need for adaptation to any new developments. Following a review, a standard may be confirmed without a change, be revised or withdrawn [4].

According to the TBT Agreement the definition of the “Technical Regulations” is:

Document which lays down product characteristics or their related processes and production methods, including the applicable administrative provisions, with which compliance is mandatory. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method.

A precise estimate of the impact of standards and technical regulations on international trade, it is difficult to establish [4]. What we could conclude with certainty is that compliance with different foreign technical requirements involves extra costs for producers and exporters. In general, the costs are associated with translation and understanding of the requirements and necessary adjustments of production facilities to comply with them, as well as to proof of such compliance.

As far as it concerns the standards and technical regulations, they set out specific characteristics of products – such as size, safety, design, functions, performance, the way it must be labelled or packaged before it is put on sale. In fact, the way an agricultural or food product is produced affects those characteristics, so, it is more appropriate to draft technical regulations and standards in terms of a product’s process and production methods rather than its characteristics per se [4].

2. QUALITY INFRASTRUCTURE

Quality Infrastructure is a complex network which includes different functions to assure and verify the quality and environmental impact of services, products and processes. Metrology and standardization, together with accreditation, form the foundations of quality. Their importance, as a whole philosophy and day-to-day practice, extend to all sectors of the economy and society in general. The creation of a protype, standardization and finally quality, are not the works of a few people but should be a tool, which is offered to all and should be provided by many [2].

NQI requires at least, access to a national standards organization; it will support setting up standards, give access to existing standards and, more important, it can help entrepreneurs in the use of standards to meet the requirements set up by their national and international clients.

A national metrology institute is another requirement; it is the custodian of the national measurement standards with their international traceability and it transfers this traceability to secondary and industrial measurement standards as well as eventually offering reliable calibration services at a reasonable cost. The third indispensable entity is a national accreditation body; its aim is to ensure the technical competence of laboratories of inspection bodies, and of the quality certifications granted in the country [3].

What is a quality infrastructure? Metrology, standards, testing and quality management are vital to products and product processes although consumers are not always aware of it. Yet these same consumers often use quality marks from product certifiers as a guide when making purchasing decisions. And their attention is drawn to the area in a negative way when, for example, technical equipment cannot be connected up abroad.

As we wrote above, a National Quality Infrastructure (NQI) is a highly integrated network of people, systems and organizations involved in the research, definition, development and promotion of quality goods, services and processes [5].

The diagram below (Fig. 2) shows the connectivity between the different parts of the NQI and the resultant impact on and from both the supplier and the customer.

Standards, Metrology and Accreditation are the pillars upon which Conformity Assessment activities are supported. Conformity Assessment procedures confirm compliance to standards through measurement and audits performed by technically competent persons and/or bodies. This proof of compliance is then used by both customers and suppliers to make decisions for doing business.

QUALITY INFRASTRUCTURE - QI (SMTQ)

Standardization = Definition of properties, dimensions, tolerances, etc.

Metrology = Guarantee of exact and reliable measurements

Testing = Analysis of properties, ingredients, characteristics, etc.

Quality Management = Reliable application of quality standards

Certification = Conformity with requirements defined in standards

Accreditation = Recognition of technical competence

Figure 2: Quality Infrastructure

As long as international trade was limited, and manufacturers and suppliers came from the same economic zone, no driving force existed to harmonize standards and measuring units. Nowadays, the impacts of the steady growth of global trade are more and more visible and many firms and industries now have organizational structures that extend across national and regional borders. This has led to the formation of truly global-scale economic systems; today, the process of economic development cannot be isolated from these global systems [6].

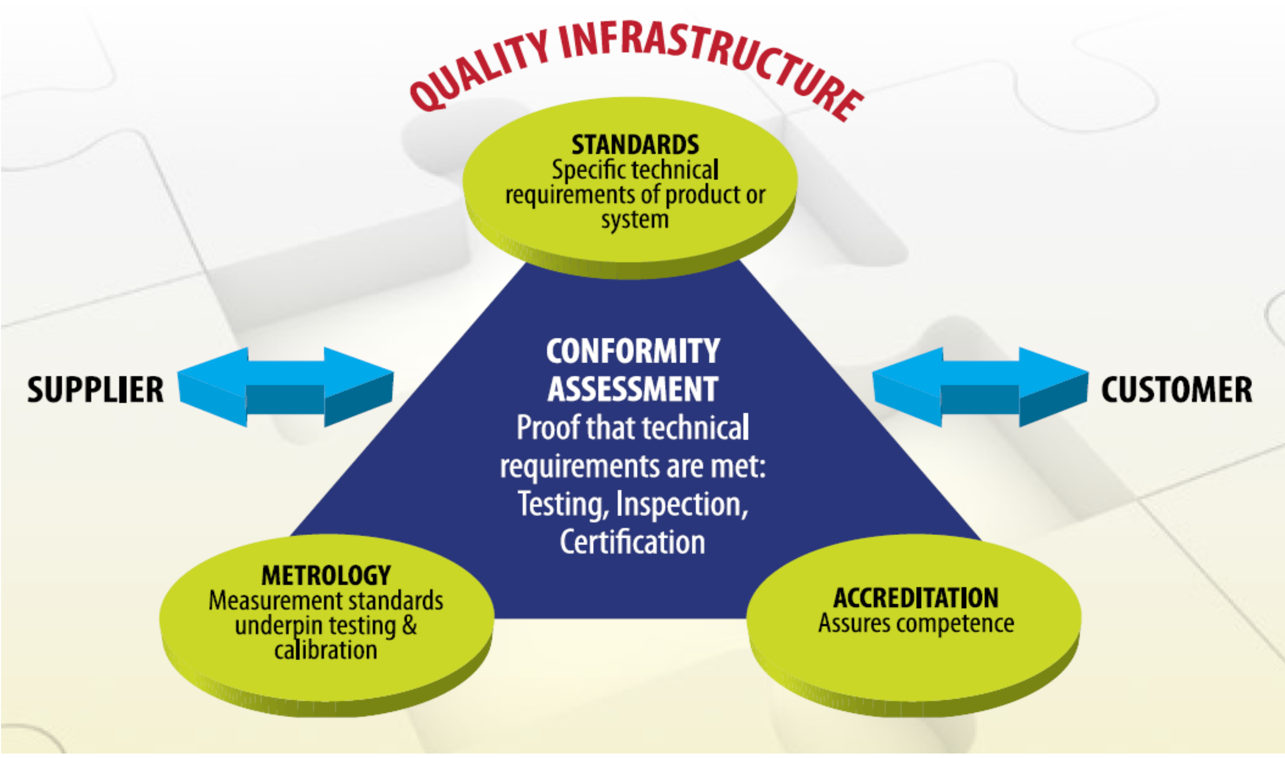

Figure 3: Connectivity of different parts of Quality Infrastructure – QI [6]

Industrialized countries have had centuries to improve and come up with functioning metrology, standardization, testing and quality management systems (known as SMTQ or similar abbreviations). By proving their technical competence through several means of evaluations and comparisons, they have achieved multilateral recognition.

In contrast, to compete with their industrialized counterparts, developing economies have to catch up fast in all relevant fields of export requirements, food safety, consumer protection or health issues. However, a realistic view shows in many countries a fragmented and uncoordinated system, with unclear responsibilities, either accepted only for certain components on a bilateral basis, periodically inspected and supervised by the importing country, or simply not recognized internationally [7].

Quality infrastructure relates to all fields of metrology, standardization and testing systems, quality management, and conformity assessment, including certification and accreditation. The concept of "quality" with its entire implications still has to be established in developing countries to protect their citizens from fraudulent trade and to open up new market opportunities. A good quality policy comprises legal and institutional framework conditions which assure compliance with and verification of internationally accepted standards and technical regulations in order to secure fair and safe trade. All quality infrastructure issues include the following activities [2,7]:

- the establishment of a legal framework for a regional QI,
- the development and harmonization of standards,
- reciprocal recognition of quality assessments
- the establishment of internationally recognized accreditation systems

Metrology and standardization are undoubtedly the cornerstones of quality. However, the day-to-day promotion of regional cooperation in the field of QI requires practical actions. Some of them could be along the lines proposed below:

- The formal establishment of a central cooperation on Metrology, Accreditation, Standardization and Quality, with the purpose of aligning and promoting relevant activities
- Provision of assistance to those less developed countries, to gain international (or mutual) recognition where needed
- The implementation of formal training programs provided by the more developed states in the region, for regional technical specialists to become internationally recognized specialist in QI related activities

The development, promotion and well-functioning of Quality Infrastructure (QI) in developing countries is very crucial for strengthening the domestic private sector export competitiveness and protecting the safety of consumers. Apart from the Governments and the Donors, a third force Quality Infrastructure Civil Society is needed in the countries to efficiently advocate and champion the development, promotion and well-functioning of the Quality Infrastructure

The following obstacles and constraints which are militating against the development and well-functioning of Quality Infrastructure (QI) in developing countries:

1. Lack of Quality Policy to lay the foundation, strategy and framework for the development, functioning and promotion of National QI.
2. Compatibility with International Standard Requirement-Most of the times the Quality Infrastructure (QI) legal systems in developing countries are not in compliance with the required standard set by the international QI bodies and experts.
3. Problems with respect to preparation and implementation of Technical Regulations. For example, who should develop the content? How should the content look like? Who should supervise the implementation and the level of participation of the private sector in the preparation of Technical Regulations?
4. Insufficient Metrology for National Measurement Reference Standards.
5. Insufficient accredited Calibration Laboratories.

6. Lack of accredited Laboratories for product testing, material analysis and health.
7. Lack of effective coordination among QI Institutions such as standardization, metrology, accreditation, regulatory authorities, inspection and supervisory mechanisms which result in inefficient use of competences and resources.
8. Insufficient information and documentation for the QI.
9. Multiple inspections, overlap between various QI.
10. Funding for the development, implementation and promotion of QI in developing countries is not sufficient which makes the long term commitments towards the development, promotion and sustainability of QI in these countries unachievable.
11. Know-how gap and capacity development-lack of know-how on QI; lack of experience in the operation of SMTQ organizations and conformity assessment schemes; lack of trained staff for the use of measurement equipment; lack of experience for standard development and preparation committees; lack of experience of assessors in accreditation; lack of trainers for trainees and lack of long-term consultants with proper knowledge.
12. Lack of awareness of the importance of a sound national QI which is a very frequent phenomena in developing countries.
13. Conflicting and inexistence of legislations create role conflict, lack of transparency, inefficiency, abuse, corruption and waste of resources

The establishment of a functioning and internationally recognized national quality infrastructure, with metrology forming an essential part of it, is crucial for developing countries. A functioning quality infrastructure becomes a key area for the ECOWAS, EAC, ASEAN, COMESA, GCC, etc. integration. So, it is fair to stipulate, that **quality is the reflection of a country's capability to effectively integrate technology with management** [2,5,7].

Growing participation of developing economies in global markets brings with it the need for these countries to demonstrate the conformity of the products produced by their industries with standards and requirements of their customers. Quality Infrastructures – (QI) are the main tools to support the manufacturing and placing on the market of products ensuring the protection of the consumer, the user and the environment. Technical regulations and Standards, including QI, however may have far reaching consequences going beyond the mere aspect of safety, and can play a major role in the economy of a country [2,7]:

- Properly used, a QI system can become a tool promoting competitiveness of enterprises, encouraging innovation and facilitating integration in international trade;
- Incorrectly used, a QI system (especially with Technical regulations) can create burdens to the industry, barriers to international trade and overall negative conditions for the competitiveness of the economy.

A national quality infrastructure is essential in breaking down technical barriers to trade.

In this sense, standards serve, for example, to describe the state of the art, point technical developments in the right direction at an early stage, define the requirements to be met by products and procedures, facilitate the interchangeability of technical components and set technical specifications for product testing. This gives market participants a uniform basis for assessing product quality and for goods to be labelled accordingly. Standardization promotes the rapid spread of technical knowledge and thus helps to make enterprises, particularly small and medium-sized, more competitive and innovative [7].

As a part of the mandatory technical regulations, standards are an integral component of the economic and legislative system and a basic element in such important areas as environmental protection and health and safety at work

The main tasks of a **standardization organization** are the support of the standardization process, harmonization and coordination (e. g. with current working standards). There are often systems in place, run by the private sector, thus ensuring a strong involvement of industry and other interest groups.

Another QI component is **Metrology**:

- The increasing globalization of trade and the emergence of new knowledge-based industries will increasingly depend on highly precise measurements to support their growth
- Measures are not a natural phenomenon. They have to be defined, described and made known

Nowadays, these are the tasks of a national metrology institute. Measures are disseminated to users on a voluntary basis via a network of calibration laboratories, which have normally undergone a process of accreditation as proof of their competence. In the field of legal metrology, this task is also performed by the verification service that checks measuring instruments subject to legal control for compliance with the regulations, provides identifications, and punishes infringements [5].

Testing: Protective provisions and standards are meaningless unless testing is carried out to ensure that they are being complied with. The tests are as varied as the areas that must be regulated.

Conformity assessment is based on systematic testing to examine whether a product or a process fulfils certain requirements as specified in standards or normative documents. There are also standards defining the requirements for the conformity assessment authorities. If the test has been carried out by an independent third party, a conformity certification is issued. This is different from the conformity declaration made by manufacturers or by the customer, for example as part of a supply agreement. Often, declarations or certification of conformity must be provided before a contract is concluded or before a product is brought to the market.

For instance, the CE mark denotes that a product meets European Union (EU) standards and facilitates free trade within the EU of products bearing this certificate.

Through assessments, **certification** confirms conformity with requirements defined in written standards. Recognition can be achieved by using standards and assessment procedures which are implemented worldwide (ISO-Standards, Codex Alimentarius recommendations, etc.). Similar to the situation described for testing and calibration laboratories, a third-party assessment of the competence of the Certification Body and regular surveillance visits by an accreditation body will confirm reliability and facilitate international recognition [2,5,7].

Accreditation and Certification are often confused or seen as equivalent, which is a misconception. Accreditation is much more than a certification. Although some procedures are similar, an accreditation contains an additional component which can be derived from the word itself: to give "credit" requires first to find out if the person, institution or laboratory is creditworthy, i.e. can be trusted regarding its competence. This cannot be noticed by just following a checklist to confirm compliance with a standard. To prove technical competence, it is essential to assess not only the correct implementation of the quality standards but also to evaluate the capabilities and the technical results.

The primary objective of a National Quality Infrastructure is to ensure that goods and services emanating from or traded in a country are designed, manufactured and supplied in a manner that matches the needs, expectations and requirements of the purchasers and consumers as well as those of the regulatory authorities in the local and in the export markets.

3. EDUCATION ABOUT STANDARDIZATION

Standards are applied in all facets of life:

- Technical (e.g., engineering, manufacturing, architecture)
- Social (e.g., law, health, governance, social relations, social responsibility, etc.)
- Economic (e.g., trading systems, services, goods, processes, manufacturing)
- Political (e.g., elections, party organizations)
- Religion (e.g., belief systems, halal, kosher)
- Environment (e.g., certification, sustainability, protection, waste disposal)

Choi & Vries [8] define standardization education as education about technical standards, their development process, their application and impact.

Education is a social infrastructure which enables citizens to prepare for intellectual and professional life in a society. As result **students** in schools or universities ought to be educated about the fundamentals and implications of standards and conformity assessment to prepare them for their career in government, businesses, standards, and conformance-related organizations or research institutions [9].

The main problem is that in mostly developing countries Graduates from schools or universities have hardly heard about standards and conformance in their classes; they rarely recognize its importance or impacts in the real world, and they are not ready to quickly adapt themselves to relevant job requirements like developing technical standards, or business strategy or trade/regulatory policy related to standards and conformance, which they are nevertheless required to understand. In most cases, older more experienced engineers that also had little formal training in the standards field mentor them. Poor practices are then handed down from one generation to the next. A clear manifestation of these bad old habits can be seen in the building and construction industry where the older engineers will issue specifications based on obsolete colonial era standards [9].

That's why the role of QI institutes and especially of the National standards Bureau/Organizations (NSB's) becomes very important in order to encourage or undertake educational work in connection with standardisation. Public spending on education about standardization shall be increased in most countries. The governments of the developing countries must assess their country's priorities and needs and invest in areas that will foster innovations and help to build a skilled and educated workforce. Public-private partnerships will bolster public education budgets to garner improvements in the overall education system. This will help developing countries to face a severe shortage of highly-skilled talent. Governments must make a concerted effort to correct a serious mismatch between skills of graduates in the field of education about standardization and the demands of a local and global workforce.

4. CONLUSIONS

The National Quality Infrastructure aims at establishing a framework for the development and operation of a suitable, relevant, effective and efficient quality infrastructure to facilitate trade, to protect the consumer, the general public and the environment, and to promote fair competition and sustainable economic development.

A National Quality Infrastructure has the very important role to harmonize and coordinate all other policies that address standardization and technical regulation in whatever form. It should also ensure that standardization and technical regulation is provided to all of these other policies in a holistic, effective and efficient manner instead of in a fragmented way, which in the end is very expensive to establish and maintain.

For Education about Standardization within the framework of the NQI, effective initiatives can be (and often are already) pursued by NSB's in developing countries with very limited resources, operating in difficult conditions and missing real support or recognition by public authorities. The scale and the impact of such initiatives vary greatly and obviously, the availability of resources and support from public authorities and other key stakeholders makes a big difference. However, we wish to underline the fact that any NSB, no matter how serious the limitation of resources or other obstacles, can make useful and important progress in this area, by setting realistic objectives and adopting a proactive approach. Public-private partnerships will bolster public education budgets to garner improvements in the overall education system.

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Brain Machine Interfaces a Solution for Impaired People

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ABSTRACT

Brain machine interfaces have started to expand into a solution for many diseases, which affect any nervous damage, with electrodes that activate and recover the damaged parts of the nervous system. As computing power and software capabilities grow exponentially, the holy grail for computing has been creating a network of tiny electrodes being driven by a quantum chip, which allows the enormous computing power to analyze the sum of all the brainwaves and to predict analytic insights to react to specific synaptic spots with electric power to maximize efficiency for the human brain well-being. Even if this device may be one or two decades away, brain machine interfaces are currently helping with the support of some invasive devices which operate similarly to the quantum device mentioned before, but are a concrete solution for people who suffer paralysis and brain damage in some cases. They are considered promising technologies which will help people recover from their disease and hopefully returning to normality. In this paper we will present a review of brain machine interfaces promising technologies applied in medicine field for the brain clinical treatment, actual applications, studies and research in progress to empower and extend its usage in the future with the main objective setting new required quality and standards in this field of medicine.

Key Words: BrainGate, wireless telemetry, connectome, optogenic solutions.

1. INTRODUCTION

The brain is the most sophisticated machinery that natural evolution has ever created. Understanding this machine is the most underdeveloped field in human knowledge comparison. Even if the science of neurology, started in the late Renaissance, with the first autopsies began, until 1890's when Santiago Ramón y Cajal's drawings revolutionized neuroscience, and it's considered as the beginning of modern neuroscience. On years with Santiago, Camillo Golgi, the first who "photograph" a neuron via a weak solution of silver nitrate which is particularly valuable in tracing the processes and most delicate ramifications of cells [1], shared with him the Nobel Prize in 1906 for the work in the structure of the nervous system. The overall progress of neurology lead in the further understanding of the brain structure, perception, behavior and memory. Even if the technological advancement was just slowly progressing, since the 1950s, research and practice in modern neurology have made great strides, leading to developments in the treatment of stroke, cardiovascular disease, multiple sclerosis (MS) and other conditions. The second revolution of neuroscience was with the invention of the fMRI in 1992 which allowed brain activity mapping [2]. Shortly after that, the internet era, and the connectivity between science facts and experiments is quantitative, technologic advancement are starting to have a broader sense of how the brain works through computer simulations and automated "Saturated Reconstruction of a Volume of Neocortex" [3], which is the practice of cutting 2m layers of a preserved cortex and instantaneously scan them to reconstruct them into a computer simulation that gives more insights to scientists than never before, but we are yet far from totally understanding and controlling the brain.

2. BRAIN COMPUTER INTERFACES

For decades, scientists and engineers have worked to create technologies that would read brain activity, using it to control machines, computers, and prosthetics. The easiest signal to read is the electroencephalograph, or EEG – small electric fields on the scalp, each representing the average of the electrical activity of billions of neurons. From EEG signals, you can tell whether you’re focused or relaxed, or how well you’re sleeping. Under laboratory conditions, EEG is a powerful tool for studying the brain. And EEG is a crucial diagnostic method for sleep medicine and epilepsy.

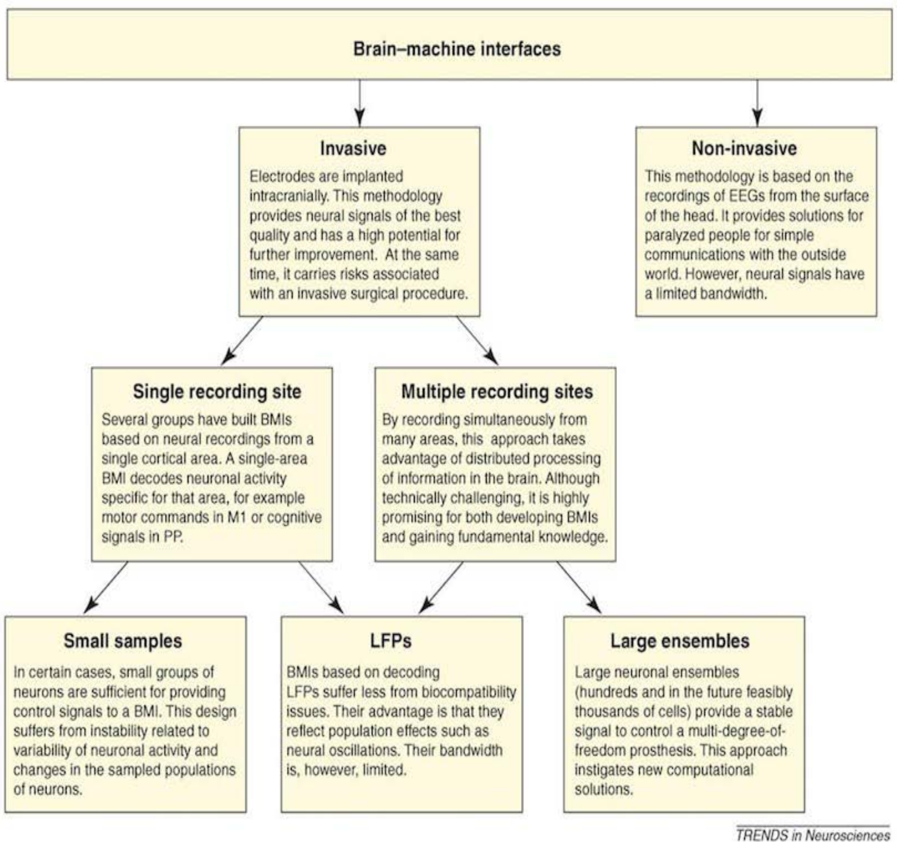

Figure 1: Classification of brain–machine interfaces[1]

But the goal of reading real output from the brain using EEG signals has remained elusive. One technology, called a P300 speller because it relies on an EEG signal called the P300 evoked potential, allows patients to slowly spell out words by focusing on a grid of letters. This is useful for some patients who suffer from late-stage amyotrophic lateral sclerosis (ALS, or “Lou Gehrig’s disease”) and have no other way to communicate. But, it’s not practical for most other patients – if you still have control over your eye movement, you can use eye-tracking technology to communicate much more rapidly. Other scalp signals like MEG (magnetoencephalographic, or the magnetic equivalent of EEG) or fNIRS (functional near-infrared spectroscopy, which uses infrared light to actually look at cerebral blood flow through your skull) may offer better performance in the future, but right now they’re mostly confined to research use [4].

Given the limitations of EEG, signals recorded at the cortical surface or even deep inside the brain may eventually be more useful. While it’s an active topic of research, only a few patients have received cortical recording implants over the past decade. These experiments have been successful, in that paralyzed patients were able to control cursors and prosthetic arms just by thinking about the movement. For now, application in real clinical medicine is limited not just by the slow pace of R&D but by limitations of electrode technology. State-of- the-art intracranial microelectrodes that actually penetrate the cortex generally lose function after a few months. There

[1] Abbreviations: BMI, brain machine interface; EEG, electroencephalogram; LFP, local field potential; M1, primary motor cortex; PP, posterior parietal cortex.

is some evidence that larger electrodes at the surface of the brain will work almost as well, which offers hope for this technology to enter clinical practice sooner [5]. That's reading; now, let's talk about writing to the brain. Neurostimulation – using technology to directly stimulate the brain, usually with small electrical currents – is the most clinically-successful form of brain-machine interface, although the state of the art relies more on disrupting pathological activity than truly writing information into the brain. Deep brain stimulation, or DBS, has been commonly used in clinical practice for twenty years now, first for essential tremor, shortly thereafter for Parkinson's disease, and occasionally for other movement disorders like dystonia. DBS requires accurately targeting and implanting a row of platinum-iridium electrodes into a deep brain structure, usually the sub-thalamic nucleus and connecting these to an implantable pulse generator placed near the collarbone. It has become the state-of-the-art treatment for Parkinson's disease and is capable of substantially delaying the progress of symptoms, even after medications are no longer effective. The electrical pulses delivered by the neurostimulator disrupt the abnormal activity that characterizes the disease, restoring normal movement [6].

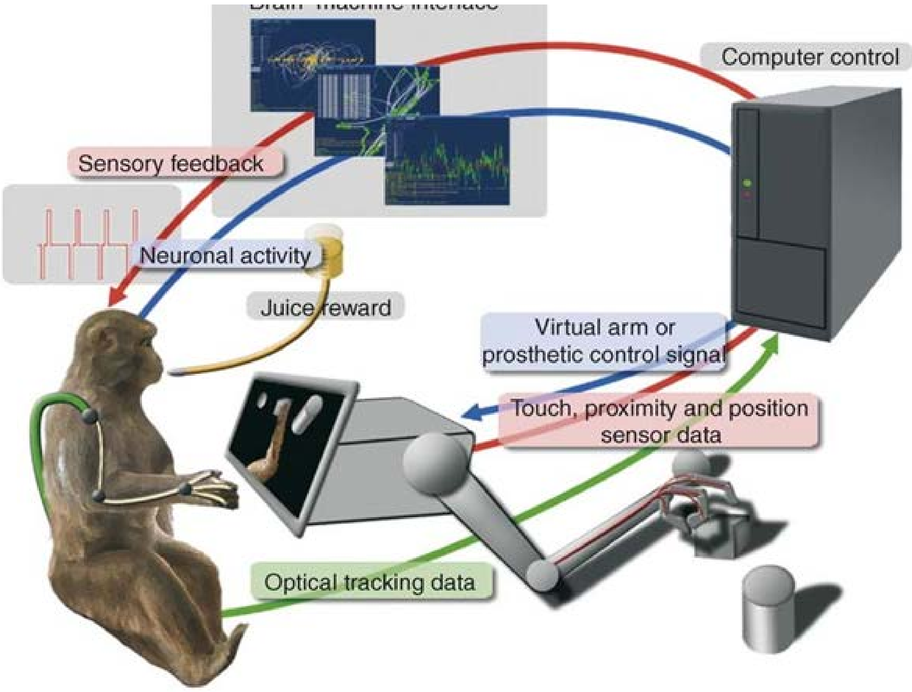

Figure 2: A BMI with multiple feedback loops

A BMI with multiple feedback loops shown in figure no.2 is being developed at the Duke University, a manipulator that reaches and grasps different objects. The manipulator is equipped with the control computer (right), which processes them and converts to microstimulation the feedback information (red loop). A series of microstimulation pulses is illustrated into commands to the actuator, via the control computer and multiple decoding algorithms the position of several markers mounted on the arm (green loop). We hypothesize that actuator into the representation of the body in the brain.

Finally, new forms of non-invasive brain stimulation may be considered brain-machine interfaces and are gradually entering clinical practice. Transcranial magnetic stimulation, or TMS, delivers magnetic pulses through the skull to the brain. It's currently cleared by the FDA for treatment of clinical depression, where the pulses are thought to modify activity of the dorsolateral prefrontal cortex. Transcranial direct current stimulation, or tDCS, is another promising treatment although it currently only has regulatory approval in Europe for treatment of chronic pain and depression. tDCS delivers a mild electrical current to the brain via the scalp, changing neural firing patterns. Like TMS, the tDCS stimulation is thought to increase activity in the dorsolateral prefrontal cortex, and may help treat these diseases by increasing cognitive control and helping the brain self-moderate the abnormal activity [7].

3. SOLUTIONS FOR IMPAIRED PEOPLE

In a world awash in technology, the line between humans and machines has begun to blur, our thoughts and actions increasingly shaped and substantiated by machines. Perhaps nowhere is the blurring more evident than in a scientific endeavor called "neural interfacing," a term for technology aimed at bridging the workings of machines and the human brain. Brain–machine interfaces operate at the nexus of thought and action, using the brain's electrical signals to maneuver external devices such as prosthetic limbs, among other applications. Noninvasive imaging techniques such as electroencephalography and functional MRI are also examples of brain– machine interfaces. The hope is that such devices will someday help paralyzed people, who have lost motor control, to lead more independent lives [8]. The idea of tapping into the brain's electrical activity to control movement is more than two decades old, with attempts to record the neural coordinates of movement from the motor cortex of the monkey brain dating back to the 1960s [9]. Progress has been understandably slow, but, within the last 5 years, impressive gains in technology have helped mark a few milestones.

In 2006, Brown University neuroscientist John Donoghue and others reported the result of a clinical trial of a surgically implanted, silicon -based device dubbed Brain Gate, which allowed a 25-year-old tetraplegic patient with spinal cord injury to move a cursor on a computer screen, open an e-mail message, operate a television, open and close a prosthetic hand, and perform simple movements using a robotic arm-3 years after paralysis. Despite the advance, the researchers wrote that the use of the device depended on the "assistance of trained experts. The need for this assistance must be eliminated through system automation" [10].

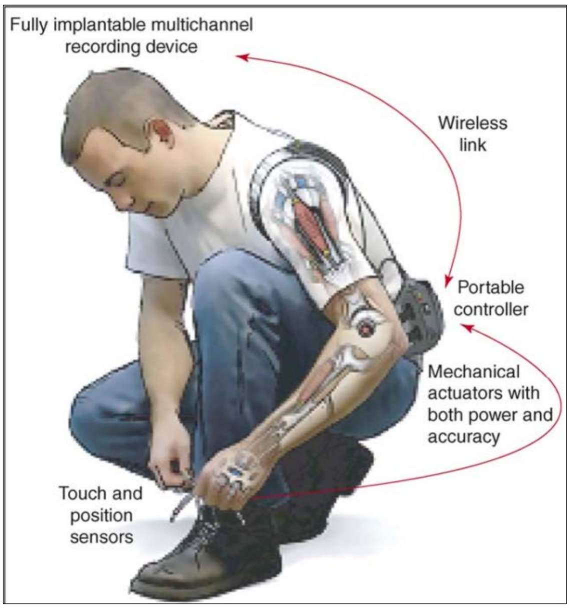

Figure 3: How a fully-implantable BMI could restore limb mobility in paralyzed subjects or amputees

Although the details of this system have to be worked out through future research, it is clear that the BMI for human clinical applications should be encased in the patient's body as much as possible. Wireless telemetry offers a viable solution for this purpose. The prosthesis not only should have the functionality of the human arm in terms of power and accuracy of the actuators, but also should be equipped with the sensors of touch and position from which signals can be transmitted back to the subject's brain.

Two years later, University of Pittsburgh neuroscientist Andrew Schwartz and others moved the field another step forward: Macaque monkeys with lightly restrained arms and silicon electrodes implanted in the motor cortex could be taught to use their thoughts to move a mechanical arm, grasp food items, and even feed themselves [11]. The advance was notable, partly because the monkeys' brain appeared to have incorporated the robotic arm as their own, fine-tuning maneuvers to affect precise moves. "It was control in free space. The movements looked natural, and the monkey could reach and grasp like humans do," says Schwartz.

In 2012, Massachusetts General Hospital neurologist Leigh Hochberg and others reported that a 58 -year-old woman and a 66-year -old man, both paralyzed from the neck down for years, learned to use implanted brain electrodes to control a robotic arm to reach and grasp small objects, and, in one case, even drink coffee from a bottle using a straw, suggesting that the technology might someday help paralyzed people carry out everyday activities [12]. The same year, Schwartz and colleagues demonstrated that a 52-year-old tetraplegic woman could use a prosthetic limb to routinely execute seven-dimensional movements, including reaching and grasping, following implantation of microelectrodes into her brain's motor cortex and 13 weeks of training [13]. Researchers working on brain–machine interfaces are no doubt making strides, but their reach has thus far exceeded their grasp. Among the many challenges tied to developing commercially viable devices for use in patients are the bulky size of the equipment, the limited durability of the implanted electrodes, and the difficulty of developing prosthetics that can relay sensory feedback to the brain [14].

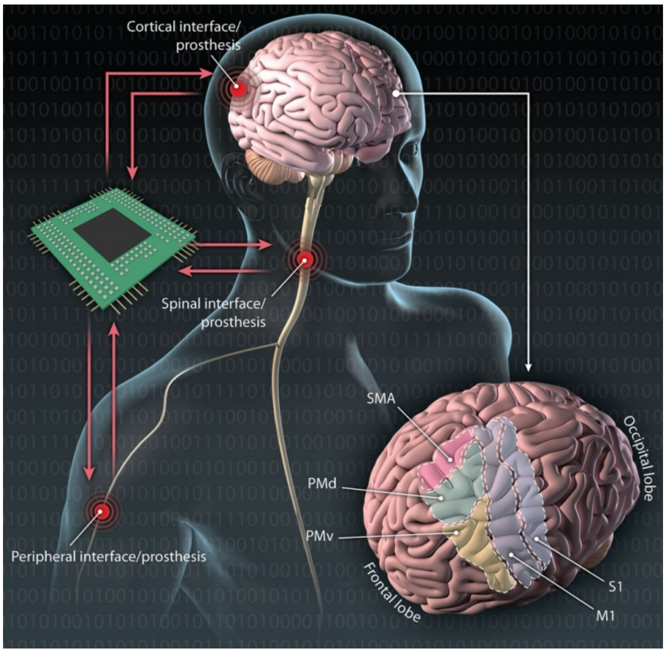

Figure 4: How a fully-implantable BMI works

4. THE PRESENT AND FUTURE OF BRAIN MACHINE INTERFACES IN MEDICAL APPLICATIONS

BrainGate, based at Brown University, is a consortium of researchers from many diverse fields including: neuroscience, neurology, engineering, computer science, mathematics and neurosurgery. The team is dedicated to developing technologies which help to restore mobility, communication and independence to individuals who suffer from neurologic diseases, trauma or limb loss. BrainGate researchers develop and tests devices such as prosthetics that can be manipulated using a brain-machine interface (BMI) and BMIs that allow people with locked-in syndrome to communicate using their brain waves to manipulate a computer cursor. Originally from Hungary, Dr. Janos Perge is a professor of neuroscience is currently a postdoctoral research associate with the BrainGate team. His specific area of study is fluctuations in brain signals and system performance over time, with the intent to identify the biological and technical sources that create these changes. His research is vital for the development of implantable BMIs that can operate for decades. Currently, Dr. Perge and his colleagues are working on a number of clinical trials using BMI, in order to fine tune the devices enough to introduce them to the medical market place so that they are accessible to anyone who needs them. “What is very important for a brain-machine interface is to operate reliably, this is the research I have been doing. It is important to understand the reasons why the performance of a device might change over time and how we a overcome those instabilities,” says Dr. Perge. These fluctuations can happen for a number of reasons. They can have technical causes, because no device is perfect, but they can also happen for biological reasons, because the brain is a dynamic system which changes over time. By overcoming these instabilities, BrainGate will be able to develop BMIs that people can use consistently 24/7 for decades at a time.

Another important aspect of current research is developing BMIs that can fit each individual user need. This is obviously not without its challenges, but customization of BMIs is essential. “For instance, we are developing a technology to control a multi-joint robot arm in three dimensions. We demonstrated that a person was able to drink a cup of coffee using a BMI to control the robot arm. But there might be situations when someone would be equally happy just to be able to say yes or no, just to be able to answer Do you need anything? Are you tired? Are you in pain? So, a simple binary switch would be useful for those who are unable to communicate,” Dr. Perge explains. BMI research and development has advanced rapidly over the past decade and are bound to continue to upgrade at a high speed over the coming decade. In the future, the application of BMIs may extend beyond the realms of medical assistive devices, and be available to all of us on a day- to-day basis. However, once again, the functionality and accuracy of the devices is a crucial factor. “Eventually it comes back to convenience. Of course, it might sound really flashy to control your computer game by thinking about it, but eventually, when it comes to practicality, you will just use a system that is most convenient, whether it’s your own hands or a brain-machine interface device?” says Dr. Perge.

Of course, for people who have restricted mobility or those who cannot move at all, even just a simple device that can increase their independence, such as a binary switch, which enables them? ”We researchers at BrainGate continue to be very excited to develop multiple technologies for people with disabilities, and it’s a very interesting journey and there is always an interesting challenge that needs to be resolved, which makes BMI a very fascinating, new and dynamic area of research. Another important thing is that the people who are involved in these clinical trials are doing this by the strength of their will and we owe them because they do this without any compensation, knowing that this may not come down in their own lives but that it will help the next generation of people suffering from severe disabilities.”

A strong amalgamation of biological intelligence with digital science has created Neural lace, a perfect answer against all neurological disorder. The technology speaks about the comparison of the human brain with its digital version itself, that too in a larger bandwidth.

This interface does not need any wires to get connected with the brain. The same will function from inside of the brain through the help of a couple of electrodes. Thereby, it will create a perfect interface between the human and the machine. The basic implantation methodology includes the insertion of the neural lace, which is a mesh actually, inside the skull through the help of the needle. As soon as the mesh leaves the needle, it will start to resonate with the brain and will mimic as one of its parts. With the growing of your brain, it will move or will show slight changes [15]. The main purpose of its creation lies in its capability to heal complex medical conditions such as Parkinson and other life-threatening disorders. The makers, however, have pitched about its strong usability in US military action, especially in US Air Force Cyborg cell program. Now coming on to its advantages on common medical science neural lace can create a perfect link between the brain and the artificially intelligent human body parts. By this, it means, there will be no need to control it from outside, the neural lace inside the brain will take care of that.

Similarly, those who are suffering from neurodegenerative conditions need no longer to get third party help, as the technology will regain their ability to eat, walk even talk. To confirm the same, scientist test tried the technology on mice, and it reported success with few drawbacks. Kernel, one of the start-up in the same line, was started in the year 2016 by Bryan Johnson. He invested his own $100 million savings with an aim to produce a budget-friendly solution with wide availability so that the patients who suffer from Parkinson's and Alzheimer's can buy it easily. The initial approach was to understand the exact functionalities of a human brain and the reason behind its failure that causes neurodegenerative disease. From the past, the experiment on controlling the lost body functionalities through electrical signals in case of Parkinson has done already. However, nowhere the approach was coded or customized. Now the approach is beyond clearing medical anxieties like spinal cord pain, obesity, and anorexia. Neural lace will try to map both brain activity and thoughts to bridge the wide gap between the machine and the human. The integration of downloading the thoughts to and from the system even make this AI more superior [16].

Elon Musk along with his partners Reid Hoffman, Jessica Livingston and Peter Thiel (and others) created a non-profit organization called OpenAI. This AI research start-up was initiated towards facilitating 'friendly AI' creation as well as deployment. Soon Elon's approach of connecting the brains to the computers through the use of neural lace got public in the leading 'The Wall Street Journal'. The paper also cited that through this, people can cope up with the rapid changing technology in the midst of AI development. Since the starting, Elon is resistive against the fact that says soon one-day people will become domestic to artificial intelligence. He had hinted about his current technological venture on Neutral ink even before on World Government Summit in Dubai last February. If the sources are to be believed, the technology is still in its development stage and may require a subtle amount of time to get released as fully functional.

Till now, we just came to know about its deep core medical advantages for neurologically challenged people. However, it has lot more to offer. The thrilling live streaming feature just adds he sees. The magical experience of younger times can be brought back with Neural lace. According to the makers, on stimulating the same with neural circuits, one can organize the brain functionalities in the same way as they were when you were younger; in short, the idea is reverse-aging to potentially reverse your life experience [17]. Alzheimer patients are more prone to have damaged brain cells. However, a neural mesh by coupling with the stem cells of the brain can repair the damaged brain tissues and can even re-grow them. Now, the application is further exercising its limits on the same to provide quicker results. The term connectome is a zombie to most people. The misinterpret as any connections with a brain. However, it is an electrical system inside your body. Our brain makes uncountable reparative attempts to learn a new skill or lesson. The same demands the change of the connectome accordingly. However, the new neural lace can augment with this one too. With a single injection of it, one can play chess like Biswanath Anand or can act like Katty Perry. However, the makers are not still confirming on its wide use as the same may have reverse health hazards too. Therefore, scientists are not highlighting this part so openly in the technical advertisement of the neural lace. The concept of the neural link carries a close resemblance with the Brain -computer interface technology. Just like the former one, Brain - computer interface acquires brain signals and converts them to machine friendly commands by deep analyzing them. Brain Sparks get converted into desired machine actions [18].

However, to carry out the same, it does not use normal neuromuscular output pathways in any manner. The sole purpose of Brain-computer interface was to make people normal from disorders like amyotrophic lateral sclerosis, cerebral palsy, stroke, or spinal cord injury. The technology holds the potential of proving handy even after stroke or other kinds of medical disorders. The algorithm is curated in such a manner that the future generation neuron surgeons may face a challenge against their proficiency from this technology. However, the successful development of the same involved the collaborative action of scientists, engineers, clinicians, and the public in general.

The makers have cited three sensitive areas that hold the smooth advancement and further flourishing of the technology. The primary requisite is the signal acquisition hardware. For a flawless output, it should be highly convenient, portable, safe, and able to function in all environments. Neural lice outsmarted BCI in this respect, as a small mesh is enough to mimic the functionality that this technology can do. Even, it emits the need of regular periodic maintenance, unlike BCI. The later also needs to be validated in long-term studies of real-world use by people with severe disabilities.

5. DISCUSSION

Direct brain reading, and control has made incredible steps forward, from a super-advanced, injectable neuro-mesh to genetically-induced optogenic solutions that can force neurons to fire in response to stimulation with light. Solutions are getting both more invasive and less, diverging into one group with super-high-fidelity by ultimately impractical designs, and one with lower fidelity but more realistic, over-the-scalp solutions. Skullcaps studded with electrodes might not look cool, but you might still pull one on, not too far into the future.

Long term, there’s almost no telling where these trends might take us. Will we end up with enlarged new portions of the motor cortex due to constant use of new pure-software appendages? Will we dictate to our computer in full thoughts? If you’re in a store and spy a sweater your friend might like, could you run it by them simply by remotely sending them the sensory feeling you get as you run your fingers over the fabric? Would this vicarious living be inherently any less worthwhile than having felt the fabric yourself?

6. CONCLUSIONS

In this paper is presented a review of brain machine interfaces promising technologies applied in medicine field for the brain clinical treatment, actual applications, studies and research in progress to empower and extend its usage in the future with the main objective setting new required quality and standards in this field of medicine. We briefly explained the capabilities of a BMI solution and the actual applications which are made to help impaired people. We further discussed promising brain machine interfaces which are the future of clinical treatment and may also be someday the pillar technology which will advance humanity in a growth rate never seen before.

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A Study on the Optical Signal Noise Ratio (OSNR): Report on the Performance of DWDM Systems

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ABSTRACT

This article is related to a study on optical signal-noise ratio (OSNR) standards, which is a very important factor in planning DWDM optical fiber systems. The signal fiber transmission consists of transmitting a light signal modulated with several noise levels in the background. If the noise level increases the receiver it is more difficult to decode the information and consequently errors appear. A well-designed system should have a level of signal strength in sufficient input (OSNR) keep communication in acceptable error limits. In most fiber optic transmission systems, the OSNR should be considered only if the link includes an optical link amplifier. In non-amplifier links, the noise power is not sufficiently acoustical are an influencing and limiting factor. The OSNR can be defined as the logarithmic ratio of the average signal power opt fails against the average noise power in a specific band that is measured at the input of the receiver photodiode (OSA). The optical spectrum analyzer serves for the measurement of the OSNR. Each individual channel in the DWDM is represented by the individual OSNR which is calculated from the corresponding equation.

Key Words: OSNR, optical fiber, OSA, DWDM.

1. INTRODUCTION

These days has been a developing enthusiasm for creating optical fiber systems to help the expanding transmission capacity requests of utilizations, for example, superior quality TV (HDTV) and World Wide Web. New methods for expanding the data transmission limit and using it successfully are being developed. One strategy for getting to the colossal transfer speed accessible in an optical fiber is wave length - division multiplexing. WDM builds the conveying limit of the fiber by approaching optical signs to particular frequencies of light (wavelengths) inside a specific recurrence band. In a WDM framework, every one of the wavelengths is propelled into the fiber and the signs are demultiplexed at the less than desirable end. The subsequent limit is a total of the info flags, every one of which is conveyed freely of the others. This implies each channel has its own committed data transmission and all signs can touch base in the meantime. By using WDM in optical systems, we can accomplish connect limits on the request of 50THz [1].

Another strategy for getting to the tremendous data transmission is the thick wavelength division multiplexing. The contrast amongst WDM and DWDM is essentially one: DWDM spaces wavelengths more intently than WDM, and in this way, has a more prominent general limit. Today, DWDM frameworks supporting 160 wavelengths transmitting at 10 Gb/s each are economically accessible. Such a framework has a limit of 1.6 terabits every second [2]. DWDM has two critical highlights, the capacity to enhance every one of the wavelengths immediately without first changing over them to electrical signs, and the capacity to convey signs of various speeds and sorts at the same time what's more, straightforwardly finished the fiber (convention and bit rate freedom). The main component implies that DWDM consolidates various optical flags with the goal that they can be opened up as a gathering and transported over a solitary fiber to build limit. The last component implies that each flag conveyed can be at an alternate rate and in an alternate arrangement [2].

The optical signal-noise ratio (OSNR) is a very important factor in the designing of fiber optic systems. The signal fiber transmission consists in transmitting a modulated light signal with several background noise levels. If the noise level increases the receiver has the most difficulty decoding the information and consequently errors appear. A well-designed system should have a power-absorbing signal strength level (OSNR) to keep communication within acceptable error limits.

All optical receivers tolerate a certain noise level which should be lower than the signal strength.

2. OPTICAL SIGNAL-NOISE RATIO (OSNR)

Noise bands can be grouped into active and passive. Active bands are lasers, receivers and amplifiers that generate new noise in a fiber optic link [3]. Passive bands are fiber, connectors, splices causing interference or shutting down or reflecting the spreading signal. Below are listed the most common sources of noise.

1 *Spontaneous signal noise*: This noise is generated by the signal mixed with the amplified spontaneous emission noise generated by the optical amplifier. This is usually the most dominant source in a fiber optic link [4]. This is commonly known as amplified spontaneous emission noise (ASE). The power of the RMS noise and RMS signal of the photodiode noise:

$$P = 2\eta hf\Delta f(G-1) \tag{1}$$

$$\sigma = \sqrt{4R_p^2 GP_s n_{sp} hf\Delta f(G-1)} \tag{2}$$

2 *Spontaneous noise:* This noise is generated by mixing the ASE with itself. Usually it is not an important factor. RMS noise of the photodiode is given by the following equation:

$$\sigma = \sqrt{4R_p^2 [n_{sp} hf(G-1)]^2 \Delta f_0 \Delta f_e} \tag{3}$$

3 *Noise Shot (sh):* This is an electrical noise generated by the reception of photodiodes (APD and PIN). The APD photodiode receivers have a better signal-to-noise ratio (SNR) thanks to the improved internal multiplication mechanism. The pickup noise level and the minimum of OSNR are determined in the design of the transceivers and the RMS noise of the photodiode is given by the equation:

$$\sigma = \sqrt{2qI_{dc}\Delta f} \tag{4}$$

4 *Spontaneous shot noise*:

$$\sigma = \sqrt{4R_p n_{sp} hf(G-1)\Delta f_0 \Delta f} \tag{5}$$

5 *Thermal Noise (th)*: This noise is generated by the diode in the receiver as a result of the thermal activity.

$$\sigma = \sqrt{\frac{4KT\Delta f}{R_L}} \tag{6}$$

6 *Multiple Path Interference Noise (MPI):* This noise is caused by the multiple reflection of the signal inside the fiber that interferes with itself. The reflections are due to Rayleigh dispersion, connectors and junctions. Usually displayed on power signals of large and large Raman amplifiers. This noise source is known as Dual Rayleigh Spread (DRS). In order to keep MPI noise to a minimum, very high-quality connectors are used [3].

7 *Spontaneous Source Emission (SSE)*: This noise is caused by spontaneous emission of photons of the optical source.

8 *Mode-Partition Noise (MPN)*: This noise appears from the normal variation in laser mode even if the total laser power remains constant [4]. Noise is generated in fiber in which the wavelength dispersion of the signal is not zero. The modes travel from various groups of speed due to the chromatic dispersion that causes the synchronization of the modes and increases the noise in the pickup. The MPN is commonly displayed in lasers where the relationship of side-mode suppression ratio (SMSR) is less than 20 dB.

9 *Cross talk noise (CTN)*: Wavelength multiplexing can cause interference between channels [4]. A channel may appear on the other channel due to interference since WDM does not provide 100% channel isolation.

10 *Non-linear distortions*: the fiber itself may cause interference due to its non-linearity. Signal strength should be kept below a recommended level because it helps minimize the level of interference. The effects caused by non-linearity are included in the calculation of the OSNR. The total photodynamic flow in the output is given as an optical power product with the sensitivity of the photodiode [3]. This current is the sum of the individual currents.

$$\sigma_N^2 = \sigma_{th}^2 + \sigma_{sh}^2 + \sigma_{sh-sp}^2 + \sigma_{sp-sp}^2 + \sigma_{si-sp}^2 + \sigma_{MPI}^2 + \sigma_{SSE}^2 + \sigma_{other}^2 \tag{7}$$

$$\sigma_{noise}^2 = \langle (\Delta i_{noise})^2 \rangle \tag{8}$$

$$i_{total} = i_{signal} + \Delta i_{noise} \tag{9}$$

$$i = R_p * P_{op} \tag{10}$$

$$P_N = \frac{\sigma_N}{R_P} \tag{11}$$

Graphically, the optical noise power, signal strength, link loss, and OSNR are given in the figure.

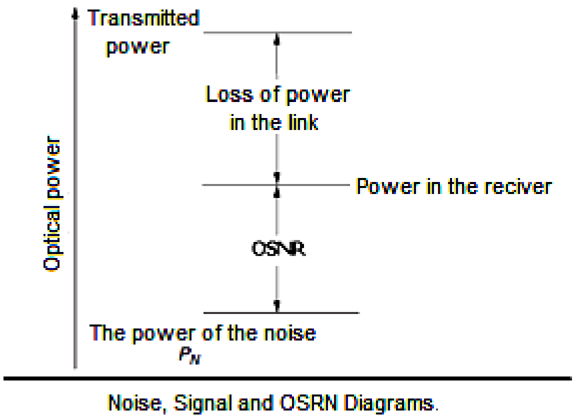


Figure 1: Noise, signal and OSNR diagrams

2.1. OSNR Calculation

In most fiber optic transmission systems, the OSNR should only be considered if an optical link amplifier is included in the connection. In non-amplifying connections, the noise power is not sufficiently acoustic to be an influential and limiting factor. The OSNR can be defined as the logarithmic ratio of the average power of the optical signal to the average noise power in a specific band measured at the input of the receiver photodiode (OSA). The optical spectrum analyzer serves for the measurement of OSNR. The optical power of the P_{sig} signal is determined by the ratio of the power of the P_{noise} noise to the width of the spectrum B_o, which should be large enough to include the full power of the signal to minimize the erroneous measurement of the signal in the bandwidth (resolution of the RBW bandwidth). Power of noise P_{noise} is the total noise power included in the bandwidth of the dissolvent B_o.

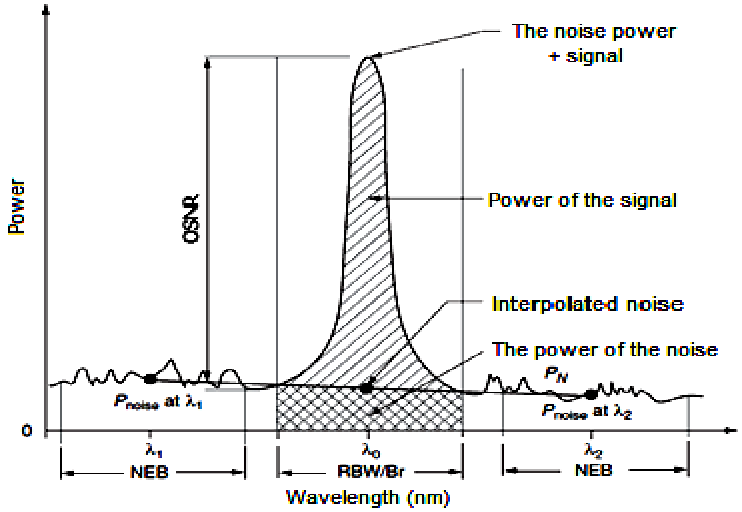


Figure 2: The optical spectrum analyzer serves for the measurement of the OSNR

Each individual channel in DWDM is represented by the individual OSNR which is calculated by the equation:

$$P_{noise} = P_{noise}(B_0) \tag{12}$$

$$P_{signal} = P_{signal+noise} - P_{noise} \tag{13}$$

The first term defines the logarithmic signal-noise ratio while the second term is known as the scaling factor used to adjust the noise band NEB band represented by B_m and the RBW signal band represented by B_r. If the NEB filter band is the same as the RBW of the signal this term is zero.

$$OSRN = 10\log(\frac{P_{signal,i}}{P_{noise,i}}) + 10\log(\frac{B_m}{B_r}) \tag{14}$$

$$P_{noise} = \frac{P_{noise}(\lambda_1) + P_{noise}(\lambda_2)}{2} \tag{15}$$

$$OSRN = 10\log(\frac{P_{signal}}{P_{noise}}) \tag{16}$$

For OSRN measurement in DWDM there is often not enough space between DWDM signals to measure the noise power in RBW, so NEB generation must be narrower than RBW [6]. RBW should be large to include all the signal strength otherwise a part of the signal strength will be out and will not be included in the measurement. As a result, the signal strength measurement error will increase little between channels in DWDM, where the width of RBW on both sides of the signal is insufficient, a narrower band is used.

2.2. Combination of wide RBW for signal and narrow RBW for noise provides the best accuracy

In the OSNR measurement, the OADM demultiplexer or ROADM (filtering effects) should be cautious because a false noise may appear in the OSA that affects the measurement of the OSNR error. This noise on both sides of the signal may completely disappear for signals with a large bandwidth (10 or 40 Gbps) where the demultiplexer filters have the same bandwidth with the signal. This could make it difficult to measure the OSNR because band noise continues to be present, but it may be difficult to detect for accurate measurement of the OSNR [7]. One way to localize the noise in the band is to polarize the source signal. Then the polarized signal is filtered by a polarizer in OSA which can let this noise level be valid for measurement.

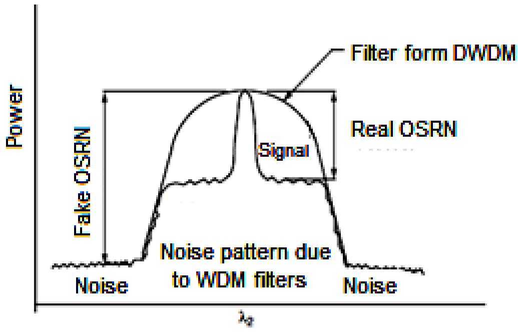


Figure 3: The signal strength measurement error will increase little between channels in DWDM where the width of RBW on both sides of the signal is insufficient is used a narrower band

Use of the correct RBW for signal measurement is necessary to ensure the highest possible accuracy [8]. If RBW is too tight, a portion of the signal will be missing during measurement, but if RBW is wider, the exact signal noise near the signal will not be taken and the measurement of any unwanted noise can be measured by the signal strength. The ideal RBW should be large enough to include all the modulated signal. Manufacturers specify the correct RBW required for the OSNR transceiver.

Table 1 The proper RBW required be used for the OSNR transceiver.

Modulation speed	Minimum RBW for errors smaller than 0.1 dB	Minimum RBW for errors smaller than 1 dB
40 Gbps	1 nm	-
10 Gbps	≥ 0.2 nm	≥ 0.1 nm
2.5 Gbps	≥ 0.09 nm	≥ 0.03 nm

When an optical amplifier is added to the connection, a small portion of the ASE noise is added to the channel in which the signal is transmitted. However, the amount of noise generated by an amplifier is small and negligible in the OSNR of the system, but if you use amplifiers, the addition will not only add the signal strength to your channel, but it will also amplify the noise for all the amplifiers. This will lead to an unwanted level of BER that directly affects the OSNR of the system [9]. For a connection to the amplifiers, ASE optical noise is the dominant source of noise. If we use a Raman amplifier with large amplification, Rayleigh's double-noise diffraction (DRS) will also be decisive. The OSNR in a link in which the ASE noise is dominant is calculated by equation [12]:

$$OSRN = \frac{P_{out}}{P_{ASE}} = \frac{gP_{in}}{2n_{ep}hfB_0(g-1)} \quad (17)$$

$$n_{sp} = 0.5F(\frac{P_{in}}{FhfB_0}) \quad (18)$$

One OSNR measurement is specified in a standard RBW width, therefore, B_r is replaced by B_o and the equation takes the form:

$$OSRN_{dB} = P_{in} - NF - 10\log(hf) - 10\log(B_r) \quad (19)$$

where NF = the noise of the figure.

A fiber link with multiple sources of noise, knowing the OSNR of each individual noise source OSNR can be calculated using the equation [13]:

$$\frac{1}{OSNR_F} = \frac{1}{OSNR_1} + \frac{1}{OSNR_2} + \ldots + \frac{1}{OSNR_N} \tag{20}$$

In a transmission system, the spontaneous emission noise source (SSE) is generated by the laser source and should be included in the total OSNR of the connection.

$$\frac{1}{OSNR_F} = \frac{1}{OSNR_{source}} + \frac{1}{OSNR_1} + \frac{1}{OSNR_2} + \ldots + \frac{1}{OSNR_N} \tag{21}$$

In fact, in a fiber optic connection with the EDFA amplifications, the length between the amplifiers and the losses is different, so the previous equations are used to measure only one channel of the OSNR. To measure the OSNR of DWDM channels the P_{in} and the P_{source} for each DWDM channel should be individually measured [10].

1. The incoming power of each EDFA should be as large as possible, especially for the first EDFA in the link, since they have a greater impact on the total OSNR.
2. If the EDFAs have different noise values than the figures, the EDFA is first used initially with the lowest noise values. This is because the first and second EDFA have the greatest impact of image noise.

$$F_{total} = F_1 + \frac{F_2 - 1}{g_1} + \frac{F_3 - 1}{g_1 g_2} + \ldots + \frac{F_N - 1}{g_1 g_2 \ldots g_{N-1}} \tag{22}$$

3. AUTOMATICALLY MEASURE OSNR IN A DWDM SIGNAL ENVIRONMENT

The objective of the OSNR calculation of a connection is to ensure that the OSNR connection does not exceed the minimum OSNR value specified on the receiver to obtain the desired error value and the level of the signal upon reception. When optical link amplifiers are not used. The OSNR connection is much larger than the minimum of OSNR in reception. When noise from amplifiers and other sources of noise is added, the minimum noise increases and affects the decrease of the OSNR value of the link. The connection is reduced even when the power of the optical connection is lost. The OSRN value of the link should never be less than the minimum OSNR acquisition value. The following is how the fiber length increases the connection of optical amplifiers to a connection [11]. The OSNR degrades if ASE is added to each amplifier.

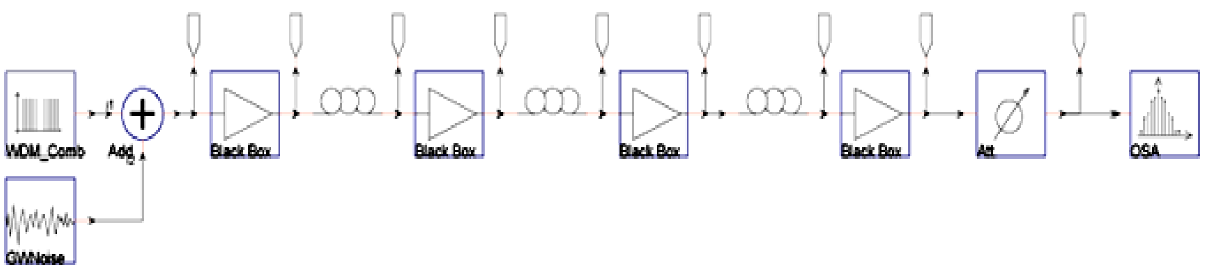
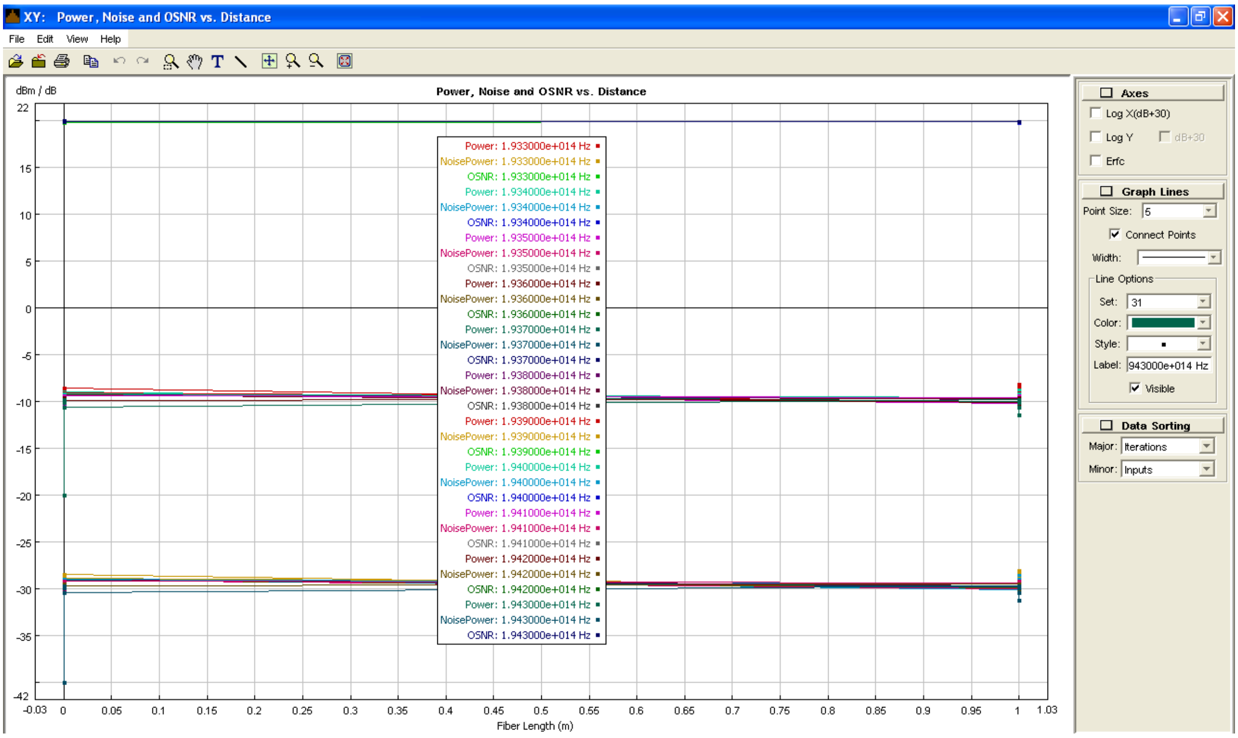


Figure 4: Shown how fiber length increases the linking of optical amplifiers to a link

With the increase of the length of the fiber connecting the two optical amplifiers see how this effects the OSNR and the OSA in a fiber optic link [14].

L=80 km



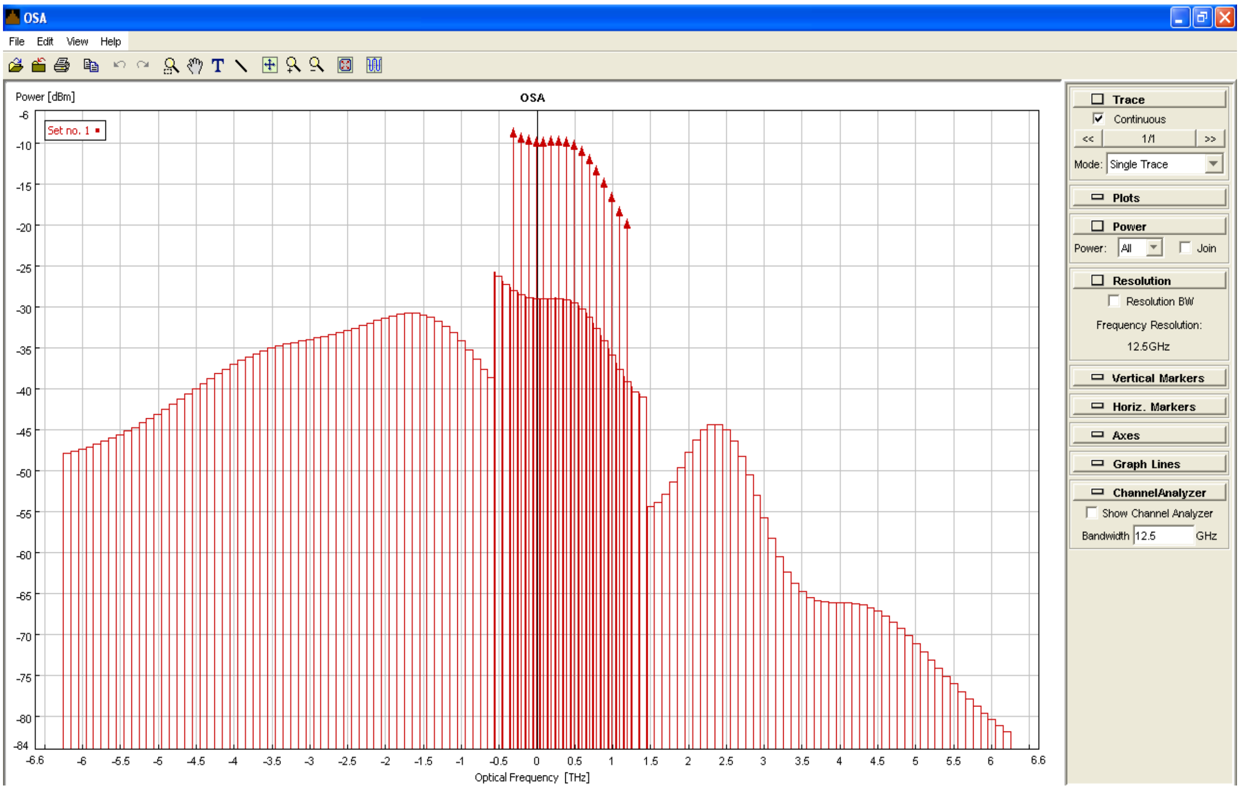


Figure 5: The effects of the OSNR and the OSA in a fiber-optic link with a length of L = 80 km

L=100km

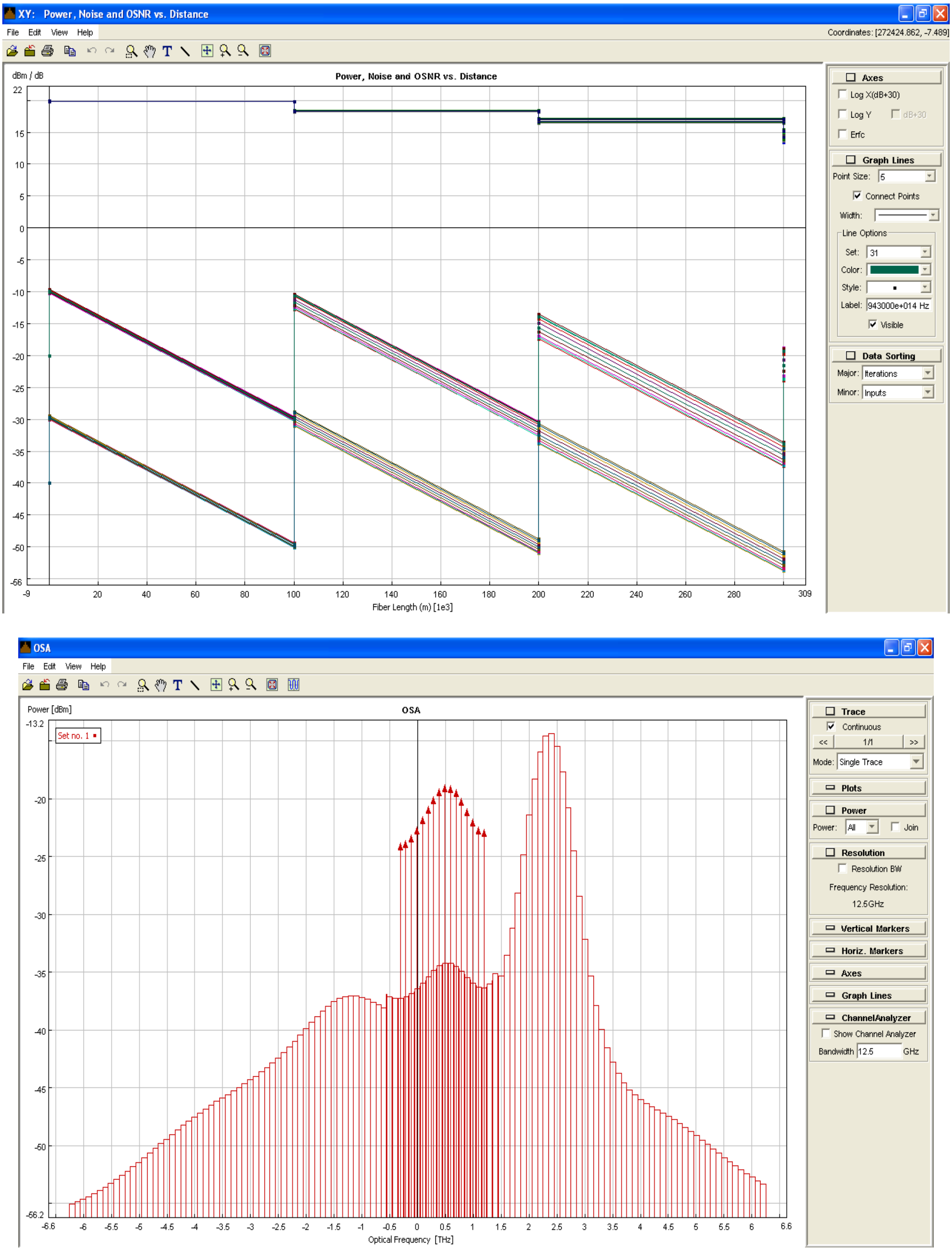


Figure 6: The effects of the OSNR and the OSA in a fiber-optic link with a length of L=100km

L=200km

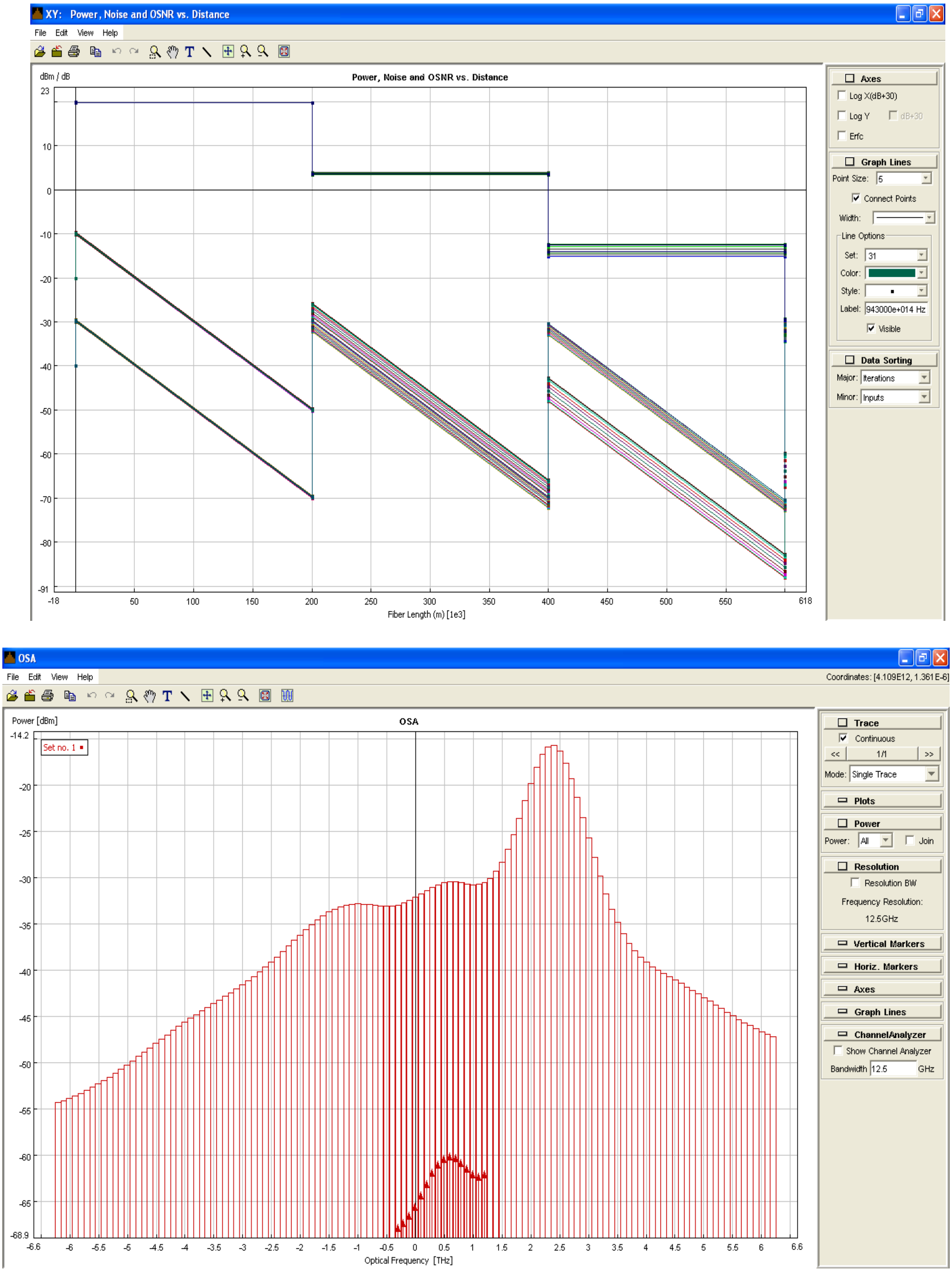


Figure 7: The effects of the OSNR and the OSA in a fiber-optic link with a length of L=200km

4. CONCLUSION

Previously, it has been said that OSNR can be a useful parameter for measuring the accumulation of ASE in a system. Clearly, with a transmission rate of 10 Gb / s and a channel spacing of 50 GHz, OSNR has limited utility. To get a better measurement of signal quality, it may be necessary to filter each channel and route the selected channel to the single-channel measurement device.

OSA can perform OSNR, channel power, and other spectral measurements. The DSA measures the extinction ratio and the parameters of the eye mask with a specific reference receiver for standardized rate.

OSNR is a valuable measure of the system's optical performance. At 10Gb / s and 50GHz channel spacing, the modulation spectra overlap by placing a limit on the measured OSNR value which is not improved with the narrower OSA RBW.

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Transverse Load Distribution Effects According to Rational Methods, Alb-TD Requirements and EN Codes

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ABSTRACT

While studying, modelling and designing of various structures, one of the factors to be considered and estimated is the Transverse Distribution Coefficient of different loads. This factor takes greater importance and is specifically treated in the case of action of loads of vehicles on road or railway superstructures, such as bridges, etc.

After the general treatment of several Methods -rational or theoretical- which consider and study this phenomenon, the study is focused in concretizing them with the considerations, findings and relevant conclusions, for the case of the 18 ml Bridge, as one of the most used bridges span in our country.

Than the results obtained using the "Eccentric Pressure Method" for the calculation of this structure under the action of the respective loads according to the Albanian Technical Design Requirements in force are compared, in different combinations, with the results from the calculation under the same loads but using the Finite Element Methods.

Further, taking in consideration the necessity of updating the norms and technical requirements in force with the relevant EN Codes, the comparison is done also with the results of calculations for the same structure under the effect of loads according to EN 1991-2, Traffic loads on bridges, September 2003.

Key Words: Bridge, Beam, Load, Distribution, Courbon. FaTa-E

1. INTRODUCTION

While studying, modelling and designing of various structures, one of the factors to be considered and estimated is the Transverse Distribution Coefficient of different loads. This factor takes greater importance and is specifically treated in the case of action of loads of vehicles on road or railway superstructures, such as bridges, etc.

The load on the bridge’s beams caused by their weight and the other structural elements, normally is uniformly distributed, therefore it has no transversal redistribution effect. Exception can be in the case of bridges with only one sidewalk or with two sidewalks of different shape, elements and dimensions. But keeping in mind the real values of these loads, especially in the cases of having the same type of sidewalk for both sides, their TD effect would be almost zero, resulting in the uniform distribution of the loads on all the beams.

This can’t be accepted for the asymmetric and not uniformly distributed live bridge loads. In this case we have to deal with the distribution of these loads over all the elements of the bridge, until the real portion of the load that would be given to each supporting beam is determined, through Coefficients of Transversal Distribution.

Determining the Transversal Distribution Coefficients is very complicated because, on one hand the bridge superstructure represents an intertwined system of main beams, transverse diaphragms and floor slab, which are of different stiffness, locations and ways of their connections, etc. and on the other hand, the live loads of vehicles, in continuous movement, applied on different points of the slab, are distributed at all the other elements up to the supporting longitudinal beams.

From above, it’s evident the difficulty of knowledge and evaluation of this distribution, to make possible the calculation of the real portion of the load that would be given to each supporting beam.

In order to solve this question, the Lateral Distribution of loads after Courbon’s Method is used, by determining the specific coefficients of transversal distribution [1]. Considering the presence of different structural elements in number, shapes and dimensions, as well as in their ways of connections, etc., the used methods and formulas would be different.

Thus, in the case when the transverse beams, diaphragms, are absent or very far from each other, the main beams can be considered as separate and independent from each other, and any of them get the portion of the load applied on it. While in the case when the transverse beams, diaphragms, are thick and very efficient, for their shape and size as well as for the rigid way of their connection with the main beams and the slab, it is assumed that, under the action of the live loads, the superstructure would rotate transversely without deforming.

Considering the above uncertainties, the bridge calculations have always been "accompanied" by the justified doubts about the accuracy of the obtained results, and historically, studies and researches have been undertaken to see and/or compare the accuracy of these acceptances with a possible "exhausted" design using calculations, programs and software with Finite Elements Method.

In this context, we can mention several works, as following:

- Search for the distribution of live loads in the slab of bridge superstructures [2], [3];
- Research in the transverse distribution of the live loads by putting into discussion the assumptions and the limitations of the Courbon’s Method and Orthotropic Plate Theory analyzing a typical 4-girder bridge having a span of 19.4 m and carriage with of 7.5 m for two critical load positions of IRC class-A loading [4];
- Search in the transverse distribution of the live loads on the Steel Plate Girder Bridges for different bridge superstructure systems, using the SAP2000 finite element program [5];
- Search for the distribution of the live loads in a bridge of two main beams, studying the structure in a 3D analysis and sub-modeling in Finite Elements [6];
- Research in the transverse distribution of the live loads for bridges of different spans and with different number of main beams, comparing the results obtained through the Courbon's method with the results obtained by using the STAAD software [7];
- Research in the transverse distribution of the live loads in relation to the variation of the torsional stiffness of the structural elements of the bridge, then comparing the obtained results with what would result following the CEB/FIB 1990 [8],
- Etc.

As general conclusions of the above-mentioned works, we can highlight the result of a research in the transverse distribution of loads, analysing a T-beam Bridge as a three-dimensional structure using the finite element plate for the deck, [9], by the graphs in Figure 1 and 2, which represent the comparison of the results obtained by the FEM analysis by Staad Pro, the Courbon's Method and the Guyon Massonet Method for the simply supported bridge:

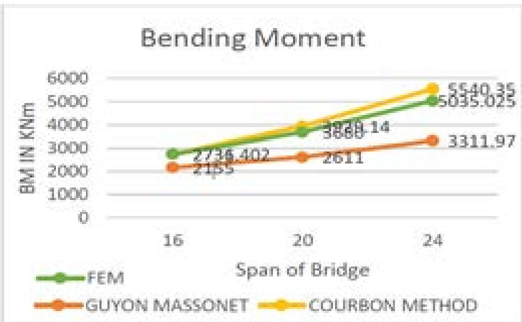


Figure 1: FEM, CM and GM results for BM

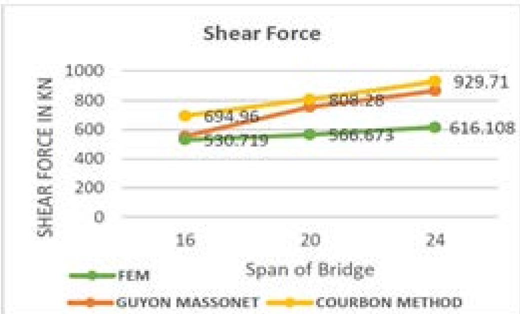


Figure 2: FEM, CM and GM results for ShF

2. CASE STUDY: 18 ML BRIDGE OF 6 BEAMS

After the general treatment of several Methods -rational or theoretical- which consider and study this phenomenon, the study is focused in concretizing them with the considerations, findings and relevant conclusions, for the case of the 18 ml Bridge, as one of the most used bridges span in our country.

Than the results obtained using the "Eccentric Pressure Method" for the calculation of this structure under the action of the respective loads according to the Albanian Technical Design

Requirements in force [10], are compared, in different combinations, with the results from the calculation under the same loads but using the Finite Element Methods.

Further, taking in consideration the necessity of updating the norms and technical requirements in force with the relevant European Norms and Codes, the comparison is done also with the results of calculations for the same structure under the effect of loads according to EN 1991-2, Traffic loads on bridges, September 2003 [11].

This case study deal with one of the most used types of bridges, so having the advantage of getting reliable feedback. With a total span of 18 ml and a calculation span of 17,40 ml, the bridge on this study has a cross section composed of two carriageways, quays and sidewalks, with a total width of 9 m (see Figure 3 and Figure 4).

During the study, for the internal forces in the longitudinal beams, the results obtained according to the Rational Methods -loading of the Influence Lines and then the TDC according to Courbon’s Method- were compared with the results obtained from the use of the FaTA-E software of STACEC – Software and Services for Civil Engineering.

Thus, Figure 4 presents the transversal section of the bridges and the possible different positions of the live loads, getting the worst case of loading, according to the respective normative N-18 and T-80 as by the Albanian Requirements and LM-1 and LM-3 as by the EN Code.

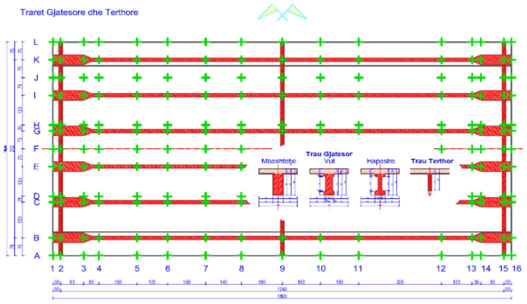


Figure 3: Shape and position of longitudinal and transversal beams

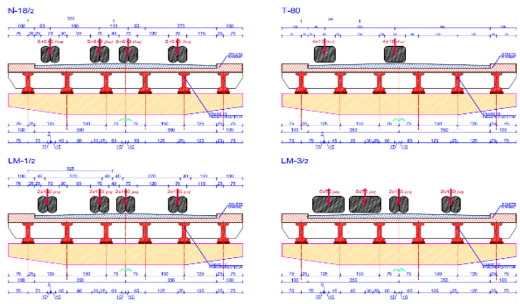


Figure 4: Transversal loads schemes

Then, Figures 5 to 8 present the positions of the live loads for having the maximum value of the Bending Moment and of the Shear Forces at the Longitudinal beams over the plan of the bridges according to the Albanian Requirements.

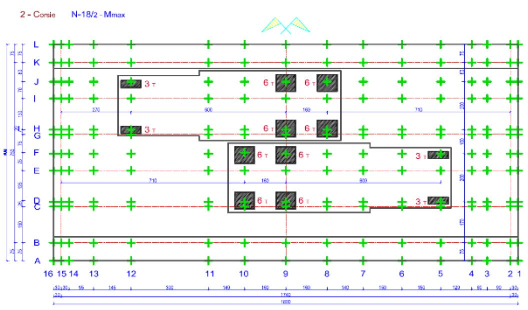


Figure 5: Positioning of the load Alb-N-18, for max BM

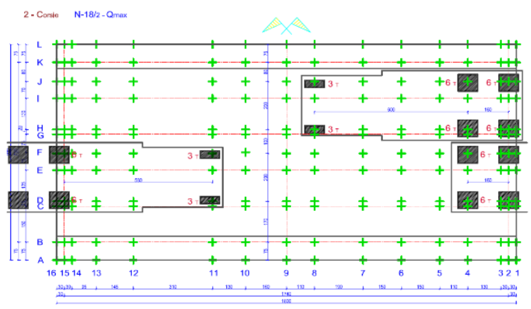


Figure 6: Positioning of the load Alb-N-18, for max ShF

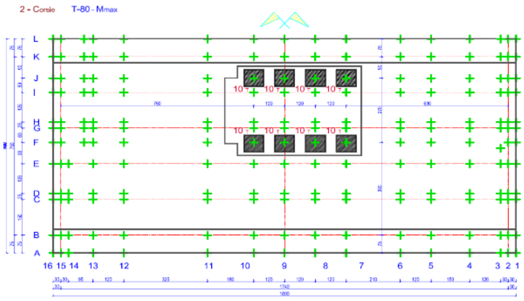


Figure 7: Positioning of the load Alb-T-80, for max BM

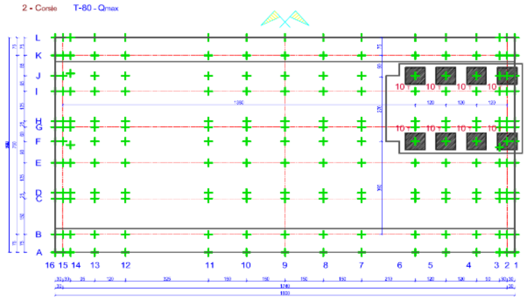


Figure 8: Positioning of the load Alb-T-80, for max ShF

The same, Figures 9 to 12 present the positions of the live loads for having the maximum value of the Bending Moment and of the Shear Forces at the Longitudinal beams over the plan of the bridges according to the EN Code.

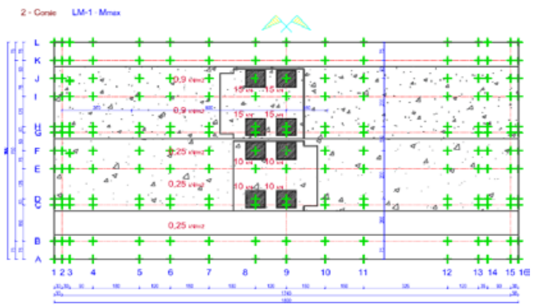


Figure 9: Positioning of the load EU-LM-1, for max BM

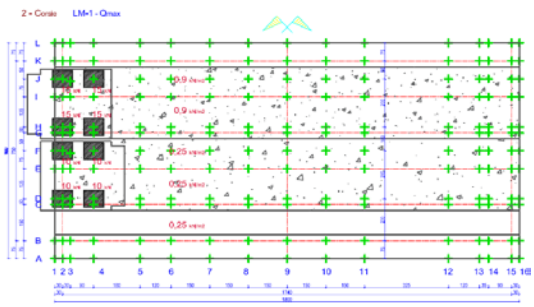


Figure 10: Positioning of the load EU-LM-1, for max ShF

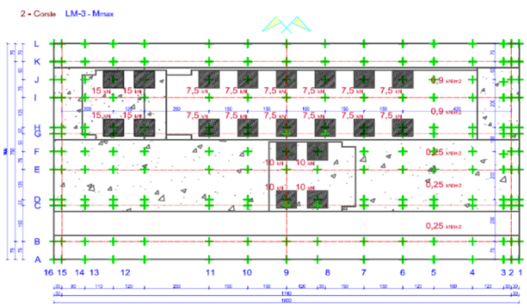


Figure 11: Positioning of the load EU-LM-3, for max BM

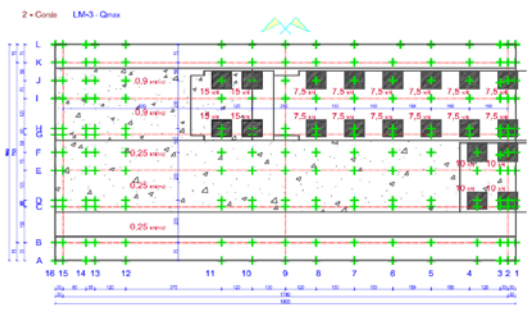


Figure 12: Positioning of the load EU-LM-3, for max ShF

Subsequently, the middle columns of M (for the BM) and Q (for the ShF) tables in Figures 13 to 15 (with the Influence Lines carried with the respective live loads multiplied by the above accepted TDC), contain the final values of the two internal force at the longitudinal beams: max Bending Moment and max Shearing Force.

Then, the last columns of M (for the BM) and Q (for the ShF) tables in Figures 13 to 15 (with the Influence Lines carried with the respective live loads multiplied by the above accepted TDC), contain the ratio in % between the value of the internal force on each one of the longitudinal beams as result of this transversal distribution and the value of the same internal force in the case of having the beam alone, without any connection with the other beams and elements of the bridge superstructure.

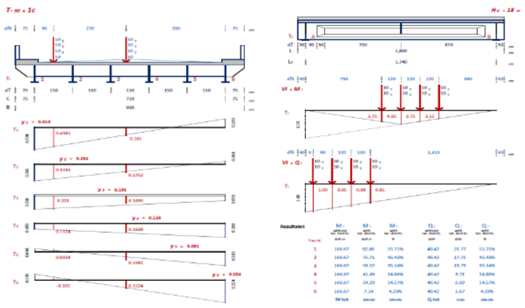


Figure 13: Transv. distribution - Influence line for max BM/ShF, Alb-N-18 over 1 carriageway

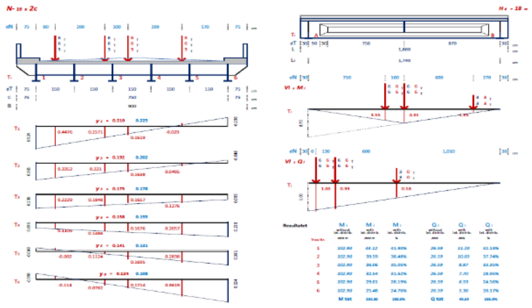


Figure 14: Transv. distribution - Influence line for max BM/ShF, Alb-N-18 over 2 carriageways

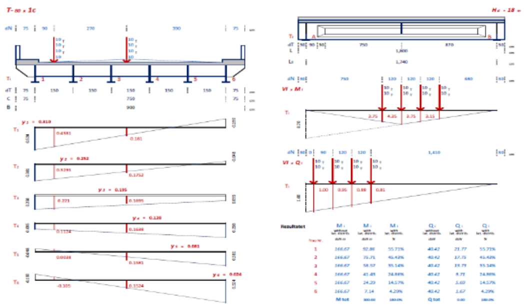


Figure 15: Transv. distribution - Influence line for max BM/ShF, Alb-T-80, over 1 carriageway

After modelling the bridge and its elements, the calculations were carried out using the FaTA-E software, until the respective results for the internal forces in the longitudinal beams were obtained.

Figures 16 to 29 present the 3D real distributions of the internal forces, Bending Moments or Shear Forces over different elements and beams of the bridge, under the effect of carriage with the live load as by the specific Requirements and Code.

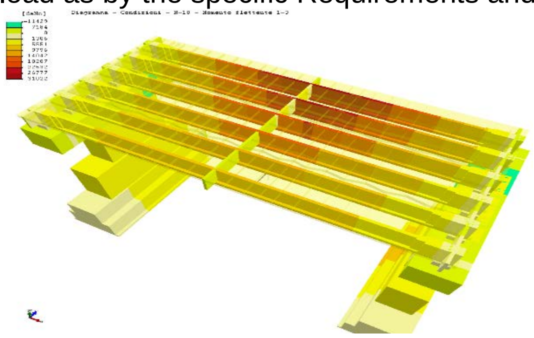


Figure 16: FEM – Transv. Distribution, max BM Alb-N-18 load over 1 carriageway

Figure 17: FEM – Transv. Distribution, max ShF Alb-N-18 load over 1 carriageway

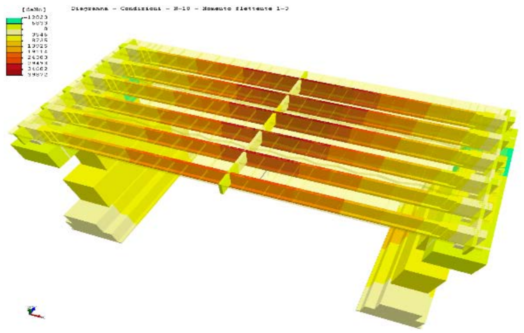


Figure 18: FEM – Transv. Distribution, max BM Alb-N-18 load over 2 carriageways

Figure 19: FEM – Transv. Distribution, max ShF Alb-N-18 load over 2 carriageways

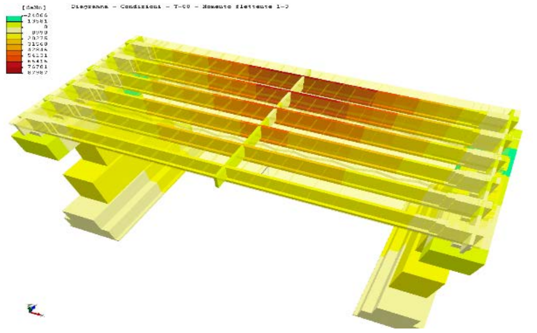


Figure 20: FEM – Transv. Distribution, max BM Alb-T-80 load over only 1 carriageway

Figure 21: FEM – Transv. Distribution, max ShF Alb-T-80 load over only 1 carriageway

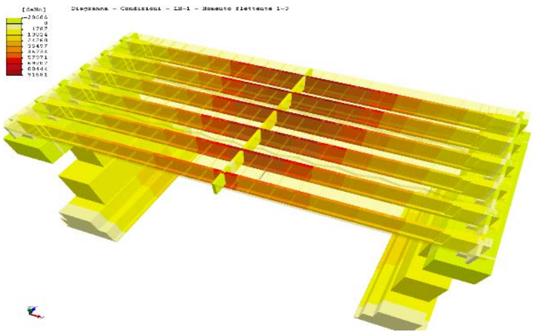


Figure 22: FEM – Transv. Distribution, max BM EU-LM-1 load over 2 carriageways

Figure 23: FEM – Transv. Distribution, max ShF EU-LM-1 load over 2 carriageways

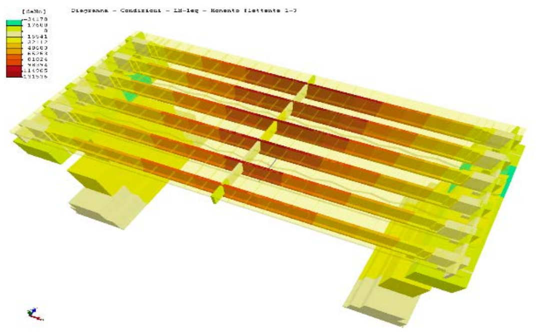


Figure 24: FEM – Transv. Distribution, max BM EU-LM-1+q load over 2 carriageways

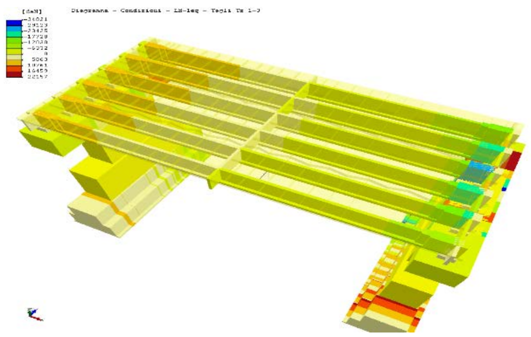


Figure 25: FEM – Transv. Distribution, max ShF EU-LM-1+q load over 2 carriageways

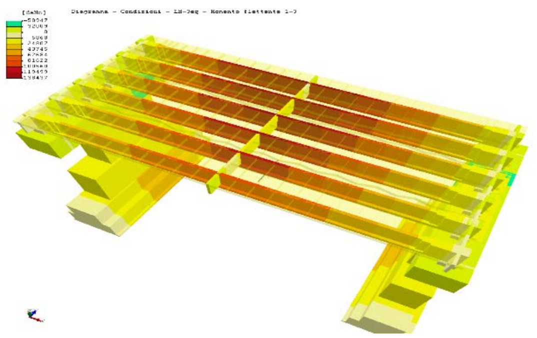


Figure 26: FEM – Transv. Distribution, max BM EU-LM-3+q load over 2 carriageways

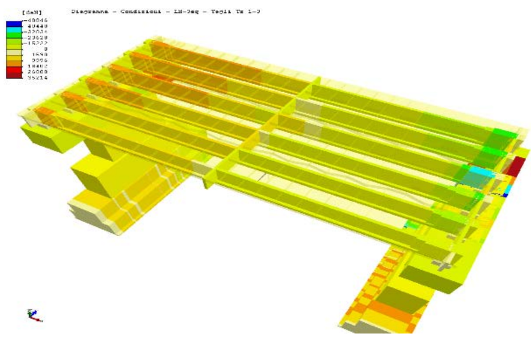


Figure 27: FEM – Transv. Distribution, max ShF EU-LM-3+q load over 2 carriageways

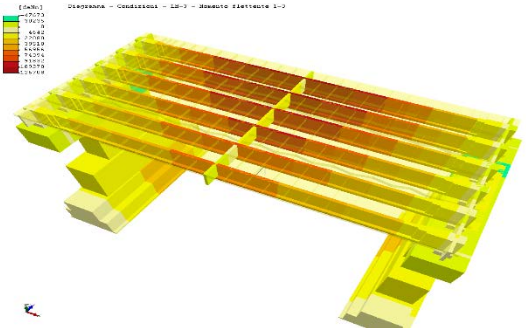


Figure 28: FEM – Transv. Distribuition, max BM
EU-LM-3 load over 2 carriageway

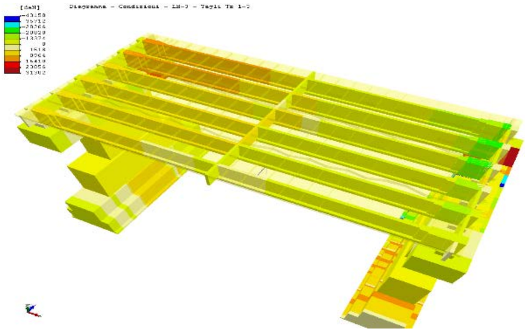
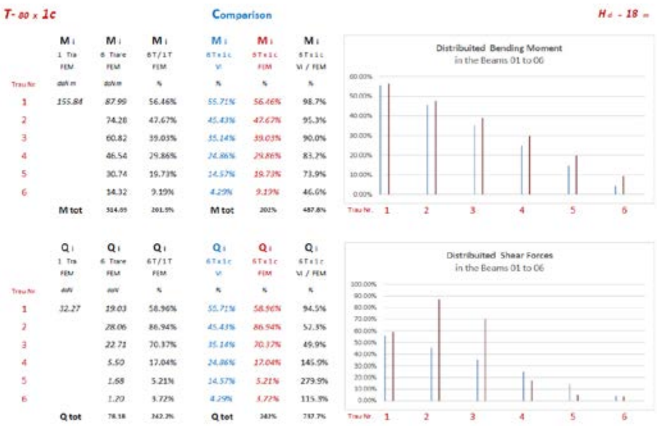


Figure 29: FEM – Transv. Distribuition, max ShF
EU-LM-3 load over 2 carriageway

The results of these calculations have been elaborated and organised for taking in evidence the relations and/or differences between the value of the TDC obtained through the acceptance and use of the Rational Method, Courbon’s ones, and the TDC that result by the values of the internal forces obtained from the calculations using the FaTA-E software.

Doing this we get the value of these internal forces under live loads. The final columns of Figures 30 to 36 present the ratio in % between the value of the internal force on each one of the longitudinal beams as part of the whole superstructure of the bridge and the value of the same internal force in the case of having the beam alone, without any connection with the other beams and elements of the bridge superstructure



T- 80 x 1c — Comparison

Trau Nr	Mi 1 Tra FEM daN m	Mi 6 Trare FEM daN m	Mi 6T/1T FEM %	Mi 6T x 1c VI %	Mi 6T x 1c FEM %	Mi 6T x 1c VI / FEM %
1	155.84	87.99	56.46%	55.71%	56.46%	98.7%
2		74.28	47.67%	45.43%	47.67%	95.3%
3		60.82	39.03%	35.14%	39.03%	90.0%
4		46.54	29.86%	24.86%	29.86%	83.2%
5		30.74	19.73%	14.57%	19.73%	73.9%
6		14.32	9.19%	4.29%	9.19%	46.6%
	M tot	314.09	201.9%	M tot	202%	487.8%

Trau Nr	Qi 1 Tra FEM daN	Qi 6 Trare FEM daN	Qi 6T/1T FEM %	Qi 6T x 1c VI %	Qi 6T x 1c FEM %	Qi 6T x 1c VI / FEM %
1	32.27	19.03	58.96%	55.71%	58.96%	94.5%
2		28.06	86.94%	45.43%	86.94%	52.3%
3		22.71	70.37%	35.14%	70.37%	49.9%
4		5.50	17.04%	24.86%	17.04%	145.9%
5		1.68	5.21%	14.57%	5.21%	279.9%
6		1.20	3.72%	4.29%	3.72%	115.3%
	Q tot	78.18	242.2%	Q tot	242%	737.7%

Figure 30: Transversal distribution - Comparison IL and FEM results,
Alb-T-80 over 1 carriageway

Then, for all the distributions of the Live Loads as by the Albanian Requirements and the EN Code, the ratio between the TDC, obtained through the acceptance and use of the Rational Method, with the TDC resulting by the values of the internal forces obtained from the calculations using the FaTA-E software, has been highlighted, both in tabular and graphic form.

Figure 31: Transv. Distribution – Comparison IL and FEM results, Alb-N-18 over 1 carriageway

Figure 32: Transv. Distribution – Comparison IL and FEM results, Alb-N-18 over 2 carriageways

Figure 33: Transv. Distribution – Comparison IL and FEM results, Alb-N-18 / EU-LM-1

Figure 34: Transv. distribution – Comparison IL and FEM results, Alb-N-18 / EU-LM-1+q

Figure 35: Transv. distribution – Comparison IL and FEM results, Alb-T-80 / EU-LM-3

Figure 36: Transv. distribution – Comparison IL and FEM results, Alb-T-80 / EU-LM-3+q

3. CONCLUSIONS: 18 ML BRIDGE OF 6 BEAMS

GENERAL

The aim of this study, which deals with the most common type of bridge superstructure used in Albania is to highlight the possible differences between the TDC of the live loads according to the Rational Methods, Courbon’s one, and the same TDC obtained from the calculation according to MEF, using the FaTa-E software, for the distribution of the Bending Moments as well as for the Shearing Forces at the different Longitudinal Beams of the Bridges.

The study took into consideration the composition and distribution of the live loads over road bridges according to both Albanian Requirements and the EN Codes highlighting the respective differences. These differences are faced not only between the values of the TD Coefficient but, what is more important, they are faced also between the values of the internal forces, BM and ShF, in the elements of the bridge superstructure calculated according to both Albanian Requirements and the EN Codes.

The latest differences come as result of the fact that the legal Albanian Requirements are not updated.

In addition, to be emphasized is the fact that actually in Albania the calculations of bridge structures, like all the other structures, are done through methods, Requirements, Codes, etc., different from those in force. Then the used physical-mechanical characteristics, factors, coefficients, etc., often if not always, are not official and do not consider the local specific values. This situation makes urgent the request of updating the existing national requirements, or their approximation to the EN Codes.

FINAL

From the calculations and the respective results using Rational Methods and FaTa-E software, regarding TDC of the internal forces, BM and ShF, under the live loads on the bridge superstructure of this study, the following conclusions can be highlighted:

1) Actually, for the calculations of BM as well as for the calculation of ShF during the bridge superstructure design, it is taken the same value of the TDC calculated with the Rational Methods. Considering the real connection of superstructure elements, as well as the positioning and modality of the discharge of the live loads from the first to the last supporting elements, this action is not justified and does not lead to the real results.
2) Comparing the results of the above calculations according to Rational Methods and FaTa-E software, for the action of the live loads after the Albanian Requirements, it is found that:
   a. for the BM distribution:
      - the TDCs for the 1st beam are almost the same and their values are 35% for the load Alb-N-18 over one carriage, 42% for the load Alb-N-18 over two carriages and 56% for the load Alb-T-80 over one carriage;
      - the TDCs for the 2nd up to the 6th beam are very different and the ratio of their respective values varies from 40% to 92% for the load Alb-N-18 over one carriage, from 78% to 87% for the load Alb-N-18 over two carriages and from 46% to 96% for the load Alb-T-80 over one carriage;
   b. for the ShF distribution:
      - the TDCs for the 1st up to the 6th beam are very different and the ratio of their respective values varies from -52% to 180% for the load Alb-N-18 over one carriage, from 90% to 227% for the load Alb-N-18 over two carriages and from 49% to 279% for the load Alb-T-80 over one carriage;
3) Comparing the results of the calculations according to Rational Methods for the action of the live loads after the Albanian Requirements and the calculations according to the FaTa-E software for the action of the live loads after the EN Code, it is found that:
   a. for the BM distribution:
      - the TDCs for the 1st beam are almost the same and their values are 42% for the loads Alb-N-18 e EN-LM-1+q, carrying both carriages;
      - while, for all the other cases of the loads and beams of the bridge superstructure, the TDCs for the 1st up to the 6th beam are very different and the ratio of their respective values varies from 63% to 78% for the Alb-N-18 vs EN-LM-1 over two carriages, from 85% to 101% for the Alb-N-18 vs EN-LM-1+q over two carriages, from 22% to 149% for the Alb-T-80 over one carriage vs EN-LM-3 over two carriage, from 16% to 135% for the Alb-T-80 over one carriage vs EN-LM-3+q over two carriages;
   b. for the ShF distribution:

- the TDCs for the 1st up to the 6th beam are very different and the ratio of their respective values varies from 68% to 451% for the Alb-N-18 vs EN-LM-1 over two carriages, from 60% to 284% for the Alb-N-18 vs EN-LM-1+q over two carriages, from 62% to 710%, (0,60% Alb-N-18 vs 4,29% EN-LM-1+q), for the Alb-T-80 over one carriage vs EN-LM-3 over two carriage, from 53% to 193% for the Alb-T-80 over one carriage vs EN-LM-3+q over two carriages.

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THE CHALLENGES OF IMPLEMENTING GENERAL DATA PROTECTION LAW (GDPR)

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ABSTRACT

The vast majority and complexity of big data being processed by the companies, imposes a need for a common guideline among all the data stakeholders regarding the personal data controlling and processing. The European General Data Protection Regulation (GDPR) imposes more restrictions towards data handling and gives the data subjects more freedom on how to share their personal data. The complexity of such law, to be implemented towards all the companies which hold European citizen data has a lot of grey areas. In this article we will see what changes are needed between data subjects, data controllers and data processors to be fully GDPR compliant. The aim is to see how GDPR really fits with recent technology processes which are in continuous evolvement.

Key Words: GDPR, data subject, data controller, data processor.

1. INTRODUCTION

It was in 1995 when the European Commission introduced the Data Protection Directive and it was in 2012 when a reform was proposed to adapt to it to the latest technical development. This can be considered as a huge progress, since jumping from a directive to a regulation is the right way of reducing legal fragmentations. This legal movement makes it applicable to all member states [1], and not only, and prevents legal inconsistencies. In most parts of it, GDPR can be considered as a Directive ’95 version 2.0 as the changes in its generality are minor and do follow the same path. On 4 May 2016, it was published on the Official Journal of the European Union, The General Data Protection Regulation (GDPR or Regulation 2016/679) and is now already in place not only in the European states but also on those states which process European residents’ data.

Things have changed since 1995 when the Data protection directive first appeared. With GDPR, the European Commission made certain updates in the context of the data processor and data controller establishments and added more criteria regarding data safety. The GDPR now has many new definitions and rights such as the consent, compensation which have been expanded into a wider scope. In the GDPR document, the usage of certain terminologies is bound to bring legal clarity. It is interesting to note that in the directive, recourse to remedy has been mentioned in the recitals and it is the national law of individual member states, which shall regulate the enforceability. GDPR, on the other hand, mentions this under its articles together with the jurisdiction of courts and exceptions to this right.

2. STATE LEGISLATION

Still, the member states to have freedom of taking provision when it comes to facts not covered by the GDPR or its recitals. Under recital 10 this is made clear:” for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller, the Member States should be allowed to maintain or introduce national provisions to further specify the application of the rules of this regulation” [2]. Regardless, GDPR lacs on terminology explanation. What is public interest is not yet defined and as such a lawful miss interpretation between cases and between member states can make part of the regulation null. An example to illustrate future examples can be: Data of a German resident has to be erased as he has filled the right of erasure in Germany as his resident country, but the data are processed in Belgium and the company uses the public Belgian interest justification to keep them. As long there is no clear definition of this, case by case this will shape its definition. As reference [3] states, there are at least 37 cases in which a member state is given freedom on interpretation. From the above reasoning, the national laws in some cases will still be effective. This is since GDPR does not strengthen the legal bar. Consequently, local legislators might not give the right importance to the territorial scope.

The GDPR introduces significant new requirements and challenges for legal and compliance functions. This means changes to the ways in which technologies are designed and managed, including a focus on profiling and security. GDPR requires clear and proactive oversight of data storage and lineage. Regardless, companies and public entities that must deal with such regulation need to be updated on the topic. Data protection authorities (DPA) in their respective websites have published national information about GDPR and in most of cases the information is not updated or does not cover all the legal aspects. This gap is filled by other private sector companies which core business is on providing legal consultancies regarding GDPR or certifying DPOs (data protection officers). There are also many other websites which slightly discuss GDPR in general, but few of them motive their findings on the respective regulation laws.

3. ROLES AND PROBLEMS

GDPR is expected to reshape the hierarchical structure of both private and public sector. As keeping track of the law and technological updates regarding privacy and protection also requires some level of expertise, GDPR has introduced the DPO role, even though for certain countries this role is not new. GDPR and its recitals define the DPO role as very important for both public or private sector, both large or small scale of data being processed, even though the scale is not defined, but if there are personal data, DPO is a must role for the company or authority.

During his/her job, a DPO, being certified or not, should have enough knowledge to guide the company towards problems that the company or public entity might have on the road towards GDPR. DPO has several duties to complain the company with GDPR regulation. But as most of the companies rely on automated decisions, their decisions sometimes can be objects of complaints. This is an increased risk for the company but also more work for the DPO which must guide the company towards more complex policies to satisfy such complaints. This right, in the GDPR document [2] tend to be ambiguous. For example, articles 13 till 15 GDPR limits somehow the information which can be shared regarding the logic that the automated system uses. The contradiction continues also with article 22. There it is specified that after the made decision which fulfills the contractual obligations or from given consent is finished, after that human intervention or express views or contest that decision can be done. It is not mentioned about getting details on the reached decision. Briefly, the word *post explanation* is mentioned in recitals, but legally a recital does not have legal power rather than just guidance. Thus, as long the automated decision meets the contractual bases, there is nothing the data subject can do about it as it is lawfully a valid decision. In legal terms as said by [4] for a right to be legal they have to be established first. For now, the data subjects can only use such "rights" as duties.

Another critical sector which will be radically shaped under GDPR is digital marketing. Regardless of fully applied legal changes or not, this sector in recent years has seen many guides from institutions or even court decisions. Still, the changes from GDPR reside on the duties aspect rather than full legal consequences as most of the processes reside under reviews. Due to the way of work e-mail marketing seems to be vanishing as explicit consent cannot be taken in such way. As a relative solution which is gaining terrain day after day seems to be the social network. Taking explicit consent there might seem easy as the published information resides under public. Greater use of social crawler tools for anticipating trends or listening to customer comments and complaints seems to be a matter of easy click with this manner. Getting data subjects behavior is a matter of scrapping public social media publications. The legality and purpose in particular are key considerations before processing personal data: many companies are not aware that if you track an individual's movement around your website it could well be personal data collection even if it is "just" an IP address. If it can be attributed to an individual, then the user must be informed. Many people also forget that when you interact with social media users, you must make it clear if their personal data will be used for other things (such as analyses) – even if that information is already publicly available.

4. GDPR DOCUMENTS

Knowing someone’s information because the data subject made it publicly available does not mean free advertising rights. The term ‘target ads’ under GDPR is not safe. Due to vogues word definitions, the public interest can serve as a shelter in some cases, but not for everyone. Personal ads rely on consent. Such cases can be the personalized ads from Microsoft under Windows 10 system or personalized Google ads. Consent will not be assumed as a result of a customer signing for a service unless that service specifically requires it. Adding to the process, consent boxes should not be pre-ticked, there should be no improper suggestion to tick the consent as mandatory or if not ticket the service will not be given at all. In the text of the consent among other things, there should be the data handling name or any other third parties which will access those data. Since GDPR is a continuous activity, every step should be saved. This documentation will detail what the data subject has consented to, the information they were given which facilitated consent, and the method of consent.

Saving a lot of documents which verify that the GDPR processes are fulfilled will mean that sooner or later big data will be present. Due to their nature, big data have the tendency to target and profile data subjects. The concept of big data goes in a clash with that of data minimization, which is required by GDPR. This problem might be guided by the code of conduct, which are self-regulations that the company or public entity will follow in order to respect the regulation. But the data authorities do not offer any initiatives to them in order to adapt to this new business model: “rights first”. Code of conducts have to be approved by data protection authorities, but there is no model to follow, they are seen case by case and that takes time. Big data somehow makes possible the re-identification of the data subjects by making use of non-personal data, such as metadata or other data forms. As such, even anonymization might be an ineffective solution to this problem. In 2010, it was published by EU Commission [5] that it is difficult to keep track of latest technological development. As these changes do not keep track of how much time is needed for a regulation to be applied, changes towards big data minimization will require big time.

Staying on the vast number of documents needed for the GDPR to happen, it can be understood that without a proper consent data processing cannot happen. But before the data subjects give that right, they have to be informed. There are changes yet to be implemented by the data controllers. Data subjects have to visit data subject’s website and analyze their privacy policies. Most of the services nowadays are given online and as such online is the place where information can be found. This information, of a company or public entity which shows that they will respect GDPR, should be made easy findable and easy to read. In [6] it was found that offering such easiness was not a complaint and, in most cases, it took more than 5 minutes to find GDPR related information. In the same article, it was found that besides the fact that GDPR must apply same for all EU countries, making public such data, was better fulfilled by Austrian websites and not others. Non-giving at this GDPR aspect the right attention imposes the data subject to the risk of a time-consuming process considering their computer handling abilities. So, maybe in GDPR v.2 among other updates, there should be a guide on how to better make visible privacy policies and not only.

4.1 PIA-DPIA

Two other needed documents per project are PIA and DPIA. It takes time to write a document for each project which imposes risks or deals with data, as it has to be: general description of the envisaged processing operations, an assessment of the risks to the rights and freedoms of data subjects, the measures envisaged to address the risks, safeguards, security measures, and mechanisms to ensure the protection of personal data [7]. By analyzing the data protection authorities’ websites, it can be understood that different countries have a different approach for these document filling. For example, UK has made PIA mandatory for governmental institutions, Spain the same. On May the 9, Nordic countries signed an agreement of cooperation [8] will collaborate with the same path regarding GDPR steps and especially on providing help for pia and dpia. So, again, even GDPR was thought to be common for every state, in practice, there are derivations from the initial idea. But all agree that PIA is required before the project is applied in order to save expenses later on. All should remember that PIA is a document which when applied it should reduce privacy impacts not eliminate them.

The collaboration between data protection authorities and companies or public entities can be clearly seen with the DPIA. DPIA resides on the obligations shown in Article 5, 24 and 35 [2]. But there is not written that DPIA should be published anywhere rather than consulted with authorities as their text might include copyrighted information. A more evident problem here is that yet there is no guide on what can be considered as screening questions. Those questions can then make the publication of DPIA valid or categorize it is protected under copyrighted information. If attention is paid to the article 35 [2], it mentions high risks but does not define what risk is. Due to this, amendments have been added to the regulation. Again, cooperation with data authorities is of high importance due to different interpretations that might arise. This is also the case for the recital 89 [2], where it is said that PIA is required when there are uncertainties in processing as an operation of a new kind. Again, new kind and how much is considered high are yet to be defined.

4.2 Out of EU zone

In a more interconnected world, keeping your privacy protected is becoming an impossible mission. If we follow [9] regarding the main property of privacy, that of preventing disclosure of personal information, every country has its own different approach on this, even though it is a right by definition from Economic Co-operation Forum (OECD) as said in [10]. Regarding boundaries, many different entities residing in different countries may process personal data. It is also stated in [11] that there must be the same level of protection for protecting European resident's data when these last are exported out of EU zone.

4.2.2 Privacy Shield

When it comes to export those data to the USA, the laws there are different. It seems that until this moment, there is no common regulation/law among states. As [12] states, that would make difficult the free trade. Due to this different view of non-common protection, Privacy shield comes in place. It is an updated version of the Safe harbor [13]. Free trade of data has changed a lot and as long there is a legal basis or any valid form of consent, there is no need for permission from a data authority and prove them that there will be no data disclosure, as it was a practice back then [14].

But laws regulating this type of transfers have not been reviewed too much from courts in connection to legal interpretations [15]. The legal interpretations given to specific cases and later translated into regulations or law are indeed weak. The case of Lindqvist [16] made relevant the fact that there is needed more precise definition regarding considering hosting place as a third country and the way how the data are accessed from third parties. The current interpretations may lead to the think that transfer to the third country, in the cloud or not, would happen at the same time to all third countries which have access to the internet. This is not a technical interpretation, so, cloud hosting providers now must make public where they save the data and EU companies are advised to keep their data within EU zone.

Not everyone who processes EU residents' data can keep with the EU laws. An interesting case is that of USA. Updating from Safe Harbour to Safe Harbour v.2 (Privacy Shield) requires that the companies have to be self-certified. Due to such legal updates, now US companies dealing with EU data are totally reshaped and have to reconsider their data strategies. There are a lot of documents to be filled, updated and newly created. One of them is the data flow mapping. This was thought to help them somehow in their relocation steps if needed. But this law does not make any distinguishing, at least declared officially, when it comes to data transfers of very importance for the security such as transferring of data about criminals, possible threatens to national security etc. US liberal mass surveillance Safe harbor v.1 was contested two times by the Austrian activist Schrems [17]. During the process, US side contested that data transfer would become complex, but the EU safety side won the cases twice. Again, this is can be considered as an example, besides the fact that Austrian websites are GDPR complaint, that Austria is serious in terms of e-privacy.

Yet, the risks that this change brought to US-EU data transfers was a big reason why the Article 29 Working Party has seen several updates. Maybe inspired by Schrems, GDPR has been updated several times. There have been court cases, which directly influenced in the privacy shield, many article were changed as suggested by [18]. Due to their difficulty into being applicable, it seems that extraterritorial laws, such as GDPR and Privacy Shield somehow the idea to treat foreign countries as they were EU part seems more of a symbolic value. GDPR was written upon cases, such as Pammer v Reederei Karl Schlu¨ter GmbH & KG11 and Hotel Alpenhof GesmbH v Oliver Heller [18], and as such companies adhering to the EU data market have to at least comply with the general regulations and recitals and what is most important to interpret GDPR with their respective DPA.

5. CONCLUSIONS

GDPR can be considered as the end of DPA era and the beginning of a new one. It can be considered as one set of rules which apply across EU and not only. As it is a new and ongoing process, the risks are evident. Even before the data are being processed, both data controller and data processor need to have in place a lot of policies which makes them compliant with the regulation. Yet, it is difficult to predict what will happen at every step of data processing. The steps include new rights to be respected, joint responsibilities and mandatory notifications, as a consequence, the company or public entity will be on alert and cooperate with their respective DPA all the time.

A lot of uncertainties, a lot of documents and many departments are involved by the GDPR. Finding the right interpretation of definitions and legal interpretations is not easy. These uncertainties can be waived if all the collected data would be anonymized, as such avoid GDPR in the first place, but in most of the cases that is not possible. How the real implementation will proceed that will be seen case by case. Yet, GDPR will be updated soon with e-privacy regulation [19]. Technology advances, law gets updated.

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Structural Changes in Oil Cokes and in Anthracites Under the Temperature Influence and the Relation with Their Physical Characteristics’ Standards

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ABSTRACT

The usage of raw materials to produce carbonic materials and composites with physical properties according to the European standards constitutes a necessity for the gaining of composite materials which are used in the technological process of melting iron connections, etc. For the study of carbonic matter’s physical properties were used physic methods such as diffractometry with x-ray and electronic microscopy. Diffractometry with x-ray was used for studying the impact that the temperature between 1000 ^{0}C -1600 ^{0}C has on the structural developments for two types of oil coke and two types of anthracites. The experimental results which we collected show that these developments are more rapid in the oil coke, where the first traces of gratification are shown at the temperature 1100 ^{0}C for the Ballsh’s (KB) oil coke and 1400^C for another type of oil coke (KI) which is produced in Italy. It is also noticed the full shortage of graphite traces from anthracites till 1600 ^{0}C. With our studied oil cokes and anthracites, it was produced the mass carbonic electrode which is used for the melting of ferrochrome in furnaces with electric arc. The structural differences have their direct impact on the electronic characteristics of carbonic matter and this is reflected in the progressive reduction of the energetic split with the thermic treatment’s temperature growth. In the interval 1100 ^{0}C -1600 ^{0}C, the electric conduct is magnified relatively slow. These analyses results contribute in the analyzation of physical properties of the first raw material in order to have a composite material according to the defined standards.

Keywords: oil coke, anthracite, composite, structure.

1. INTRODUCTION

Now a day’s carbonic materials have gained interest for the production industry and science. As carbon and graphite have thermic stability in elevated temperatures, anti-corrosive properties, etc., their production has found vast usage in different technical areas and scientific research. Considerable importance and interest are given towards physic methods for the study of structural carbographies materials, from which we can mention: diffractometry, spectroscopy with absorbism, spin-electronic resonance, spin-protonic resonance, tentgenoanalyse, etc. One of the main study methods for the structure of the carbonic material remains diffractometry in general and particularly the x-diffractometry which with the spread and strengthening of calculation technique gives a maximal structural information from the results of the experiment. Modeling or simulation of the diffraction occurrence has open new fields of study which makes possible the knowing of carbonic materials structure in general. Through the experimental information processing, new microstructural knowledge for these materials, which is necessary for the technological intervention etc., it is gained.

2. METHODS OF STUDY

Diffractometry with x rays is used for the study that the temperatures from 1000 ^{0}C till 1600 ^{0}C have on the structural developments for two types of oil cokes, two types of anthracites and their composites, which macrostructure and microstructure are shown in the below pictures.

Fig. 1a.Oil cokes microstructure

Fig. 1b. Anthracite macrostruture

Fig. 1c.Oil coke mactrostructure

Fig.1d. Anthracite microstructure

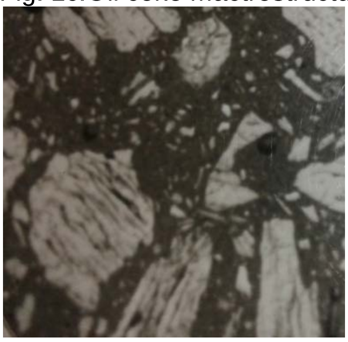

Fig. 1e. Macrostructure of carbonic composite K-1

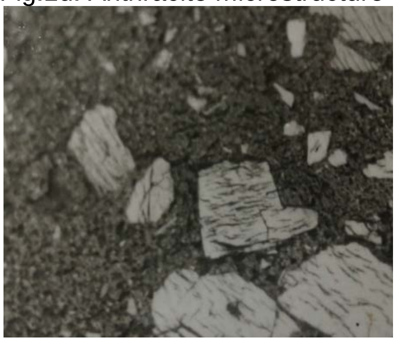

Fig. 1f. Macrostructure of carbonic composite K-2

Figure 1: Macrostructure and microstructure for oil cokes types KB, KI (1a, 1b, 1c, 1d) and carbonic composites K-1 and K-2 (1e, 1f)

Our collected experimental data have shown that these developments are faster at those oil cokes where the first traces of graphitization are shown at the temperature $1100\,^{0}C$ for the Ballsh’s oil coke (KB) and at 1400^{C} for another oil coke type (KI) produced in Italy [1]. With our studied oil cokes and anthracites, it was the produced the mass carbonic electrode which is used for the melting of ferrochrome in furnaces with electric arc [2]. The structural differences have their direct impact on the electronic characteristics of carbonic matter and this is reflected in the progressive reduction of the energetic split with the thermic treatment’s temperature growth. In the interval $1100\,^{0}C$ -$1600\,^{0}C$, the electric conduct is magnified relatively slow.

2.1. Characteristics of advanced carbonic structures

Advanced structures have a two-dimensional regularity which is spotted in industrial carbonic materials such as cokes or in carbonic mineral materials with an advanced high scale of metamorphism such as anthracites. The base of these structures is the turbostratic package which is composed of carbonic layers with two-dimensional structure. Such a layer has as a unitary cell the hexagonal ring (fig.1a). Inside of every turbostratic package, layers are nearly parallel with each other, instead, the azimuthal orientation is characterized by disorder, which last depends on the thermic processing temperature [4][5]. The package has two characteristic dimensions L_A and L_C which are subject of the statistical distribution (fig.1b).

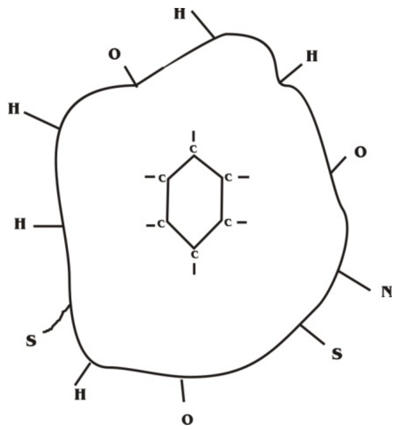

Figure 1: a. Turbostrate package with two parameters structure and carbonic layers

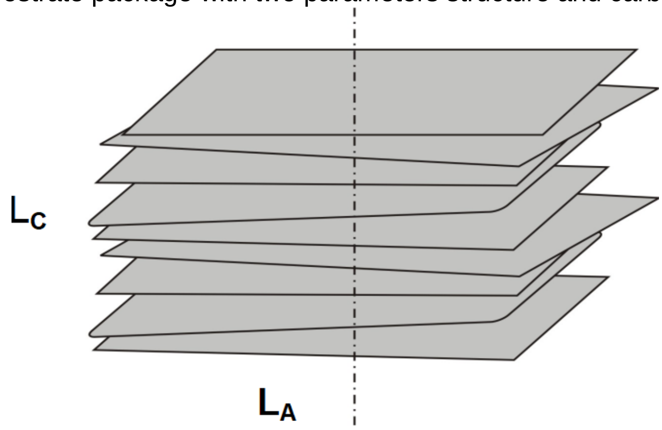

Figure 1: b. Statistical distribution L_A and L_C

With the thermic treatment temperature increase over $1500\,^0C$ -1600^0C, the layers are grown fast and the azimuthal orientation progresses, instead, at temperatures over 2000^C the packages are united in a massive way and are gradually transformed in graphite crystals. The graphitization process is very complicated, especially in its first phase which happens in temperatures 1200^C-1800^C for oil cokes and $2000\,^0C$ -$2500\,^0C$ for anthracites [1], [4]. We have collected information for the first phase of graphitization for two oil cokes type [1], [6].

2.2. Experimental results and interpretation

The structural changes which happen during the thermic treatment are reflected in the changes of some microscopic elements such as the distance between turbostratic layers (d), package dimensions L_A and L_C and the layers number <N> inside of a package. The statistical distribution of some packages according to their dimension makes possible that from the experimental data we can get the medium values of the above parameters. Structural advances during the thermic treatments can be seen also in the changes that the irregulate azimuthal parameter (p), graphite scale (g) have and these are connected among them with the expression $g=1-p^2$ [4]. Naturally, these changes are reflected also at the macroscopic parameters such as structure density, total defects, electric conduction, thermic conduction, etc. In fig. 2 is shown the dependency of the stratified distance, instead of in fig. 3 is shown the number for the dependency between turbostratic packages from the thermic treatment temperature.

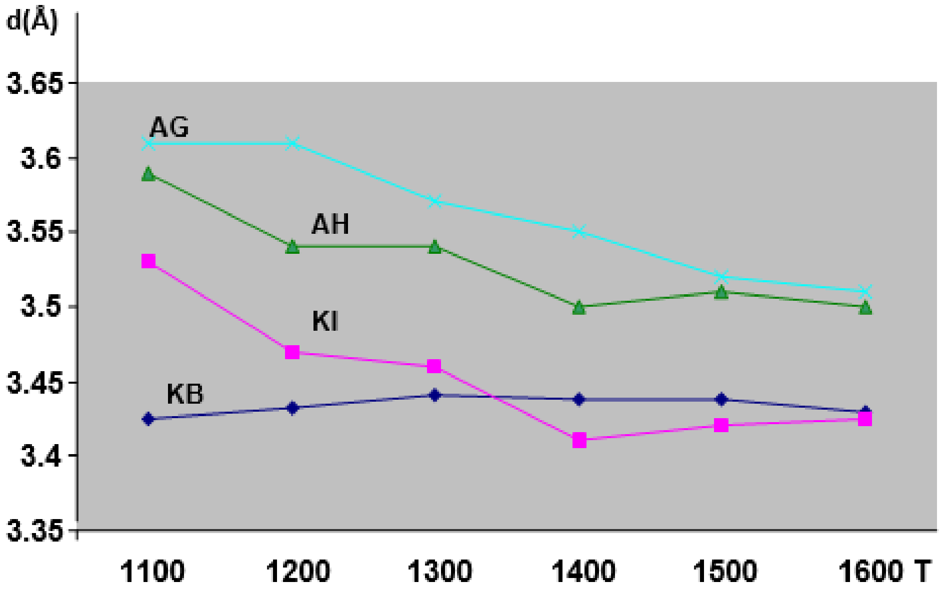

Figure 2: The dependency of the stratified distance from the thermic treatment temperature T

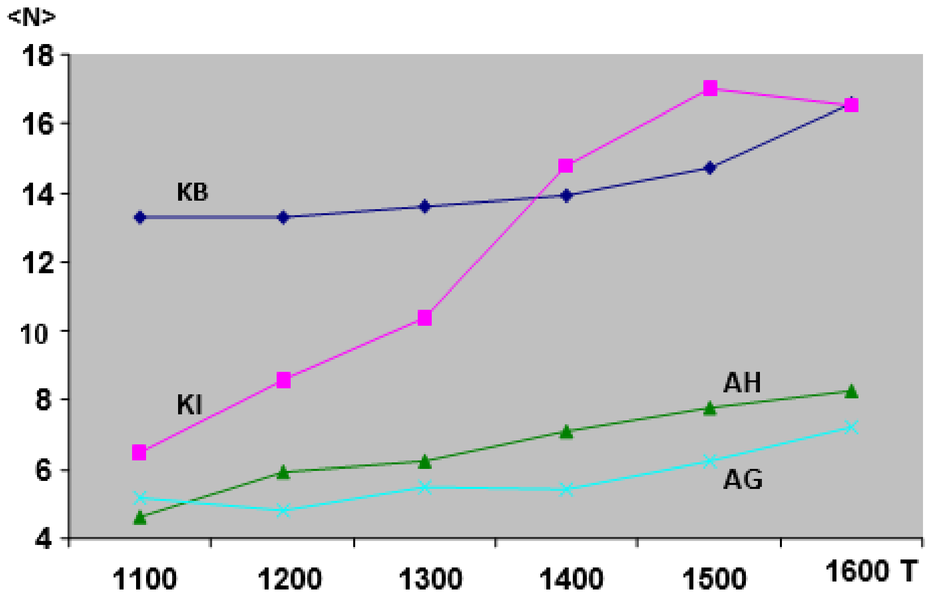

Figure 3: The dependency between turbostratic packages from the thermic treatment temperature T

It is clearly seen that the oil cokes’ structure is more advanced from the anthracites one and that the structural changes depend on the carbonic material type. Between anthracites, more advanced in terms of structure is the anthracite type AH and between cokes is the type KB. The dimensions L_A and L_{C} of the turbostratic packages are determined with the help of half-width B_{002} of the main carbonic materials diffractogram’s line [4], [1]. With the temperature increase till 1600 ^{0}C, these dimensions are increased relatively fast and with more or less the same rates for each dimension as shown in the fig.4 for the Ballsh’s oil coke.

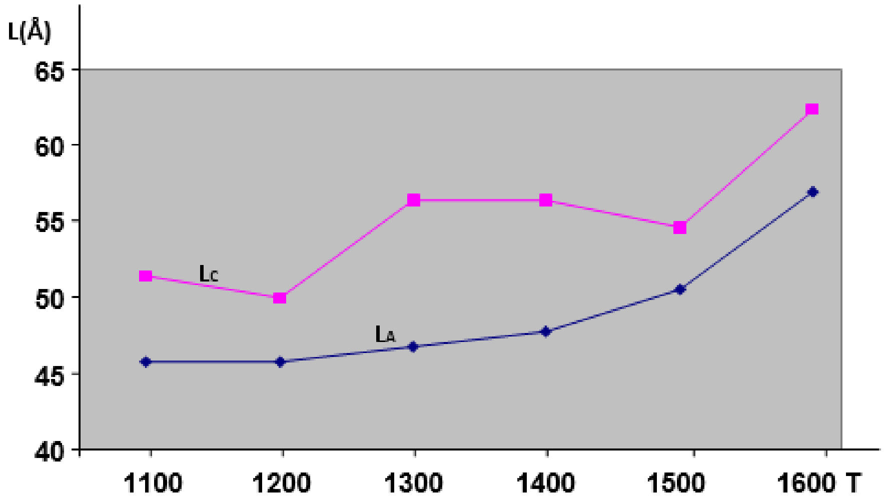

Figure 4: The dependency of dimensions L_A and L_C from the thermic treatment temperature T

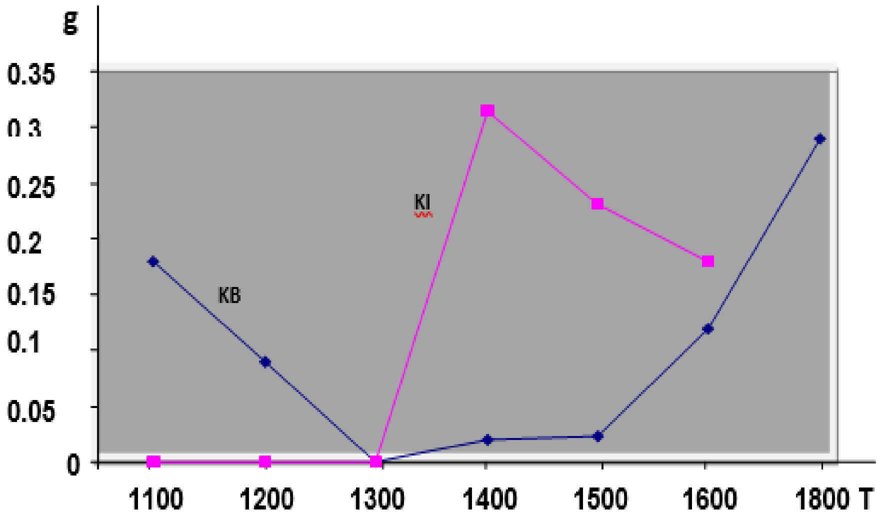

Figure 5: The dependency's scale of graphitization between KB, KI and the thermic treatment temperature T

Graphitization constitutes a qualitative structural change from two to three dimensions. This process is very complex and is gradually developed with the thermic treatment temperature increase. Especially the initial phase has a zig-zag development character [1], [2], [6]. The first graphitization traces were noticed at 1100 ^{0}C for the KB and at 1400^{0}C for the KI. Instead, the dependency's scale of graphitization from the thermic processing temperature for KB and KI is shown in fig.5. There it is clearly seen also the coke's type impact over this dependency. In our study, it is also noticed the disappearing of the graphitization traces phenomena at a certain temperature and the reappearing of them with its increase. Diffractometric data show that the graphitization development at the initial phase is accompanied with the temporary appearance of a peak dwarf satellite (f002) near at the main peak (002) and that its disappearance shows further stable developments towards the three-dimensional structure [6].

Knowing beforehand the raw materials' structural characteristics, which have “distant” characteristics with each other, such as oil cokes and anthracites, and which are used for producing carbonic composites, offers the possibility to make qualitative differential analyses for finding these components in the carbonic composites compound. This idea can be derived from the data shown in fig.6.

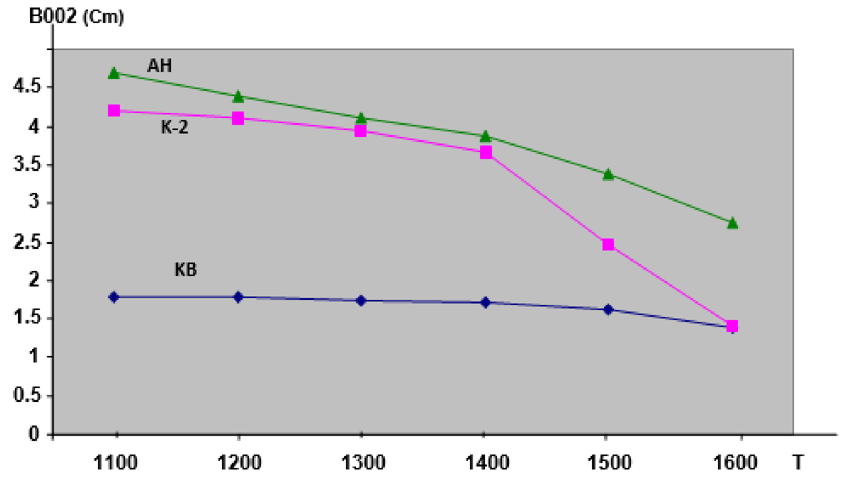

Figure 6: The dependency Boo2 from the temperature for AH, KB, and the composite K-2

Here it is shown the B_{002} temperature dependency for AH, KB and for the composite K-2, which despite components AH and KB has also pekor bindings. During the K-2 curve progress, the presence of the pekor binding, which at T>1000 ^{0}C is cokefized and with further temperature increases, its structural changes happen faster than anthracite. This is the reason which with the temperature increase the composite’s curve K-2 inclines more and more towards to the KB curve.

The structural changes for carbonic material affect significantly in the electronic characteristics of the carbonic structure. Carbonic materials show similar properties with semi-conductive materials [5] and their electric conduciveness varies from the temperature measurements according to the known law:

$$\sigma \approx \exp\left(-\frac{\Delta\varepsilon}{kT}\right) \qquad (1)$$

The energetic split $\Delta\varepsilon$ varies significantly from the thermic processing temperature and progressively decreases with its increase as in the Table 1.

Table 1: Values for the energetic tear Δ ε from the temperature T

Temperature (^{0}C)	500	700	900	1100	1200	1400	1600	1800	2500
Δ ε (eV)	1.02	0.4	0.2	0.11	0.10	0.08	0.07	0.06	0.01

Our experimental measurements for this dependence are shown in fig.7; instead of in fig.8 it is shown the electric conductivity dimension L_C for the turbostratic cellule. These data belong to the K-2 composite which produced the electrode mass which is widely used even nowadays in the industrial melting furnaces with an electric arc.

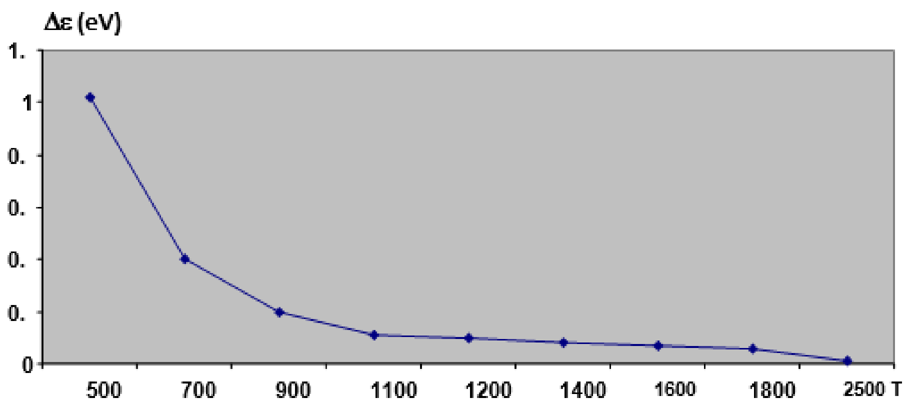

Figure 7: The dependency for the energetic tear from the temperature

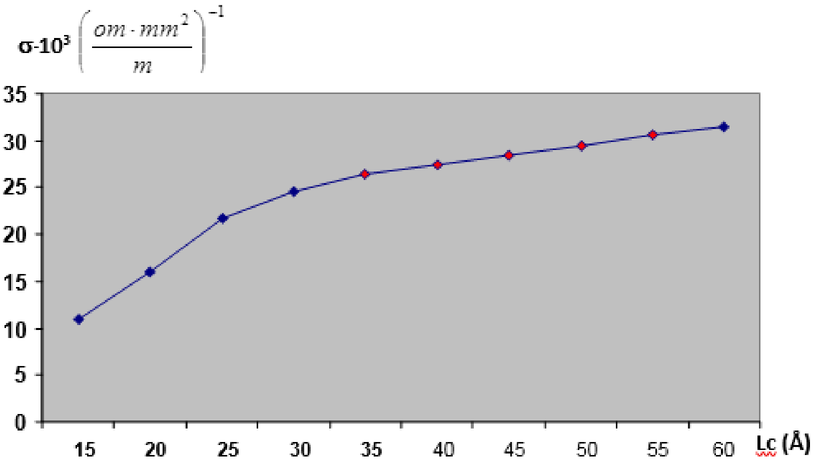

Figure 8: The dependency for the electric conductivity σ from the Lc dimensions

3. CONCLUSIONS AND RESULTS

Electric's aresistance of the carbonic composite depends from the binding quantity in the recipe. The binder's percentage interval which permits good electric resistance values for the two composite types K-1 and K-2 is between 22-25% pekor binding. The composite's electric resistance is influenced from the type of the filling material.

Open porosity is the main parameter which establishes the values for the carbonic 's composite electric resistance. In structures with low porosity, amid-granular contacts happen more often, contact potential barriers are lower and as such electric resistance is lower.

Optimal granular reports for the dry mass of the filler secure, besides the maximal value of the voluminous poured mass, minimal values for the specific electric resistance.

During the different baking phases, the specific resistance of the carbonic composite is lowered significantly in 500 ^{0}C -600 ^{0}C, which is the temperature where the half-cokesification process for the pekor binding is finalized, and where changes happen in its macromolecule structure.

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Refugee Camp Design Based on Moduler System Structures

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ABSTRACT

Disasters pose the housing problem to many people. The need for temporary shelter from natural disasters such as earthquakes, floods, and fires has increased considerably with the wars in recent years. For security reasons, asylum seekers who are driven by forced migration and escape the battle in Syria live in camps, on the streets or in the houses. According to the report of the AFAD, only eight percent of refugees settled in Turkey stay in the camps. This number is 228.918 people according to the immigration administration. Refugees who migrated to Turkey first settled in camps and then migrate to the cities. Due to the uncertainty of the future of their country, asylum seekers do not prefer to stay for a long time in refugee-camps, which is the first place where they fled from their country.

This study assesses the issue of housing for asylum seekers in terms of spatial qualities. Considering the inadequacies and disruptions in the physical conditions and contribution to social life of the camp areas, the study has focused on bi-directional architectural solutions that assess the problems of camp sites both physically and socially. In this context firstly, in this paper camp areas in Turkey which is in compliance with standards set for camp areas by the UNHCR have been analyzed. Although asylum seekers settle in camps to meet urgent shelter needs, they need long-term accommodation because of the uncertain situation in their country. As the duration of sheltering in camps increases, in addition to physical conditions, social conditions come to the forefront. Secondly, it has been researched how to organize and gather the housing modules to increase the social relations in the camp areas. In this study, suggestions for camp areas, temporary sheltering standards have been examined and used for comparative evaluation.

In the light of the above-mentioned arguments, our paper discusses how architecture can respond to the asylum-seeker's problem physically and socially through the milieu of the Architectural Design Studio in master program at Kocaeli University. Design decisions have been made at different scales ranging from urban planning scale to the smallest living module. In consideration of the specified needs program, a design approach has been followed that allows asylum seekers to meet their own needs, not just life support. In determining the design of the physical conditions of the temporary shelters has focused on the construction of shelters from convertible materials, providing energy efficiency with passive energy systems, ease of installation and deriving modularly. In the planning, the neighborhood relations of the people stay in the different modules have been taken into consideration and the findings related to mutual communication have been transmitted. In this context, it has been deduced that only thinking individual temporary shelter is not sufficient to solve the problems of current temporary camp areas. Although the results are provisional, this study may give a broader understanding of the importance of building-up the morale and cohesiveness they need and reconstruction of the camp area through the modular system.

Key Words: Refugee, Shelter Design, Module, Campgrounds.

1. INTRODUCTION

The most basic request of mankind is the desire to keep living. To survive, man has migrated throughout history. Immigration takes place either mandatory or arbitrary. Each country all around the world has had a bearing on immigration. But countries like Turkey with the important geopolitical position is affected even more. According to the United Nations (UN) reports, the current world population is 7.6 billion. About 232 million of this population have moved. When immigration reports are examined, compared to many immigrated countries it seems that Turkey embrace a much higher rate of immigration. Refugees from different countries live in Turkey [1]. Ratio in Figure 1 indicates that Turkey is faced with how big a problem.

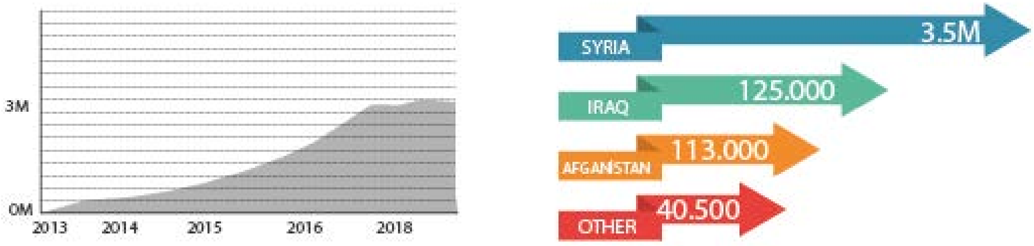

Figure 1: Number of Refuge in Turkey

As the foremost problems caused by migration, economic, social, cultural and psychological problems can be list. The data of the problems in association with migration increase day by day. That shows how important and critical the problem is. In recent years, especially wars have forced millions of people to live under difficult and human living condition in other countries [2].

This research aims to establish new approaches to solve refugee problems. Efforts have been made to implement a sustainable settlement/life proposal, which includes the energy, social, cultural and economic elements, as well as rethinking the current immigration problem, discussing spatial proposals and seeking new spatial solutions. With this study is aimed to reintroduce the current immigration problem, look for a new spatial solution for refugee crisis and discuss spatial proposals for it, as well as to implement a sustainable settlement and living suggestion including energy efficient, social, cultural and economic components.

In the first part of the work, forced migration is defined. Secondly, in consideration of numerical data, in order to meet the need for refugees, it has been tried to design a modular accommodation space which can be produced quickly, is comfortable and economical, responds to basic needs for housing. The number of people who will live in the designed spaces is important for study. Within the scope of the study, the number of people in refugee families range from two to sixteen. Considering the psychological state of immigrants, the desire of people, who have been separated from their homes and countries, to live together in a different country is one of the main decisions in design. In this respect, the modules are designed to can be attached so that more people can be accommodated when needed. In addition to this, it is explained which standard modules should have, from which material should be choosen and convey combination details. In addition to the design of living-modules, the consideration of everyday life in camp sites where living-modules are located is also very important for the quality of life and psychology of refugees. For this reason, closed, open, semi-open public spaces outside of private living-modules are designed by considering additional programs for everyday life. In the establishment of these public area, the private living-module has been utilized once more and proposals for combinations of these modules have been presented in the following part.

2. FORCED MIGRATION

Migration can be defined in a general sense as a movement singularly and collectively. Wars, facts of nature, religious, cultural, economic, political and familial matters are the reasons for migration. Since the beginning of history of humanity, immigration has been one of the most important determinants of communal living [3]. In the near future, increasing global warming drive people to migrate to reach water resources is predicted.

Turkey with important geographical position is one of the most affected countries of immigration. Especially due to the new migration waves arise from increasing the severity of wars in the Middle East, problems related with migration are increasing day by day and reach a more dramatic situation for the asylum-seekers.

Immigrants either continue to stay in the country they migrated to, or go on to different countries, according to the conditions of that country. Asylum seekers bring with them huge economic, social and cultural problems in the country they dwell. In addition, refugees are waiting for a variety of problems in the country they migrated. Especially the problem of transnational migrants is language consequently communication matters too. In addition to this, there are also issues such as identity seeking, religious fragmentation, social harmony, integration, loneliness, alienation [4].

2.1. Refugee Camp

For whatever reason, forced migrants are faced with serious problems in many aspects such as nutrition, housing, health, economy, education. When the reports are analyzed, it is seen that the refugees first settled in the camping areas after many days of journey. In the camps established by the state or charities, the priority is to meet the need for housing. But over time, migrants leave their camp areas to have better living conditions and more education and job opportunities. Camp areas are inadequate to meet their everyday life needs, especially if they need to stay in the new country for a long time. Camp areas are inadequate to meet their everyday life needs, especially if they are in need to stay in the new country for a long time. Most of the immigrants live in crowded groups in cheap rentable and unhealthy small houses, which are usually located in the suburb, if they have relatives or/and friends live in city. And unfortunately, some of them continue to live in streets.

“UNHCR’s policy on alternatives to camps promotes the pursuit of alternatives to camps, whenever possible. When refugee planned settlements must be established, they are endorsing an operational response encouraging ‘phase-out’ of planned settlements at the earliest possible opportunity” [4].

Institutions establish camp areas' planning and emergency management plans by investigating existing camp areas. One of the most important sources for that investigating is the Emergency Handbook published by the UNHRC. Recently refugee camps as a temporary accommodation areas are planned according to the standard principles and those standards are arranged based on the needs that develop over time. The UNHRC has set a numerical standard for the size of camping capacities: Table 1. According to the determined scales, a family consists of 4-6 persons on average. Traditionally, UNHCR follows a modular approach to site planning starting with the family unit as the smallest planning ‘module’ [5].

Table 1 UNHCR Module Standard

MODULE	STRUCTURE	PERSON
1 Family	1 / family	4 - 6
1 Community	16 / families	80
1 Block	16 / communities	1,250
1 Sector	4 / block	5,000
1 Settlement	4 / sector	20,000

As the family population increases, the scale of the modules grows. One block settlement in camp consist of four zones can be called 'village' and in each zone are included additional necessary service units. Comprehensive units such as schools or hospitals are located in a block or provide service for a couple of block [6].

States have different alternatives to housing for asylum seekers. Often a camp area is planned near the border and asylum seekers are first placed in those camps. Today, the number of refugees worldwide and correspondingly the number and size of refugee-camps and size of refugee camps is increasing significantly. In this context, it is very important that the living in the camps is sustainable both economically, socially and ecologically and that a self-sufficient system is established. Establishing a sustainable model in ecological and economic sense is a priority and an important necessity in the provision of all the necessities of everyday life such as agriculture, energy production, wastewater management, infrastructure systems, engineering solutions, design of urban areas.

It is necessary to plan, design and implement engineering studies taking into consideration the geographical features of the place where the camp areas are located. In order to be able to yield from the camp area, the selected region must have certain natural characteristics. When the existing camp areas are examined, it is seen that they are generally far away from the water resources are close to the border. The selection of an efficient topographical field is one of the most important steps in the efficient use of the financing resources of both the public and private sectors at the beginning. In addition to this, it should be worked on providing information and advising about financial planning.

Agricultural production should be planned in such a manner that it can meet the crop and animal products consumed by the refugees. For agricultural activities, seed production and storage must be realized. The local characteristics of the region where the camp area is located should be considered in determining the agricultural and production activities for each the camp area.

Private, semi-public and public spaces should not be too close together and big differences between them. Transitional spaces and thresholds between these public and private spaces should also be considered. Through the design of the transition-spaces, privacy and more security will be available. These fields can be analyzed by space syntax method in the following study. Within each quarter, parks and small open spaces need to be designed. These areas should allow asylum seekers to change in time. Thus, they have faith in their private area and camp.

3. TURKEY REFUGEE CAMP

Most of the reasons behind the migration affecting Turkey is concerned with the globalization tendency. Over the last thirty years, due to political developments, wars and economic transformations in contiguous countries, there has been an increase in migration and refugee issues have gained importance.

According to the data of June 2018, totally 3,579,254 Syrian refugees living in Turkey. Only 215,028 of them live in temporary shelter areas and camps. On accepting refugees, Turkey is the country which hosts the most refugees in the world, due to the policy of opening-border gate [7].

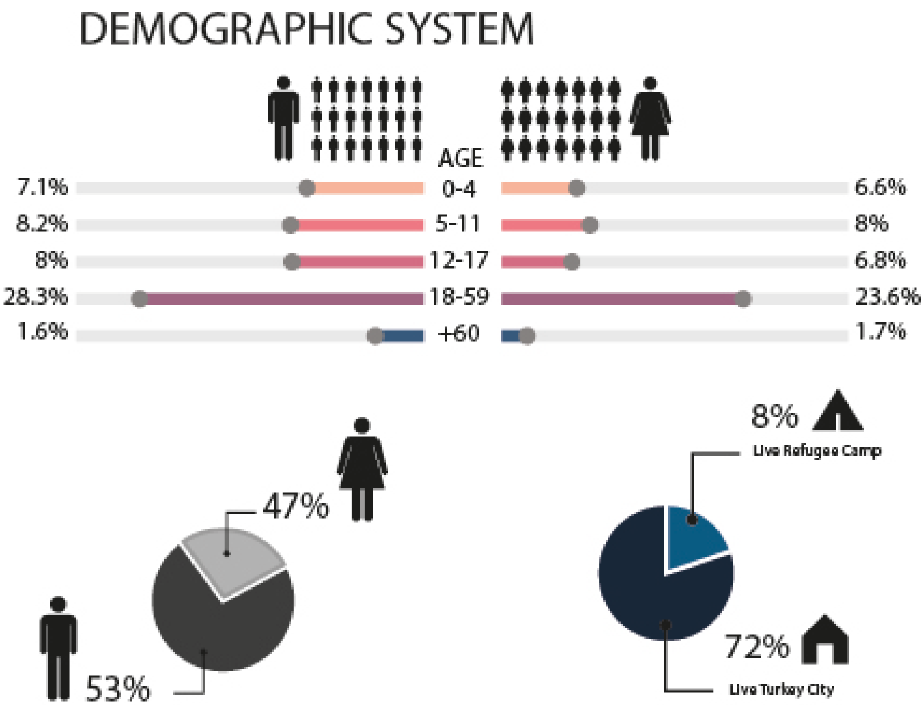

Figure 2: Demographic and Camp Chart

Camps in Turkey are tried to be managed in accordance with the planning structure and international standards of camps. However, it is not easy for Turkey be able to finance such a large population housing need. For this reason, the targeted stay periods in the camps cannot be achieved and asylum seekers migrate to the cities in hopes of increasing their living comfort. Refugees live in 22 camps in Turkey [8].

AFAD is authorized to intervene after natural disaster and manage refugee camps in Turkey. AFAD sets the standards for their operations. In the guide published by AFAD in 2015, it is seen that water supply, camp size, accessibility, location, topography, soil type, planting, ecology, culture and environmental criterias are considered like UNHCR guidelines. In the published guidelines from AFAD it is emphasized that camp areas should be in a location where is far enough from the border in order to play safe and easily coordinated. Accordingly, it should be based on a maximum of 3 meters high from water basin, and on from 2% to 6% sloping land [9].

4. MODULAR CAMP PROTOTYPE DESIGN

The physical approach of the design of the shelter module and camp planning based on the choice of convertible materials, using passive energy systems which supply energy efficiency, easily installable and appendable with other modules (Figure 3). According to researches design of singular shelter-module is not sufficient to solve problems of current temporary camp areas (Figure 4). It is aimed to reconstruct the housing area through the modular system, in order to strengthen the morale and the sense of coexistence that they need. The camp site and the module should be considered together. The plan for the prototype modular unit was designed (Figure 5).

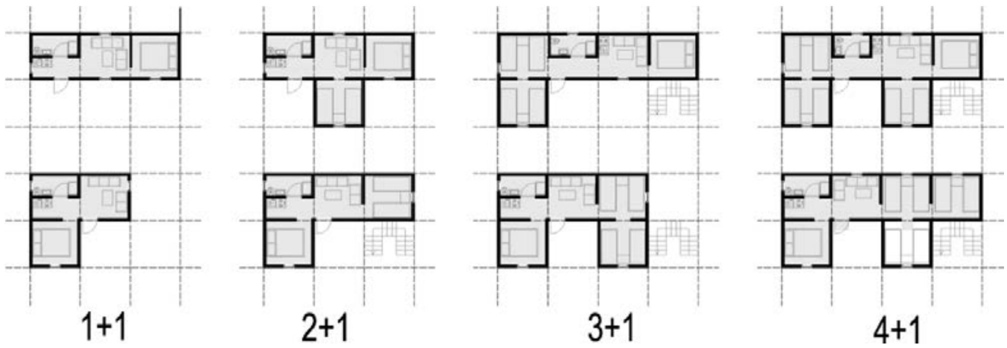

Figure 3: Module Prototype

Figure 4: Module Prototype

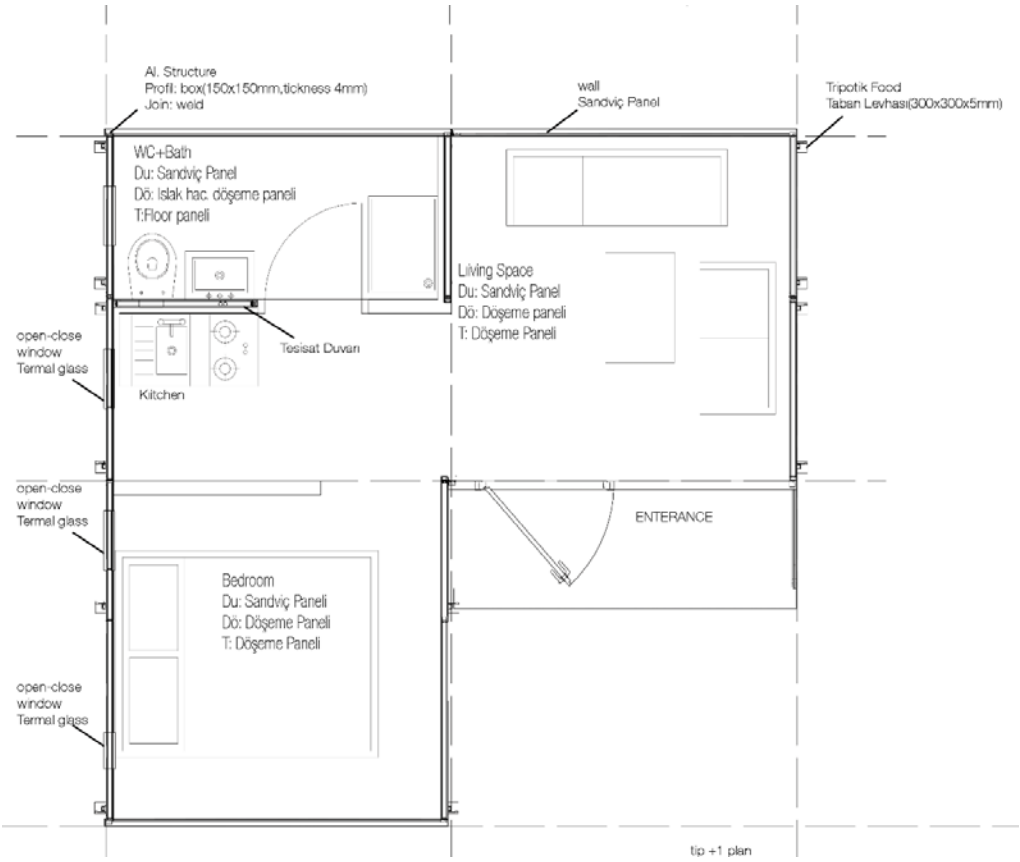

Figure 5: Module Prototype Plan

There are many different parameters in module design. The most important of these are using of local materials, compliance with environmental conditions and quick installation. The first criteria for designing a camp site is the site selection (Figure 6).

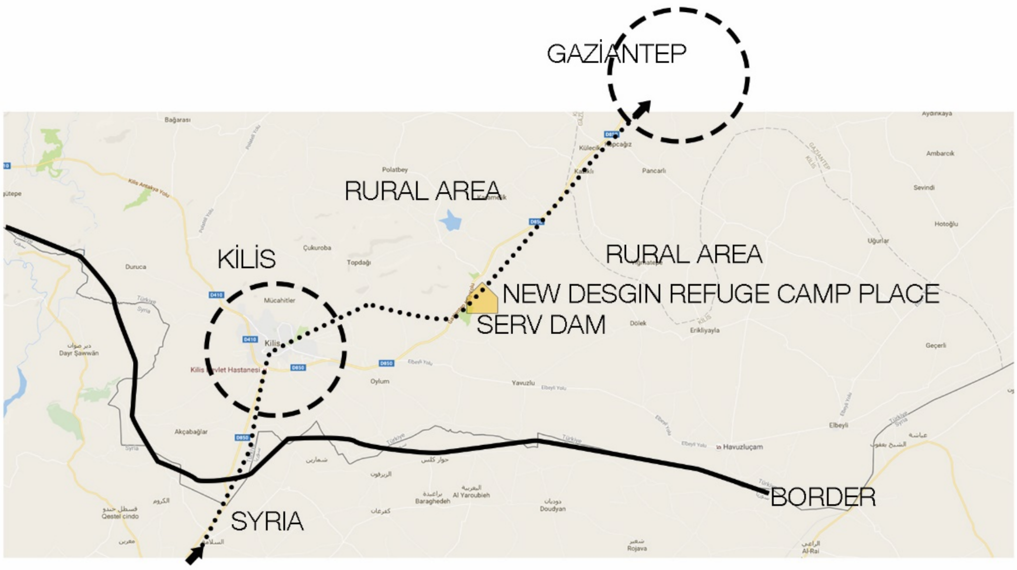

Figure 6: Location

In cases such as natural disaster or migration, it is necessary for the states to carry out preparatory labour in advance. The pre-determination of camp areas against possible immigration is very important in terms of ensuring the urgent need for housing within the shortest time. In site selection topographical and geographical features such as wind direction, solar movements, flood, loam should be determined. The prototype camp site of this study is located on the loam is near the water source, transportation network and border. With the report prepared for the selected region, the potential of the region has been revealed. Fruit and vegetable farming, which is firstly promoted to meet the needs of asylum seekers, can be turned into an income source for asylum seekers by selling out with increasing production. This may allow asylum seekers to stay longer in camp areas. In addition to agriculture, stockbreeding should be encouraged in camp sites. The planning of education modules and training on stockbreeding and agriculture contribute to the formation of certain standards and to ranch and be engaged in agriculture efficiently. The procurance of the camp area's own energy is important for sustainable energy and protection of energy resources. For this reason, it is necessary to make use of solar energy and/or wind power for heating, cooling and lighting (Figure 7).

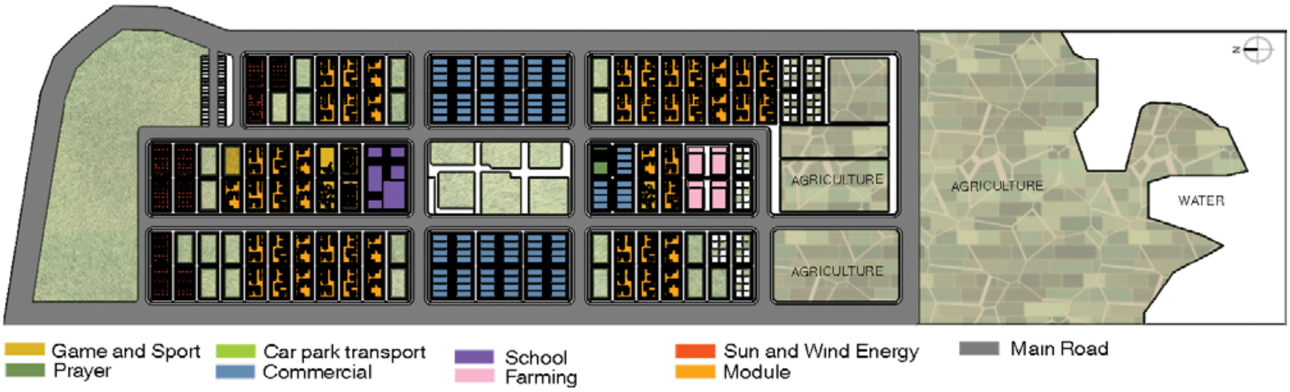

Figure 7: Suggestion Camp Site Plan

To select reducible materials for the accommodation space was a real priority in this project. Lightened concrete slabs view selected as the main material of entrance space, aluminum was selected for the joining elements, and glass was selected for the translucent surfaces. To produce the floors, cork -an organic and fibrous material- was selected. İnside the floors, to meet the heating requirements of the space, the use of the resistance between the lightened concrete slabs were selected as the main material of the entrance space, aluminum was selected for the joining elements, and glass was selected for the translucent surfaces. To produce the floors, cork – an organic and fibrous material – was selected. Inside the floors, to meet the heating requirements of the space, the use of the resistance between the lightened concrete slabs was decided. Besides, to provide energy efficiency in module designing, it was aimed to use passive energy system. For the windows, double glazing with argon gas – which is not harmful to the environment – was decided to use. By using that gas, which is lighter than the air, it was aimed to block hotter outer air to enter inside the space during the summer, and warmer inner air to go out during the winter. Because the thermal mass value of the concrete is high, it is possible to benefit from solar radiation during the winter: The concrete floor will be getting warmer during the day, and during the night, to benefit from that warmer air is possible. To avoid reduced level of comfort because of that effect during the summer by blocking the steep solar radiation, eaves were designed over the windows (Figure 8).

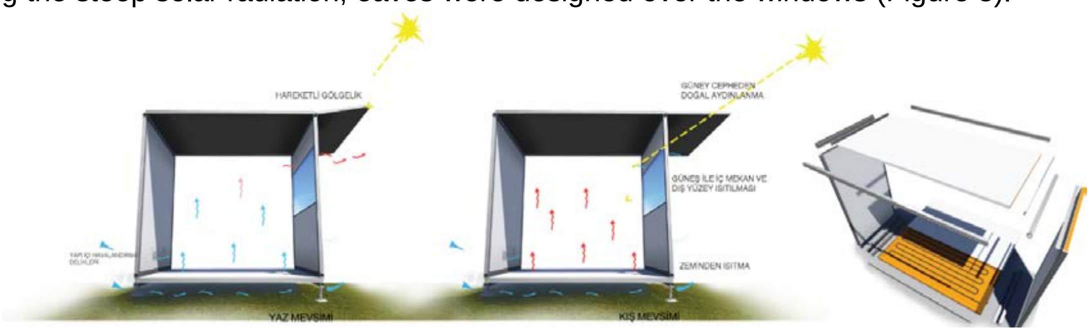

Figure 8: Camp Prototype Module Diagram

The living-modules are designed to be 'foldable', without the need for specialists during installation everyone can easily build up so that a large number of shelter moduled can be built quickly. The modules carried as foded and it can be installed by opening without the need for any additional parts. The bed/sitting planes in the modules are mounted in a module as foldable. The entrance, the terrace and the eaves are also designed in a similar way. These folded modules, which provide storage convenience, can be transported to the area with different transport vehicles (trucks, helicopters, ships). With its telescopic pillars, it can sit on sloping and rough terrain (Figure 9).

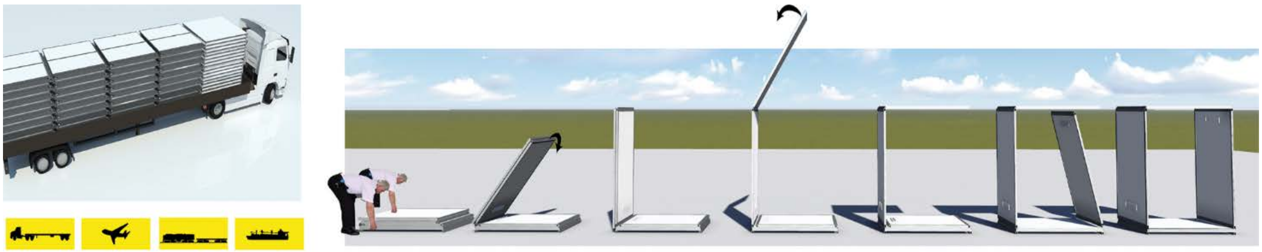

Figure 9: Fast Setup and Easy Transportation

Because a great number of people are forced to live together in existing accommodation spaces, the privacy is damaged. To solve that privacy problem, the space was designed modular, so the space can expand according to number of individuals of a family. Therefore, it was aimed to make those people to live in a space which is suitable for different needs of individuals. It was also aimed to design modules which can be able to join each other in different directions so the modules could be able to create courtyards that can increase the solidarity. Shower baths and toilets were also designed for those "habitats", in certain distances. While designing these kind of habitats, psychological effects of the space should be considered, so the eaves and terraces of the accommodation space were designed in moral and relaxing colors. Besides, it was also aimed to avoid an effect of being "emergency unit" of the spaces.

The units where the programs are provided for the camp area are located in the island is arranged between the main evacuation routes that cut the camp site in two directions. On the central axis of the camp site, a children's activity area and meeting areas and units for adults are regulated. The other needed functions are grouped and placed on the side of the area. The education units that are created separately by age group are combined; psychological support and health care units are considered together. The common dining area and the kitchen (Cooking by the users of the meals is recommended to create a new business area and the same applies to other units), laundry and additional toilet-shower units are closely related for easy access to the service. Religious spaces, barber-hairdresser, groceries and shops are also suggested in the camp area (Figure 10).

Figure 10: Suggestion Camp Perspective

5. RESULT AND RECOMMENDATIONS

This research has drawn attention to the problems of refugee camps, which were designed as temporary and are used for years. It is necessary to review current knowledge for people, who are struggling to survive, deprived of basic living conditions and unable to meet their need for housing, to live in better standards in camps. At this point, it is important to design a self-sufficient system.

First, camp sites must be built quickly. In this respect, it is necessary to create regional camp area’s maps before disasters and wars. For the rapid construction of camp areas, it is necessary to design units that allow for different uses with a modular system in advance.

When the current camps are used for a long period, the sustainability of the camps is negatively affected because the operating costs increase. In this context, a range of additional programs should be proposed to contribute sustainability for refugee camps. The use of local materials and the design of easy transportable modules provide logistical convenience and economy. It emphasizes the use of renewable energy sources such as wind and sun and passive energy systems for the energy needed. In examined regulations, it was emphasized that camp sites should not be built on loam. In this study, this approach was changed by suggesting that the camp sites should be established close to fertile land and that agricultural land should be utilized efficiently. When the living modules must be on loam, the tripod (rising-descending) pillar under the module are designed to avoid damage to the soil. These pillars also allow for the modules to be built on sloping and rough terrain (Figure 11).

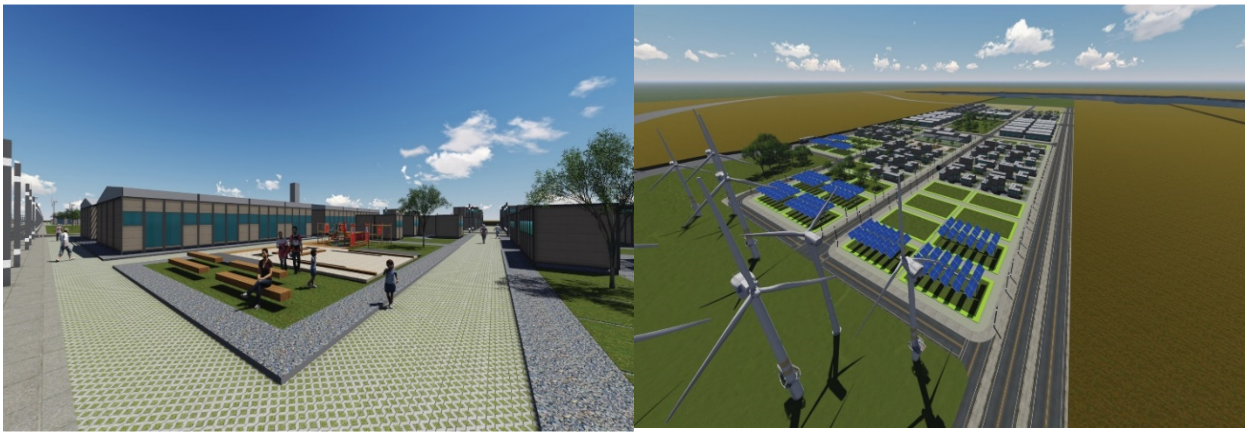

Figure 11: 30 Suggestion Camp Perspective

In this context, the rethinking of the standards created by the institutions, the implementation on a project and the designing and interpretation of the modules will constitute a reference to future works. Private, semi-public and public spaces should not be too close together and big differences between them. Transitional spaces and thresholds between these public and private spaces should also be considered. Through the design of the transition-spaces, privacy and more security will be available. These fields can be analyzed by space syntax method in the following study.

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Environmental Impact Assessment Specific to Manufacturing Processes

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ABSTRACT

In this paper is presented a case study regarding the environmental impact assessment specific to manufacturing processes. Depending on the complexity of the organization activities and the products that delivers, products that can influence or affect the environment, each organization identifies and implements its own environmental assessment method and the acceptability limit of significant environmental aspects.

The identified environmental aspects are evaluated taking into account the generating source (activity, technological phase, equipment) and operating conditions. Significant environmental aspects are monitored and controlled by implementing the appropriate corrective actions in order to treat them.

Key Words: waste management, environmental aspects, significant impact.

1. INTRODUCTION

Compliance with environmental policies in the waste management sector requires a long-term systematic approach. The Sectoral Operational Program (SOP) - Environment is focused in particular on improving municipal waste management practices, identified as the most critical point in the SWOT analysis and reflected in the Accession Treaty. The aim is to prepare a long-term strategy, to inventory all categories of contaminated sites and to develop an investment plan based on a priority list [1].

From the large number of contaminated sites (other than municipal landfills that are addressed under the priority), some pilot projects are planned to be implemented to close / rehabilitate several contaminated sites with a major environmental impact. Under this priority axis, SOP- Environment promote as a priority, the integrated waste management projects that reflect EU policy and principles in this environmental sector and are in line with the Waste Management National Plan and Waste Management Regional Plans.

The general concept of waste management involves the aspects presented in Figure 1.

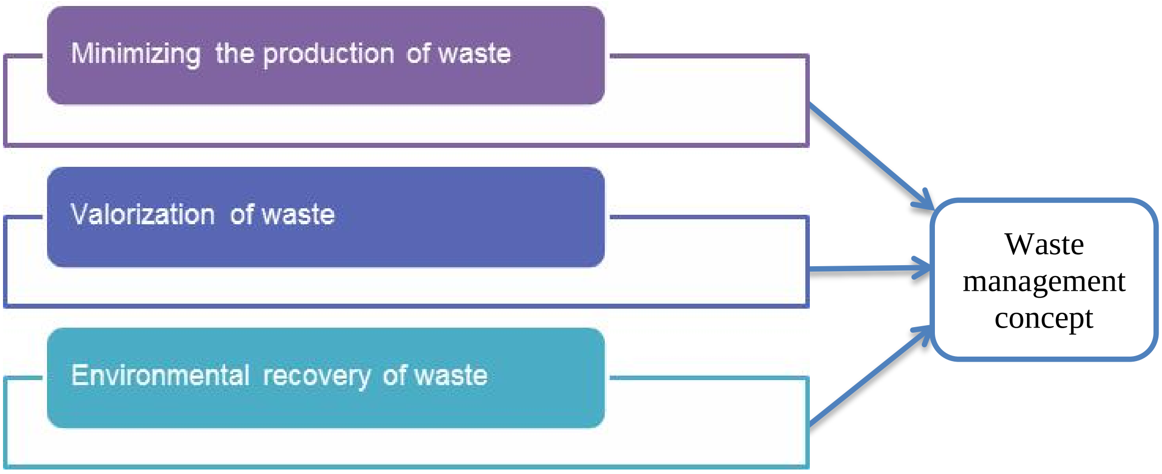

Figure 1: Waste management

Waste management is a complex subject consists of a multitude of components. In particular, waste management in the European Union is a particular challenge. Although there is not a recipe to be applied in all situations, the Union specific firm principles underlying the different levels of waste management systems [2].

These principles have gained a more concrete form in general strategy on waste of the European Union's that hierarchies waste management activities as follows:

- Preventing the occurrence of waste;
- Recycling and reuse of waste;
- Optimal final storage and improved monitoring.

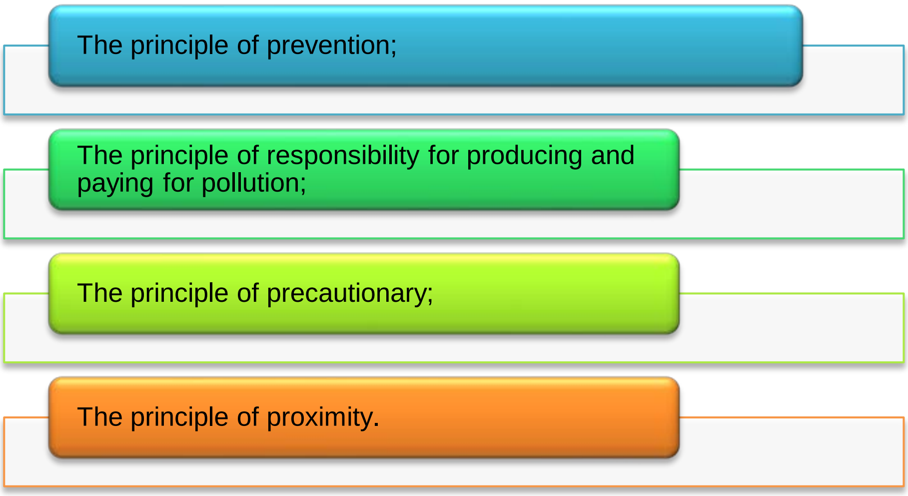

Figure 2: Principles of waste management

2. EVALUATION METHODOLOGY

In accordance with the complexity of the activities of the organization, and the products they provide (products that can influence / affect the environment), each organization shall identify and implement their own method of evaluating the environmental aspects (AM) and limit of acceptability of significant environmental aspects (AMS) [3].

Considerations in establishing the criteria for assessing the importance of environmental issues may include:

- Environmental status data to identify organizations' activities, products and services that may have an impact on the environment;
- Existing organization data on material and energy consumption, disposal, waste and emissions from potential risk points;
- Regulated activities related to environmental management at the organization level;
- Acquisition activities;
- Activities of the organization that involve the highest environmental costs and environmental benefits.

Criteria for assessing the importance of environmental impact imply defining the method for assessing the environmental importance of its activities, products and services to determine which ones have a significant impact on the environment (Table 1).

To establish that the environmental aspect has significant impact, the organization must establish the own criteria:

- Compliance with the requirements of the legal regulations: exceedance of the allowed limit for noxes; non-compliance with waste management requirements; compliance measures for authorizations, court decisions;
- Severity, frequency, impact;
- Attitude of interested parties (environmental bodies, neighbors, customers, etc.).

Table 1 Quantification matrix of environmental aspects

Criteria	Score	10 points	5 points	1 point
Regulations (R)	5	The legal requirements / regulations are not complied	Conformity. The monitored indicators do not exceed the maximum admissible limits.	Conformity. They are not regulated by legal specifications.
Severity (G)	4	Risk to humans and the environment	Risk to environment	There is no risk to the environment
Quantity (C)	3	Significant level	Medium level	Low level
Frequency (F)	2	Every day	Average	Occasionally
Public opinion (V)	1	Complaints and systematic criticism	Sporadic complaints and criticism	There are no complaints or criticism

An environmental aspect it is considered to have a significant impact on the environment when the calculated score with the equation 1 ins *P > 26* points.

$$P = F \cdot 2 + G \cdot 4 + C \cdot 4 + R \cdot 5 + V \cdot 2. \qquad (1)$$

3. ENVIRONMENTAL ASPECTS ASSESSMENT. CASE STUDY.

The identified environmental aspects are evaluated taking into account the generating source (activity, technological phase, equipment) and operating conditions. Significant environmental aspects are monitored and controlled by implementing appropriate corrective actions in order to treat them [3], [4].

This study describes the methodology, assessment and control of significant environmental aspects of the generated waste as a result of specific activities to manufacturing processes, so as to ensure compliance with legal requirements and other requirements applicable to significant environmental aspects of waste and not to deviate from the policy, objectives and targets set in the field of environmental management.

The procedure is applied to all activities that generate significant environmental issues relating to the generation, handling, storage, recovery or disposal of waste.

Due to the investments in clean technologies, the organization does not face the daily activity with the appearance of environmental problems that lead to infringement of the applicable legislation in this field.

The main environmental aspects generated by the activities carried out are:

- use of raw materials, materials and utilities from natural resources (non-ferrous materials, methane, diesel, oil, water, energy, etc.);
- emissions of pollutants into the atmosphere;
- the handling and storage of hazardous chemicals;
- generating of waste of all categories, hazardous and non-hazardous, recoverable and non-recoverable;
- possible accidents and emergencies;

After evaluating the environmental aspects specific to the production processes, 21 environmental aspects were identified, of which 12 have a significant impact on the environment (Figure 3).

As a result of the corrective actions, the score of the significant environmental aspects decreased, they fall within the category of insignificant environmental aspects (Figure 4).

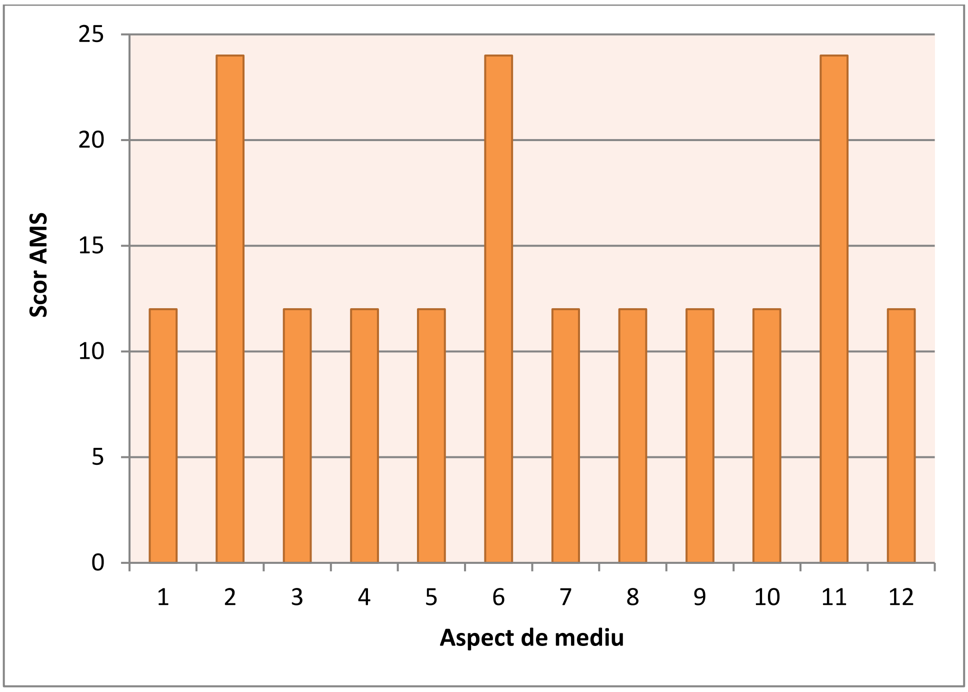

Figure 3: Distribution of environmental aspects for initial assessment

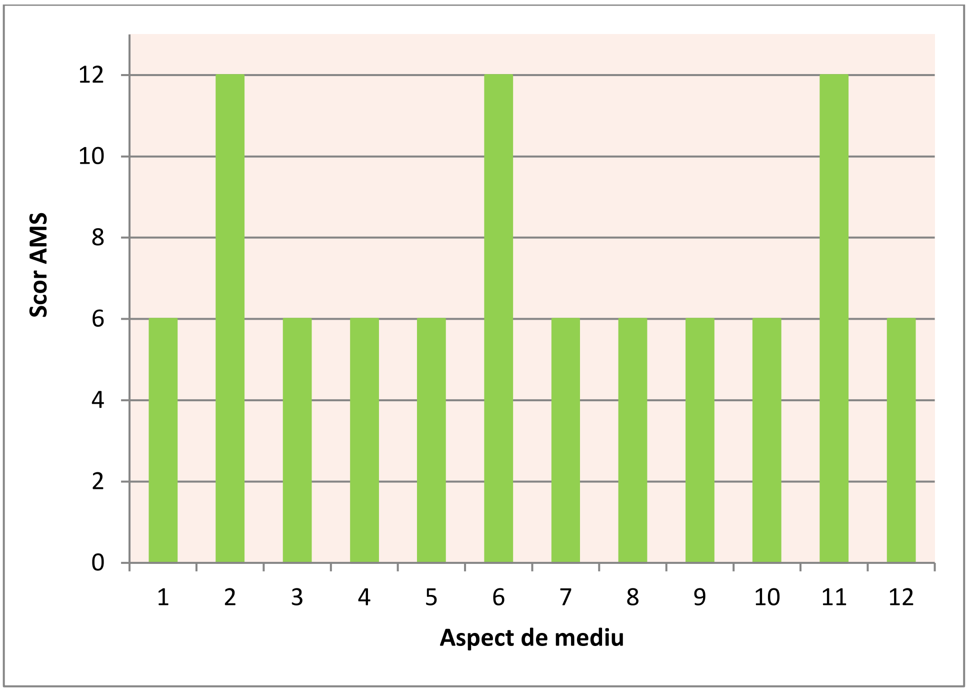

Figure 4: Distribution of environmental aspects for optimized assessment

4. CONCLUSIONS

- Waste management is becoming more and more a concern of local citizens and authorities in all parts of the country, as the accidental dumping of waste in specially undeveloped areas over many years has led to a dangerous impact on the environment.
- Waste management includes all the activities of collection, transportation, treatment, recovery and disposal of the waste. Responsibility for waste management activities lies with their generators in accordance with the “polluter pays” principle or, where appropriate, with manufacturers in accordance with the "producer responsibility" principle.

- The case study objectives were:
  - protecting the environment and increasing the quality of life;
  - efficient and effective waste collection;
  - minimizing the amount of waste;
  - waste recovery;

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The Ottoman-Turkish Hamams in Urban History and Culture in Balkan Countries

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ABSTRACT

Ottoman rule, which lasted five centuries, takes an important part of the history of Balkan countries and with its rich Turkish culture has left significant marks in the history. Out of the rich variety of inflences of different cultures in one of Balkan coutry-Macedonia, stands the impact of Ottoman culture and art that have significant role throughout the ages backwards, being an integral part of the common cultural heritage. The spirit of a past time enriched with cultural and artistic influences Turkish – Ottoman period is most visible in the architecture and life traditions of Macedonia.

The Ottoman-Turkish hamam has a unique position within Ottoman-Turkish bathing culture and architecture. It has proved to be not only a communal bathing venue of cleaning and purification based on Islamic norms, but also a space of social interaction among users of the same gender, where men and women communicate, entertain and realize traditional rituals separately.

This paper contains a research of the public monuments from Ottoman period – Turkish Hamams. The research concentrated and discussed the main architectural characteristics, geography, history, demographic properties, settlement texture (plan, construction and facade characteristics) which was performed by aid of site investigation, reliefs, relate to literature and old-new photographs. The hamams and regions presented through this paper do not cover all the regions of Macedonia but only the territories of Skopje, the capital of Macedonia and Ohrid.

Key Words: Cultural heritage, Ottoman architecture, Turkish Hamams, Macedonia.

1. INTRODUCTION

Macedonia (*Македонија*) (Fig. 1) is an ancient, biblical land, geographically located in the central part of the Balkan Peninsula. Throughout history, many important events have intertwined on the territories of the Republic of Macedonia, part Balkan, part Mediterranean and rich in Greek, Roman and Ottoman history.

Ottoman rule, which lasted five centuries, takes an important part of the history of Macedonia, and with its rich Turkish influence, it has left significant marks that reflect Macedonian culture. The subjugation of Macedonia under Ottoman authority both had hindered the development of architecture and encouraged it to adapt to the requirements of Islam and Ottoman urban life. Fortified towns have given way to open settlements where the inn, the Turkish bath (hamam) and the mosque, concentrated as a group of public monumental artifacts, have become a typical characteristic of the Ottoman urban planning. This has been the greatest influence of Ottoman architecture on Macedonian architects during Ottoman rule [1].

Figure 1: Map of Republic of Macedonia

As much as religious reasons account for the spread of baths in Islamic cultures, environmental and architectural factors are just as significant for the popularity of Turkish Hamams. Their practical function, of course, was to provide services to the urban population. In this research, three historical Turkish baths belonging to the Ottoman period were examined. The first two are the Daut Pasha Hamam and Çifte Hamam which are a typical double public baths in the strongest density of Skopje and the third one is the Yukarı Hamam which is a typical single public bath, located in province of Ohrid. Focusing on this aim, this study is structured by considering the environment and the architectural characteristics of Turkish Hamams by its documentation, analyses, plans, historical research, comparative study, evaluation of the building and restitution through a case studies.

2. THEORY: GENERAL CHARACTERISTICS OF TURKISH HAMAMS

Throughout the history, bathing activity has always been in mankind's agenda, therefore closed and open spaces for bathing in different size and configuration were in the mankind's architectural program. Baths are buildings which are used by people for collectively washing. "*Hamma*" in Arabic means to heat; "*Hamam*" in Hebrew means to be hot. Today the word "*Hamam*" in Turkish means a place where one washes or bathes [2]. The Hamam tradition reached a peak in the 16th Century parallel to the growth of the Ottoman Empire. The Hamam has a unique position within Ottoman-Turkish bathing culture and architecture, so it became an indispensable part of urban architecture under the administration of the *vakıf* organization, within the reach of the public. It has proved to be not only a communal bathing venue of cleaning and purification based on Islamic norms, but also a space of social interaction among users of the same gender, where men and women communicate, entertain and realize traditional rituals separately.

2.1. Environmental characteristics of Turkish Hamams

The historical Turkish baths in Anatolia as well as Macedonia, could be classified into two groups as private and public. While the former group referred to the baths of palaces, military barracks or caravanserais to serve a small group of people; the latter group was open to public serving for the people living in a village, a district or a part of a city. The public baths, which can also be called as *halk hamamı* or *carsı hamamı*, were either constructed as *single baths* or mostly as *double baths.* In twin-baths, the men's part was slightly larger than the women's part. Entrance to the men's part was from the main street, while that of women's was from a side street for privacy [3]. Due to prevent the heat losses other than some exceptions these two parts are completely connected. Few single-baths served males and females in different hours. Çarsı hamams are social edifices which function as means of income to the building complexes (külliye) in the pius foundation system. Single baths were either for men or for women. It was called as "*kusluk hamamı*" when used by both men and women by arranging different days and hours.

There are two reasons for Ottomans built many baths in this case in Macedonia, through their history. First of all, the baths were devoted to the pius foundations as a means of income and secondly they served to the congregation of the mosques which together with the baths and other buildings constituting the building complexes (*külliye*) [6]. However, these facilities were used as long as they produced income and when they lost this value they were quit. It is well known that baths which were one of the most hilarious typologies of Ottoman architecture were abandoned due to these reasons.

2.2. Architectural characteristics of Turkish Hamams

Due to the specific requirements of hygiene understanding of Islamic bathing tradition, the Ottoman hamams are unique in terms of their architectural layout, building materials, construction techniques, and installations related to water supply and disposal, heating, and illumination indigenous to their specific function.

Historical Turkish baths keep their original architectural and building technologies reflecting the achievements of the past in terms of building materials, functional systems and their design [5]. Generally, these Turkish baths belonging to Ottoman period consist of four sections. They were given below:

1.Soyunmalık /Camegah (undressing room/ the Apodyterium)
2.Ilıklık (the Tepidarium – the warm space)
3.Sıcaklık (the Caldarium – the hot space)
4.Kulhan (the furnace)

3. CASE STUDY 1: TURKISH HAMAMS IN SKOPJE

Hundreds of years of Ottoman domination have left Skopje with a distinct oriental feel and look, and many monuments from this period are remained. Unlike the darkness of the medieval Byzantine times, the Ottoman Empire has brought narcotic scent of the Orient. Due to the presence of Islamic and public buildings, the old part known as the Old Bazaar has got an oriental shape in the late middle ages. These buildings suffered from the earthquake in 1555, the great fire from the Austrian general Piccolomini in 1689, as well as the fire in Skopje in 1910 and the disastrous earthquake in 1963 [4].

The old town of Skopje has been developed according to the oriental urban principles into two separate zones: the first zone comprised the Bazaar as a center of crafts, trade and traffic, and the second zone included neighborhoods as residential area. The public buildings which includes Turkish hamams, have been developed in the city center and could be approached from all sides, while residential neighborhoods were developed in a separate area, away from the business noise, protected from the street and with spacious gardens and rich interior setting [4]. The Old Bazaar has been located in the central part of the city which gravitated to all roads. To its composition, public facilities were built for the needs of the population, hamams, bezisten, mosques, inns, caravan palaces, seminaries, etc.

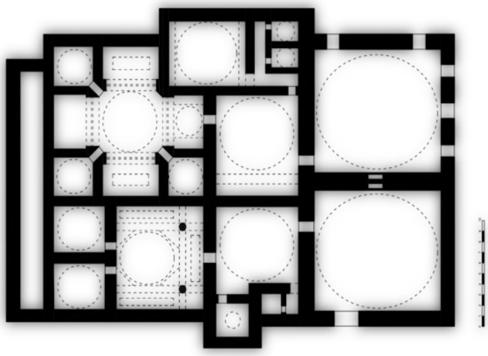
Today, many of the historic buildings of the Bazaar have been transformed into museums and galleries. It is, however, still home to several active mosques, shrines, two churches and the Clock Tower, together with the buildings of the Museum of Macedonia and the Museum of Modern Art, form the core of the modern Bazaar (Fig. 2).

Figure 2: Skopje Old-Ottoman Town Area and Its Buildings

3.1. Daut Pasha Hamam

Daut Pasha Hamam is one of the two hamams that exist in Skopje and it is located in a medium dense area of Old Town Bazaar and mostly surrounded by other Ottoman public facilities. The Daut Pasha Hamam stands on the left bank of the river Vardar, in the immediate vicinity of the Stone Bridge (Fig. 2). The exact year for construction of the monument is not known but is thought to be the work of Daut Pasha, who has built it in the second half of the 15th century, between 1489 to 1497. Generally, the buildings around the Hamam are physically in good condition because of the rare alteration on their structure. Only a few numbers of traditional residential buildings are in bad condition.

Daut Pasha Hamam belongs to the “Çifte” (double) type of hamams Its dimensions and aesthetic values make it a masterpiece of profane Islamic architecture. It stands along the axis East-West and has twelve rooms (Fig. 3,4). In terms of its function, it is divided along its length into two parts, men’s and women’s. The men’s part was accessed from the west side, from the street which leads from the Stone Bridge to the Old Bazaar, while the women’s part was concealed and was accessed from a side street on the north side of the building [7]. Hamam basically takes the form of a rectangle with minor extensions toward north and south. Its entrance has been from the east, west and north. Over the western part of the building are dominating two large domes, and the rest is covered by 11 unsymmetrical placed and unequal domes, erected on trompi and on low polygonal “tamburi”. The interior of the rooms is illuminated by the star open domes covered with glass [8]. This hamam, like the others, has anterooms, warmed bathing rooms, a “gobektash” (a stone or marble platform in the middle of the hot room of a hamam), etc. It is covered with a large number of domes of different dimensions which are fascinating in their asymmetric and yet completely harmonious and rhythmic arrangement [7] (Fig. 5, 6).



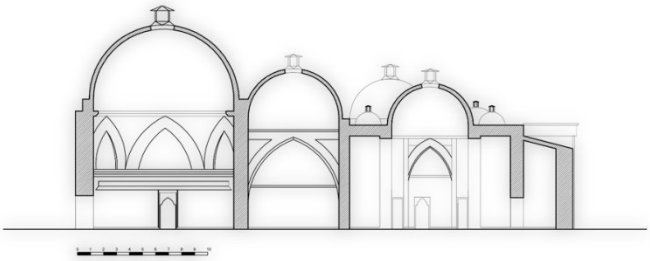


Figure 3, 4: Plan and Section of Daut Pasha Hamam

Today, Daut Pasha Hamam is used as an art gallery. It is not known when the hamam lost its function. The elements such as the kurna, the şadırvan (fountain) and marble slabs do not survive and were probably carried off after it ceased to serve as a public bath. It can be safely assumed that, like the other buildings, this hamam suffered heavy damages in wars, natural disasters, the earthquake of 1555, the fire set to Skopje by Piccolomini in 1689 and the earthquake of 1963. After it lost its function it served as a warehouse. Its reconstruction began in 1935/36, and has been the site of the Art Gallery since 1948. Today’s permanent exhibition was formed in 2000, with the purpose of presenting a survey of the development of Macedonian visual arts from the 14th to the 20th centuries, with an emphasis on the Macedonian 20th-century painting and sculpture [7].

Figure 5, 6: Daut Pasha Hamam

3.2. Çifte Hamam

In the middle of the 15th century was built Çifte Hamam, the second largest hamam during the Ottoman Rule in Skopje. It is located in the north-east axis in the strong center of the old city and the bazaar (Fig.2). The bath also had a space in the northwest part which served as a bath for the Jewish population [7]. This was, in fact, a separate halvet with a pool for ritual bathing. The bath was lit with the light which came from the openings in the domes and window openings below the domes when the Sun was in its zenith. The name of Çifte Hamam (double bath) becomes from the two divided parts with separate entrances for men and women of the building.

The main rooms are covered with two large domes, while the halvets (bathing cubicles) and other chambers are vaulted with a large number of small domes, today covered with sheet metal (Fig. 7,8). The women’s bath was in the southwest part of the building and its outline/setup resembles those of single baths. The men’s part stood in the northeast part of the building and had a larger number of chambers than the women’s part. The arrangement of the rooms in both parts, i.e., their organization is typical and depends on their purpose: first, one entered the anteroom (meydan or şadırvan) which was also intended for relaxation and then, through a partially warmed room (kapaluk), to the bathing space (halvet). The rich wall decoration of the surfaces below the domes, that is, the tromps and pendentives, contribute to the significance of this public bath. Today, the stylized geometric and vegetative ornaments, stalactites and rhombuses rendered with great precision in low relief survive only in fragments in some of the halvets. The characteristic frieze with Turkish triangles provides the transition to the surfaces below the domes. The application and presence of decorative elements is yet another visible difference between the men’s and women’s baths – they are more numerous in the men’s part of the bath [7].

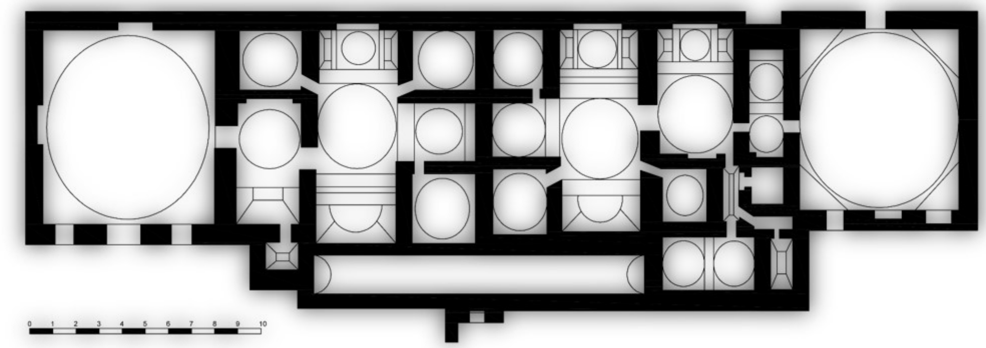


Figure 7: Çifte Hamam, Plan

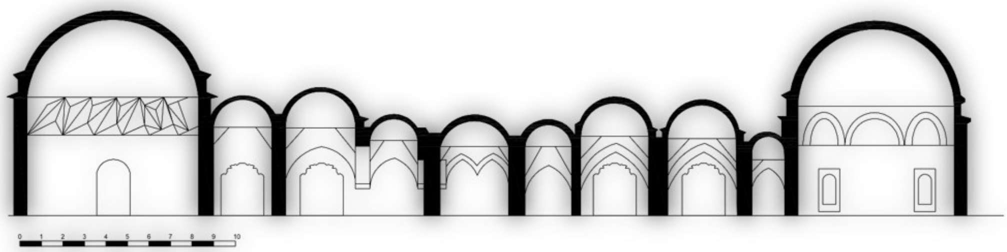


Figure 8: Çifte Hamam, Section

During its existence Çifte Hamam was probably damaged several times: in the earthquake which struck the Skopje region in 1555, in which a number of buildings were damaged as well, and during the great fire in the 17th century when the structure was damaged to a lesser extent. Its full conservation began after the earthquake of 1963, when the bath suffered more extensive damage. Due to the fact that it was solidly built, the hamam mainly preserved its original appearance; however, the elements characteristic of all Turkish baths, such as gobektash (navel stone), kurnes (marble basins), etc., have not survived. Çifte Hamam lost its function in 1916/17 and its rooms, with certain adaptations, were used as a storage space. Çifte Hamam today is used as an art gallery and within it is located part of the exhibition from the National Gallery of Macedonia (Fig. 9, 10).

Figure 9, 10: Çifte Hamam

4. CASE STUDY 2: TURKISH HAMAMS IN OHRID

The Ottoman Turks held Ohrid from the end of the 14th century to the beginning of the 20th century from 1395 to 1912. At first the Turkish sultans helped the Archbishopric of Ohrid to expand its jurisdiction. But this changed after 1466, when a number of distinguished citizens of Ohrid had assisted an uprising launched against Turkish domination by the legendary Albanian warrior Skanderbeg [9]. Ohrid traditional architecture has “important place in the cultural heritage” of the city. The syntagma of Ohrid traditional architecture refers to the oriental style of building public facilities and family houses which has been developed in the 18th and 19th centuries during the Ottoman reign [10].

At the turn of the 19th century, Ohrid was a powerful economic and cultural center. The well-known Turkish traveler and writer Evlija Chelebi in 1679 gives detailed description of Ohrid. He describes the town as a developed, rich and big trade center. He compares it with Damask and Cairo in those times, as well as with other towns in the Near East and Ottoman Empire. Ohrid had several beautiful and big mosques. Among them, Chelebija mentiones Aya Sophia (the cathedral church St. Sophia), then the mosque Ohrizade or the Tzar Mosque in the old hilly part of Ohrid, known as Imaret Mosque. He also mentions the public facilities such as Yukarı Hamam, Ohrizade and Gazi Huseyin Pasha Hamams [9].

4.1. Yukarı Hamam

Yukari Hamam is the sole hamam that exists in Ohrid. The second name for this Hamam is Voska Hamamı. It has been built in the first half of the 17th century [10]. This hamam is located in the south-north axis, in the province of the city of Ohrid, on the road for the city of Struga. While the city of Ohrid was ruled by Ottoman Empire, in this part of the city has been and still dominate Turkish population. Right in from of Yukarı Hamam stands Emin Mahmud Mosque, also an old mosque dating from Ottoman period (Fig. 11).

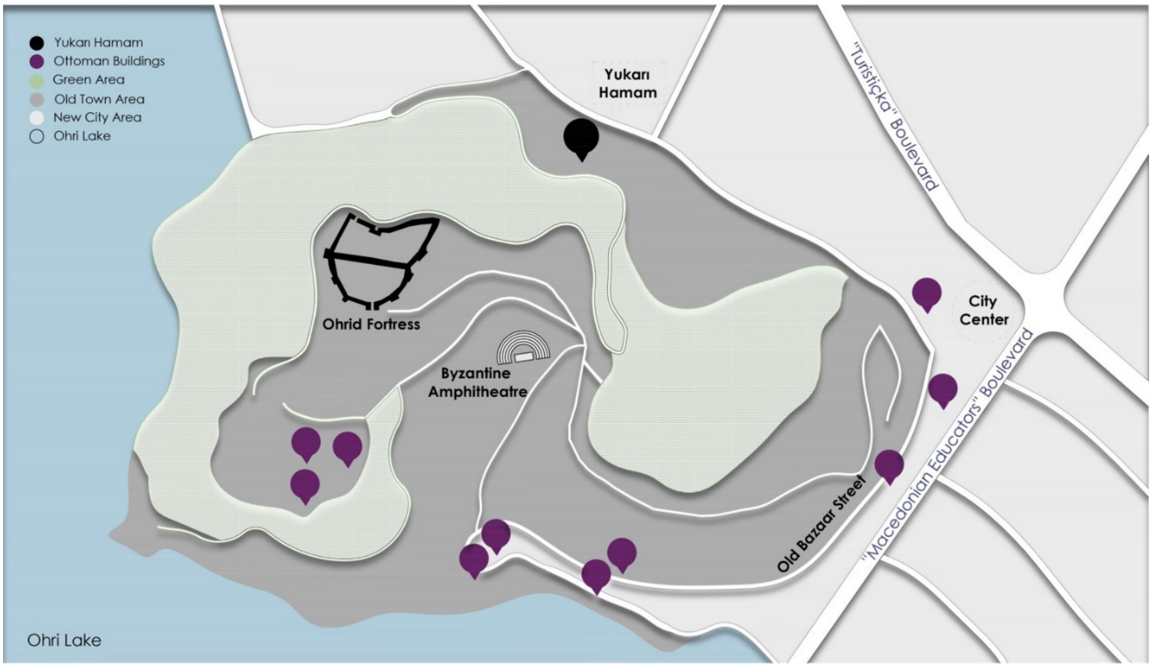


Figure 11: Ohrid Ottoman Old Town with its Buildings

The Hamam is made of rough rubble stone and it gives the impression of the work of 17th Century in a low degree. Yukarı Hamam belongs in the group of single public hamams, which means it has been used by both male and female but in different hours. The building has one entrance, and very simple rectangular plan. It has five rooms which were used as a furnace, undressing room, as well as a warm and a hot room (Fig. 12).

Yukarı Hamam has been restorated accordıng to the building’s old principles and culture and today it serves as a national art gallery (Fig. 13).

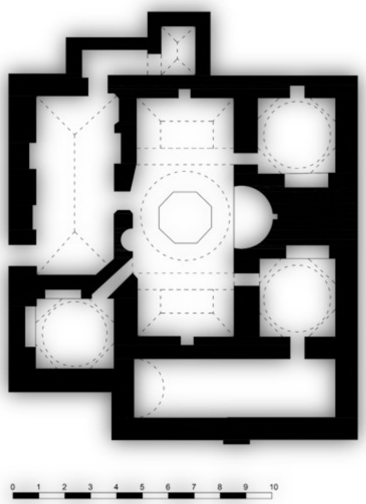


Figure 12: Yukarı Hamam, Plan

Figure 13: Yukarı Hamam

5. CONCLUSIONS

Historic buildings are living witnesses of their age-old traditions embracing architectural, functional, social, and economic features of their period. In other words, they are the physical evidences of space use, material use, construction techniques as well as social life. Thus, “the values of the Turkish Hamams are not only in their appearance, but also in the integrity of all their components as a unique product of the specific building technology of their time. Turkish Hamams are the one of the major building types and have a central place for social life with complex urban and societal relations.

Today the new architectural project of 2014 in the center of Skopje stirs a big controversy. In order to rewrite the history of Macedonia and put in a shadow the old historical buildings from Ottoman period are being built new public facilities in a style its proponents label either neoclassical or baroque, in striking contrast to the Ottoman character of most of Skopje. Within this framework, the aim of this study is to prevent the loss of documentary, research, and educational values of Ottoman’s architectural heritage. The rich Ottoman traditions that has been inherited by the Ottoman ancestors should be a source for inspiring the architects in establishing the guiding principles for new building in the traditional districts with Ottoman heritage in Skopje and Ohrid. By submitting the researched topics and analysis of the Turkish Hamams in Macedonia, it is expected to attract more tourists with hope to put Macedonia (in this case the cities of Skopje and Ohrid) in the world tourist destination map. In this manner, the cultural continuity for achieving the sustainable development would have been attained in the long run.

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A Case Study on Seismic Standards of Countries in High Seismic Hazards Regions

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ABSTRACT

Earthquake is defined as the determination of a ground motion caused by an earthquake in a certain place and within a certain period, which can cause damage and loss of life. Many different countries that placed different location and different developed level have suffered considerable damage and material and moral losses from the negative effects of the earthquake. Many countries, especially the countries on active fault lines, have made official regulations for the design of earthquake resist structures, which have introduced standards in building design in the direction of data concerning the geographical, physical and economic conditions in the countries. However, in every major earthquake, building construction standards have undergone some change and development. In this study, the countries with a high risk of earthquakes in world earthquake map and according to development levels four developed, four developing countries were identified, and earthquake standards in these countries were examined comparatively. The comparison has been made on the basis of effective parameters in the calculation of horizontal earthquake load, Effective Ground Acceleration Coefficient, Building Importance Coefficient, Construction Weight Coefficient (n), Spectrum Coefficient (TA / TB), Structural Behavior Coefficient (R) and Near the Fault Coefficient.

As a result of this comparison, it has been determined that the countries in the European Union use similar standards and values because they adopt Eurocode 8, which is considered as a common language in the earthquake standard, while other countries use relatively different measures.

Key Words: Seismic loads, Earthquake standards.

1. INTRODUCTION

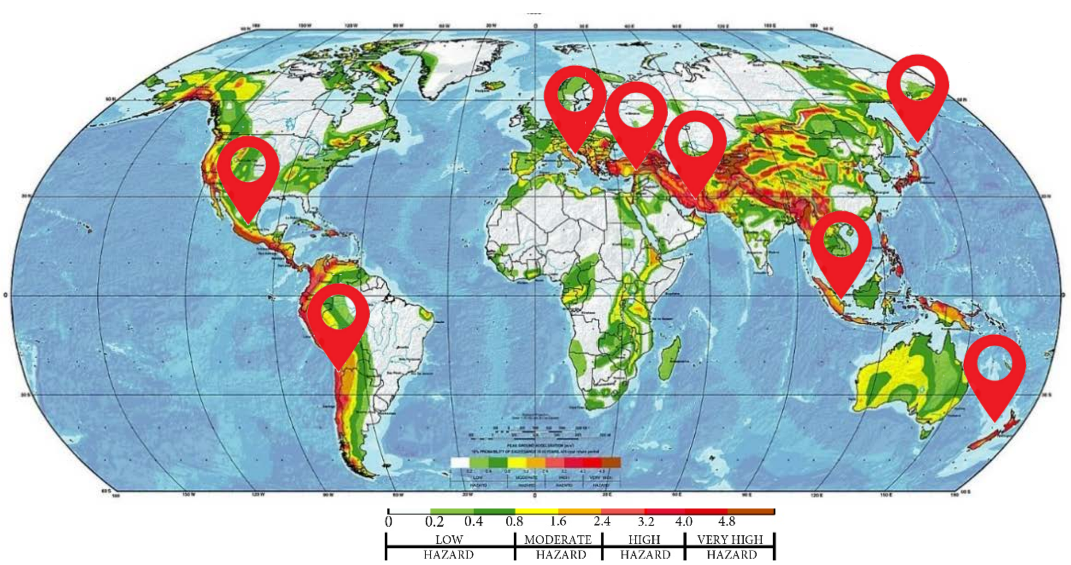
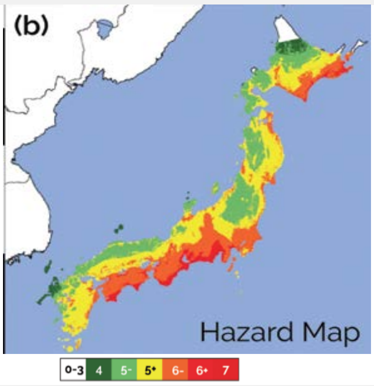
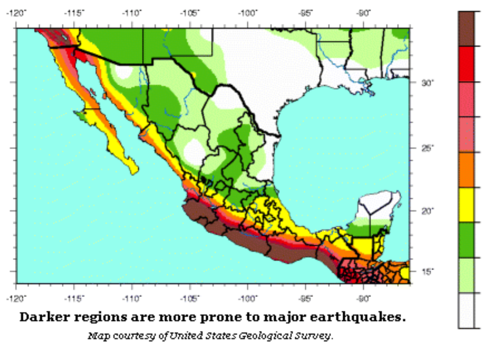
The earthquake hazard is defined as the determination of the ground motion caused by a large earthquake which can cause damage and loss in a certain place and within a certain period of time. The lithosphere layer of the Earth is divided into platelets which are sliding on each other or are in constant motion. There are 500,000 detectable earthquakes every year in the world, and about 100,000 of them can be felt and 100 are earthquakes that cause damage. Many different countries at different levels of development in the world have suffered considerable damage and material and spiritual losses from the negative effects of the earthquake. However, every major earthquake has brought some changes and improvements in building construction standards.

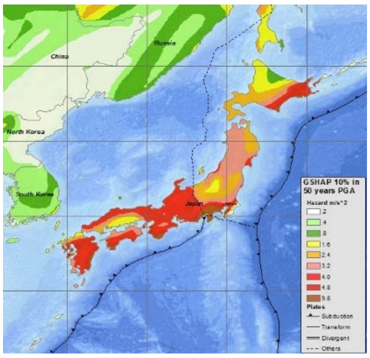
Each country has limitations in the design of buildings in terms of data on geographical, physical and economic conditions in which they are located. Among them, many countries, especially the countries on active fault lines, have made official regulations for the design of durable structures. The European Union has appointed an international commission to prepare the regulations to be used in civil engineering in 1978 to bring a common language to these regulations and to standardize in the field of civil engineering, and the rules to be followed in constructions to be carried out in earthquake zones are given in Eurocode 8. Today, earthquake regulations of many countries along with European countries are based on Eurocode 8. However, as it is known, the regulations of the countries vary depending on the data about the physical conditions. At the beginning of these physical conditions comes the risk of earthquakes in countries. In this study, eight countries (Japan, New Zealand, Chile, Italy), which were classified as high risk and very high hazard according to the International MMI (According to Modified Mercalli Intensity) determined and their changings of seismic building standards until now are discussed.

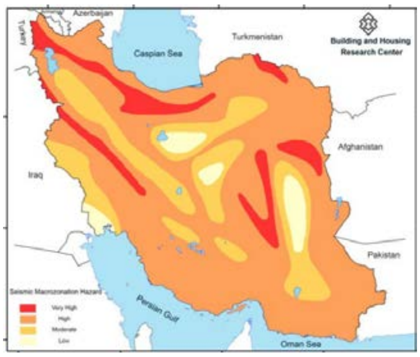
2. INVESTIGATION OF GENERATION AND DEVELOPMENT OF EARTHQUAKE REGULATIONS

The level of vulnerability of countries is largely due to the lack of a realistic earthquake-safe settlement policy and planning approach. However, the balance between the quantity and quality of the built environment is thought to largely confirm the differences in earthquake deaths in low, medium and high-income countries. For this reason, selected countries to be investigated in the study have been determined by considering different levels of development. The earthquake regulations of the countries listed in the table below are examined in detail in terms of the formation and development.

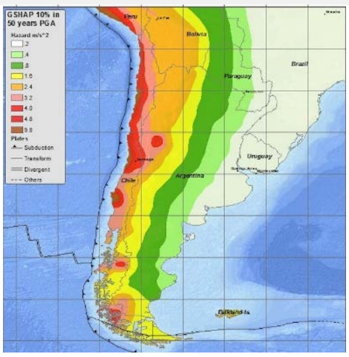
Table 2.1. Earthquake Hazard High Countries in the World

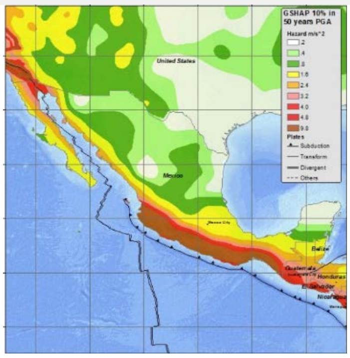
World Earthquake Map [1]	
	
Developed Countries	**Developing Countries**
1. Japanese Earthquake Hazard Map [2]	**1.Mexico Earthquake Hazard Map [3]**
	
2.New Zealand Earthquake Hazard Map [4]	**2.Iranian Earthquake Hazard Map [5]**



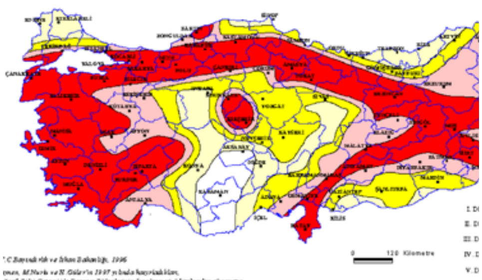


3.Chile Earthquake Hazard Map [6] **3.Indonesian Earthquake Hazard Map [7]**





4.Italian Earthquake Hazard Map [8] **4.Turkey Earthquake Hazard Map [9]**



Japan is located in the Pacific Ocean region between a few seismic regions, both high and moderate, a moderate earthquake region on the Japanese Sea, and a low-grade earthquake region on the inner part of the country. The Japanese earthquake regulation "The Building Standard Law of Japan" was created to contribute to the improvement of the welfare level of the people by taking into account the purpose of using the places, structures, equipment and buildings as the minimum standards necessary to protect human life, health and existence. Scientific research on earthquakes started in 1868. After this date, a series of developments have been made after every major earthquake, in the regulation and in the stable structural technology. 1891 The Earthquake Investigation Committee was established with the Nobi earthquake. The Great Kanto earthquake in 1923, changed the earthquake zone coefficient, and the Tokachi-oki earthquake in 1968 caused the shear force to undergo a revision in reinforced concrete columns. With the Miyagi-Ken-oki earthquake in 1978, the earthquake calculation method was changed. In 1995, the large Hanshin-Awaji earthquake shape factor was revised and the rules related to the repair of existing buildings were regulated. The Great East Japan Earthquake in 2011 provided new notification for buildings evacuated due to tsunami [10].

New Zealand, located between the borders of Australia and Indian Pacific plates. Because of this location, it is exposed to frequent and strong earthquakes. In 1931, the Building Regulation Committee was established with the large damaged Hawkes Bay earthquake. In 1935, the New Zealand Standard Building Model Regulation (NZSS 95) was issued with the condition that the earthquake loads should be included in the calculation in the building design. The standards on earthquakes revised in the regulation published in 1965, and were revised again in "NZS 4203: 1976 General Rules of Implementation" published in 1976. And then the revised regulation, published in 1992 as NZS 4203: 1992, played an important role in building construction and detailing and in providing a reliable earthquake resistance. In this arrangement, it is stated that symmetrical forms should be produced in the design of the structure. In 2006, a new regulation was published in the name of NZS 3101: 2006. In 2008, the NZS1170 regulation was developed. This regulation is issued to describe forces or actions affecting structures from different sources, including earthquakes, and to design standards for concrete, steel and timber structures [11].

Italy has a long history of strong seismic activity. Earthquake-resistant design arrangements began in 1786 as the result of destructive effects of Calabria earthquake in 1783. In 1860, a series of rules for the city of Norcia was issued, the first official earthquake regulation for the earthquake zones of Italy after the earthquake in Sicily, which resulted in the death of 80,000 people in 1908. The regulation was published in the name of the Royal Decree of 1909. This decree was later revised in 1916 after the earthquake of Avezzeno in 1915 and resulted in the death of 30,000 people. These resolutions, which were revised in 1924 and 1927 respectively, started to apply the rules for seismic zone separation. The general framework of today's Italian earthquake regulation was established with the regulation published in 1975. Between 1980 and 1984, a series of decrees were issued to draw the boundaries of Italy's earthquake zones [12]. This regulation was revised in 1986. Although the Molise earthquake in 2002 was described as a normal event for Italy in terms of seismologists, the collapse of a primary school in this earthquake caused the directive to be revised several times over and over again. It was revised in 2003 to divide the region into 4 different sub-seismic zones as proposed in Eurocode 8 (EC8 for structures in seismic regions), "Ordinanza del Presidente del Consiglio dei Ministri" [13]. Completed at the beginning of 2008, these revisions made Italy's current earthquake regulations. This regulation is based on Eurocode 8.

Chile is a country located on the southwestern coast of South America, between the Pacific Ocean and the Andes Mountains, and has a history of earthquake activity. The main seismic resource in Chile is the Nazca subduction zone. In this area, the Nazca tectonic plates are connected to the South American tectonic plate (80 mm / year) at a relatively high speed. This causes many large-scale earthquakes in Chile due to shallow crustal movements. Chile's first regulations concerning the earthquake date to 1928. As a consequence of the earthquake in Talca, a commission was established in 1929 to conduct earthquake-related regulations. In 1935 the Chilean earthquake regulations (Ordenanza General de Construcciones y Urbanizaciones) were officially published. After the 1939 Chilan earthquake, the revisions to the regulation were formalized in 1949. With another earthquake in 1958, the current regulation was revised and officially published in 1972 as "Calculo Antisismico de Edificios". Later, in 1993 all regulations that have been applied to date, have been revised to incorporate the latest techniques of the age. Since 2003, a regulation (Chilean code Nch 433 of 96 "Earthquake resistant design of buildings") has been put into effect to be approved by a control mechanism of earthquake calculations [14]. With this regulation, it can be said that the number of losses decreased in the earthquake of magnitude M = 8.8 in 2010 [15].

Indonesia is located on 5 active tectonic plates geologically. It is therefore located in one of the world's most active earthquake zones. Indonesia's first earthquake code was published in 1970 (Indonesian Loading Code, NI-18). This regulation created the first official earthquake map of Indonesia. In 1976, the governments of Indonesia and New Zealand conducted a bilateral program on earthquake engineering studies. In the end of the program, a decision was made to design a new earthquake resistant design and earthquake map for Indonesia, and in 1983 the Indonesian Constrution Resistant Building Construction Regulation, based on this work, was published. In 1987, with the minor revisions made in the previous regulation, the regulation was named Indonesian Building Construction Standards and in 1989 it was published as Indonesian National Standard (SNI-1726-1989-F) [12]. This regulation (SNI 03-1726-2002), which was revised and published in 2002, remained in effect until 2012. This regulation (SNI 1726: 2012), which was revised again in 2012, is still in force today [16].

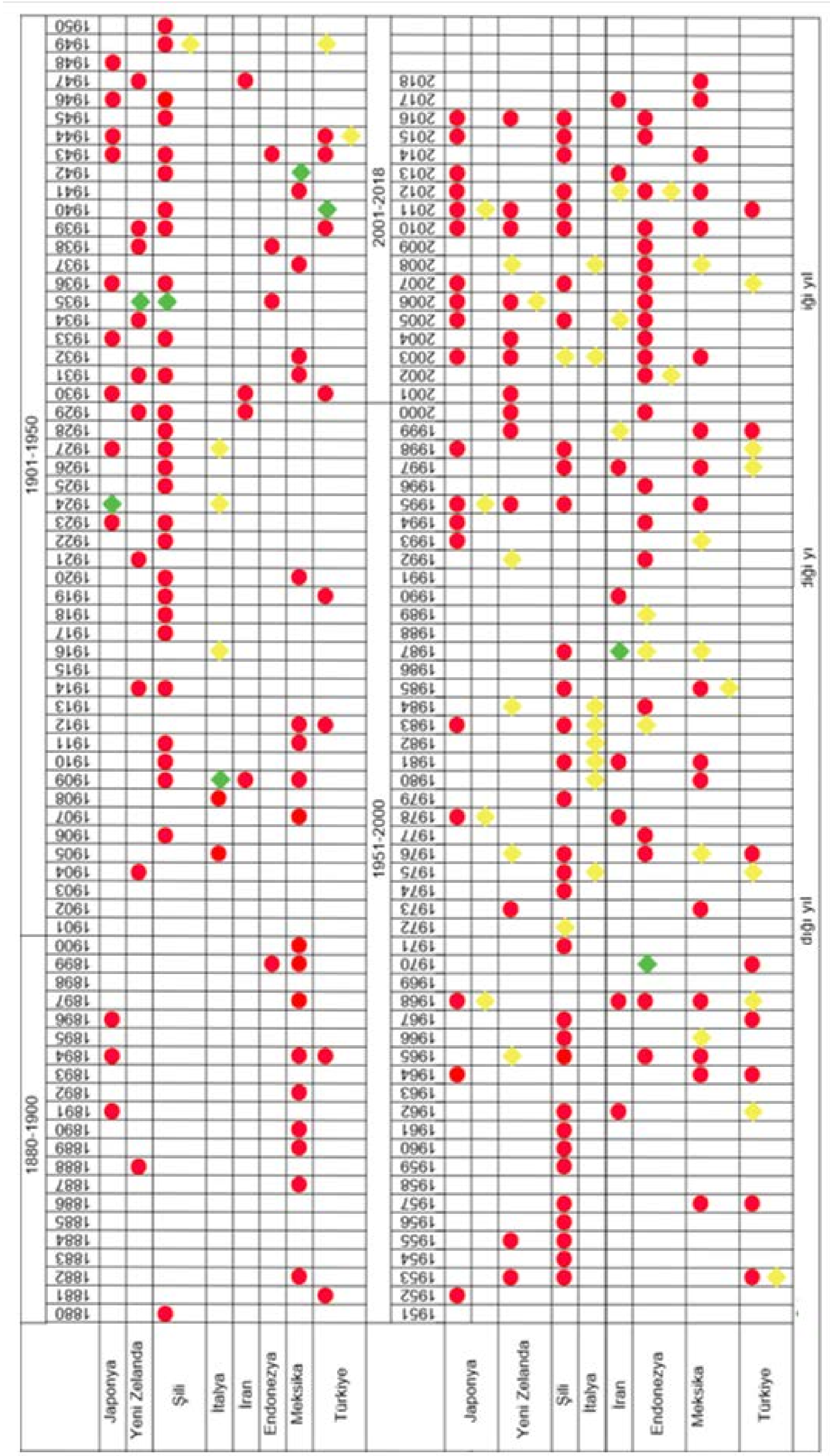
Iran is one of the most active seismic countries in the world. This activity of the Country is due to its position as a compression zone of 1000 km between the plates of the Eurasian and Arabian conflicting clashes. The first committee was established in 1960 to organize Iran's building construction rules and it was first established by the committee as the "Building Standard Code No. 519 ". This standard is based on the regulation of the rules derived from building construction regulations of Germany, France, USSR, UK and USA. However, these arrangements are not specific to Iran, as the earthquake activities of other countries and Iran are not similar. After the heavy losses in the 1962 Boien-zahra Earthquake, the first draft was created by a committee set up in 1964 under the name "Safety regulations of buildings against earthquakes" (Standard No. 519) was revised in 1969 [17]. The first official earthquake regulation of Iran was published in 1987 under the name "2800 (Iranian Code for Seismic Resistant Design of Buildings Standard No. 2800)". The basis of this regulation is based on the principles of the Eurocode-8 regulations adopted jointly by the American earthquake regulations (UBC, IBC and NEHRP) and Europe. Due to some uncertain circumstances in this regulation and developments in earthquake engineering, this regulation was revised in 1999 and 2005 respectively [18]. This regulation, which was last revised in 2012, is still in force today [19].

Mexico is located on 4 tectonic plates in the area called the fire belt where 80% of the seismic activity on Earth is located. Between 1900 and 1998, 84 earthquakes with magnitudes greater than 7.0 were experienced. Mexico City's first stable building construction regulations were published in 1942, with no earthquake regulations and building construction guidelines covering the entire country in Mexico. After the destructive effects of the earthquake in 1957, the regulation was revised. Then earthquake regulations were revised again in 1966 and 1976, respectively. In 1981 a building construction manual was published by the local government. Since this is not an official earthquake regulation, this guide is used in the construction of buildings in each territory of the country (although it does not have an official character). However, some areas with a high population ratio, such as Mexico City, are subject to earthquake regulations approved by the relevant sections of the peninsula. The Regulation underwent a drastic change in 1985. The regulation, which was revised again in 1987, underwent a major revision in 1993 and this regulation remained in effect until 2008 [12]. The regulation published in 2008 as "The Manual of Civil Structures" revised all the building types (buildings, bridges, dams, power plants, industrial facilities, chimneys, silos, tanks and reservoirs, tunnels, retaining walls, etc.) earthquake and wind threats [20].

Turkey, one of the world's most active fault is located on the Alpine-Himalayan fault line. Because of this location, earthquake is one of Turkey's largest natural disaster problem. Very close to the surface (about 5-30 km), earthquakes that occur especially in the North Anatolian fault are very dangerous [21]. The first regulations for earthquake resistant design of structures in Turkey, after the great Erzincan earthquake in 1939, prepared by the Ministry of Public Works and Housing in 1940. These regulations immediately revised after the big earthquakes in Turkey, 1944-1949, respectively in 1953, 1962, 1968, 1975, 1998 and last revised in 2007 after the Kocaeli Earthquake in 1999. This regulation, "Structures To Be Built İn Disaster Areas Regulation On / Turkish Earthquake Code) 2007" is still in force today.

In some cases, earthquakes can cause a major loss of lives and property losses, which in some cases can have a triggering role in the restructuring of the countries. In some cases, the improvements that can be made in the earthquake regulations may be delayed and lead to new destructions in other earthquakes. The table prepared by taking into account M=7.0 (very strong according to MMI) and above earthquakes and the revisions of the earthquake regulations afterwards (Table 2.2).

Table 2.2. Earthquakes Formation and Development Process



Italy is the first country to make earthquake-related regulations (1909), as seen in Table 2.2. M = 7.0 and above earthquakes, only occured twice during this process and the first arrangements were made after these earthquakes. In addition, Italy is the country that revises most of the earthquake regulations. Although, the country that published the earthquake regulation officially in the nearest time (1987) and made the least revision is Iran, although M = 7.0 and above earhquakes occur there often. Japan can be shown as the country that made most regular development on earthquake regulations. After every major earthquake that occurred in Japan, revisions were made in the same year. Rapid revision is an effective way to reduce the damage that a major earthquake could cause in a country where large-scale earthquakes occur frequently. According to the table, Chile, Mexico and Indonesia, where M = 7.0 and above, are the most frequent occurrences of severe earthquakes. Although the Chilean-developed, Mexico and Indonesia are included in the category of developing countries and the earthquake hazard is high, there are not many revisions in its regulations. New Zealand and Turkey have similar characteristics to each other in terms of seismicity. Although they are listed in different income level categories according to their development status, the publication date and revision status of the regulations are similar.

3. INVESTIGATION OF PARAMETERS AFFECTING EARTHQUAKE LOAD

Parameters such as Effective Ground Acceleration Coefficient, Building Importance Coefficient, Live Load Coefficient, Spectrum Coefficient, Structural Behavior Coefficient and earthquake load effect are effective in calculating the total effective earthquake load of the building. One of the most important parameters in determining earthquake hazard is earthquake acceleration. **The effective ground acceleration coefficient** is determined considering the Design Earthquake with a probability of exceeding 10% over a period of 50 years, while defining this acceleration based on the determination of the zones in the earthquake map. **The Building Importance Factor** is used to calculate the vulnerability ratio of the structure according to the load case. These coefficients are defined for each building group. In the calculation of earthquake loads, the work-specific equipment possessed by the structure is calculated by multiplying the live loads by the **Live Load Coefficient**. **The spectrum coefficient** is calculated according to the local ground conditions and the natural period of the building. The spectrum coefficient used to determine the earthquake effect has the largest value in the wider period on soft grounds, while it is higher on the hard grounds. **The Structural Behavior Coefficient** is also known as the earthquake load reduction coefficient. In static calculations, the R coefficient reduces the load on earthquake impact of structure compared to ductility design. Earthquake loads and storey masses, it is assumed that the live and dead loads are uniformly distributed over the floors of the structures. However, in practice, these loads are not spread properly due to the impact of **Seismic Load Impact** (R coefficient). The current earthquake standards according to the effective parameters in the earthquake load calculation of the countries mentioned above are given in the table below (Table 3.1).

Table 3.1. Effective Parameters and Limit Values for Determining Earthquake Loads

		Effective Parameters and Limit Values for Determining Earthquake Loads					
		Effective Ground Acceleration Coefficient [A_0]	**Building Importance Coefficient [I]**	**Live Load Coefficient [n] / kg/m²**	**Spectrum Coefficient [T_a/T_b]/T**	**Structural Behavior Coefficient [R]**	**Earthquake Load Impact [D_i]**
DEVELOPED	Japan **[22]**	I. zone 1.0 II. zone 0.9 III. zone 0.8	——— They are classified according to their height.	———	Type I (rock, sand or rocky soils) = 0.40 Type II (soils other than Type I and Type III) = 0.60 Type III (organic or soft soil with ali) = 0.80	For all constructions, R = 4 is assumed.	———
	New Zealand **[23]**	I. zone 0.8 II. zone 0.7 III zone 0.6 IV. zone 0.5 V. zone 0.4	Constitutions that can be secured 1.3 Constructs where people are crowded 1.2 Constructs with national values 1.1 Constructions not	———	Type A (hard and extra hard rock ground) = 1.89 Type B (rock ground) 1.89 Type C (shallow soil ground) = 2.36	For ductile structures: Steel system μ = 6, Reinforced concrete system μ = 6 (moment resisting frame), μ = 5 (walls) ,	Only 10% of the length in the x direction of the plan

			included in a category 1.0 Constructions in the secondary constellation 0.6		Type D (Deep or soft soil ground) = 3.0 Type E (very soft soil ground) = 3.0	For elastic structures: μ = 1.25	
	Chile **[24]**	I. zone 0.20 II. zone 0.30 III. zone 0.40	Buildings I = 1.2, Buildings, libraries, schools, social buildings I = 1.2, Buildings that are in use by people who are not in the first 2 categories I = 1.0, Buildings not in public use I = 0.6	Stores-0.5 Normal areas-0.25 Diagonal supporting vertical loads-1.0 Roof, platforms and walkways-0	Type I (rocky soils) = 0.15 Type II (dense sand and gravel or cohesive soils) = 0.30 Type III (medium dense sand and gravel or medium solid cohesive soils) = 0.75 Type IV (soft cohesive soils) = 1.20	Moment resistant frames R = 7 for steel structures, R = 7 for reinforced concrete	Horizontal earthquake force perpendicular to the direction of 10%
	Italy **[25]**	I. zone 0.35 II. zone 0.25 III. zone 0.15 IV. zone 0.05	Agricultural buildings: 0.7 Typical areas of use: 1.0 Official and strategically important structures: 2.0	——	Type A = hard rock soils: 0.3, 0.27, 0.2. Type B = Rock Floors Type C soft rock and very hard / very dense soil Type D and E = hard soil and soft soil. Type B, C, D, E = 0.28, 0.24, 0.20.	——	Each layer has a center of mass of + 5% of the y and x axis respectively.
DEVELOPING COUNTRIES	Mexico **[26]**	I. zone 0.04 II. zone 0.08 III_a. zone 0.10 III_b=0.11 III_c=0.10 III_d=0.10	Buildings with hazardous substances which should be used after earthquake I = 1.5 Other buildings I = 1.0	Houses - 90 kg / m2 Office and lab. 180 Circulation 150 Stadium and public 350 Social buildings 250	Type I (hard ground) = 0.2 / 1.35 Type II (transition grade) = 0.2 / 1.35 Type IIIa = 0.53 / 1.8 Type IIIb = 0.85 / 3.0 Type IIIc = 1.25 / 4.2 Type IIId = 0.85 / 4.2	R_0 = 2.0 for ductility level normal and medium moment strength frames High moment strength frame with ductility level R_0 = 2.5 Mixed systems with high moment strength frame connection at ductility level R_0 = 3.0,	Horizontal earthquake force perpendicular to the direction of 10%
	Iran **[27]**	I. zone -0.35 II. zone -0.30 III. zone -0.25 IV. zone -0.20	I = 1.2 for residential buildings, libraries, national archives I = 1.2 for residential buildings, offices, hotels, industrial buildings I = 1.0 for agriculture, warehouses and animal farm buildings I = 0.8	(in%) Slope 20% or more sloped roof-0 Slope 20% or flat roof-20 Hotel, residential and office buildings-20 Hospitals, schools, warehouses-40, Warehouses and libraries-60 Water tanks- 100	Type I (rocky soil-hard soil) = 0.1 / 0.4 Type II (loose rock-hard soil) = 0.1 / 0.5 Type III = 0.15 / 1.0 (T is calculated by the coefficient S)	Süneklik düzeyi yüksek çerçevelerde, ba perde duvar=8, orta çerçevede=7, genel=5 Süneklik düzeyi yüksek moment dayanımlı çerçevelerde: baç-10, orta baç-7,genel-4,süneklik düzeyi yüksek çelik çerçeve 10, orta-7, genel-5.	Horizontal earthquake force perpendicular to + - 5%
	Indonesia **[28]**	I. zone 0.8 II. zone 0.7 III. zone 0.6 IV. zone 0.5 V. zone 0.5 VI. zone 0.5	Buildings to be used after an earthquake 1.5 Museum buildings-1.5 Buildings containing dangerous substances-2.0 bacalar and water tanks-2.0 Other buildings-1.0	Houses 250kg / m2 Offices-200kg / m2	Type A (hard ground) = 0.5 Type B (medium hard ground) = 0.6 Tip C (soft ground) = 1.0	For ductile structures: Steel system = 1.0 Reinforced concrete system = 1.0 Wood = 1.7 For structures with a low ductility level: Reinforced concrete = 1.5 Wood = 2.5 Steel with diagonal frame = 2.5	Horizontal earthquake force perpendicular to + - 5%
	Turkey **[29]**	I. zone 0.4 II. zone 0.3 III zone 0.2 IV. zone 0.1	I = 1.5 for schools, educational facilities, dormitories and prisons I = 1.4 Sports facilities, social structures I = 1.2 Housing, office, hotel, industrial buildings I = 1.0	N = 0.80 for warehouse, warehouse n = 0.60 for school, dormitory, sports facility, social building n = 0.30 for residence, workplace, hotel, hospital	Type I (Soft rocks, medium tight sand, soft clay) = 0.1 / 0.3 Type II (Loose volcanic rocks, = 0.15 / 0.6 Type III (Soft rocks, medium tight sand, soft clay) = 0.15 / 0.6 Type IV (Soft alluvium strata, loose sand, soft clay) = 0.2 / 0.9	The ductility level is high. frames = 8, Reinforced concrete curtain wall = 6, steel frames = 8, ductility level normal Reinforced concrete frames = 4, Reinforced concrete curtain wall = 4, steel frames = 5.	+ - 5% of the floor size in the direction perpendicular to the horizontal earthquake

R_0 is the effective coefficient for calculating the R factor.

According to the table, earthquake zone coefficients differ according to the degree of earthquake hazard of countries. The live load coefficient (construction weight) is taken as a weight unit (kg / m2) instead of coefficient in some countries. The spectrum coefficient varies depending on the soil structure and soil classes of the countries. The structural behavior coefficient is given by a single factor for all structures in Japan, but by the ductility class of structures in other countries. The effect of earthquake loading is given in the standards of all countries outside Japan.

4. CONCLUSION AND EVALUATION

The extent of damage to the environment of earthquakes can change depending on the characteristics, their magnitudes (severity), and places where they ocur (rural or urban) etc. The comprehensive assessment of the regulations in each period, the analysis of every damage in the earthquakes that are happening, and the solutions to be produced, will reduce the new damage rates that might be caused by possible big earthquakes at any moment. Nevertheless, it is thought that earthquake damage and earthquakes regulations are influenced by the development levels of the countries as a sign of the value given to the individual with the level of income and welfare per capita in that country. Frequent updates in earthquake regulations indicate that earthquakes are always aware, and revisions are made in accordance with the regulations.

When it comes to earthquake regulations, Japan is the country that clearly differs from the other countries where current earthquake standards that are examined. Japan's earthquake regulations, in contrast to other countries, make earthquake calculations based on building heights, not building importance values. The earthquake regulations of other countries are basically similar to each other, since they are based Eurocode 8.

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New Development Opportunities by Implementing the Industry 4.0 Concept

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ABSTRACT

Diversification of production, product lifecycle reduction, correlated with IT sector development have led in recent years to the development of integrated production systems and advanced production technologies. Increasing the competitive advantage of companies' performance, especially in the industrial sector, requires innovations and continuous adaptations of production systems and business processes for products and services. Considered as a new paradigm in manufacturing, the concept of Industry 4.0 creates a new perspective of a company by digitizing current production systems. Integration of intelligent machine tools, industrial robots into flexible production systems, the development of new software to monitor and control production processes require profound transformations in the industry.

Companies need to rethink their entire production process through the implementation of digital technologies and the Internet of Things (IoT) in order to respond effectively to new market demands. The Industry 4.0 concept opens a new stage in industrial evolution, both technically and economically, representing an opportunity to re-technologize and relaunch production. The main objective of the paper is to highlight the opportunities for applying this concept in the context of the sustainable development of manufacturing. Through a new approach, the authors will conduct a study of the literature on the current state of development and implementation of the concept, as well as an analysis of the methodology, advantages and limitations of the implementation in the Romanian companies, in view of the transition to Industry 4.0.

Key Words: Industry 4.0, production systems.

1. INTRODUCTION

Currently, we are witnessing a changing market by diversifying production and development of personalized products whose added value is growing. Develop and implement models of artificial intelligence and IT sector companies require profound changes in terms of improving internal processes in production, while developing new business models and adopting new management techniques and human resource training [1]. Management wants agile, flexible, responsive, competitive, innovative, efficient, customer-oriented businesses and not ultimately profitable. There is a need for a qualitative leap in performance, which can be achieved through completely new processes and structures, and new businesses can self-reinvent themselves. Modern, digitized information technology plays an essential role in redesigning business as it enables companies to transform their internal processes.

The changes that have occurred over time in society have influenced industrial development. It is considered [2] that until now the industry has evolved into four major transition periods in the manufacturing process, called industrial revolutions, bringing new innovations and technologies (Figure 1):

- The end of the 18th century - the beginning of the 19th century: *The first industrial revolution* consists in the beginning of mechanization of production, using the energy of water and steam. The discovery and realization of the steam machine in England belongs to James Watt in 1769; this has contributed to the creation of a new form of energy used to drive locomotives, wagons, pumps, machines and equipment from increasingly growing factories.
- The end of the 19th century - the beginning of the 20th century: *The second industrial revolution* is marked by the use of electricity, gas and oil, which have led to the development of mass production. The huge leap in development was made with the discovery in 1876 by Nicholaus

of the combustion engine, followed by other inventions, such as the appearance of the telegraph, the phone, the car and the plane at the beginning of the 20th century.

- The second half of the 20th century: *The third industrial revolution* is the result of great discoveries in the field of nuclear energy. It is the stage of automation of the industry, through the development of electronics, telecommunication and informatics; new discoveries on space, nanomaterials and biotechnologies, robotics are highlighted.
- We are currently witnessing a 4th Industrial Revolution, based on the previous automation and information technology stage.

The new Industry 4.0 concept consists of developing digital manufacturing in the enterprise by creating smart grids across the entire value chain, which can independently control each other, networks formed by interconnecting intelligent machines, advanced manufacturing systems and products. Tools and embedded components are 4.0 Industry concept: Cyber-Physical Systems (CPS), Internet of Things (IoT), cloud computing, robotics, systems based on artificial intelligence and cognitive computation.

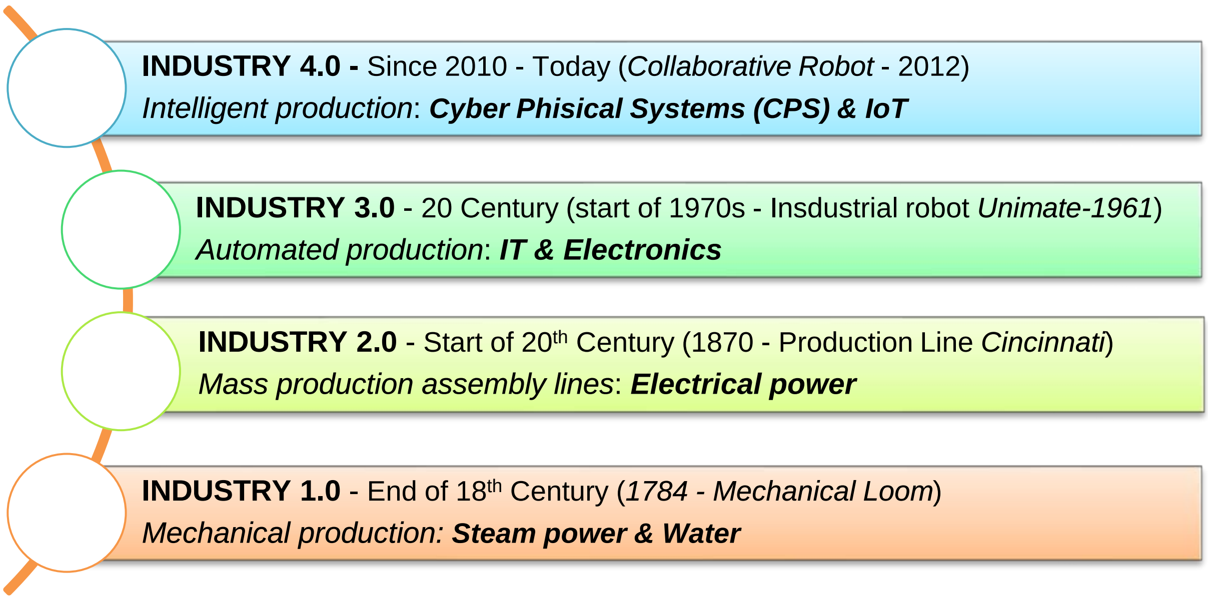

Figure 1: Stages in industrial evolution

Currently the EU economy industry represents 15% of added value (compared to 12% in the USA), [3]. According to this study, industry can be considered the EU's economic and social engine, a key factor in research, innovation, productivity, job creation (over 33 million jobs in over 2 million companies) and exports (generates 80% of EU innovations and 75% of its exports). However, the European industry lost 10% of the value added over the last ten years to emerging countries.

The new Industry 4.0 concept developed by the EU is fundamental to ensuring the sustainable development of today's manufacturing systems and the continuity of success in international competition. Scientific studies [4], [5] have set great potential for reducing the production cycle, increasing the degree of automation, the possibility of achieving some high-tech products in limited series and also an efficient use of numerous production data that has so far not been exploited.

Given the state of development currently being developed by industry in developed and EU countries, the development of automation and the IT sector with applications in the automotive industry, the present study proposes an analysis to highlight the limits on the transition to the application of the new concept. It is also proposed to find opportunities and implementation methodology in the industrial field for aligning Romania to the European countries where the Industry 4.0 program takes place.

2. INDUSTRY 4.0 CONCEPT 4.0. A REVIEW LITERATURE

The new digitization and manufacturing paradigm called "Industry 4.0" brings profound transformations to factories through intelligent and autonomous production [6].

Industry 4.0 concept, which defines the current stage of industrial development, was launched for the first time in Europe in 2011 and supported by Germany through government programs [7] and top companies such as Boch and Siemens. Similar initiatives have existed in other countries, such as France, but under the name of "Industrie du futur" or "Catapult" in the UK. In the US, the concept of "Smart Manufacturing" was launched in March 2014 by the Industrial Internet Consortium (IIC), which includes compamies: AT & T, Cisco, General Electric, IBM and Intel. The goal is to develop new interconnected technologies, not only in the industrial field but also in the services. In Japan, there is a similar initiative under the name of the "Industrial Value-Chain Initiative" (IVI), created by large Japanese enterprises. China also launched in the spring of 2015 such a "Made in China - 2025" initiative.

The strategic development programs of some developed countries in Europe, America and Asia include the current Industry 4.0 concept. A strategic initiative to promote digital transformation was recently presented in Germany, the Digital Transformation Monitor - 2017 [8]. The goal of the "Industry 4.0" concept (I40) as a strategic German initiative is to stimulate digital production by increasing digitization and interconnection of products, value chains and business models. Another strategic dimension in referred is to support research, networking partners from industry and standardization. I40 is followed over a period of 10-15 years and is based on high-tech strategy of the German government in 2020, launched in 2011, became institutionalized with the creation of Industry Platform 4.0 which now serves as a central contact point for policymakers. It already has over 250 participants from over 100 organizations (enterprises, research institutes and universities). According to the report [7], BMBF and BMWI have allocated together 200 million euros in funding for project implementation.

According to Ghide to Industry 4.0, developed by i-SCOOP in Belgium „Industry 4.0 is the information-intensive transformation of manufacturing and other industries in a connected environment of data, people, processes, services, systems and IoT-enabled industrial assets with the generation, leverage and utilization of actionable information as a way and means to realize smart industry and ecosystems of industrial innovation and collaboration” [9]. The Deloitte study [10], conducted in Switzerland, provides information on changes and solutions of digital transformation and the use of exponential technologies (intelligent robots, autonomous drone, sensor technology, 3D printing - additive manufacturing, etc.) in Industry 4.0. The authors of the study consider four major features of the Indutrie 4.0 concept: the vertical networking of smart production systems; horizontal integration by means of a new generation of global value-creation networks; through-engineering throughout the entire value chain; acceleration through exponential technologies.

According to the report World Economic Forum 2018, the production of USA "is renowned worldwide for its ability to innovate and is now leading the main development around emerging technologies of the fourth industrial revolution" [11]. A recent study [12] in May 2017 in Canada shows that nearly 40% of Canadian small and medium-sized producers have implemented industry projects of 4.0, including 3%, which have digitized their production completely, while another 17% is in the planning phase. On average, they have invested over $ 250,000 in their digitization projects over the past two years.

In the literature [13], [14], [15] studies and research were carried out on the current state of implementation in industry, especially in the manufacturing and automotive industry, of the new concept of industrialization. Trying thus to identify the limits of implementation and find solutions that lead to opportunities in industrial development, in order to help companies to face new challenges.

The Industry 4.0 concept and the upcoming trends are also emerging from the recent and wide-ranging study on the opportunities and challenges of implementation presented in the scientific paper [15]. The authors developed a model applied to a sample of 746 German production companies in five industrial sectors. The results have identified positive factors in the application of Industry 4.0 as strategic, operational, environmental and social opportunities, depending on the characteristics of different companies. The McKinsey Global Institute report [16] highlights that 90%

of companies considered Industry 4.0 to be an opportunity rather than a threat, especially in Germany, and expect growth in competitiveness over the next few years.

The study [1] carried out in Italy, contributing to the improvement of the knowledge Industry 4.0 concept, offering insight into the new paradigm digitization of the industry and could be a guide for companies adopting new business models to implement an innovative and competitive environment. The paper [14] makes a major contribution by presenting a multi-layered model of Industry 4.0 implementation. In this context, it identifies research gaps between current production systems and Industry 4.0 requirements, concluding that the future of manufacturing is developing towards industry 4.0.

The peculiarities of other industries and the possibilities for application of Industry 4.0 for sustainable development are presented in several other studies [17], [18]. The paper [19] examines architectural models of complex fields of Industry 4.0, suggesting that they might integrate the basic principles of Lean Management / Lean Production as these approaches still offer appropriate measures to optimize production.

2.1 Industry 4.0 Components

According to [20], the Boston Consulting Group estimates that Industry 4.0 specifically includes nine technological advances that created the fourth revolution: autonomous robots, simulation, integration of horizontal and vertical systems, industrial Internet objects, cyber security, cloud, additive manufacturing. These components can be grouped into four technology domains that characterize Industry 4.0 (Figure 2).

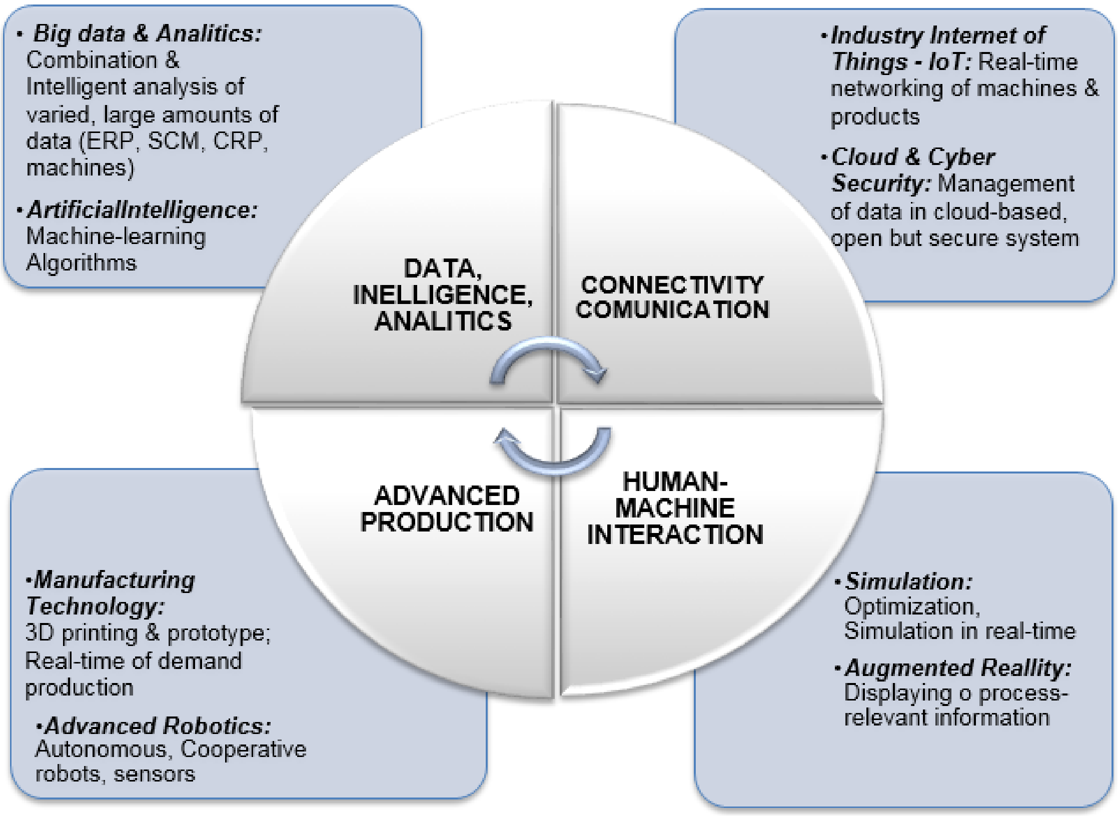

Figure 2: Industry 4.0 Components

3. INDUSTRY 4.0 IMPLEMENTATION METHODOLOGY

The Analytical Study for the ITRE Committee [7], developed in 2016 in Germany, emphasizes that „Industry 4.0 will only succeed if certain key requirements are met: standardisation of systems, platforms, protocols; changes in work organisation reflecting new business models; digital security and protection of know-how; availability of appropriately skilled workers; research and investment; and, a common EU legal framework to support the dissemination of Industry 4.0 in the internal market. If successfully implemented, the potential benefits of Industry 4.0 relate to productivity gains, revenue growth, and competitiveness. The implementation horizon is to have pilots running in 2016 and full implementation as of about 2025".

3.1. Implementation steps

The study by PwC [21] provides a vision of the integration methodology in Industry 4.0, according to the plan for digital success shown in Figure 3.

Figure 3: Blueprint for digital success (*Source: PwC*)

3.2. Standadization

Standardization and its progress with the implementation of Industry 4.0 is currently one of the biggest challenges. Standardized reference models are required in several areas involved in Industry 4.0: engineering, digital manufacturing, robotics, IT and communications, augmented reality, modeling and simulation, data analysis and processing, engineering and product lifecycle management. The lack of uniform standards would lead to the impossibility of communication between the various global production networks and applications globally. Digitization also requires an effort towards standardization in data protection and IT security.

The overall standardization features in Industry 4.0 were outlined in the study [7] to make the first major step towards establishing a common approach and terminology in all member countries. The integration of Industry 4.0 into the global economy implies the adoption of industry standards in the form of architectures or a coherent reference system that facilitates the interoperability of the production systems of companies in different countries. According to this study, for Industry 4.0, „standards could be applied to the labeling and certification of IT interfaces (hardware, data formats, web services), programming platforms and control software, protocols and connections, data transfer and security procedures".

Recently in March 2018, in Germany, „The German Standardization Roadmap Industry 4.0. Version 3" [22] was developed, through collaboration of organizations and ministries: Standardization Council Industry 4.0, Plattform Industry 4.0, Labs Network Industry 4.0, Federal Ministry of Economic Affairs and Energy (BMWi), Federal Ministry of Education and Research (BMBF), the European Commission and the G20. Standardization Council Industry 4.0 (SCI 4.0) coordinates standardization activities. A strategic and technical document entitled "Standardization Roadmap Industry 4.0" was developed by a SCI 4.0 Working Group of industry, research, science and policy experts. It outlines the general and specific standards relevant for Industry 4.0 and some recommendations. Thus, a basis for the development of the standardization work currently under way was established, aiming at cooperation between the national and international standardization institutions, as well as among the various factors (economic, politics, companies, ministries) involved in the implementation of the concept Industry 4.0. It is thus possible to develop open and feasible standards that can be applied on a large scale, with the possibility of periodic review, on the basis of new findings. Among the activities carried out within the SCI 4.0 Working Group can be mentioned [7]: associating professional associations and other stakeholders to build mutual confidence in setting common standards; aligning key terminology and developing a "Industry 4.0 glossary"; elaboration of standards for service architecture, procedural and functional descriptions, terminology of standards, understanding of autonomous and self-organizing systems, description of the structure of the system; developing an upward map describing existing standardization institutions and approaches relevant to industry 4.0; developing a Standardization Roadmap to be open to participants. Standardization in Industry 4.0 is a matter of major concern, given the business involvement of many companies around the world. According to [7], policy- makers could play a constructive role in supporting the work of introducing relevant international standards for industry and research, both at national and global level. Development of standards and specifications occurs at different levels (national, European and international). Standards and specifications are an effective tool for applying research results in a fast and user-friendly way, thus promoting rapid access to the innovation market. To achieve a successful international standardization system, equipping the digitization industry, the aim is to achieve a consensual and global harmonization of the concepts underlying Industry 4.0 [22].

4. OPPORTUNITIES FOR IMPLEMENTATION OF INDUSTRY 4.0

The opportunity for implementation has been studied in a series of researches [15, 17, 18] demonstrating the effect of Industry 4.0's application, such as creating new business models and new value offerings to enhance competitive advantage. One of the key points of successful implementation of Industry 4.0 is to identify the necessary preconditions that may vary between different companies. Based on a survey conducted in 2013 [7] was prepared according to a ranking of the identified criteria shown in the diagram in Figure 4.

Figure 4: Preconditions for implementation of Industry 4.0 (*Source: ITRE Committee, EU*)

4.1. Benefits and implementation limits

The process of implementing the Industry 4.0 concept is a challenge for companies that want to increase their competitiveness.

Following the launch of the Industry 4.0 implementation program, applying to European companies [7], a number of benefits have been identified for the development of the industry: increasing the productivity, efficiency and competitiveness of firms; increased production flexibility, product diversification and thus gaining new markets, print better meet customer requirements; production optimization by integrating flexible manufacturing systems and robots, the use of artificial intelligence and network interconnection through IoT; changing business management by adopting new business models. Switching to Industry 4.0 generates opportunities for Europe. The EU can strengthen its global leadership position in the industry, especially in manufacturing, social change by creating highly skilled jobs, influence positive demographics, etc.

At the same time, however, some shortcomings were also found: the lack of qualified staff with skills in the new areas, excessive costs [7, 8, 12]. On the other hand, the EU has identified several possible threats, especially in the area of IT security and data protection, and the development and implementation of the concept, even if under another name, the competing companies from other regions. Last but not least, there is concern about the difficult conditions for switching to Industry 4.0 of some member states, which will affect the whole global value chain [7].

4.2. Implementation opportunities in Romania

An important factor for switching to Industry 4.0 of any country is the analysis of the industry-specific factors, as is the case with Romanian industry, by key stakeholders (government, ministries, research institutions, universities, and not least industrial companies).

Even if Romania was not actively involved in the European Agenda for Industry 4.0, there is currently a major concern of large multinationals in the country, such as industrial companies Bosch, Siemens, Festo, and telecoms (Vodafone) to switch to the new digitalization stage [23].

The "Digital Romania - Industry 4.0" Forum organized in Bucharest in November 2016 by the Romanian Government focused on "The Fourth Industrial Revolution", the conclusions of the Working Commission being that "digitization is the future of our society and our economy" [24]. The industry's literature on the new Industry 4.0 concept does not provide much information, some articles are relevant [23], [25], [26] complemented by specialized technical journals and in-house associations and companies that promote and offer technical expertise in the field, [27].

Even if the leap to Industry 4.0 will be difficult and the transition will not be a quick one and maybe not in a very near future, Romania has resources. In Romania, industry has a steady contribution to economic growth. Thus, according to the Eurostat report [28], Romania (25.7%) is among the EU countries with the highest gross value added (VAB), along with Ireland (36.6%), Czech Republic (32.1%), Slovenia (27.1%), Slovakia (26.9%), Hungary (26.8%) and Poland (26.5%) and Germany (25.7%). Also, a positive trend in Romania was the increase in the number of fast-growing companies in the European Union (EU) with an advance of 34% in 2016 compared to 2015, many of which are in the manufacturing sector [28].

Romania has a recognized competitiveness through the two major manufacturers in the auto industry - Dacia (Renault) and Ford, with a network of suppliers very well built. It is also a great attraction for investors in the manufacturing and automotive industry, Germany being one of the largest investors in Romania. In addition to these factors, there are other advantages that create a prerequisite for development: a well-developed IT sector and a highly skilled, digitally skilled workforce can contribute to the digitization of manufacturing; the speed of the internet connection is one of the highest in Europe; the existence of technical universities that can support the field of research-innovation by participating in the implementation of some European projects in Industry 4.0.

We also identified weaknesses that negatively affect the implementation of the new Industry 4.0 concept in Romania: lack of a coherent strategy for industry digitization; poor representation of Romania and companies within the European Industry 4.0 Agenda and a digital platform; minimum financial support for research and innovation and poor involvement in attracting European funds; low participation of specialists and academics to international conferences in the field; lack of a national strategy for keeping top IT and industrial specialists in the country; lack of transport infrastructure for the development of the business environment.

5. CONCLUSIONS

This paper presents common views on 4.0 Industry development opportunities of digitization manufacture. Many companies that have taken the first step towards implementation consider the development of the digitized industry to be timely, showing that the future of today's manufacturing is expanding towards Industry 4.0. The goal is to increase flexibility, shorten the life cycle of industrial products / services, increase production efficiency and increase competitive advantage.

The studies and research presented show that transformation to Industry 4.0 will have three major dimensions: technological change, paradigm shift in business models and social change, and digitalisation being the determining factor. In addition to these aspects, it is recommended to take into account other specific factors such as: highly qualified staff with the development of new skills, migration, the development of a framework including digital security standards and programs, and the development of international collaboration programs. The transition to Industry 4.0 through the European model offers great development opportunities for European countries, contributing to the sustainable development of industry and socio-human development through new employee qualifications, taking into account the characteristics of each industrial sector in each country.

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Playing a Game to Evaluate Teaching, Learning and Outcomes in a University

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ABSTRACT

The globalization and internationalization, challenging universities to become competitive and trustworthy for students. This is becoming more and more difficult if we take into account, the bureaucracy, financial inevitability and strong competition from the high ranked universities. To be competitive and challenging, universities should be able to use the new opportunities offered by the development of communication technology, change their management and functioning mentality to develop them in the promotion of ideas and development. What about a successful university? Simply, be pragmatic and avoid bureaucracy, 100 % accountability and 0 % bureaucracy and the balance of the two guarantees the success of the university. Of course, achieving these values is not easy and, in this study, based on several years of experience in the field of higher education, we have shaped the appreciation of one of the main components of a university, such are teaching, learning and the competence (TLC). We have called the accountability as the X factor and the bureaucracy Y factor. The main contributors to the teaching, learning and the competence and for quality of TLC, are the academic staff. Analyzing a set of indicators, evaluation methods, individual tests, it was concluded that the academic staff should be within the factor of X and should demonstrate it. We have shown an empirical test to show the importance of the number 2/3 and brought this exercise as a game.

Keywords: universities, education, quality assurance, 2/3 number, X factor.

1. INTRODUCTION

The university is an institution that exists to advance culture, both by acquiring more knowledge and by disseminating received knowledge in ways that inspire young people to use it both creatively and constructively. As an institution which advance the culture and knowledge, we are very interested that both of them to have in high level of quality or in excellent level. But the question is what does mean quality in higher education? Based on Joseph Juran, (Juran (1951, 1999) *"Quality is the degree to which a product or service meets the expectations or aims the stakeholders require or desire, and the degree to which it gives undisturbed satisfaction during its expected life"* [1], [2]. Quality, as defined by its stakeholders, is the added value between input and output. Excellent output ≠ most added value = improvement = transformation, while still meeting the international minimum standards. For many years the quality was introduced as concept of excellence but with general description, "*Looking at the criteria different interest groups use in judging quality rather than starting with a single definition of quality might offer a practical solution to a complex philosophical question*" [2, pg. 18].

The concept of quality assurance in higher education has been introduced in 1980 and after that this concept had a wide usage in higher education. Defining quality and quality assurance in the context of higher education continues to pose significant challenges but there is still no consensus for final definition. The actual concept of the quality is based in four terms, purposeful, exceptional, transformative and accountable [1], [2], which are now more elaborated and detailed [6].

2. MATERIALS AND METHOD

To have a world-class university or ranked in top of global lists of higher education institutions, we have to measure, evaluate or assess the quality of institution. The question is quality of what? We define several indicators and criteria to measure the quality at the institution [6], [7]. Also, we have to conduct standards, processes and procedures as a mechanism which works in parallel with institution life. QA is a management approach to focus on the quality of the institution and is based on participation of all parts and stakeholders in order to satisfy their expectations and aims as long as possible. This management approach is defended as Quality Assurance System (QAS) and has several components:

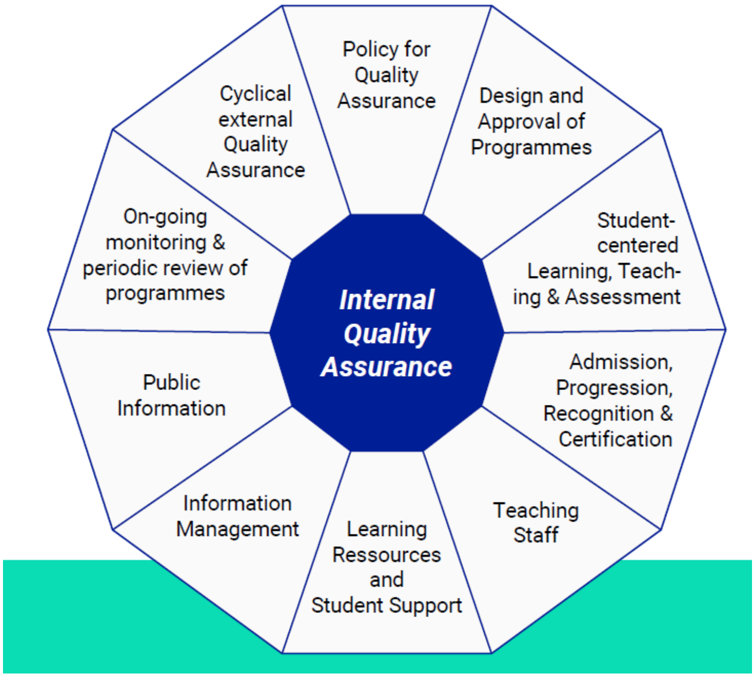

Figure 1: Main internal quality standards for higher education institutions

If fact QA is different from quality control or quality audit because is not: just quantitative assessment, just a question of defining processes, be reduced to a “tick the box” approach, be coupled with reporting and bureaucracy and sure is linked with the universities’ autonomy, but the most important thing is that the QA should be a vision and culture of the overall university and ambition of its University senior management [5], [6].

An academic Institution is not like an orchestra with a Rector as conductor. University is more like a jam session among a lot of talented musicians who listen to each other and get into the flow. The Rector, deans and other administrators strive to hire the right musicians, draw the themes from the evolving music, and keep the beat going.

We need several ingredients for a good university; high quality students, appropriate autonomy, academic freedom, innovative environment, adequate level of funding, high quality infrastructure and facilities, appropriate leadership and governance. All of these, are connected with two simple components, accountability and bureaucracy which if are in good balance, guarantee the success of the university.

Knowing that the bureaucracy is part of management and administrative component, in our study we have focused in the accountability component. What is the accountability in HE and how to measure it?

Accountability doesn't happen just by chance, it has to be implemented, it starts with you, it is the difference between success and failure and cannot be delegated [2].

All parts of the university, stakeholders (academic staff and students), should be accountable in their duties and competences.

Taking into account that the most important part of the HE institution is the quality of the teaching and learning process, [8] we are interested to know individually or as an institution if each of the stakeholders of the institution carries out its task of comity and accountability.
Of course, to measure quality in teaching and learning, the university or responsible agencies for quality assurance, draft guidelines, standards and criteria that qualitatively and quantitatively assess the quality in all areas of activity of the institution involving and teaching and learning component [7], [9].
Teaching as a process involves the whole institution, stakeholders, student staff, infrastructure associates, etc. In our focus is the academic staff and the students to analyze getting the best that the other components are in the right quality.
In one academic year, a number of activities are under way in teaching and teaching as they are; lessons (lectures / seminars / labs / practices), information hours, counseling hours, activation, ongoing assessment, preparation for exams, tests / exams, assessment and information of students.
What makes a responsible professor to possesses the factor X? Below are listed some of the indicators that determine factor X linked to number 2/3.

Table 1: Indicators to ensure quality for teaching and learning

Indicators	Components
1. Qualified academic staff	Strong academic background, quality preparation prior to entry Qualifications and certifications in the field taught, long experience
2. Effective teachers during the teaching and learning process	Engaging students in active learning, creating intellectually ambitious tasks, using a variety of teaching strategies, adapt teaching to student needs, creating effective scaffolds and supports, constant feedback, and opportunities for revising the student work, developing and effectively manage a collaborative classroom in which all students have membership.
3. Information throughout the year	Academic staff should inform the student about his / her responsibilities, about the importance of the teaching process, promoting his / her participation and activism in the teaching process not by means of compulsory but raising the awareness and awareness of the students. On a continuous basis, the academic staff should ensure the participation of at least 2/3 of the students in lecturers during the course.
4. Continuous evaluation	Academic staff uses different forms of assessment that helps not only as motivation for the student but mostly helps the academic staff to understand the reality, to change for improvements, assess the student learning continuously and guarantee active participation of at least two thirds of students and to provide absorbing knowledge and competences from students
5. Testing and knowledge evaluation	Academic staff uses mechanisms and information methods for students regarding assessment. Student should be clear that testing / exam is not a mechanism for teaching knowledge since the professor himself has clear estimates for each of them before the exam. The student should be clear that beyond knowledge testing and assessment grades, it is more important if the knowledge gained and made it more knowledgeable and able to solve the problems and situations that can be created. If the academic staff has achieved this, he is able to determine the exact grade of 2/3 of the students and get their approval before the final exam.
6. Final assessment and information of students	The professor provides a fair, transparent evaluation based on merit for each student. It discloses the assessment method to the students and informs them of the results in a timely and transparent manner.

And based on the indicators of the table 1, an empirical example was conducted as a game for a private university in Albania. This test was conducted in a classroom of 53 students during the first semester of the course. The analysis included:

1. *Student participation in the lectures*

The students were informed and trained throughout the semester (15 weeks) according to point 3 of the previous table, regardless of whether they were informed by the institution as well. Participation in the lectures has been non-binding (without absence). Referring to points 2 and 4, different teaching methods have been used, coupled with interactive hours and discussions where students' involvement is always required. At the end of the course, the results of the participation are presented in Figure 2.

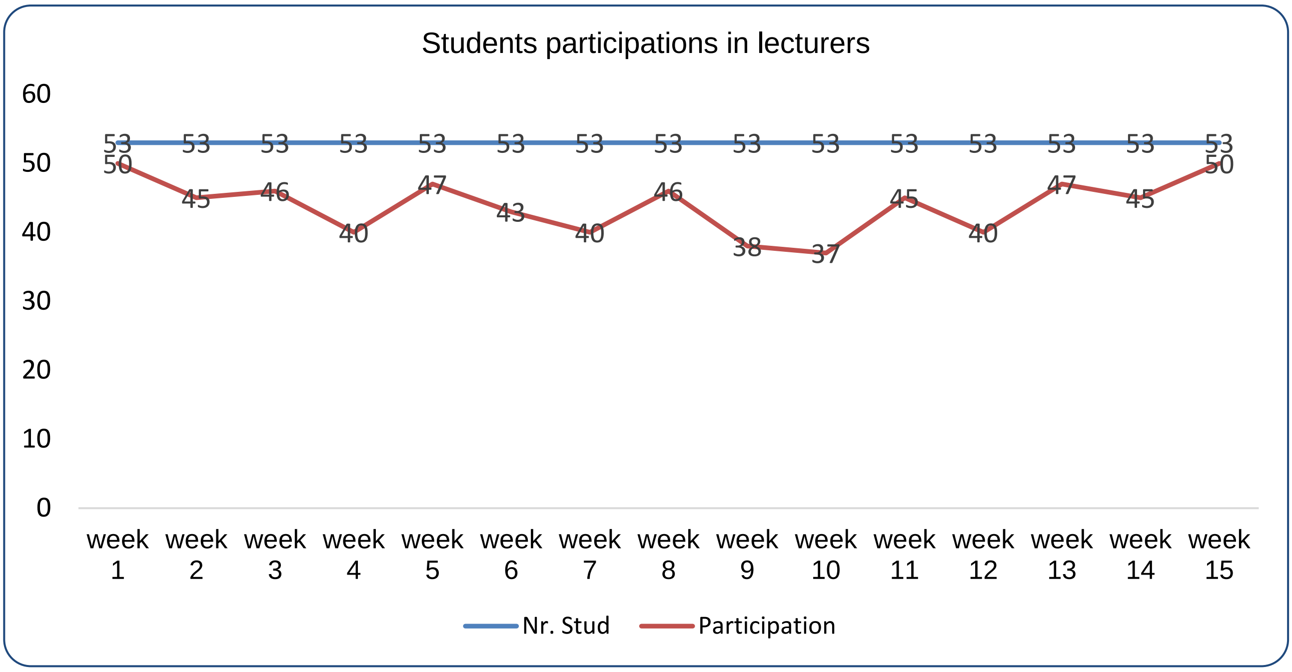

Figure 2: Participation rate of students in lectures for 15 weeks, one semester

Referring to the graph, a large participation is initiated and at the end of the course, while the average participation is 82% > 2/3. It is good to see that students are interested to take part in lectures, seminars and laboratories.

2. *Student assessment*

In addition to the evaluation in the laboratory, students are informed about the continued evaluation. The final grade is defined by three components, partial exam 1, 10%, 20% laboratory and final exam 70%. For assessments 1 and 2, students have been informed before the final test. At the end of the test 3, professor distributed to the students individually a piece of paper with score before exam check (based on their acquaintance, engagement, and performance during the semester) and were asked to evaluate themselves about the exam grade. After exam assessment, the results were compared with the professor's preliminary assessment and self-assessment of the students are given in figure 3.
It is noteworthy that the professor's assessment is close to the 61% close to 2/3, while the student rating is around 39%, much smaller than the 2/3. Students trend to assess them self-much higher than professor

This is very important because shows the trend that the students are more interested in the grades than for the content, knowledge and competences.

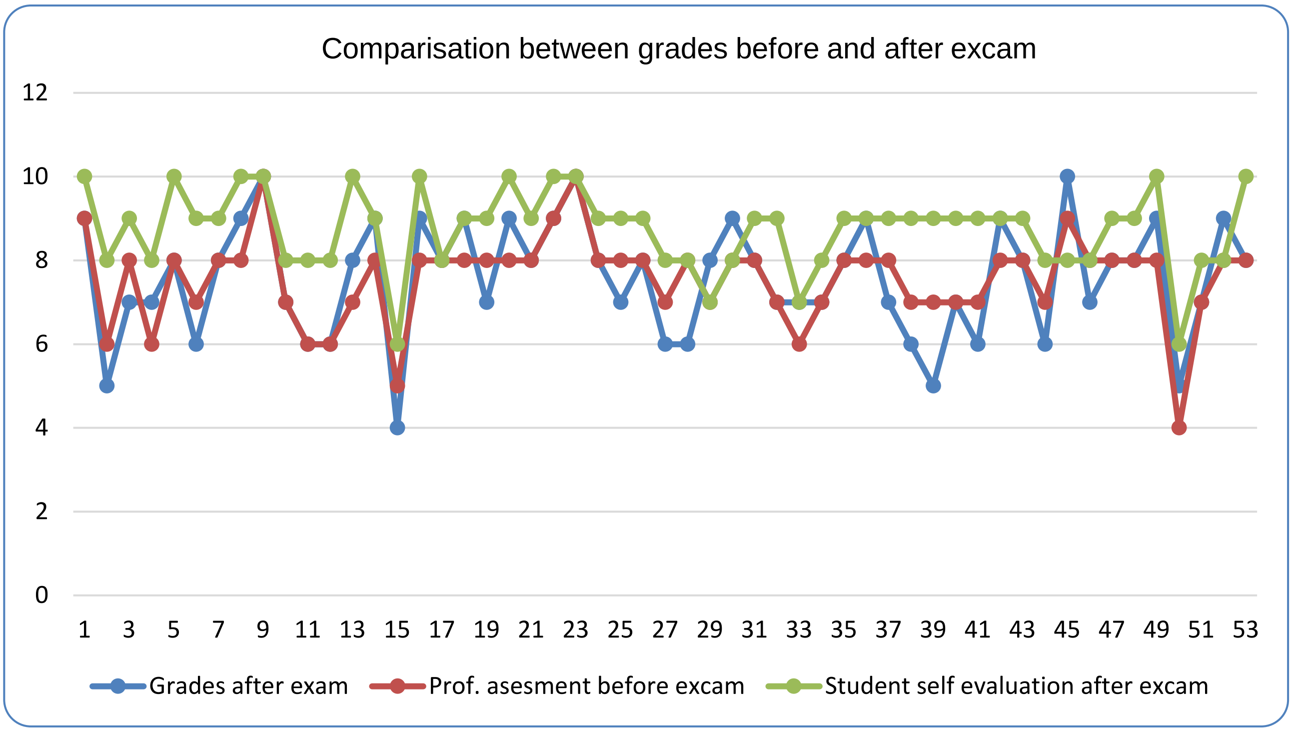

Figure 3: Participation rate of students in lectures for 15 weeks, one semester

3. RESULTS AND CONCLUSIONS

Quality in teaching and learning is a rather complex concept and involves all components of a university. The above results show that it can be achieved in the desired quality if all parties are responsible for their work (they have factor X).

More work needs to be done with students, to guide them more towards knowledge and competences than to the results of the evaluation.

While at the institutional level it should be:

A clear QA mechanism and QA system, meaningful standards, examine performance with standards-based measures that look at practice, teacher decision making, and student work, developing expertise for evaluation and support, plan for evaluation, feedback, and follow up coaching and professional development, develop structures to support strong professional teaching skills for academic staff, embed to the students that the evaluation is based in a performance-based system of learning and career advancement.

Now we can say that the X factor (accountability) is very important and each one has to prove individually that he has it. But at the same time the institution should provide mechanisms for promoting accountability as an important element that affects the performance of the institution.

Also, through standards, indicators, qualitative and quantitative indicators, and assessment methods, the institution monitors, matures, continuously evaluates quality in teaching with the aim of continuous improvement

We look to the autonomy and to have 0 bureaucracy but first we must guaranty that all of us have the X factor, we are accountable.

The path to a world class university begins from us as part of it.

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Standardizing Tradition: The Building Code as a Series of Prototypes for New Structures in the Traditional District of Ano Poli in Thessaloniki

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ABSTRACT

The conservation and management of historic sites demands, prior to any action, the documentation and recording of the built and natural environment, as well as, the social and economic parameters defining the urban landscape and its functions. Managing new construction in listed sites has to be controlled through the application of guidelines defining architectural style and functions, in order to preserve their unique character while providing for the formulation and application of strategies and projects that would allow for their future development. Building codes for heritage sites, as a result of the systematic survey of buildings and urban patterns, consist of a standardization of elements that could be applied in new structures, embodying the basic geometric and morphological components of the protected site.

In the case of the traditional district of Ano Poli in Thessaloniki, following the documentation and systematic survey of the site, the working team proceeded in the elaboration of a series of exemplary projects and prototype elements that should be incorporated in new developments, safeguarding selectively the reproduction of certain morphological features of the existing buildings. While codifying the "architectural style" of this area, the emphasis was mainly on the redevelopment of the entire urban fabric through new construction, allowing the maximum exploitation of the existing urban plots. The standardization of the local tradition was a design tool for promoting a "conservation" approach that resulted in the massive replacement of the existing building stock while the qualities and character of the entire urban fabric and townscape were largely ignored.

Key Words: building code, sustainable conservation plan, rehabilitation of historic districts, standardization of architectural elements.

1. INTRODUCTION

In this paper we will present the legislative and planning policies that were undertaken by the Greek state for the protection of the built heritage of Ano Poli district in Thessaloniki. First, we will make an introductory comment on the way post-war Greek urban centers managed housing policies and heritage protection. Then we will present the subsequent initiatives undertaken by the state for managing the district in an effort to safeguard its intrinsic townscape qualities while allowing for the modernization of existing buildings, the provision of public infrastructure and the protection of the important monuments located within its limits. Finally, we will focus on the project undertaken by a group of specialists under the guidance of Prof N. Moutsopoulos that elaborated the building code that is still applied, with certain later modifications, for any new construction in the area.

2. REHABILITATION OF ANO POLI: THE CONTEXT OF TIME AND PLACE

Late 40's and the decades that followed, present a major transition period for Greek urban townscapes. Major flows of population towards the urban centers in relation to important destruction of the existing building stock during the war, resulted in an unprecedented need for new urban housing. State social policies in terms of housing were extremely limited and inefficient, resulting in a series of conditions that marked the character of the townscape quality of Greeks cities after the '50s. Three among them are the most crucial and defining ones, namely:

a) the speculation on urban land through building regulations that provided for the possibility of densifying urban tissues, by permitting for all the existing urban plots, the construction of buildings considerably higher, and bigger in plan through the exploitation of existing private open and built spaces,

b) private initiative carried out construction involving private contractors, since the owners of urban plots could provide only the land without further capital, in exchange for a certain percentage of the final building. This method was applied plot by plot, since there was no will or legislative frame for a major redesign of the existing urban fabric and the operation was extremely profitable for both parts of this agreement namely contractors and land owners. This method of urban land management and redevelopment was given the name “antiparochi” meaning literally recompensation. Under these conditions the state conveyed the provision of housing to the private sector. Construction activity was a major economic developing tool helping the recovery of the Greek state after the war,

c) while urban townscapes were changing rapidly through this redevelopment operation, there was no coherent and efficient legislative frame, if any at all, for conserving built urban heritage, resulting in a massive loss of 19th and early 20th century building stock of great architectural value. There was no consideration of protecting and preserving urban sectors apart for the conservation of isolated monuments. Housing standards in new constructions was considerably higher in terms of modern amenities, architectural design quality was mediocre, the owners of the plots could redesign part of the building’s plan in order to accommodate their needs, while contactors were investing capital with limited risk, so nothing was spared.

Finally, the redevelopment of post war Greek cities was carried out with a single building code for the entire country, resulting in a uniform townscape that obliterated particular local qualities and regional urban forms and patterns. The densification of the urban fabric resulted in a scarcity of open public spaces, since urban land had become precious and the state was unable to expropriate it. The case of the historic district of Ano Poli in the city of Thessaloniki, presents a series of unique elements in terms of the strategy applied for the “protection” of its intrinsic townscape qualities. Ano Poli preserved its original organic fabric as well as, most of its building stock until the late ‘60s and even ‘70s [1] (fig.1).

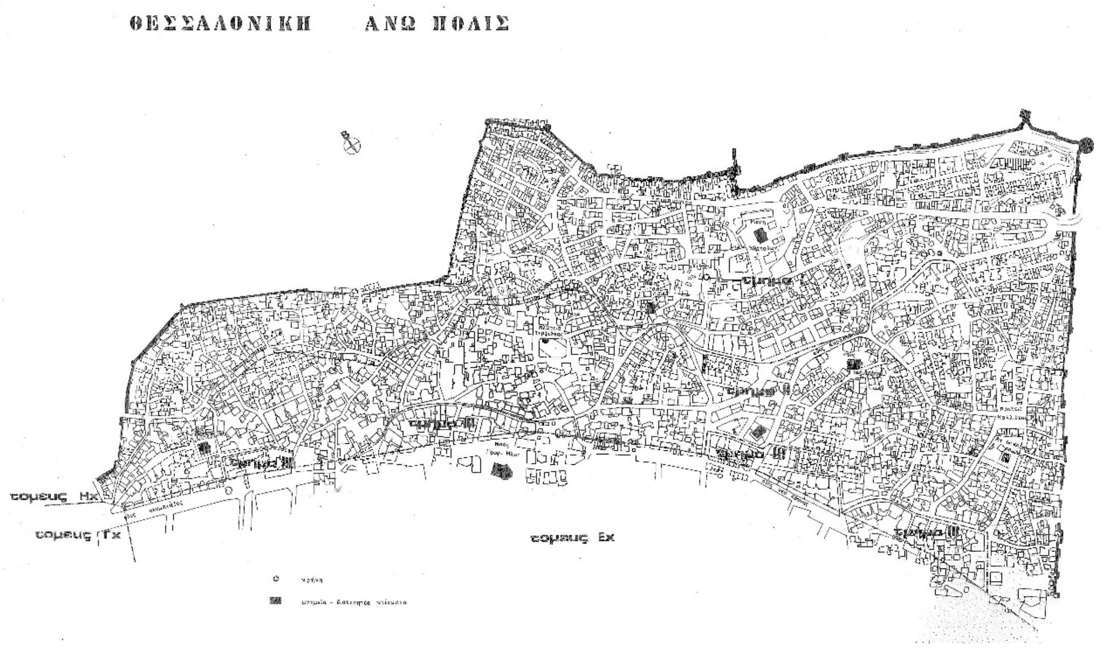

Figure 1: Ano Poli Thessaloniki, Site plan in 1979, from Moutsopoulos, N.: *The Ano Poli in Thessaloniki*, edition of the Ministry of Public Works, Thessaloniki, 1979

It had escaped massive reconstruction, through the above mentioned processes, because of certain particular features of its urban fabric. Plots were of an exceedingly limited scale so, their redevelopment could not prove profitable through the “recompensation”/ “antiparochy” process. Among the existing urban sites in the late ‘70s, 25% were having the size for permitting profitable redevelopment, while 43.05% did not have a size capable for issuing a legal building permit [6]. The district of Ano Poli was the muslim quarter of the city during the Ottoman rule and after the exchange of the populations between Greece and Turkey in 1922, it received a large number of Greek refugees from Asia Minor [1]. Plots were successively divided in order to host the maximum number of people. The topography of the site was quite particular with inclination of sites reaching, in certain quarters, 40% [4]. The street network, with its organic structure could not accommodate vehicular traffic since most of the streets had a width of 3,0 to 5,0 meters. In 1931, the new plan for the area could not be implemented, since there were no means provided by the state for expropriating private properties and opening up axis that could serve the district, linking it to the major street network of the city [4]. The non- implementation of this plan was one of the reasons the district was so well conserved. Ano Poli was lacking major urban infrastructure, like schools, kindergartens, playgrounds, administrative public buildings, health services, cultural facilities etc. A large number of important byzantine, post-byzantine and ottoman monuments were found within its dense fabric, listed and protected by the Greek Ministry of Culture [6]. The ancient walls of the city form until today, the clear and definite boundary of the area to the east, north and west. The major earthquake of 1978, while not damaging structurally, aggravated the condition of the already badly maintained building stock of the district, since the area was populated mainly by low-income households that could not afford renovating costs for their houses. Despite all these inefficiencies, Ano Poli had kept a vibrant social fabric, had preserved human scale as a neighborhood and presented a high quality public urban realm. The houses presented an interesting variety of building types and architectural forms [5]. Old Turkish mansions, traditional houses with eclectic and neoclassical elements, small scale refugee houses built in the outskirts of the neighborhood next to the walls, created a hybrid urban fabric, where green areas and private gardens protected by high fences, formed, along with the houses’ fronts, the continuous streetscape of the winding streets and paths. The district of Ano Poli, built on a hill, on the north-west part of the city around the Acropolis presented spectacular views of the lower historic center of the city, the sea and Mount Olympus. The site was spared by earthquakes during the last centuries, since the rocky terrain on which it was built had proved to be very resistant, while the way houses were constructed provided with heavy stone walls on the lower level and upper storeys made with flexible and light timber framed walls, resisted well seismic action. The integrity of the organic fabric of the district was in deep contrast with that of the central sector of the city, redesigned after the big fire of 1917, according to plans by Ernest Hebrard and a group of architects according to an eclectic urban plan.

In June 1968, during the dictatorship in Greece, there was a special decree valid for the entire country that permitted the legal addition of one floor on every existing structure. This decree allowed for the first building permits to be issued in Ano Poli for those plots, -mainly at the outskirts of the district-, that could allow profit through redevelopment. The Ministry of Culture, six months after the issue of the decree, abolished its implementation in the district, giving as a reason the alteration of the immediate surrounding of important listed monuments in the area [4]. So, all redevelopment activity was halted, causing the massive reaction of the local population that expected to profit and modernize their houses. Local inhabitants anticipated all legislative restrictions that were excluding them from profiting from their own properties. Most of the plots in the central and eastern sector of the city had already been redeveloped, where people of considerable higher incomes were able to redevelop their land causing though the irreversible loss of important architectural and urban heritage. Meanwhile the typical apartment blocks, like the ones found all over the country, severely altered the well preserved townscape of the neighborhood. Their scale and morphology seemed alien, disrupting the integrity of its townscape but the situation had to be resolved since there were serious conservation, but also social parameters involved in the planning of Ano Poli.

From 1975 to 1978 a number of Committees formed either by the Ministry of Culture or that of Public Works studied the case of Ano Poli dealing both with the protection of the monuments but also addressing the housing and urban problems of the district [4]. The extensive loss of entire historic sectors during the past decades and the integrity of its townscape were two of the reasons Ano Poli was considered with skepticism as a potential conservation area. Thalis Argyropoulos, professor at the School of Architecture of the Aristotle University of Thessaloniki undertook the study of Ano Poli as head of a group of experts, having as objective its conservation and the urban redesign of the neighborhood [2]. Survey plans were carried out and a report had been prepared concluding for the need of: a) allowing local residents to continue reside in the area, b) ensure the role of monuments in the urban fabric as landmarks and points or orientation and c) delimit the scale of new constructions and make sure that basic design principles of the existing buildings would be applied to new ones. They proposed an urban planning project for resolving the accentuated problems of the district. The preliminary study unable to evaluate the hybrid style of existing buildings resolved that only 5% of the building stock could be characterized as traditional thus needing protection. Refugee houses of small or larger scale were not considered worthy of preservation while there was some mention of these structures as accompanying buildings that should be revaluated. Recognition of the historic district as a self-contained entity was not yet discussed. Ano Poli was finally not considered either as a conservation area or as a historic ensemble of important value.

During the period Thalis Argyropoulos was in charge of the working team, Piero Gazzola and Raymont Lemaire (the two main authors of the Charter of Venice and founders of ICOMOS) visited Thessaloniki and issued a report on the "Problems of the District of Ano Poli", found in Argyropoulos' archive (document not dated) [3]. They underlined the traditional Balkan urban fabric of great townscape interest, proposing the protection of certain sectors where no incompatible construction had taken place and the site was well preserved. They noted the importance of conserving old significant structures through the maintenance of original materials and construction techniques. They also proposed the use of design elements of local architecture to be adopted for new buildings, while commenting on issues of density, ownership and public infrastructure in the area. They considered small scale refugee buildings built next to the Theodosian walls as elements enhancing their monumental value being obviously negative in terms of their demolition. This valuable report, despite its insights and meaningful proposals had little resonance among the experts managing the site.

3. THE ELABORATION OF THE BUILDING CODE: PROTOTYPES FOR NEW CONSTRUCTION.

In 1978, right after the big earthquake in the city of Thessaloniki, a project for the planning and management of the district was commissioned by the Ministry of Public Works to a group of architects and planners having in charge Nikos Moutsopoulos, professor at the Aristotle University of Thessaloniki – School of Architecture. Moutsopoulos was a prominent researcher of traditional Greek and Balkan architecture. Having studied over a long period of time the building types and construction techniques of vernacular Macedonian houses, he sat out to prepare a study that according to his words "should try to preserve the scale of the neighborhood but should also help people to construct their houses… Our mission was clearly defined in a few words. There should be a series of projects of land management, circulation planning and a special Building Code in order for the inhabitants to be able to build immediately…" [6]. Right from the start, the protection of the district, according to a comprehensive conservation plan like those already carried out throughout Europe, like the ones in Assisi (1955) or Bologna (1969), Chester or York (1967), the Marais in Paris (1969) had not been considered. On the contrary, in a period of a strong post-modern movement prevailing in architecture, the possibility of reproducing local architecture by codifying its style and adapting the existing building code through certain adjustments, was appearing reasonable. We consider possible that Moutsopoulos was aware of Gazzola and Lemaire's report. He is commenting on the preservation of traditional materials, stating that they are impossible to repair and that the only solution for a deteriorated vernacular structure of this type, if it is to be preserved as a monument, is its demolition and reconstruction with new materials. In the final report he is referring to the employment of all preexisting projects that were made available to him, while admitting that he adopted many of their recommendations.

The first phase comprised a detailed survey of the area. Every single house was listed, and site survey plans were prepared for all existing building blocks. A qualitative analysis of the existing street network was also carried out, in order to proceed with proposals concerning the opening up of axis and planning of open public spaces. Managing vehicular traffic through the district with a minimum damage of historic streetscapes and expropriation of private land was a priority, while areas around listed monuments were protected. There was provision for new squares and parking spaces that were inexistent in the district.

Out of 4000 existing buildings there were only 48 that were finally listed and protected by the Ministry of Culture, while all other structures could be demolished and redeveloped. So, in a namely conservation area only 1% of the building stock was conserved [4].

Restrictions in terms of plot sizes were suspended allowing the issue of building permits even for plots of 40 sq.m (as mentioned before 43% were below 100sq.m surface and not allowing the issue of a building permit). One basic element of the existing street fronts was the alternative repetition of building masses and private garden protected by high fences. Given the fact that new building standards would considerably augment the volumes of new buildings the street fronts would radically change. New buildings, as well, were considerably higher allowing the construction of 3 to 4 storeys, and even more by exploiting the inclination of the site. Overall, new structures, under the proposed new standards, would considerably alter the density of the district.

The rehabilitation project of the district was aiming at maintaining the existing residents and provide for them better housing standards. The working team was in close contact with the committee formed by the residents of Ano Poli that had always claimed their right for modernizing their houses [6]. Since still, the redevelopment of the plots despite their allowed exploitation could not be profitable for private developers, mortgages were provided by the state for local residents.

The area was divided in sectors taking into consideration major existing axis, the local topography and the existence of major byzantine and ottoman monuments. The public infrastructure and facilities provided by the new plan namely schools, commercial areas, public buildings were distributed accordingly. Some of the listed buildings were proposed to host some of these public services. The proposed street network was intended to facilitate wherever possible vehicular traffic linking the neighborhood to the surrounding urban fabric. Allowed functions were designated also by sector [6].

Apart from the new building standards provided in the proposed building code, affecting height, land occupation and percentage of legal new construction in relation to the plot’s size, there were special articles concerning the morphology and architectural style of new buildings. We will analyze in more detail the special clauses referring to the standardization of architectural qualities present in the existing buildings that was attempted. Despite the detailed survey and the pertinent knowledge of traditional Macedonian architecture by Moutsopoulos there was an oversimplification of the qualities and architectural elements that had to survive in modern structures. The use of modern materials was incontestable. Reinforced concrete, bricks and plasters used in all standard new developments were going to be used providing for a low-cost and feasible construction. The plans of new structures would follow the traditional typologies but those of conventional plans of modern apartment buildings [6]. The traditional architectural elements evaluated and proposed to be applied in new structures were:

a) the typical overhanging volumes, projecting over the streets called “sachnisia”. These elements of triangular or orthogonal plans were distributed in a variety of ways on the main facades of the traditional existing buildings

b) the distribution, size and arrangement of open or covered balconies

c) the distribution of openings, their proportions in terms of the facades’ surfaces and their special design features and material

d) the morphology and distribution of roofs

e) the color scheme of the plastered walls, window frames and railing of balconies and stairs of traditional facades

The final document prepared by the project was supposed to provide architects, working in the area, with necessary typological tables, survey plans and alternative designs for all the above mentioned elements. So, in the final textbook exemplary solutions and construction details of the original prototypes were included along with details for their construction with new materials. Street fronts and building blocks were presented for further documentation. For better illustrating the way the building code could be applied, the redevelopment of certain building blocks was also included. The existing condition of the blocks was juxtaposed with the proposed redesign, allowing for a series of observations regarding the outcome of these proposals. The density of the new structures eliminated all preexisting private open spaces, the street fronts were aligned with solid building volumes, while the uniformity of the way neo-traditional elements were applied could not succeed in evoking the original townscape qualities of the area that was characterized by a variety of architectural styles [6], (fig.2, 3, 4, 5).

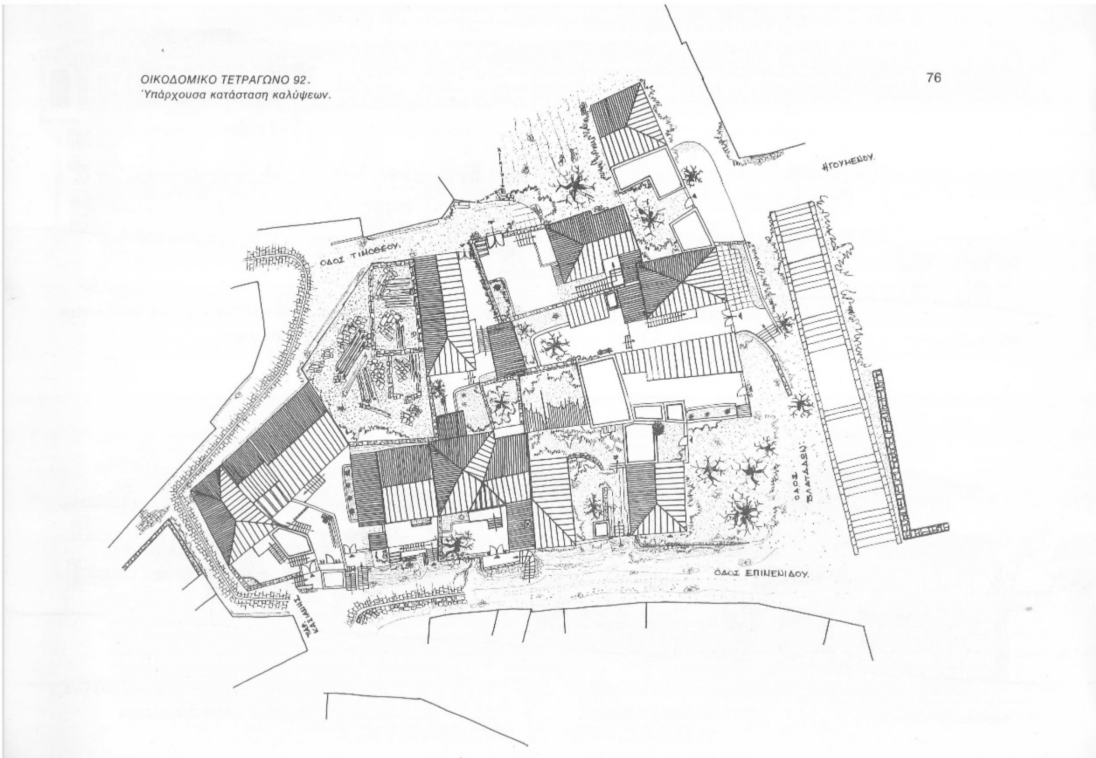

Figure 2: Ano Poli, Thessaloniki: Building block no92 in 1979, from Moutsopoulos, N.: *The Ano Poli in Thessaloniki*, edition of the Ministry of Public Works, Thessaloniki, 1979

Figure 3: Ano Poli, Thessaloniki: Building block no92, proposed redevelopment, from Moutsopoulos, N.: *The Ano Poli in Thessaloniki*, edition of the Ministry of Public Works, Thessaloniki, 1979

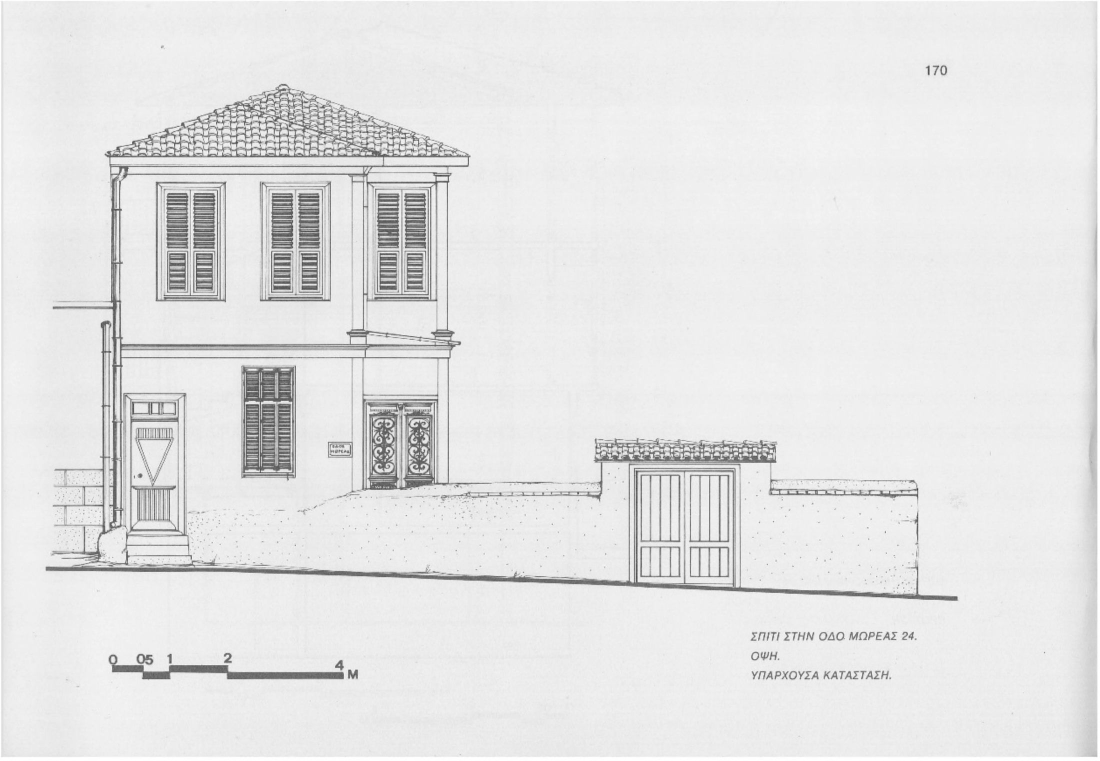

Figure 4: Ano Poli, Thessaloniki: House on 24, Moreas str in 1979, from Moutsopoulos, N.: *The Ano Poli in Thessaloniki*, edition of the Ministry of Public Works, Thessaloniki, 1979

Figure 5: Ano Poli, Thessaloniki: House on 24, Moreas str, proposed redevelopment, from Moutsopoulos, N.: *The Ano Poli in Thessaloniki*, edition of the Ministry of Public Works, Thessaloniki, 1979

The decree released in 31/5/1979 comprised in 5 pages and 6 articles all necessary prerequisites for issuing a building permit. In article 3 titled “Design, Arrangement of Buildings, Morphological Elements" there were explicit instructions dealing with all five points stated above. Height, construction materials and overhanging parts of roofs were accurately defined. The proportions and measurements of overhanging volumes were defined in relation to the surfaces of the facades and the width of streets. Covered and open balconies were similarly discussed. For windows and doors there were certain proportions and standard dimensions to be followed. The color scheme should follow the samples included in the final document of the project. Finally, there were restrictions concerning the arrangement of shops facades and the posting of advertising material. All projects should be controlled by a special committee of the planning department that was responsible for controlling the proposed designs making necessary recommendations for the application of the new building code.

The plan of the district regarding the new road network was issued the following year. The new plan was conserving to a major degree the organic fabric making adjustments and clearing up certain parts of the fabric for allowing through traffic. The impossibility by the state to expropriate necessary land for carrying out the plan delayed its implementation. In 1986 there was a new plan for the area that allowed for a subtler adjustment of the road network to the morphology of the site. The new plan was avoiding massive demolitions of existing buildings, contributing largely to the definite conservation of the organic urban tissue. As expected, added by the available mortgages, building construction was rapidly fostered in the area. The density of the new blocks was in deep contrast with that of the old fabric and the exploitation of the topography made possible the construction of even 4 and 5 storeys buildings. In 1997 the Ministry of Northern Greece established a special committee responsible for the control and planning of Ano Poli. They prepared a revised edition of the existing building code, issued in 1999, proposing a series of regulations for decreasing densities in the area and better controlling building permits. The same committee proceeded with listing more than 200 buildings over the next 12 years. They also listed more than 100 elements like public fountains, trees, fences, rocks and arrangements of public paths and open public and private spaces.

The number of new residents arriving in the area rapidly augmented, proving that provided urban facilities were inefficient for the district [4]. Parking spaces were not sufficient, and the vehicular traffic could not be accommodated in the new street network, green areas have been largely redeveloped and environmental conditions where aggravated with low quality of air and less access to natural sunlight for many of the new buildings. The local population mainly remained in the area, while newcomers, attracted by the particular urban character of the area and its proximity to the center of the city included architects, artists and a special group of middle class people looking for the opportunity to construct private family houses. Some of the traditional houses were conserved through private initiative and the state, during the year Thessaloniki was the European Cultural Capital in 1997. Itineraries linking the important monuments of the district were programed allowing the improvement of public realm in the area [5]. In the neighborhood new recreation activities, mainly bars and restaurants, altered the calm everyday life. The state was unable finally to proceed with the implementation of the proposals stated in the project concerning public infrastructure. The operation facilitated mainly the redevelopment of plots through private initiative and when mortgages were not any more available, construction activity was halted. Today, the district preserves to a certain extend its distinct character having still the potential for improving and enhancing its latent urban qualities through a comprehensive and sustainable conservation plan.

4. CONCLUSIONS

The imposed building code eliminated a big part of the pluralistic urban and architectural character of the district, but still Ano Poli, due to the inefficiencies of the public sector preserves a considerable percentage of its original building stock while the well preserved urban fabric has a potential, if managed well, to restore to a considerable degree the original character of the district. Little by little it became evident that the approach adopted by Moutsopoulos and his team was lacking a thorough appreciation of the site. The traditional urban ensemble was not just a sum of individual monuments and a collection of houses of limited value, instead it was a coherent ensemble where every element was part of an organic pattern with aesthetic and cultural rules that should have been viewed as a whole and analyzed carefully. Once more, as in many cases before it, the realization of the intrinsic value of this urban fabric was born out of disorientation and dismay. Urban conservation is a complex operation demanding an interdisciplinary approach for managing the historic, urban, social and environmental parameters. None of these dimensions could be obliterated when dealing with the complexities of historic urban centers. Standardizing elements of architectural interest has to refer to all levels of scale of built space while taking into consideration the quality of urban life contained in a historic settlement. The standardization of the local traditional architecture in Ano Poli through the applied building code, succeeded in conserving partially a particular character in the area. Since the present economic crisis has stopped any construction activity, a revision of the policies applied could provide the opportunity for a better management of the site through a comprehensive and sustainable conservation plan. This plan should take into consideration both public and private sector interests and local governments should indispensably launch, design and finance such an operation. Local governments, in addition to being responsible for the infrastructures and public spaces of heritage areas (the rehabilitation of infrastructure and public spaces must precede the rehabilitation of private buildings), are the only actors capable of coordinating confronted private actors operating in deteriorated urban heritage areas—the issue that prevents the process from taking off through pure market forces [7]. Greek cities have long suffered from the inefficiencies of the state to manage the planning and quality of the urban public realm. As with other types of urban rehabilitation, the execution of an effective sustainable conservation strategy requires the efficient cooperation of all interested actors, both public and private—a condition that poses institutional and financial challenges. The public sector, in close cooperation with local communities should stand for the preservation of the public-good component of urban heritage, mostly its sociocultural values: the existence of buildings and public spaces of aesthetic, spiritual, social, historic, and symbolic value to be enjoyed by future generations.

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Standards, Canons, Traditions and Freedom in Architectural Design

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ABSTRACT

The designer creates his model limited by several frames. These are: standards, canons, traditions and personal views, as well as available technology and investor mitigation. The article examines the interaction between these factors, with examples only from authors' practice in sacral architecture. In each architectural creation, said frames have their own specific scope. They do not contradict one another, but complement each other, giving the artist more arguments. Thus, the concreteness of the result is justified by the whole spectrum of shaping factors, allowing for a complete satisfaction of the needs and, ultimately, of a successful architecture, without arguments against and at the same time with its specificity. The mastery of the successful designer is in combining the freedom of personal creative vision with restrictive standards, laws, canons and traditions. In the successful decision all this is working harmony. Here are some examples of churches resolved in the spirit of specific traditions. The more liberal treatment of Catholicism and the strict and restrictive canon of Orthodoxy, each with its own specific result, are compared. A decision algorithm based on the morphological analysis of the influencing factors is shown. Graphics, as well as drawings and pictures of specific examples are used. The author has a practice with objects in Bulgaria and Africa, very specific and different, all in realization.

Key Words: Architecture, Standards, traditions, Freedom

1. INTRODUCTION

The report is based on authorial practice in the field of sacral architecture - four conversions. Three of them are a modern design in the service of a Catholic, in which the norms and standards were absolutely met, but there was complete freedom of creative expression based on the worldview and the perceptions of the local people - in this case - those of western Central Africa. The fourth example is from the 17th century in the Middle Balkans, in the conditions of a dominant religion and a low budget. In this case, the canons of a specific local religion - Eastern Orthodoxy - are a priority factor, and the author has the task of restoring works. Standards then did not exist, even if the general ergonomics rules were respected.

2. SAMPLES FROM AUTORIAL PRACTISE

At first glance, canons, traditions and standards limit the creative impulse. In practice, however, as the author considers, these factors influence each other by specifying the author's decision and making it unique in itself. The condition for a good result is the sensation and the mastery of the designer to capture the specifics of each condition in combination with the others. In other words, to create a harmony of general and specific impact factors.

In Examples 1, 2 and 3, the main thing was the fact that, unlike in Europe, in Africa there are no traditions and canons in sacral buildings. At the same time, it is hardly feasible to imitate the form of local huts. That is, there is no canon, which is a problem, but also freedom, even more so that the Employer granted the author freedom. The condition was - a living-minded architecture corresponding to the local mentality.

In the first example, the Catholic Cathedral in the city of Joss, Nigeria, the factors are: 5,000 seating in compliance with the standards, norms and regulations, taking into account the specifics of local folklore. Celtta is a cheerful perception of the world and religion, harmonizing with local temperament and worldview. The references are the colors of the local nature, reflected in the decorative and cavallian art as well as in the clothes and the lifestyle.

The second example is again in Nigeria - a church in Agja, which is relatively smaller - 1200 seats and a modest budget. The solution looks for its harmony through clean and strict lines and white in contrast to the environment.

The third example is again from there, as the main motive is from the Bible - the words of God to Moses that the seal of the covenant that there will be no eternal death is the heavenly arc.

The fourth example is radically different. Here the factors are a depressed and poor nation, stagnant in the canons of a specific sacral tradition where there is basically a sense of guilt and hope. It is a small mountain village church built 300 years ago and in need of restoration work.

The presentation is sufficiently meaningful.

Interesting is the question of what ultimately is to imply a sacred architecture. Whether fear, despondency, guilt or joy, elevation and life. This, of course, is another big topic. The fact is, however, that African churches are far more visited, and the church is not a place where people can meet in communion with God.

We leave the viewer alone to judge things by looking at the brief presentation

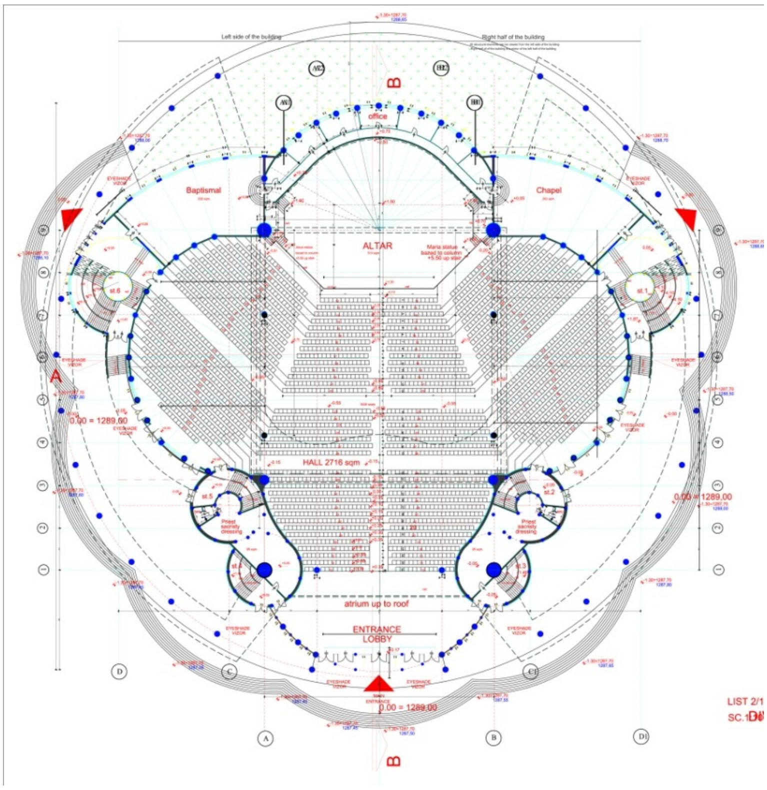

Figure 1: Catholic Cathedral in Joss – level 0.00. 5000 seats on 2 levels

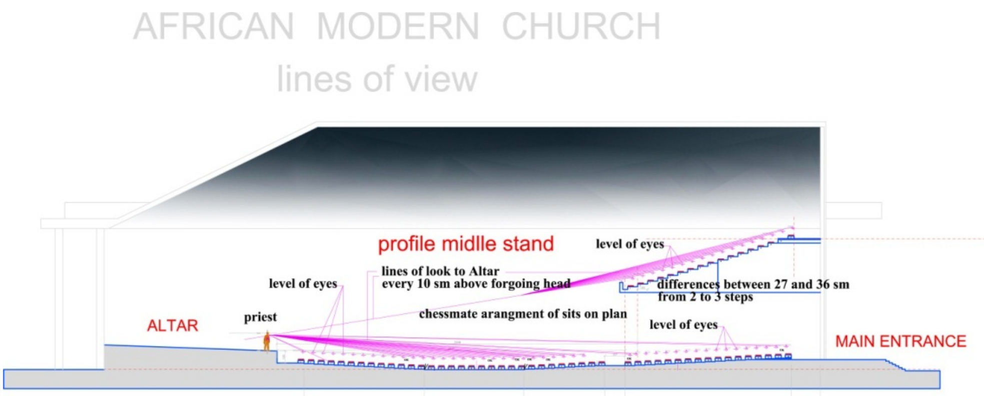

Figure 2: Catholic Cathedral in Joss – line of visibility


Figure 3 and 4: African colors and expression. Vitality and energy

Figure 5 and 6: Catholic Cathedral in Joss – people come here with joy every Sunday


Figure 7 and 8: Church in Agja - 800 seating. Very different from the atmosphere of guilt and repentance

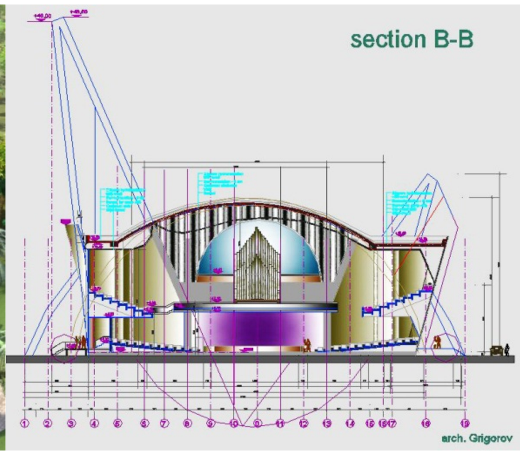

Figure 9 and 10: Modern Church – design 1200 seats. The Heavenly Arc as the seal of God in a covenant of eternal life – text from Bible

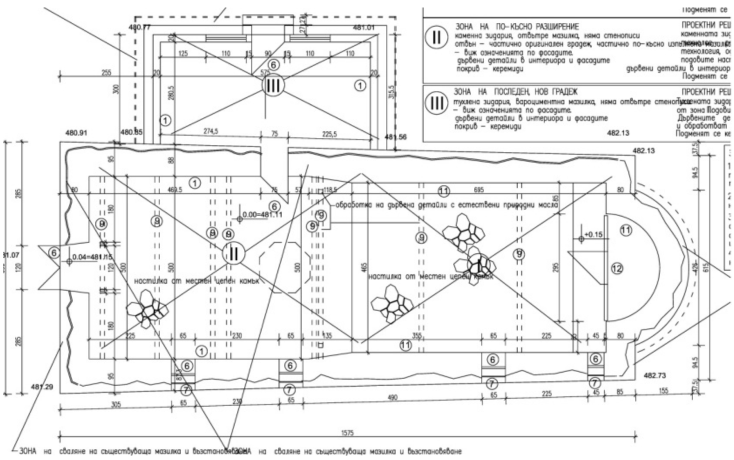

Figure 11 and 12: Small mountain church - Eastern Orthodoxy. In conclusion, let the audience only judge where the truth is about the good approach to successful design

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Some Researches for Using Efficient Energy Management Programme for the Processing Industry

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ABSTRACT

The first part of the paper discusses the necessity of developing an energy saving programme, and presents the main energy consumers of industry and the significant weight held by energy related costs in the turnover of production systems in processing industry.

Further the paper describes and analyses the steps to be followed in developing an efficient energy management programme. Some of these steps are: appointment by the administration board of a manager for energy related issues, an energy audit, including a complete inventory of the energy consuming equipment, the diagram of the process flow, a general view on the operation practice, answers to a list of specific questions, identification of opportunities and their economic assessment, prioritising and grouping them into the fields of: lighting, drives, cooling, ventilation, heating, approval of the energy management programme by the administration board, implementation of the approved programme, starting with the engineering design part required by each established measure.

The second part of the paper shows a way to produce energy using a wind turbine with vertical axis helical rotor shape with good energetic performances even at low wind speed. In a renewable energy system, the energy is generated according to the weather rather than on demand. In the absence of storage, a great deal of this energy will be dumped.

On of the problem with renewable energy is the high capital cost. The energy is diffuse and demands large structures to collect and convert it. The equipment is expensive and comes with a large amount of infrastructure. There is an energy cost associated with manufacturing renewable energy output. Other problem with renewable energy is its intermittency. Unlike fossil fuel, the source cannot be controlled to match demand. The energy is not available all the time, and may not even be easy to predict. To match supply to demand, it may be necessary to store energy, or to reschedule our use of energy, or to use a mixture of different energy sources.

Also, is presented a Monte-Carlo simulation of wind turbine parameters for cumulative frequency distribution for wind speed and for relative frequency histogram for annual energy output.

Keywords - energy management, wind turbine, renewable energy, Monte-Carlo simulation.

1. INTRODUCTION

In the economy of a country of a certain level of industrial development, the most significant energy consumer is industry, particularly the metallurgical, chemical and raw material processing branches. In Romania, in processing industry, the main weight in energy consumption is held by the already traditional branches: machines manufacturing, electrical industry and wood industry. These consumptions are included in the manufacturing cost of a product and consequently in its degree of market competitiveness. If in the metallurgical and chemical industry energy saving can be achieved mainly by technological amendments involving significant investments, in the processing industry considerable reductions of the energy consumptions can be obtained also by process studies and optimisation of the processing methods and procedures. In principle, in the processing industry, in accordance with the technological process, parts follow a specific route, including working posts, where the processing corresponding to a certain operation is carried out.

For each type of surface to be processed on a part several, either conventional or unconventional procedures can be employed, the selection of the optimum one being determined by the surface shape, the processing precision, the material to be processed and the cost of processing. The processing cost also includes energy costs, directly determined by the efficiency of the processing system.

A major reduction of the specific energy consumptions of the processing industry needs to include studies and analyses of the subsystems composing by the processing system.

The analyses will be then expanded upon other energy consumers involved in the operations costs of the production systems.

A study completed in the U.S.A. has shown that in the industrial sector the main consumers are the electric motors, melting processes, primary and secondary heat treatments, electrochemical separation and lighting processes. Thus, electric motors employ 67% of the electrical energy utilised in industry. The second and third position are held by lighting with 12% and electricity based heat processes, respectively [2]. Another study conducted by a commercial company representative for the machines manufacturing branch of Romania has also highlighted the significant weight of costs generated by the use of electrical energy in the operation of the system that is 73% of the total of energy costs [3].

If further taken into account that at the same company energy costs represent 12.5% of the turnover, the development and implementation of an energy management programme follows as a necessity for increasing the efficiency of electrical energy use, as part of both the manufacturing process and the other components of production systems.

2. THE DEVELOPMENT STAGES OF THE MANAGEMENT PROGRAMME

An efficient energy management programme calls for the involvement of the administration board and for the appointment of an energy manager, who should know and comprehend what kind of energy and in what quantity is used by the system. A first stage of the programme development consists in the analysis of the energy bills of the last 12 months. The high energy consumptions between October and March indicate the use of additional energy for heating, while an increase during the summer months is a sign of intensive air conditioning use. A larger demand of energy during one month can be attributed to deficient operation or to an increased production, while a lower demand may reflect a partial disruption of the production system operation. Conversion factors based on the heating power of the fuel will be employed for the analysis of different variants of efficient use of energy.

The energy monitoring technique frequently employed by energy managers resides in comparing the energy bills with those of previous years, of identical periods. Such comparisons, which can be conducted for the unit of fuel and its cost will highlight the trends of energy consumption and allow an analysis of changes.

The second stage in the programme development refers to the energy audit. The analysis of the bills identifies only the area of potential problems. The alternatives of increasing the efficiency of energy use can be established only by an energy audit, which implies several steps.

The first step involves obtaining a complete inventory of the energy consuming equipment. For this, starting from the plans of the buildings diagrams are plotted, which specify the characteristics (dimensions included) of the walls, windows and roof, followed by a diagram of the process flow.

The inventory of the equipment needs to include: the motors driving the machines, also the compressors, heaters and coolers, ventilation and air conditioning equipment, lighting supports, etc. A detailed inventory simplifies the assessment of opportunities and the development of a maintenance programme. For motors the type should be specified, the operation mode, power and working speeds(s). Lighting supports will be grouped by source type (fluorescent, incandescent, etc.), lamp type, ballast (the starting element of gas discharge), voltage, power, number of lamps on one support and type of support.

The second step of the audit includes a general view on the operation practice within the production system. How many hours a day does the system operate and when is the equipment used? What controls are there possible? What are the temperatures and the set of established points? is the equipment fully used? How well is it maintained? This way equipment can be identified, which operate both during working hours and outside them, lights and equipment left to operate idly, by negligence.

Based on the data obtained consequently to these two steps, a manger can estimate the energy consumed by various users and identify opportunities of reducing energy costs. The evaluation can be carried out with or without computer aid.

The third step includes the answers to the following list of questions:

- which is the weight held by energy cost in: the turnover, the production cost, in relation to profit?
- by how much have these weights been reduced over the last three years?
- what reductions of the energy consumption have been achieved in the last year, by what methods, in relation to what type of energy, at what cost?
- what is the budget allocated for the reduction of energy consumption for the following years and what profit will the allocated investments yield?
- what is the efficiency of the use of electrical energy in the production system?
- which are the consumptions and efficiencies in each profit centre, section, for each piece of equipment?

Regardless of the methods employed for evaluation, the costs related to installation, annual operation, energy saving and updating in dependence on bank interests have to be known. The total cost has to include also the cost of the feasibility study, of engineering design, of the building process and of the equipment. A recovery time of 2 –3 years is considered acceptable for most production systems, but in accordance with the policy of the production system also shorter or longer periods may be admitted [4].

3. CHARACTERISTICS OF WIND TURBINE

The helical wind turbine with vertical axis, that will be analyzed and tested for Romanian regions in order to estimate the reliability function and hazard rate, it was designed to generate 1000 W. This type of wind turbine is easy to mount on the roof of a house, having the main advantage of don’t need to be pointed into the wind direction with a system as other types of wind turbines.

Figure 1: Analyzed wind turbine with vertical axis helical type

In the same time, it works without any noise and the shape of the rotor make these turbines to be with any damage for the birds [1]. The rotor of this wind turbine was made by the FINEX Company, patented in Romania, and it is with three blades with fiber glass material (Fig. 1), [2].

The rotor was mathematically designed and tested in experimental conditions on the car adapted as a mobile laboratory, where it was measured the next parameters:

- output power of turbine [W];

- wind speed [m/s];
- rotational movement of rotor shaft [rpm];
- air temperature [°C]

Also, it was measured the following parameters:

- turbine rotational speed;
- wind speed;
- system voltage;
- system current.

Because the rotational movement of the rotor shaft is of maximum 120 rpm, it was needed to use a device that increase the rotation movement and ensure optimum conditions of working for the permanent generator magnet. The electric current is three fazed and it is needed to use a device to modify it in order to be measured as good accuracy as possible the current generated at different number of rotor shaft rotation.

One rotor can generate a power of 600 W, at the wind speed of 12 m/s, and by mounting on a common axle of two rotors it is obtained a total power of 1200 W.

4. MONTE CARLO SIMULATION OF PARAMETERS OF WIND TURBINE

Since the beginning of the XX century, an intensive development of the use of Monte Carlo method has taken place due to a massive increase of the new generations computers’ processing power. At the same time, the formalism linked with the Monte Carlo method application has been intensively developed [4]. Particular role in learning the reality could be attributed to the methods using occurrences treated as random, but only a development of sciences associated with random processes, provided rational basis to evaluate methods and the results of examining these processes.

It turned out that, rational treating of the occurrences, whose natures - as random - is essentially irrational, can be the source of useful knowledge about objectively learned reality. Formalized approach to learning the reality – thanks to the random reality created by people – found its place in science under the name of Monte Carlo method, which can be associated not only with a world’s hazard capital, but also – what is important – also with elegance, as the Monte Carlo method itself, and eternal longing of people for power, either material or intellectual. The Monte-Carlo technique is a device for modeling and simulating processes that involve chance variable [4]. By studying the distributions of results, we can see the range of possible outcomes and the most likely results. Using simulation, a deterministic value can become a stochastic variable. We can then study the impact of changes in the variable on the rest of the spreadsheet.

Recent popularity of the triangular distribution can be attributed to its use in Monte Carlo simulation modeling and its use in standard uncertainty analysis software. The triangular distribution is also found in cases where two uniformly distributed errors with the same mean and bounding limits are combined linearly [3].

The Monte-Carlo simulation of parameters of helical wind turbine with vertical axis includes elements of reliability theory and notions of probability and statistical inferences. In our simulation process we used triangular distributions because the input data can be obtained very easily and it does not require laborious investigations.

The most important parameter that influence the reliability of wind turbine with vertical axis it is wind speed. In this case, interesting results may be expected from the implementation of the Monte-Carlo simulation. Considering the wind speed between 4 m/s and 6 m/s for Romanian analyzed region, it can be determined the cumulative probability expressed by cumulative frequency curve for these data and looks like in Fig. 2. Cumulative distributions functions are usually presented graphically, where we plot the cumulative frequencies at the class boundaries. The resulting points are connected by means of straight lines, as shown in Fig. 2, Fig. 4 and Fig. 5. The normal probability graph paper is a useful device for checking whether the observations come from a normally distributed population, but such a device is approximate. One usually rejects normality when remarkable departure from linearity is quite evident [2].

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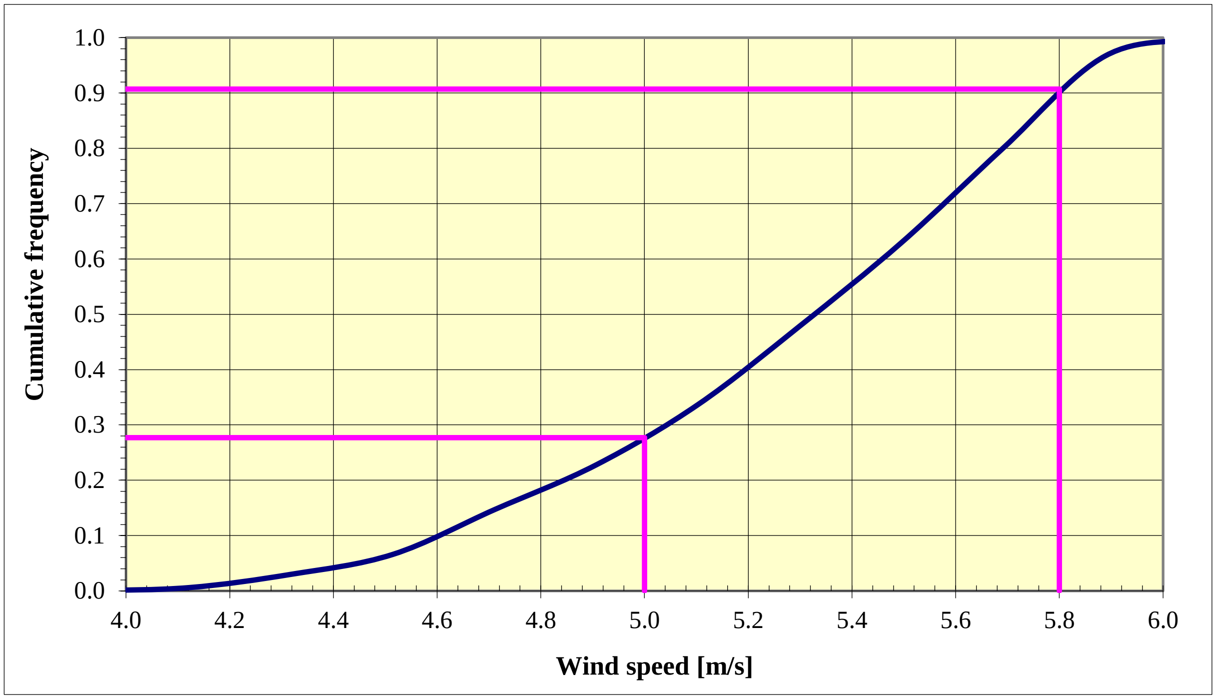

Figure 2: Cumulative frequency distribution for wind speed using Monte-Carlo simulation

Another measure of helical wind turbine reliability is the annual energy production. In a similar manner, it can be simulated the daily and annual energy output. As a result, the simulation data are represented by relative frequency histograms (Fig.3) and diagram (Fig.4). Cumulative distribution curve indicates the probability that it will be obtained the daily or annual energy output. Each time when the simulation is executed, the cell will be updated to show a random value drawn from the specified distribution.

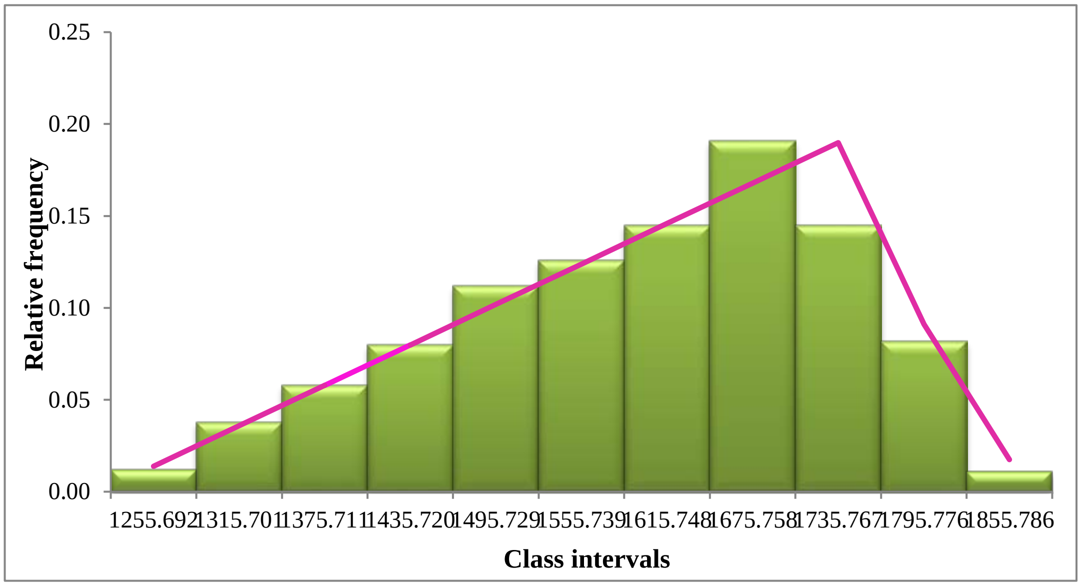

Figure 3: Monte-Carlo simulation of relative frequency histogram for annual energy output.

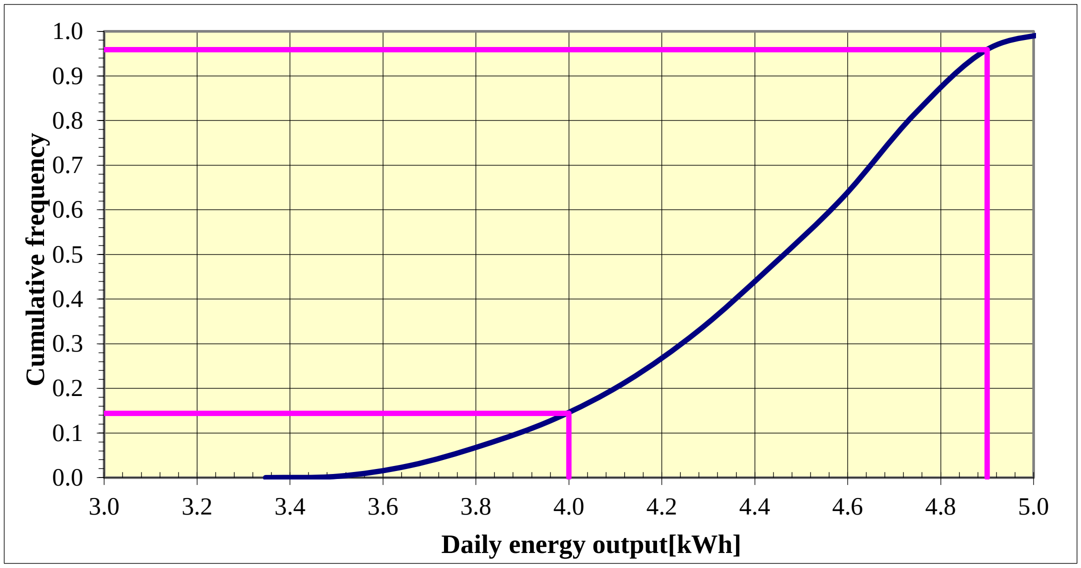

Figure 4: Monte-Carlo simulation of cumulative frequency distribution for daily energy output.

In Fig. 5 it is presented the simulation results of annual energy output according to relative frequency histograms, and it can be seen the standard asymmetric triangular distribution.

Analyzing the cumulative frequency distribution (Fig. 2, Fig. 4 and Fig. 5), the simulation results are presented synthetically in Table 1.

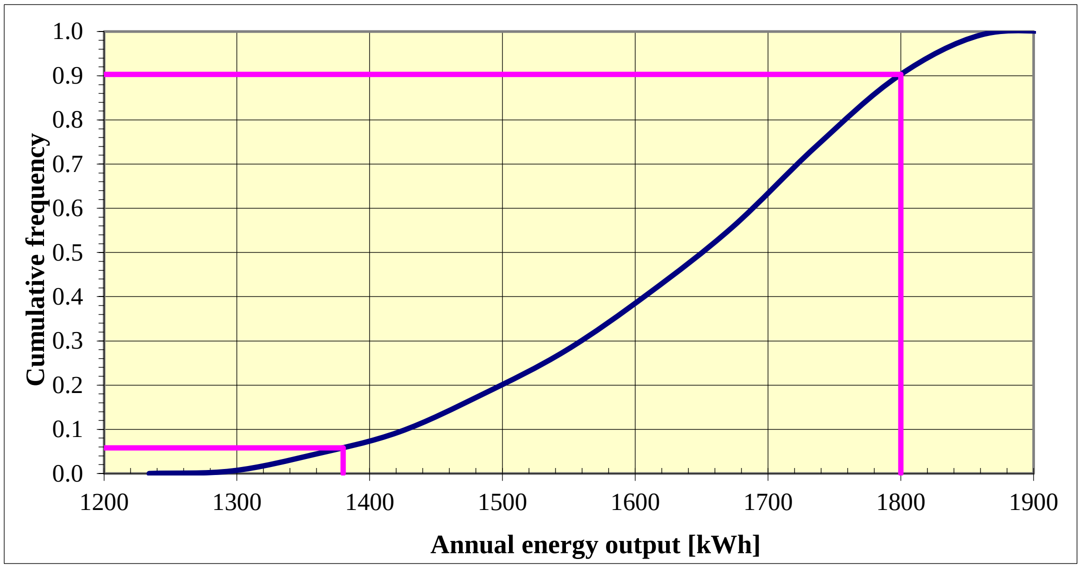

Figure 5: Monte-Carlo simulation of cumulative frequency distribution for annual energy output.

Table 1 Simulation process results

Parameter	Prob{$x \leq x_0$}	Prob{$x \leq x_1$}	Prob{$x > x_1$}
Wind speed [m/s]	0.269	0.899	0.101
Daily energy output [kWh]	0.144	0.959	0.041
Annual energy output [kWh]	0.058	0.903	0.097

It can be observed that the probability to exceed the maximum value of wind turbine parameters it is approximately 10% for wind speed, 4% for daily energy and 9.7% for annual energy. These percentages are obtained for different intervals set as acceptable limits.

5. CONCLUSIONS

As it has been proved by a lot of researchers and energy engineers, it will be a very positive and economic solution the replacement of bigger part of diesel generators with stand-alone hybrid energy systems, especially in medium and high wind and solar potential locations. Power systems which can generate and supply electricity to such remote locations are variously termed - "Remote decentralized, autonomous, or stand alone".

The main advantages of this type of wind turbine with helical rotor which main rotor shaft runs to the flow streamlines, from other type of wind turbines with horizontal axis are:

- high reliability;
- in isolated area, with no connection to national network, it can be used with good results a wind turbine with vertical axis helical type;
- simplicity in construction and good rigidity;
- smaller cost with 20 % as similar turbines;
- specific power bigger on the active surface;
- high torque moment at starting;
- at the wind speed bigger than 20 m/s is self-breaking without mechanical components, due to its original shape of rotor;
- it doesn't need orientation after the wind direction;
- it can work to high wind speed, as 50 m/s;
- it is only one wind turbine that is accepted by environmental agencies, because it doesn't kill birds;

Application of Monte-Carlo simulation allows us to determine the cumulative distribution curve and it helps to estimate the probability to obtain the daily and annually energy output with a specified wind speed.

These charts can be used to establish upper and lower specification limits on energy production and this information can be very useful to optimize the parameter and components of wind turbine. Based on simulation principles, it was performed the statistical processing of experimental data. By this means, it was determined the wind speed, the output power and annual energy output.

Considering this parameter, it was estimated the reliability function, unreliability functions, and failure rate. So, the reliability modeling and analysis of wind turbine permits us to understanding and minimizing wind turbine operation and maintenance costs. Information derived from these measurements can help to identify where the problems are. Further interpretation of the data could help to optimize the wind turbine and it could assess if it has been chosen the optimum parameters of the system. After the tests results was demonstrated the advantages of this type of wind turbine with vertical axis, against the other types of wind turbines patented in the world. In the time that will follow, based on the tests in laboratory and in aerodynamic tunnel, we intend to improve its performances.

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Physiology of Human Vision and Multidimensional Perspective Presentation in the Design

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ABSTRACT

The image that forms the perception depends not only on the objective reality, but also on the viewer, as well as on the way the brain treats the information received, which ultimately represents an electromagnetic record. There is a compilation of object and subject. For example, a visual impression in a bird's brain is projected onto a spherical screen because the bird's field of vision is the full range of a sphere. The image in an insect's mind is on a faceted screen. We - people can not really imagine the perception of a visual system built on a principle different from ours. Studies have shown that the closest model is a compilation between a spherical and a cylindrical perspective projected on an oval screen developed on a narrow spatial angle. For the first time, Leonardo da Vinci and Albrecht Durer in their creations apply this concept quite accurately. The images at first glance do not differ from the modern computer perspective, but the careful study shows that the image created by the method of these two geniuses, thanks to the softness of the curve line, is perceived as more realistic. Computer graphics seem more angular and unnatural, without the mind being able to explain it. The authors have developed a precise graphical methodology. Creating software to offer presentations based on this method requires a complex calculation of each pixel using the tensor calculus apparatus. This has not been done so far. In the end, we have an area where human vision and skills are at least as far away as computer computing. A free development area.

Key Words: Spherical and Cylindrical Perspective View.

1. INTRODUCTION

Why are we talking about a compilation between a cylindrical and a spherical perspective? Because of our bifocal vision, we actually see volume only in horizontal unfolding. Therefore, the image taken through the eyes is a cylindrical perspective. By simply lifting and lowering the position of the eyes, head and body, just like the cat makes before the jump we build in our brains and the vision in the vertical. Thus, ultimately, by obtaining a superposition of perception, a spherical thought image is obtained.

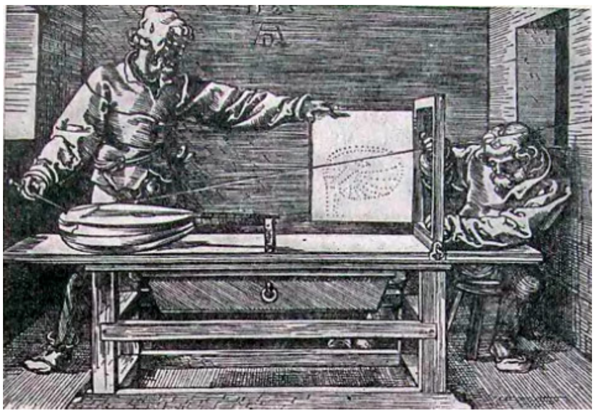


Figure 1: Renaissance explorers of the perspective image

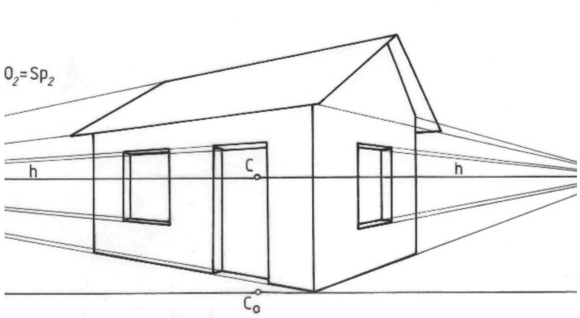


Figure 2: Classical Perspective

2. EXPLANATION

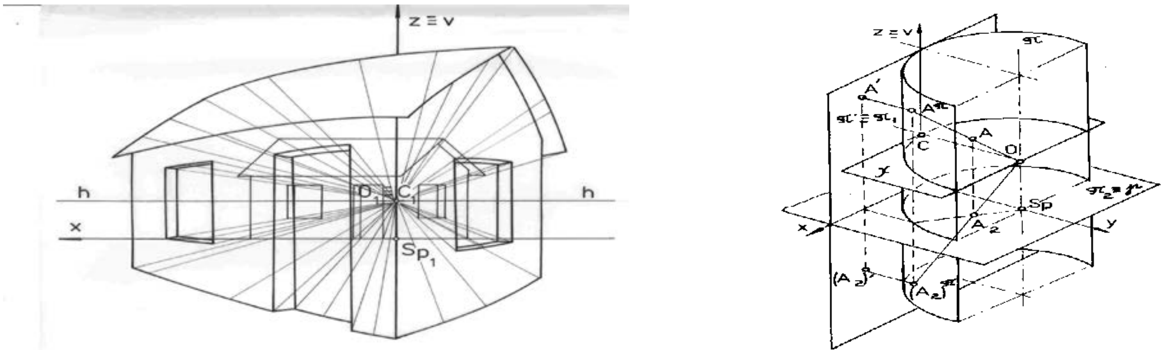


Figure 3: Geometric method for building a cylindrical perspective.

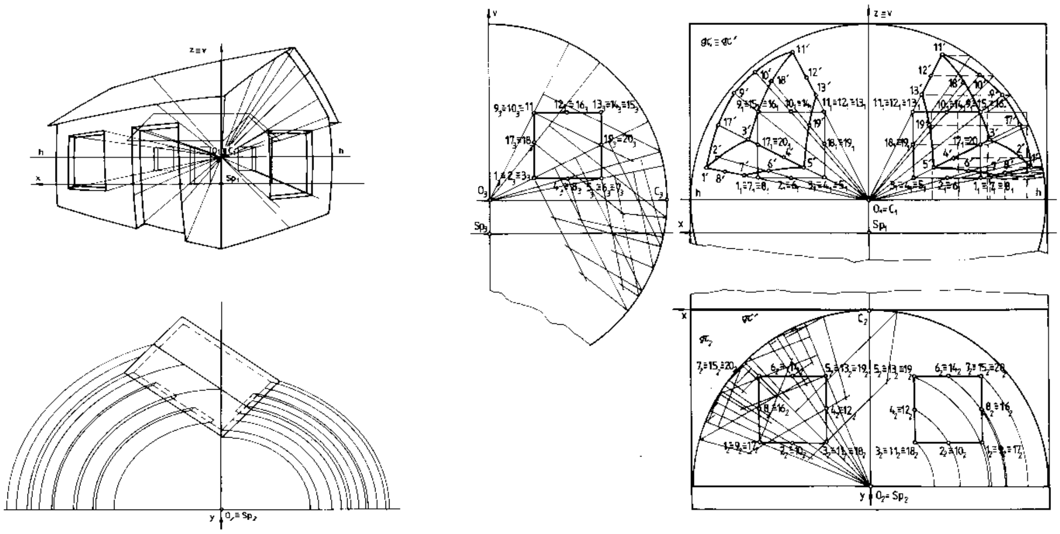


Figure 4: Geometric method for building a spherical perspective

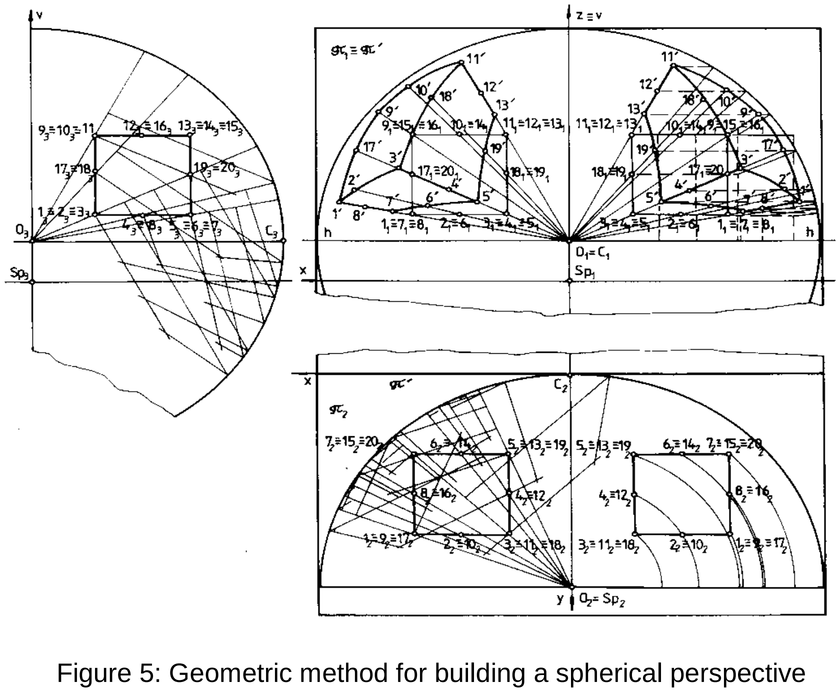


Figure 5: Geometric method for building a spherical perspective

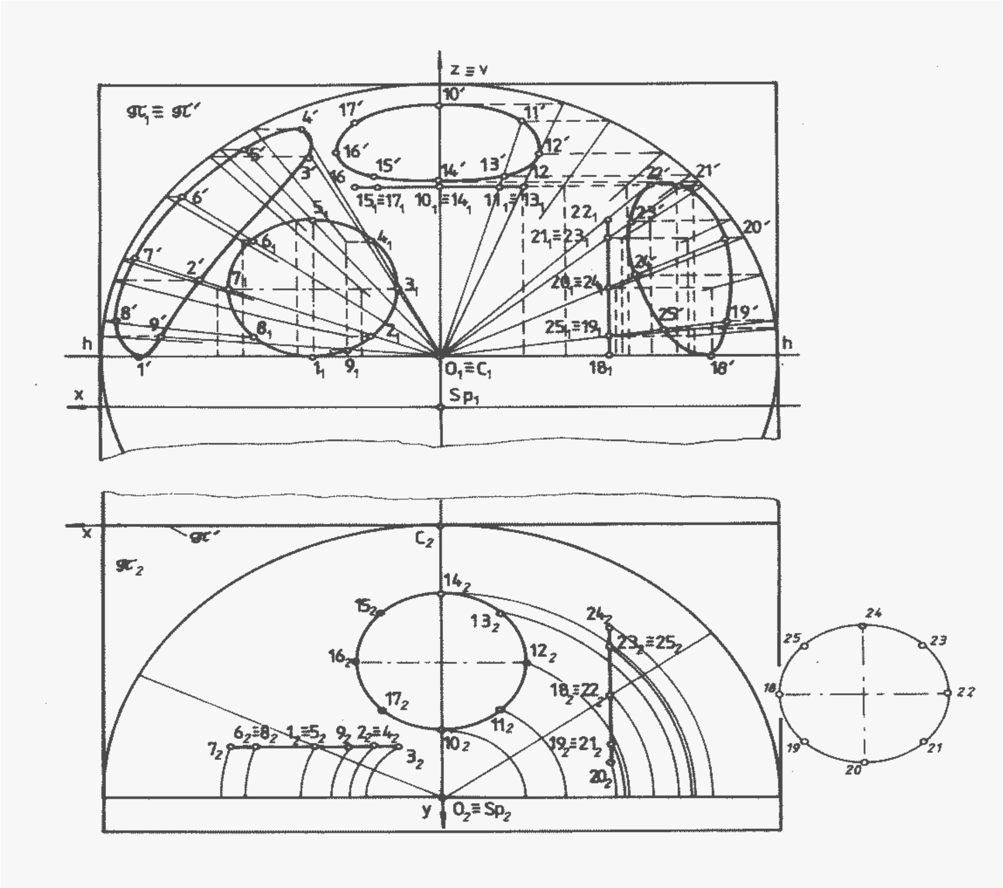


Figure 6: Geometric method for building a spherical perspective

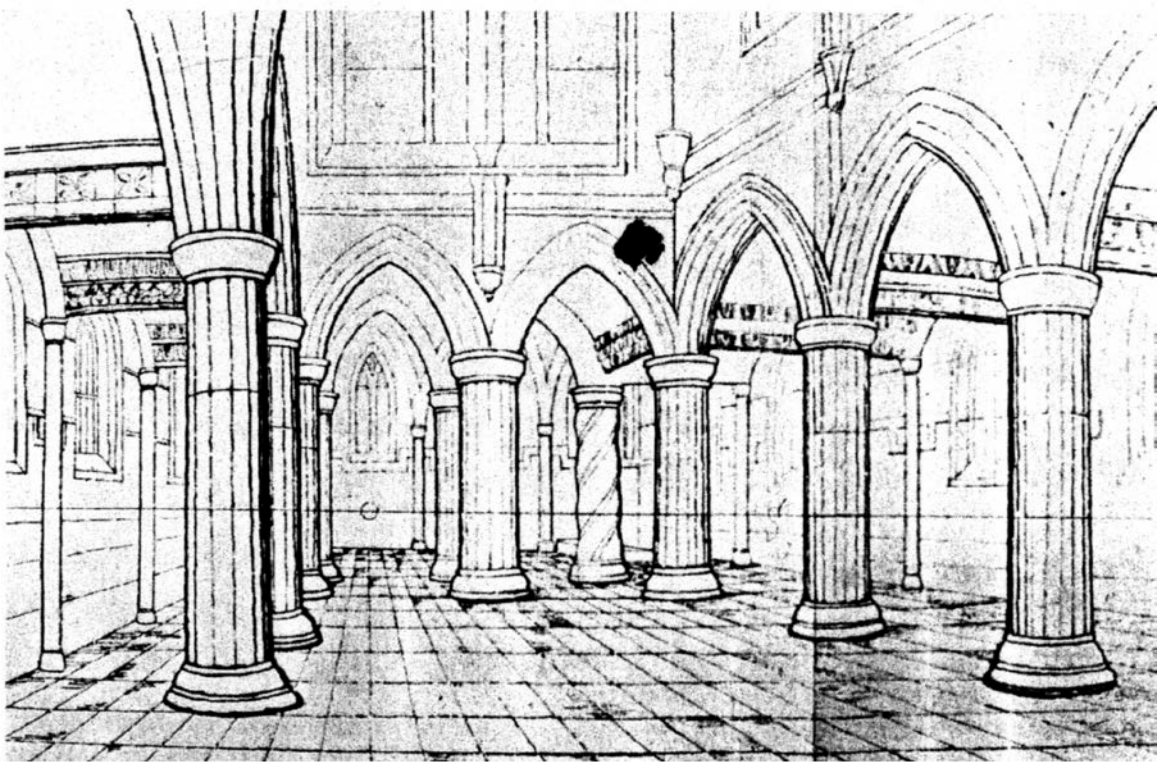


Figure 7: Interior presented through a spherical perspective

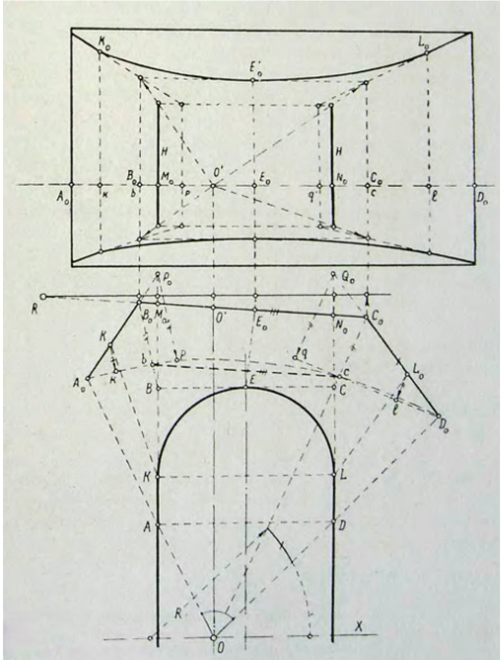


Figure 8: Cylindrical perspective

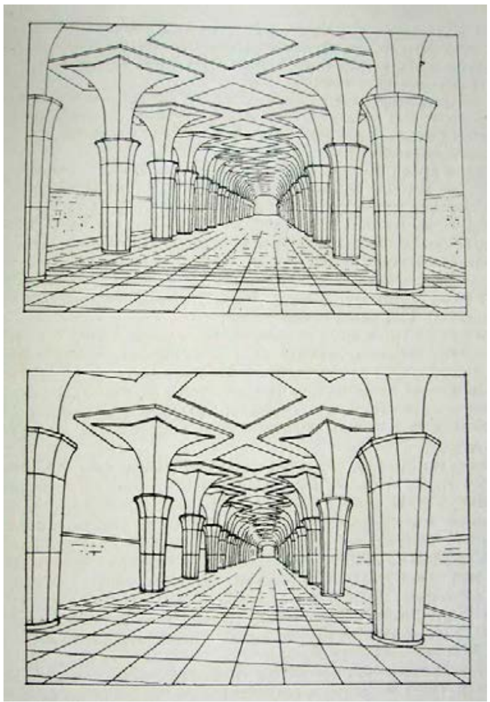
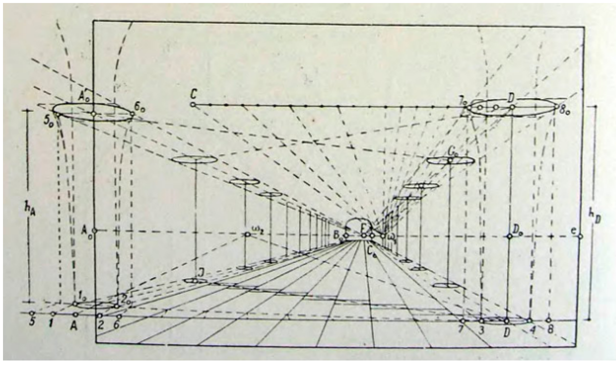


Figure 9: Spherical perspective



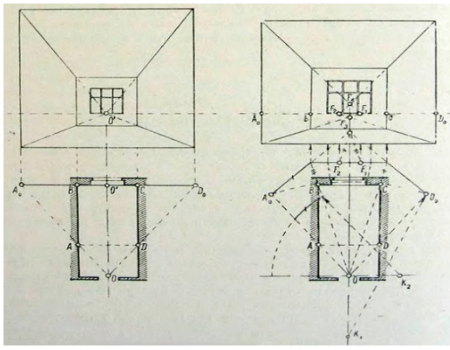


Figure 10 and 11: Comparative images

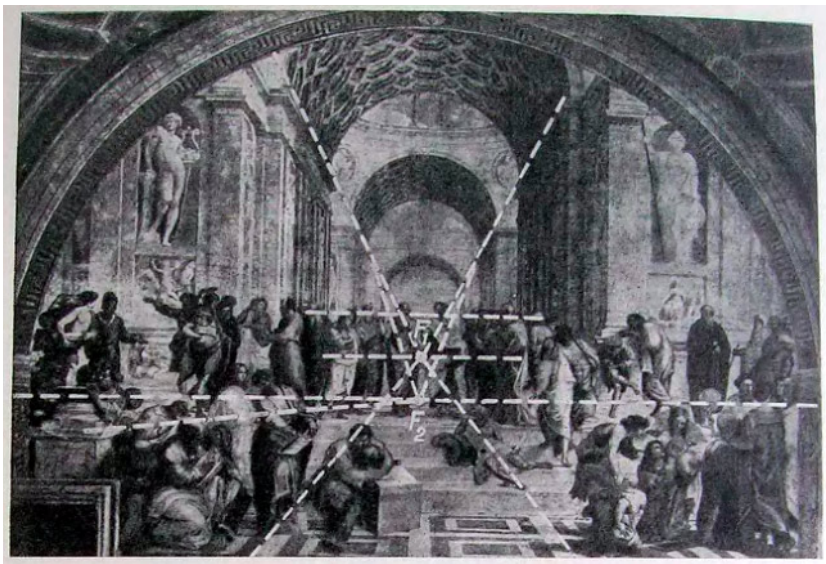


Figure .12: Raphael. Spherical perspective

Figure 13: Raphael. Spherical perspective

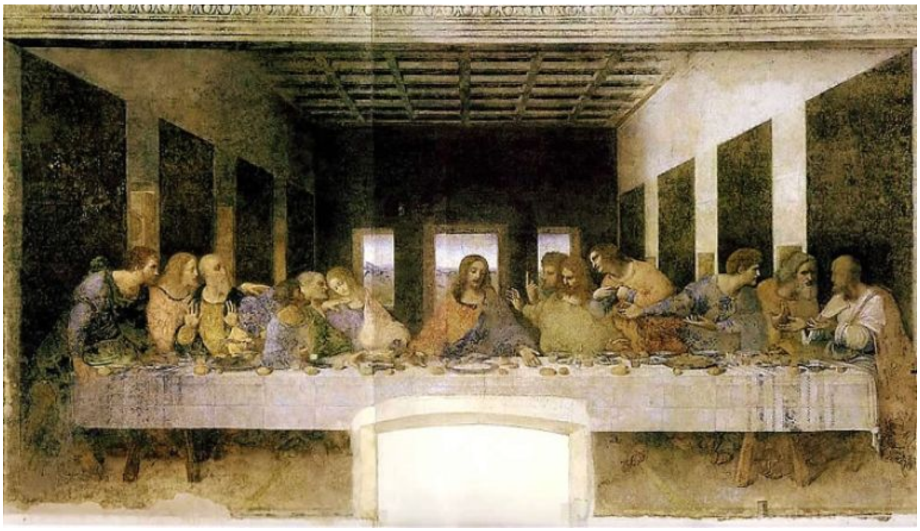


Figure 14: Leonardo. Spherical perspective

The examples illustrate the advantage of the spherical image in front of the angular and rudimentary image of the classical computer image. Renaissance geniuses have understood this issue better than modern computer programmers.

Now we give only first step in this direction. Another aspect of the work is the development of a purely mathematical methods for building a promising image, which in itself has its value. The practice and theory of perspective- image in projective geometry is based on the Euclidean - geometry. The volume of the mathematical justification of non- Euclidean geometries is colossal. The theme of a perspective image in those, curved, non- Euclidean rebuilt almost not affected and developed. In this short work will try to show only some general principles on the issue relating to the practice and with the need for a more realistic image of prosperous image in the design.

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Investigation of Environmental Assessment Tools in Terms of Construction and Building Materials

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ABSTRACT

Problems such as global warming and rapid depletion of natural resources have increased the efficiency of energy and efficient use of natural resources all over the world. Today, buildings use more than 40% of primary energy consumption. In the construction sector, research is being conducted to reduce the carbon emissions of the buildings and the negative impacts on the environment, and environmental assessment tools are used in this process. One of these methods is carbon footprint. The carbon footprint is a measure of the CO_2 release that occurs at each stage of the product lifecycle (production, transportation, use, recycling, and destruction).

In the study, the energy consumption and carbon emissions of a building selected as an area work in Kırklareli were evaluated. Building model created in Archicad reports and calculations related to the building have been obtained through Eco Designer Star, the extension of Archicad. The energy consumption of the building is calculated by net heating consumption, fuel cost, and CO_2 emissions. According to the types of fuel used in the building (coal, fuel oil, natural gas) 3 different scenarios were created. When building thermal insulated and sealed manner in energy consumption compared to 60% in total annual energy consumption of the primary energy consumption is 51%, the net energy consumption was measured to provide 85% power savings.

Key Words: Environmental Assessment Tools, Energy Consumption, Carbon Emissions, Carbon Footprint.

1. INTRODUCTION

Construction industry is causing a deterioration of ecological balance by using a significant portion of natural resources. This negatively affects the interaction between humans, nature and environment. However, the negative consequences of building production and usages are not only the gases released to the atmosphere. The effects of buildings on environmental pollution are due to activities related to constructions: 50% of greenhouse gases which causes global warming, 40% of pollution in drinking water, 24% of air pollution and 20% of solid wastes are originated by constructions [1].

The energy consumption worldwide is provided 81% by fossil fuels such as coal, oil and natural gas. Currently buildings use primary energy consumption more than 40%. According to the industrial energy consumption data 7.1% of coal, 5.6% of fuel oil, 30% of gas and 27% of electricity are used by the constructions. In this context, consumption is above the sustainability level [2]. To reduce the adverse effects of climate change on humans, a number of studies has been conducted under the leadership of the United Nations and international organizations since the late 1980s. The United Nations Framework Convention on Climate Change (UNFCCC) was signed in 1992 at the United Nations Conference on Environment and Development (Rio Earth Summit). The aim of the convention which entered into force in 1994 is to keep the greenhouse gas in the atmosphere and the human-induced effectiveness on the climate system at a certain level. Turkey participated United Nations Framework Convention on Climate Change (UNFCCC) in 2004 [3].

According to the Climate Change Synthesis Report published in 2014; Carbon dioxide (CO_2) from fossil fuels and industrial production in greenhouse gas formation has the largest share with 76%. Followed by 16% methane (CH_4), 6,2% nitrogen (N_2O) and 2% HFCs [4]. Distribution of greenhouse gases according to the economic sectors are; electricity and heat production 25%, agriculture, forestry and other land use 24%, industry 21%, transportation 14%, building 6.3%, and other energies 9.6%. Sectors within the electricity and heat production are affecting greenhouse gas emissions indirectly. At this point, shares of buildings and industry are 12% and 11% respectively [4]. In 2016, Turkey's 134.6 million tons of oil equivalent (Mtoe) primary energy demand provided 31% from oil, 28% from natural gas, and 27% from coal (Figure 1) [5].

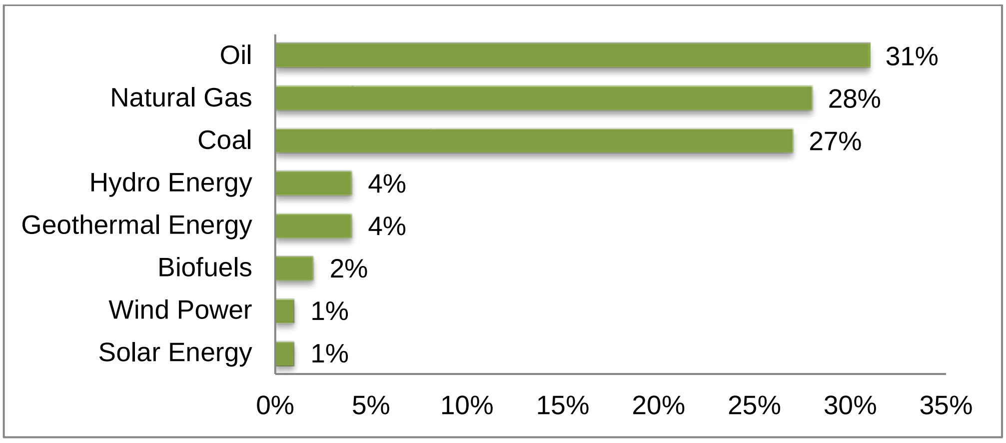


Figure 1: Turkey's Primary Energy Distribution [5]

Sectoral distribution of Turkey's primary energy demand was highest in industrial sector by 36%, and followed by transportation, residence and commerce sector at 24%, 22% and 18% respectively (Figure 2) [5]. In 2012 the rate of meeting primary energy demand with domestic production was 28%. In other words, Turkey's external dependence of energy was 52% in 1990, 68% in 2000, and increased to 72% in 2012 [6].

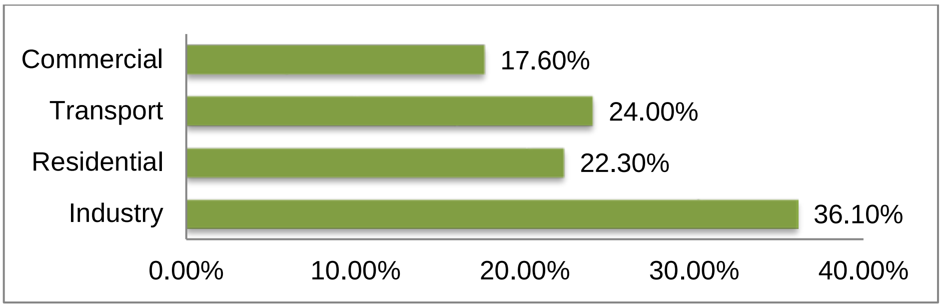


Figure 2: The Distribution by Sector of Turkey's Primary Energy Demand [5]

22% of the energy in Turkey is spent by the construction industry [5]. This paper examines the influence of building and building materials on the environment. In Kırklareli (Turkey), which is chosen as study area, the energy consumption and carbon emissions of the building are evaluated by examining the carbon footprint from the environmental evaluation tools on the sample building.

2. ENVIRONMENTAL ASSESSMENT TOOLS

With the help of the advance in technology, the products that used in construction, building usage, maintenance, and repair areas are changing in the construction industry, which causes more damage to the environment every day. The environmental effects of construction products and the amount of energy used in construction determine the environmental attributes of the building. It is important to evaluate the environmental impact of the buildings in which the new construction products are used and provide the sustainable building design according to the new developments. As a result of all efforts to reduce the environmental impact of constructions and to develop environmentally friendly structures the sustainability has come to the forefront and the inspection of building and building materials has started to be carried out using environmental assessment tools. Environmental assessment tools; is an effective methodology that provides appropriate indicators for assessing the environmental performance of building and building materials that target the sustainable development, design, construction and marketing of a building's entire life cycle according to environmental regulations and standards. These methods include; Life Cycle Assessment (LCA), Rating/certification systems, Carbon Footprint Analysis (CFA) and Eco Label.

In this study, the carbon footprint examined in terms of environmental assessment instruments is a measure of the CO_2 release occurring at each stage of the product life cycle (production, transport, construction, use and destruction) [7].

2.1. Carbon Footprint Analysis, CFA

Human beings leave a trail on earth due to the consumption and production activities they have carried out throughout their lives. This trace is not so small if we think about the foods consumed throughout our lives, the clothes, all durable and non-durable goods, the resources used for heating and transportation, and all the wastes [8].

The Carbon Footprint is divided into to two: Primary (direct) footprint and secondary (indirect) footprint. The primary footprint is a measure of direct CO_2 emissions from burning fossil fuels, including domestic energy consumption and transportation (such as cars and airplanes). The secondary footprint is a measure of the indirect CO_2 emissions associated with the manufacture and eventual degradation of the products through the entire life cycle of these products we use. The amount of carbon footprint resulting from activities in human life is mostly caused by fossil fuel use and vacation, as shown in Figure 3 [9].

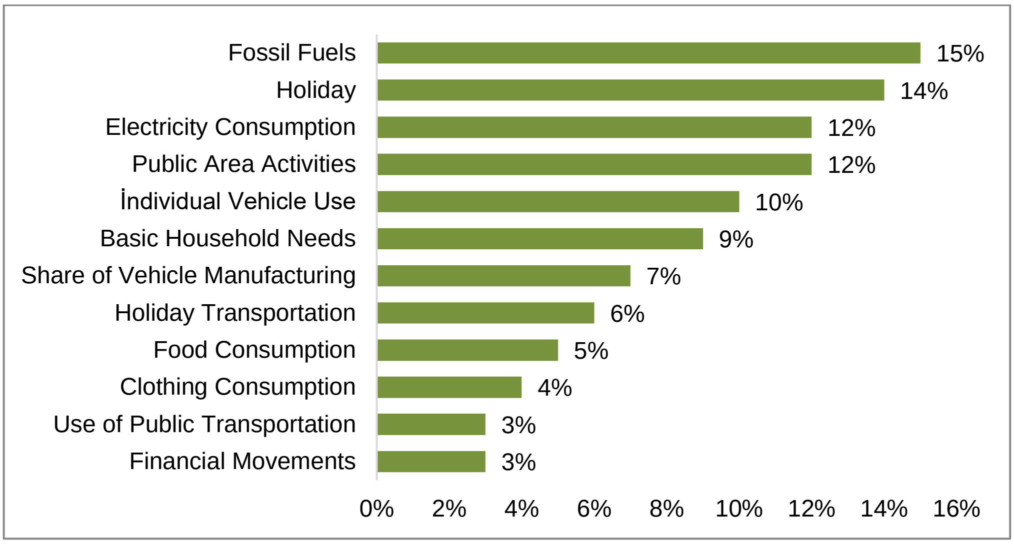


Figure 3: Carbon Footprint of Various Activities [9]

The carbon footprint and biological capacity results of the countries are calculated annually by the Global Footprint Network. Each year, the Global Footprint Network measures the biological capacity of more than 150 countries worldwide and publishes national footprint calculations. The carbon footprint, which is the largest footprint component at global level, was 44% in 1961, however it increased to 60% in 2013 [10]. 43% of CO_2 emissions from fuels are related to coal use. Emissions from natural gas are 30.5%. Oil products, which used predominantly in transportation sector, is 26.5% (Figure 4) [11].

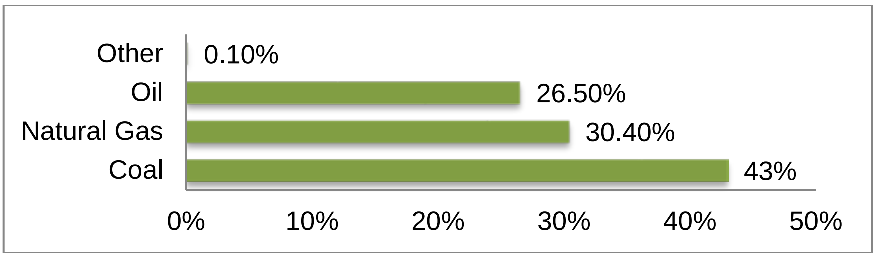


Figure 4: CO_2 Emissions by fuel [11]

According to the analysis of sectoral basis, the largest share of the carbon footprint belongs to the electricity sector with 43%. This is followed by transportation (19.8%), manufacturing and construction (14.6%), housing (9.1%), commercial and other services (9.7%) and other energy industries (3.7%) [11].

A brief summary of the carbon footprint calculations of building and building materials in the literature is given below.

In his study, Kneifel examined the lifecycle energy savings and carbon emissions reduction using an integrated design approach in new commercial buildings. A total of 576 energy simulations were performed for the 12 prototype buildings in 16 provinces, and there are 3 building designs for each building-site combination. The results show that traditional energy efficiency technologies have reduced the energy use of new buildings by 20-30% on average. These developments not only saved money and energy, but also reduced the average carbon footprint of a building by 16% [12].

Catalina, Blanco and Virgone designed a zero-energy building and tried to figure out the building's carbon footprint. Therefore, some active systems and insulation have been used in the building in order to reduce the energy consumption of heating and electricity. The zero-energy building has a carbon footprint of 934 kg_eC annually for a lifetime of 40 years. This value was found as 1106 kg_eC in a normal house. The new technology used in the zero-energy building has been reported to reduce carbon emissions by 15% compared to a conventional building [13].

Biswas, assessed carbon footprint and energy consumption using the Building Management System (BMS) at University of Curtin University in Western Australia. In his study, the building cooling system was 69% efficient, so he found a saving of 63% in greenhouse gas emissions over a 50-year life cycle [14].

Bonamente and Cotana have analyzed greenhouse gas emissions (carbon footprint) and primary energy consumption (energy footprint) throughout the life cycle of prefabricated industrial buildings in their studies. 50 years of life are considered for 4 different buildings. The results of the four buildings decrease from 144.6 $kgCO_2/m^3$ and 649.5 kWh/m^3 down to 123.5 $kgCO_2/m^3$'e and 556.8 kWh/m^3 as the building floor area increases from 1048 m^2 to 21.910 m^2. It is stated that the carbon footprint in the usage phase of the building is about 76% effective. For a 10.000 m^2 building, assuming 50 and 20 year lifetimes, the carbon footprint is 2.608 $kgCO_2/m^3$/year and 3.516 $kgCO_2/m^3$/year respectively [15].

Huang et al. found that the carbon footprint of urban buildings increased from 8.95 million tons in 2005 to 13.57 million tons in 2009 in Xiamen, with average annual growth rate of 12.87%. The carbon emissions from building material production and building energy use contributed 45% and 40% of building carbon footprint respectively. It has been shown that, in low-carbon scenarios, there will be an energy saving of 1.590.400 tce for urban buildings, with a corresponding carbon emission reduction of 3.1491 million tons by 2020, and decrease of 2.98% in the annual growth rate of the total energy consumption of buildings, compared with the baseline scenario [16].

Kunic compared 15 kinds of materials which have been used often in construction with new and efficient thermal insulation materials in his study. Emission of CO_2 was found 11.8 kg/m^2 with EPS usage, 33.6 kg/m^2 with XPS usage and lastly 1.8 kg/m^2 with low density MW. For energy savings in the building envelope, EPS 2 years, XPS 4 years, and MW 1 year have started to save carbon footprint [17].

3. STUDY AREA

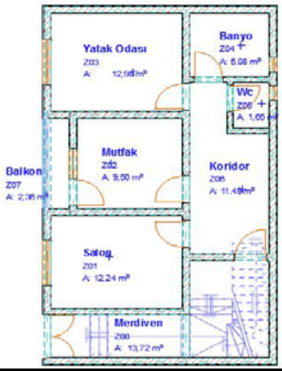
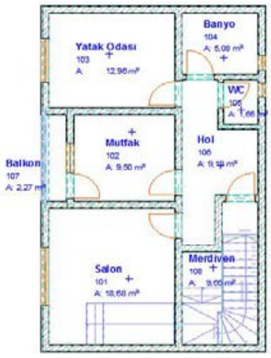
A carbon footprint survey was conducted using Archicad program on a sample house in Kırklareli province, which was selected as a study area. Through Graphisoft Archicad Eco Designer STAR can be done climate analysis, building energy model calibration, low-energy architectural design, carbon emission assessment. The program uses StruSoft's VIPcore calculation engine conforming to the ANSI / ASHRAE 140-2007 standard [18].

The selected residence is located in the south of the city of Kırklareli province central district. The building was constructed as two floors building with masonry construction system. The general Features of the building are shown in Table 1. The ground floor area of the building is 79.65m^2 and the total construction area is 159.30m^2. Before the calculations and modeling, the details and material properties were determined of the building for thermally insulated and uninsulated conditions (Table 2, Table 3). Then energy consumption and CO_2 emissions are evaluated according to the 3 scenarios that are accepted according to the following 3 different fuel types to be used in the building.

- ✓ Type 1 is Solid fuel (coal),
- ✓ Type 2 is Liquid fuel (fuel oil),
- ✓ Type 3 is Natural gas,

The Archicad program provides information on the thermal conductivity, density, heat capacity, embodied energy and embodied carbon energies of building materials used in buildings (Table 2 - Table 3). Suitable materials for the building were modeled in two different forms: thermally insulated and uninsulated. For the calculation part, primary energy, net heating consumption, fuel cost and CO_2 emissions are accounted for in the reports by entering building environment, climate data, required ambient temperatures, system and fuel type used in the building, and energy costs.

Table 1: General Features of the Building

<table>
<tr><td>Building Function</td><td>House</td><td rowspan="3"></td></tr>
<tr><td>Building Construction System</td><td>Masonry</td></tr>
<tr><td>Building Address</td><td>Karacaibrahim Mah. 10. Vahit Lütfi Salcı Sok. No: Merkez/KIRKLARELİ</td></tr>
<tr><td colspan="2">Ground Floor Plan 
</td><td>1st Floor Plan 
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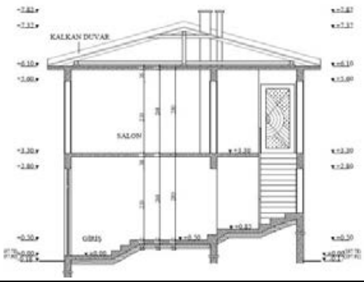
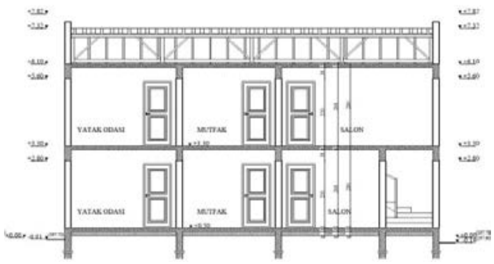
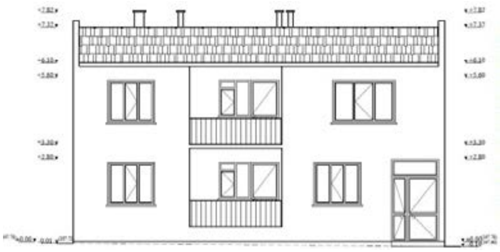
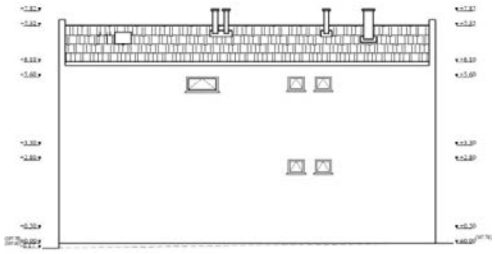
<tr><td colspan="2">A-A Section </td><td>B-B Section </td></tr>
<tr><td colspan="2">West Elevation </td><td>East Elevation </td></tr>
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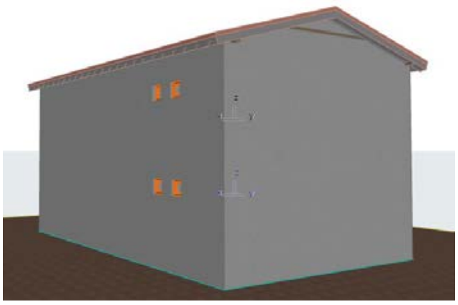
<tr><td colspan="2"></td><td></td></tr>
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Table 2: The Building and Material Properties in Uninsulated Case

BUILDING ELEMENTS	MATERIAL	Thermal Conductivity (W/mK)	Density (kg/m³)	Heat Capacity (c)(J/kgK)	Embodied Energy (MJ/kg)	Embodied Carbon (kg/CO_2kg)
WALL	Gypsum Plaster	0.57	1300	1000	1.8	0.13
	Brick - Structural	0.6	1500	840	3	0.24
	Plaster - Lime Sand	1	1800	1000	1.34	0.213
BEAMS	Concrete-Structural	2.3	2300	1000	1.92	0.198
FOUNDATION	Reinforced Concrete-Structural	2.5	2400	1000	2.33	0.242
GROUND FLOOR	Blockage	0.121	648	920	6	0.48
	Concrete	1.15	1800	1000	0.74	0.107
	Screed Concrete	1.4	2000	1000	0.78	0.113
	Parquet	0.13	500	2500	7.11	0.32
	Tile	1.5	2000	900	6.5	0.48
MEZZANINE FLOOR	Gypsum Plaster	0.57	1300	1000	1.8	0.13
	Reinforced Concrete Slab	2.5	2400	1000	2.33	0.242
	Screed Concrete	1.4	2000	1000	0.78	0.113
	Parquet	0.13	500	2500	7.11	0.32
	Tile	1.5	2000	900	6.5	0.48
ROOF	Gypsum Plaster	0.57	1300	1000	1.8	0.13
	Reinforced Concrete Slab	2.5	2400	1000	2.33	0.242
	Screed Concrete	1.4	2000	1000	0.78	0.113
WINDOW	Heat Treated Glass	1	2500	750	15	0.91
	PVC Windows	0.17	1390	900	77.2	3.1

Table 3: The Building and Material Properties in thermal Insulated Case

BUILDING ELEMENTS	MATERIAL	Thermal Conductivity (W/mK)	Density (kg/m³)	Heat Capacity (c) (J/kgK)	Embodied Energy (MJ/kg)	Embodied Carbon (kg/CO_2kg)
WALL	Gypsum Plaster	0.57	1300	1000	1.8	0.13
	Brick - Structural	0.6	1500	840	3	0.24
	EPS	0.042	15	1450	76	3.18
	Insulation Plaster*	0.3	800	1000	8	1.2
BEAM	Concrete - Structural	2.3	2300	1000	1.92	0.198
FOUNDATION	Reinforced Concrete - Structural	2.5	2400	1000	2.33	0.242
GROUND FLOOR	Blockade	0.121	648	920	6	0.48
	Concrete	1.15	1800	1000	0.74	0.107
	EPS	0.036	25	1450	86.6	3.29
	Screed Concrete	1.4	2000	1000	0.78	0.113
	Parquet	0.13	500	2500	7.11	0.32
	Tile	1.5	2000	900	6.5	0.48
MEZZANINE FLOOR	Gypsum Plaster	0.57	1300	1000	1.8	0.13
	Reinforced Concrete - Structural	2.5	2400	1000	2.33	0.242
	Screed Concrete	1.4	2000	1000	0.78	0.113
	Parquet	0.13	500	2500	7.11	0.32
	Tile	1.5	2000	900	6.5	0.48
ROOF	Gypsum Plaster	0.57	1300	1000	1.8	0.13
	Reinforced Concrete - Structural	2.5	2400	1000	2.33	0.242
	EPS	0.036	25	1450	86.6	3.29
	Screed Concrete	1.4	2000	1000	0.78	0.113
WINDOW	Heat Treated Glass	1	2500	750	15	0.91
	PVC Windows	0.17	1390	900	77.2	3.1

*TS 825 material properties [19]

4. RESULTS

The results obtained through Archicad's building model and Archicad's own extension, Eco Designer Star, are given in Table 4 and Table 5 for thermal insulation, annual primary energy, net heating consumption, fuel cost and CO_2 emissions calculations for the case insulated and uninsulated.

The value of the **U Value (Thermal Transmittance Coefficient)** calculated by the program according to the material properties of the building and the accepted ambient temperatures is 2.27 W/m²K without insulation and this value is 0.57 W/m²K when thermal insulated (Table 4). In the case of uninsulation in building the U values of the ground floor is 1.69 W/m²K, the walls are 1.81 W/m²K, the roof floor is 3.98 W/m²K, when the building is thermal insulated, U values changed to 0.30 W/m²K for the ground floor, 0.55 W/m²K for the walls, and 0.33 W/m²K for the roof floor.

Table 4: The building Uninsulated and Insulated Situation U Value (W/m²K)

Building Situation	Building Envelope Average (W/m²K)	Opaque Surface (W/m²K)	Glass Surface (W/m²K)
Uninsulated	2.27	1.00 – 3.98	1.70 – 2.55
Insulated	0.57	0.30 – 2.11	1.70 – 2.55

The comparison and results of 3 different types of fuels CO_2 emissions in uninsulated building, Type 1 (Coal) was the first with 143.87 kg/m², Type 2 (Fuel Oil) was the second with 136.45 kg/m², Type 3 (Natural Gas) was 100.71 kg/m². The CO_2 emissions results in insulated building are; Type 1 (Coal) was calculated as 54.12 kg/m², Type 2 (Fuel Oil) was calculated as 50.01 kg/m² and Type 3 (Natural Gas) was calculated as 31.02 kg/m². The values of CO_2 emissions according to the type of fuel used are quite different in scenarios of thermally insulated and uninsulated buildings. The lowest carbon footprint is seen when the building is insulated and natural gas is used as fuel (Figure 5).

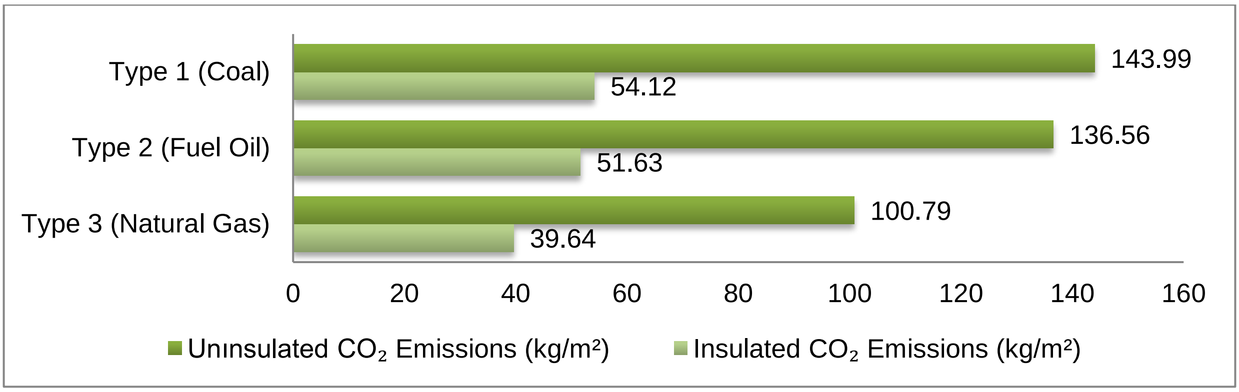

Figure 5: The Building Thermal Uninsulated – Thermal Insulated CO_2 Emissions (kg/m²)

Without thermal insulation, the annual primary energy consumption of the building was 508.36 kWh/m² whereas with thermal insulation the annual primary energy consumption was reduced to 251.47 kWh/m² (Table 5).

Table 5: According to the Building's Fuel Type and Insulation Situation Energy Consumption and CO_2 Emissions

BUILDING SITUATION	UNINSULATED					INSULATED				
FUEL TYPE	Annual Energy Consumption (kWh/m²)	Annual Net Heating Energy (kWh/m²)	Annual Primary Energy Consumption (kWh/m²)	Annual CO_2 Emissions (kg/m²)	Fuel Cost (TL/m²)	Annual Energy Consumption (kWh/m²)	Annual Net Heating Energy (kWh/m²)	Annual Primary Energy Consumption (kWh/m²)	Annual CO_2 Emissions (kg/m²)	Fuel Cost (TL/m²)
TYPE 1 (COAL)	427.33	302.05	508.36	143.87	141.50	170.44	45.17	251.47	54.17	58.64
TYPE 2 (FUEL OIL)				136.45	115.91				51.68	50.05
TYPE 3 (NATURAL GAS)				100.71	59.28				39.67	31.02

5. CONCLUSION

In the study, the carbon footprint calculations were made through the Archicad extension **Eco Designer Star** on the sample house selected in Kırklareli (Turkey), and it has shown that net heating consumption, fuel cost and CO_2 emissions vary according to the insulation state of the building and the primary energy. The U value was 2.27 W/m²K when the building is uninsulated, but the U value decreases to 0.57 W/m²K when building is insulated. Without building insulation the annual CO_2 emissions are; Type 1 (Coal) is the highest value with 143.87 kg/m², Type 2 (Fuel Oil) is the second rank with 136.45 kg/m² and Type 3 (Natural Gas) is the third rank with 100.71 kg/m². Annual CO_2 emissions when the building is insulated; Type 1 (Coal) is 54.12 kg/m², Type 2 (Fuel Oil) is 50.01 kg/m², Type 3 (Natural Gas) is 31.02 kg/m². Compared with the uninsulated and insulated energy consumption of the building, it is observed that annual energy consumption is 60%, primary energy consumption is 51%, net energy consumption is 85% energy saving.

As a result of these calculations, it is clearly seen, how important the thermal insulation in reducing the energy consumption of the building and the carbon footprint is. It has been determined that the results vary according to the type of fuel used. However, fossil fuels like coal, fuel-oil and natural gas are used generally. In recent years it's aimed to use clean renewable energy sources especially in reducing the environmental impacts of buildings. By integrating these systems into the buildings and use it as preferred resources to satisfy buildings' energy needs, it will be more beneficial in terms of reducing the environmental impacts and carbon footprint that caused by buildings.

The building studied in this paper was built with masonry construction technique, modeled and calculated this way in the program. Environmental impacts and carbon footprint can be analyzed by making calculations on examples of buildings with different construction systems and materials that have integrated systems of renewable energy sources on buildings. Inspection of building and building materials are provided through the environmental assessment tools in the buildings. In addition, buildings can be controlled via building management systems and these systems will also contribute to prevent unnecessary energy losses.

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The Role of Higher Education in Quality Infrastructure: The Case of Serbia

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ABSTRACT

Activities of a quality infrastructure (QI) provide an essential base for global trade and economy. As an institutional framework, the QI encompasses a standardization, a metrology, an accreditation and conformity assessment processes necessary to provide that products and services meet specific safety, quality and others requirements. An entrance, as well as competitiveness on the global market for many companies, are related to the solid understanding of QIs of target markets. In order to improve their present and future capacities, companies need to have competent employees or adequate support for their activities on the market.There are many European and global initiatives for education about standardization, however too often standardization related activities such as accreditation, certification, metrology, and others, are neglected.Standardisation and related activities need to find their place in higher education curricula in order to respond to the challenging environment – particularly in transitional & industrialized and developing countries as a base for their catch up strategies. Modern universities face the challenge of responding to a dynamical job market with new demands for professions and skills. Therefore, education in the QI field is a basic prerequisite for the successful building and improvement of national QI in every country. The aim of this paper is to raise awareness related to higher education for QI.

Key Words: Quality Infrastructure, Higher education.

1. INTRODUCTION

Standardization is neither a science nor even generally accepted academic discipline. Standardization might be described as a new, emerging and multipoint discipline in which applied science, technology, industry and economic play extremely important parts [1]. Standardization is practical discipline which needs to find its place in formal higher education and lifelong learning globally in order to have future professionals who can use their knowledge about standards and standardization for technology transfer, economic growth, and global sustainability or in the case of latecomer countries for strategies of “accept and learn” or of (technology) ”catch up“.

Many organizations for standardization and other international organizations call for more content about standardization in higher education curricula and their activities to support education about standardization were and are still valuable. In 1970, the UNECE Government Officials Responsible for Standardization Policies (the predecessor of WP. 6) developed Recommendation I that urged governments to include standardization in the curricula of educational institutions. Need for cooperation among industry, academia, and standards organizations, with aims to promote, initiate and foster education about standardization was seen as crucial by many.

Based on EU - Joint Initiative on Standardization - Action 3: Programmes for education in standardization, on May 16th 2017, European Commission invited university professors from 22 European Countries, Serbia and Turkey to one day discussion entitled: “European Commission meets with Academia: Standardization in the 21st century: societal, economic and educational aspects“. More than 80 professors were there. The next the European Commission meeting with academia is planned for autumn 2018 when the teaching materials of the ETSI will be presented. On the May 20th, 2018, at China Jiliang University in Hangzhou China, The Belt and the Road University Alliance for Standardization Education and Academics (B&RUAS, UAS) was established by 106 universities from 30 countries. In October 2018, in Busan, Korea, The Standards Education Convention 2018, will be held as back to back event with IEC General Meeting 2018, with the aim to collect global best practices of standard education provided by universities, national and international organizations for standardization.

Awareness about the importance of education about standardization is growing. However, it is often neglected that related disciplines e.g. certification, accreditation, metrology needs too to find its places in education for QI. This paper aim is to address needs of the QI related to higher education in Serbia. In the next part of the paper, the QI in Serbia is described. In the third part of the paper, the program of Department of Quality management is presented. After, this part conclusion remarks and reference were given.

2. THE QUALITY INFRASTRUCTURE IN SERBIA

Quality Infrastructure was coined by the International Technical Cooperation of PTB [2] and it is needed "to ensure the proper performance of a country's regulatory environment" [3]. According to Pejović et al. [4], "quality infrastructure relates to all fields of metrology, standardization, and testing, of quality management and conformity assessment, including certification and accreditation". QI operates as a highly decentralized network of public and private institutions and it is the legal framework that:

- regulates, formulates, edits and implements standards and
- provides evidence of its fulfillment [5].

After the dissolution of the State Union of Serbia and Montenegro in 2006, Republic of Serbia "inherited" an outdated legal and institutional framework governing QI [6]. It was necessary to set up a new, modern system in this area that would be in line with the new trends in the European Union with aims to enable industry f Serbia to be more competitive. In Serbia, the QI is based on four umbrella laws: Law on Technical Requirements for Products and Conformity Assessment, Law on Standardization, Law on Metrology, and Law on Accreditation. Accreditation is an accepted process by which a third party gives formal recognition that an organization is competent to carry out specific tasks [7]. Metrology ensures that measurements are made with appropriate accuracy and reliability [8], while conformity assessment is "demonstration that specified requirements relating to a product, process, system, person or body are fulfilled" [9]. Finally, standards are a significant factor in who wins and who loses in the global market [10].

Figure 1 illustrates the Serbian QI Model by Ruso et al. [11]. The same authors pointed out that the principal institutions in the QI network are the Directorate of Measures and Precious Metals, the Accreditation Body, the Institute for Standardization, the Ministry of Economy (QI department) and conformity assessment bodies. The institutions involved in the periphery are the Ministry of Trade, Tourism and Telecommunications, the Ministry of Finance, the Ministry of Agriculture and Environmental Protection, the Ministry of Education, Science and Technological Development, the Chamber of Commerce and Industry and faculties, and each of them has a special department or office related to QI. Nowadays, information portals are important communication link among the QI institutions, which follow and present the latest information in the field of the management system and exchange knowledge in Serbia. Therefore, the portals have an important role in IQ model.

Also, the Figure 1 highlights that the connections between universities and other institutions are multiple. For instance, faculties educate students in the QI field who will be employed in other relevant institutions, the mobility of profesors and students contribute to good practices sharing, experts and lecturers should be encouraged, and QI experts can be engaged in teaching as well. Collaboration on common QI national and international projects in both research and education is just another one benefit in a row when it comes to the QI institutional networking in Serbia.

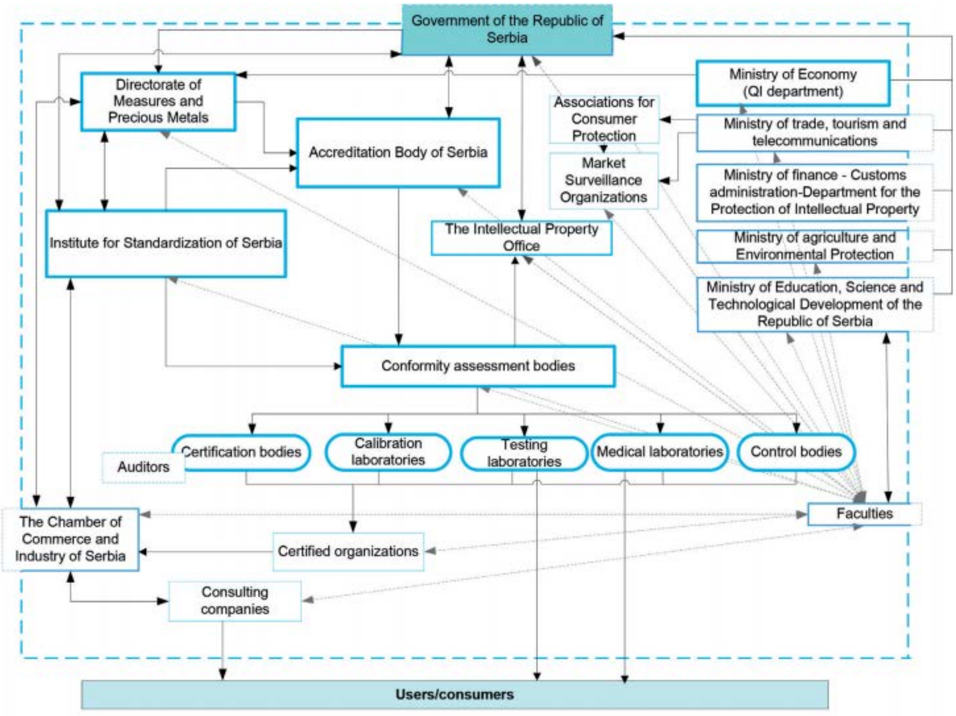

Figure 1: Quality infrastructure institutions in Serbia

Dramatic and drastic changes in social circumstances and the tempting idea of European integration provided an appropriate setting for higher education reforms in Serbia [12]. The majority of countries have developed an entire industry of higher education with the strong influence of quality initiatives through the national and professional accreditation shemes, as part of the national quality infrastructure (NQI) and more specifically of the educational quality assurance process regarding the ways to meet the needs of different stakeholders and interested parties [13]. Higher education institutions represent an important link in improving and building the NQI [14] and academic community must quest after an innovative way of connection between higher education institutions and the community, predominantly through the modernization of curricula [15]. Moreover, the idea of institutions of higher education working on producing quality management experts is paramount [16] and crucial for the success of NQI policy-making. Although universities may not be the cause of many of our current problems, they may contribute to them, especially through the production of knowledge and education [17], quoted by Ferrer-Balas [18].

Ruso et al. [14] noticed that the QI issues are incorporated in curricula of many universities in Serbia and the results show that the courses with QI contents are present at a number of engineering departments and at some humanities, but still lacking at humanistic departments. The subjects of analysis were the titles and descriptions of 307 syllabi from 19 public faculties (four universities) including only undergraduate courses. One of the selection criteria for public faculties were accredited courses with the rationale that accredited courses provide that higher education institutions satisfy specific standards of educational quality. By using keywords, three categories were selected and Ruso et al. [14] classified faculties on whose subjects:

a) directly indicate QI elements such as metrology, standardization, quality and accreditation;
b) shape perception about QI as they provide enough knowledge to understand and manage problems related to the topic; and
c) provide basic knowledge of the issue at an introductory level. However, the lack of the study was that the results were methodology dependent and keywords did not allow them to penetrate the subjects’ content more deeply.

3. HIGHER EDUCATION ABOUT THE QUALITY INFRASTRUCTURE - THE CASE OF SERBIA

The University of Belgrade is a state university with the tradition over 200 years. Its main activities in the fields of higher education and scientific research are activities of public interest, and they are strictly carried out by legal regulations. Faculties of the University are separate legal entity, i.e. they have their own management bodies, whose responsibilities are regulated by the Law on Universities, as well as business and financial independence from the University [19]. On the other hand, it is within the University's authority to set the faculty as a parent institution in organizing undergraduate, graduate and doctoral studies and awarding doctorates.

The University of Belgrade consists of 31 faculties grouped in 4 scientific fields: social sciences and humanities, medical sciences, sciences and mathematics and technology and engineering sciences. The Faculty of Organizational Sciences is in a group of Faculties of Technology and Engineering Sciences. Within University there are also 11 scientific research Institutes which carry out fundamental, developmental and applied research in natural, technical, technological, biological, environmental, physics, and social science.

The Faculty of Organizational Sciences (FOS) was founded in 1969, as a response for initiative from a large number of companies, with the aim to develop potentials of domestic economy and society [20]. The FOS, as a higher education institution, is a part of the University of Belgrade. It deals with education, scientific research, and consultancy through the development of knowledge and skills among students in the field of organizational sciences, management, and informational systems and technologies. Faculty today has over 3600 students on 18 different study programs on undergraduate, graduate and postgraduate level of studies.

The Quality Management and Standardization Program is a specialization on the Bachelor studies in Management and Organization Program of Faculty of Organizational Sciences. The Program was established in 1997, by Professor Zivko Mitrovic who was at that time a pioneer in introducing quality management initiatives in former Yugoslavia. Since the establishment of bachelor program, through the Program 15 courses regarding quality management and standardization at the undergraduate level of studies were developed. The courses are aimed at educating engineers demanded on the labor market who have knowledge of standardization and standards, quality management systems, and quality tools and methods in practice.

The Program consists of 45 courses regarding organizational and management science, with emphasis on quality management and standardization. Figure 2 represents 15 specialised courses related to quality management and standardization. Also, in Figure 2 are given standards with requirements for management systems that are reviewed and studied in several courses. The remaining courses on Program are listed in tables below (see Table 2 and Table 2). When we talk about education about standardization course Standardization 1 could be recognized as the linkage between courses in the field of quality management and standardization (see Figure 2).

The course Standardization 1 is intended for use at bachelor level of business studies with aim to provide students with deeper understanding of the basics of standardization and a broader picture of different mechanizams for standards development, significance and affiliation of roles and relationships among organizations for standardization. The teaching material is provided in textbook with 14 teaching case studies [26]. The content of the course Standardization 1 is devided in 10 teaching units whic are base for active work on clasess (one units needs 6-8 classes with class discussion, role play workshops, solving teaching case studies), class asignmenets (teams case study competions) with the aim to develop critical thinking among students.The ten teaching units of course Standardization 1 are:

1. Importance of standards and standardization for business
2. Standardization and standards – definitions
3. Types of standardization and classifications of standards
4. Importance and benefits of standards implementation
5. History of standardization
6. Organizations for standardization
7. Standardization Systems (EU, U.S., Russian Federation and PR China)
8. Consortia based standardization
9. Company standardization

10. Legal aspects of standardization

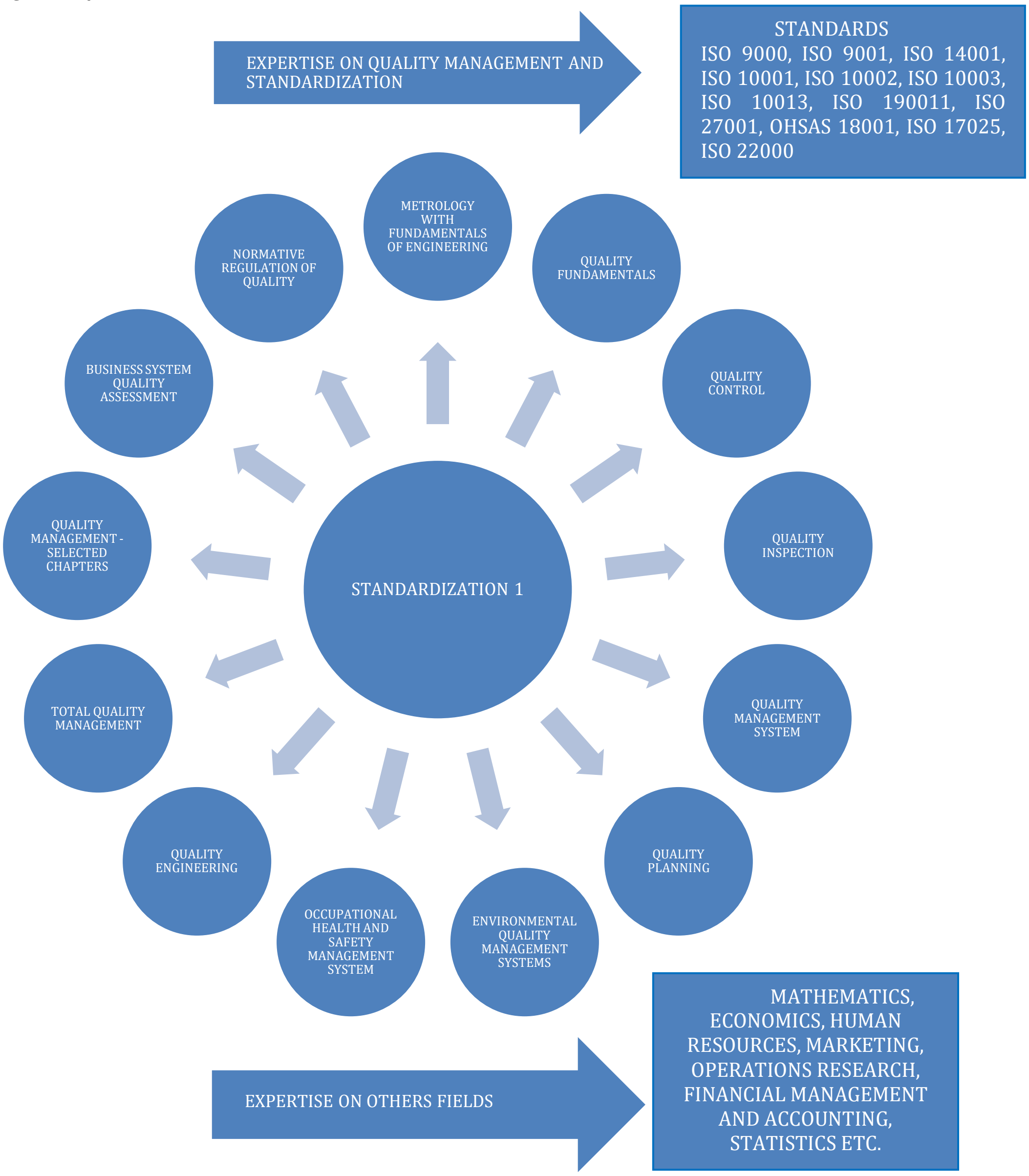

Figure 2: Quality Management and Standardization Program

Figure 2 represents courses and expected given expertise in the field of quality management and standardization and others such as mathematics, economics, human resources etc. The main aim of the Program is to develop students' skills and knowledge about organizational and management science, and role of standardization, standards and management systems in business. Through the courses, students acquire competencies and knowledge to understand and implement requirements regarding management systems given in standards such as ISO 9001, ISO 14001, OHSAS 18 001 etc. Accordingly, they have the ability to understand the importance, purposes, and benefits of quality infrastructure at national, regional and international level. Quality infrastructure encompasses standardization, metrology, accreditation and conformity assessment processes necessary to provide that products and services meet defined requirements.

In the tables below are listed courses of Quality Management and Standardization Program (see Table1, Table 2, and Table 3). In Table 1 are given 15 courses regarding quality management and standardization. Table 2 comprises 26 courses regarding, in global, areas of economics, human resources management, operations research, information systems, marketing, finance and accounting, and organizational and management science. In Table 3 are listed elective courses.

Table 1 Courses in the field of Quality Management and Standardization (on second, third and fourth year)

No	Course	Year of study
1	Quality Fundamentals	2
2	Quality Control	2
3	Standardization 1	3
4	Quality inspection	3
5	Metrology with fundamentals of engineering	3
6	Quality management system	3
7	Quality planning	3
8	Documents management	3
9	Normative regulation of quality	3
10	Environmental quality management systems	4
11	Occupational health and safety management system	4
12	Quality engineering	4
13	Total quality management or Risk and reliability analysis	4
14	Quality management - selected chapters 1	4
15	Business system quality assessment	4

In Table 1 are listed courses regarding quality management systems and standardization on the second, third and fourth year of study. On the second year, Program consists of two courses with the objective to enable students to understand basic concepts and terminology of quality management and to establish a basis for dealing with forthcoming courses. On the third year, there are seven courses dealing with concepts and methods regarding quality management systems, standardization, and standards. These courses deal with knowledge about: standardization in business; quality inspection methods and techniques; metrology on the levels of understanding basic technical and organizational aspects of metrology; concepts and terminology of quality and understanding its place and role in the management of the organization, and understand requirements for management system given in standards and design solutions to meet that requirements; quality planning on the levels of understanding, and application of the methods, techniques and concepts for quality planning; principles, rules, and methods of document management and design of business processes and supporting documentation; and procedure and the necessary conditions for companies to obtain the CE mark, or mark for its product. Fourth year of study consists of six courses that provide: knowledge of environmental management systems, mastering the skills and strategies for their implementation; basis for addressing the problems of health and safety at work, through the study of the corresponding system, introducing the national Law and the EU Directives on occupational safety and health, implementing regulations, and review of standards for management systems that apply in this area; knowledge about quality engineering; competence for quality management know – how for various industries, with application and integration of quality tools and methods in practice; basic knowledge about reliability theory and possibilities of its application and achievements in solving practical engineering and management problems, methods and approaches for practical reliability and risk assessment in technical systems.

Table 2 Remaining courses on Program (on first, second, third and fourth year)

No	Course	Year of study
1	Mathematics 1	1
2	Economics	1
3	Management	1
4	Fundamentals of Information and communication technologies	1
5	Sociology	1
6	English language of profession/French language of profession 1	1
7	Psychology	1
8	Mathematics 2	1
9	Organizational theory	1

10	Production systems	1
11	Introduction to Information systems	1
12	Human resources management	2
13	Process engineering	2
14	Marketing	2
15	Probability theory	2
16	English language of profession 2 or French language of profession 2	2
17	Financial management and accounting	2
18	Statistics	2
19	Management of technology and development	2
20	Fundamentals of Industrial engineering	2
21	Operations research 1	3
22	Logistics or Business economics and planning	3
23	Decision-making theory	3
24	Operations research 2	3
25	Project management or Business Information systems	4
26	Organizational design or Production systems design	4
27	Elective course – 1	4
28	Elective course – 2	4
29	Internship	4
30	Final paper	4

There are 26 remaining courses on Program, except elective courses, internship, and final paper, which are the crucial background for acquiring knowledge and developing skills and competencies for engineers in organizational and management science. The main competencies that these courses develop among students are in the field of economics, human resources management, operations research, information systems, marketing, finance and accounting and organizational and management science. All of these competencies are valuable for educating good quality management system engineer and standardization engineer by demands on the labor market. The elective courses are listed in Table below (see Table 3).

Table 3 Elective courses (fourth year)

No	Course
1	Quality management – selected chapters 2
2	Quality management – selected chapters 3
3	Quality management – selected chapters 4
4	Accreditation and certification
5	English language of profession 3
6	French language of profession 3
7	Group dynamics and interpersonal relations
8	Statistical inference
9	Maintenance management
10	Project management software support

The elective courses, listed in Table 3, cover foreign language knowledge and acquiring competence such as statistical data analysis and master software tools for project management, and also courses regarding quality management and standardization. Especially, on Accreditation and certification course students acquire a sufficient amount of knowledge and information on accreditation and certification, as well as on competence of accredited bodies performing conformity assessment of laboratories, inspection and certification bodies. Courses Quality management – selected chapters 2, 3 and 4 cover the fields regarding knowledge about quantitative methods and techniques of quality management, such as Six Sigma, DMAIC model and FMEA, on the levels of understanding and application; concepts and terminology of food safety management system, and requirements given in standard ISO 22000, regarding that management system.

Gain from the Program:

- Ability to understand basic quality management concepts, advantages, and shortcomings in the application of these concepts.
- Ability to implement the principles and approaches of quality management in practice in specific organizational systems.
- Ability to understand the importance, purposes, and benefits of standardization and standards; and roles and complex relationships among organizations for standardization in business.
- Competencies to analyze, design, and implement a documentmanagement system, as well as managing documents.
- Knowledge about the scope of the European regulatory environment and understanding of the mechanisms/processes of their interconnectedness.
- Ability to solve problems related to design and implementation of quality control and inspection activities in organizational systems.
- Ability to understand the importance, purposes, and benefits of metrology and metrology infrastructure at national, regional and international level.
- Ability to understand the requirements for a quality management system and its place in the integrated management system; ability to design solutions to meet the requirements for a quality management system; ability to draft basic documents necessary for the establishment of quality management systems.
- Acquiring knowledge about quality planning on the levels of understanding, and application of the methods, techniques, and concepts for quality planning.
- Acquiring knowledge about the systems of environmental quality, as well as management strategies and management skills for the implementation of results of the environmental science into practice to ensure the management and protection of environmental quality and the implementation of sustainable development strategies.
- Competence to understand the importance, purposes, benefits, and limitations of different concepts of quality engineering as well as be able to adequately.
- Ability to develop and work in standardized management systems.
- Acquiring skills to solve quality-related problems and issues.
- Basic knowledge about reliability theory and possibilities of its application and achievements in solving practicalengineering and management problems, methods and approaches for practical reliability and risk assessment in technical systems.

When it comes to the career opportunities, the value of our Program is noticeable in the successful careers of our graduates. The Program gives valuable preparation for work in consulting and in corporations on managerial positions. Recent graduates have build careers in consultancy, automobile industry, food industry, IT and information systems, logistics, marketing and CSR, the financial sector, the pharmaceutical sector etc.

4.CONCLUSIONS

The aim of this paper is to raise awareness in how higher education has an important role in QI processes. The paper also describes the QI in Republic of Serbia and program of Department of Quality management and Standardization, at The Faculty of Organizational Sciences, University of Belgrade. The Program consists of 15/45 courses regarding quality management and standardization, which includes standards with requirements for management systems that are reviewed and studied in several courses (e.g. ISO 9000, ISO 9001, ISO 14001, ISO 10001, ISO 10002, ISO 10003, ISO 10013, ISO 190011, ISO 27001, OHSAS 18001, ISO 17025, ISO 22000). Not only knowledge, but skills are also highly emphasized and developed within the Program. There are so many gains from it, such as an ability to understand standardization and related disciplines and quality management concepts, ability to implement the principles and approaches of quality management in practice in specific organizational systems, as well as ability to understand and implement processes related to other described QI aspects. Generally, it can be concluded that the accredited courses provide that higher education institutions satisfy specific standards of educational quality [25].

Standardization can be found in any process when companies require a consistent level of quality. Standards are everywhere and form the basis for the introduction of new technologies and innovations, and ensure that products, components, and services supplied by different companies will be mutually compatible [21]. “Standards are a significant factor in who wins and who loses in the global marketplace” [22]. Standards also disseminate knowledge in industries, so it is seen as cooperation among industry, consumers, public authorities, researchers and other interested parties[21]. So, the role of higher education is extremely important when it comes to the standardization development, taking into the consideration such unbreakable interaction between markets’ and quality infrastructure’s elements. Regulators and governments count on standards to develop better technical regulation, knowing that they have a sound basis thanks to the involvement of globally-established experts [23]. Related disciplines e.g. certification, accreditation, metrology also should not be neglected and need to find their places in education for quality infrastructure. Aiming at pointing out the role of higher education in quality infrastructure, this paper discusses needs of quality infrastructure related to higher education in Serbia.

In line with this, the quality infrastructure in Serbia is described in the paper. As an institutional framework, quality infrastructure refers to standardization, metrology, accreditation and conformity assessment processes necessary to provide that products and services meet defined requirements. It can be concluded, that the benefits of multiple connections among higher education institutions within institutions of QI in Serbia are still not explored in full capacity. Some of benefits are obvious, e.g. faculties educate people in the QI field who will be employed in other relevant institutions, the mobility of students, experts and lecturers should be encouraged, and QI experts can be engaged in teaching as well. Collaboration on common QI national and international projects in both research and education is just another one benefit in a row when it comes to the QI institutional networking in Serbia.

It can also be concluded that higher education institutions need to be permanently involved in the QI processes. Education in the QI field is a basic prerequisite for the successful building and improvement of the QI. High education could make an important contribution to quality infrastructure in each its part, especially through the transfer of knowledge and skills. Thus, raising awareness of the importance of higher education in the QI field could significantly contribute to the development of this area.

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Analysis and Structure of the Regulatory Framework of Market Surveillance in Bulgaria

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ABSTRACT

The legislation of European Union allows each Member State to organize market surveillance (MS) in the most appropriate way according to its governance. This article presents analysis and scope of work of institution carrying out MS in Bulgaria. A functional structure of Bulgarian MS authority is presented. The results of analysis may serve for developing a database. The database would include Bulgarian MS authorities, the relevant legislation acts, the product categories under the scope of these acts.

Key Words: Market surveillance, Bulgaria, European legislation.

1. INTRODUCTION

Regulation (EC) No 765/2008 is the European legislative act defining a framework for MS and a framework for controlling products, imported from third countries. Article 16 of the Regulation allows the Member States to organize and adapt their market surveillance in a manner accordingly with their administrative structures. Therefore, the competences and powers of market surveillance authorities (MSAs) in the Member States will differ. The model of market surveillance in Bulgaria is centralized, i.e. the activities are carried out by one or more bodies [1]. Market surveillance activities in Bulgaria are provided by 8 MSAs, which are secondary budget spenders of different ministries. The Customs Agency controls products imported from third countries. When there is more than one authority in the Member State, responsible for market surveillance and control at the external borders, then they are obliged to cooperate (Article 18 (1) and Article 27 (2) of Regulation (EC) No 765/2008) [2]. The Council of Ministers in Bulgaria establishes a Coordination and Information Exchange Council between the authorities controlling the commodity market by Government decree No 180 of the Council of Ministers of 1.08.2005 [3]. The main functions and tasks of the Council are: it plans joint inspections between MSAs and other authorities in accordance with their competence; set up expert working groups within the council; approve a national market surveillance program for the calendar year; reviewing and evaluating of the implementation of market surveillance activities which is sent to the European Commission and other Member States, and so on.

2. REGULATORY FRAMEWORK OF MARKET SURVEILLANCE IN BULGARIA

2.1. National authorities for market surveillance

State Agency for Metrology and Technical Surveillance (SAMTS) is a legal entity on the budget support. The President of SAMTS is a secondary order with budget by the budget of the Ministry of Economy [4]. The Agency consists of general directorates (DGs) and directorates (Ds) organized in general and specialized administration. The specialized administration is set up with 5 DGs and one D. Direct attitude to market surveillance on products have the following DGs.

DG Metrology Supervision - main activities:

- monitoring of the use of measuring units in accordance with Act on Measures and legislation for its implementation;
- market surveillance on measuring instruments placed on the market and / or in use for which there are essential requirements
- organize and conduct the activities of authorization of persons for verification of measuring instruments and etc.

Main sectors where it works: Means of measurement

DG Market Surveillance - main activities:

- performs checks of the products placed on the market and / or in operation, except for measuring instruments and high-risk equipment;
- controls for compliance with the requirements for correct and safe technical operation and maintenance of the built-in elements, filtration and swimming pool pumps;
- market surveillance to products in main sectors of work*.

*Main sectors where it works: machinery, radio equipment, toys, personal protective equipment, construction products, outdoor work equipment for noise, electrical equipment designed for use within certain voltage limits, EMC equipment, explosives for civil use, simple pressure vessels, pressure equipment, recreational crafts, pyrotechnical articles, gas appliances, transportable pressure equipment.

DG Technical Inspection - main activities:

- register and issue certificates to persons for performing the activities related to maintenance, repair and reconstruction of high-risk equipment;
- licensing persons for carrying out of technical Inspection of high-risk equipment;
- carries out technical inspections, checks and tests of high-risk equipment, as well as inspections at the enterprises, buildings and other sites where the equipment is manufactured, installed, maintained, repaired and used, for its compliance with the provisions of the law;

Main sectors where it works: High-risk equipment - boilers, pressure vessels, steam and hot water pipelines, gas installations, pipelines and installations for liquefied hydrocarbon gases, transmission and distribution of gas pipelines, equipment, installations and appliances for natural gas, acetylene installations, oil pipelines, lifts, lifting equipment, cableways and ski lifts.

DG Quality control of liquid fuels- main activities:

- Monitoring and control of liquid fuels for which quality requirements are established; performing actions on ascertaining the liquid fuels’ compliance with the quality requirements by carrying out checks of the persons which place or import liquid fuels on the market, distribute, transport, store or use liquid fuels and etc. [5].

Main sectors where it works: liquid fuels.

The Consumer Protection Commission (CPC) is a state commission to the Minister of Economy. The CPC is a legal entity of budget support with headquarters in Sofia and with regional units on the territory of the country. The President of the Commission is a secondary order with budget by the budget of the Ministry of Economy [6]. It consists of DGs and D, organized in general and specialized administrations. Specialized Administration is set up with 2 D. D “Market Surveillance” is responsible for market surveillance to product. The regional directorates of the DG “Market Control” carries out checks for complying with the requirements of the regulatory acts in the following sectors: goods for children that are not toys, textiles, leather goods, lighters, motor vehicles, food imitation products, aerosol packaging, batteries and accumulators and waste batteries, packaging and packaging waste, household appliances and etc.

Directorate for National Construction Supervision (DNCS) is a secondary order with budget to the Minister of Regional Development and Public. The DNCS controlling the compliances with Spatial Planning Act (APS) and the normative acts for its implementation. The controlling is in the design and construction, including the incorporation of quality construction materials and articles in order to ensure the security, safety, accessibility and other normative requirements for the construction works. DNCS is a legal entity with headquarters in Sofia. It is headed and represented by a chief. The chief has the right to prohibit the incorporation of construction products which are not assessed for compliance with the contraction works essential requirements [7]. DNSC is responsible for supervises building products that cannot be stored and / or delivered directly to the construction site.

Regional Directorates of Agriculture are 28, they are specialized territorial administrations to the Minister of Agriculture and Food. The administrative units in the directorates are divided into general and specialized administration. Attitude to market surveillance have the specialized DG “Agrarian Development”. DG Agrarian Development carries out control over the:

- technical state and the safety of the equipment described in the main sectors *;
- the registration of the technique;

- the impact of the technique on the environment;
- the availability of valid certificates of conformity
- reviews of the registered technique;
- the placing on the market, registration or placing into service of new wheeled tractors, track-laying tractors, trailers and interchangeable towed machinery, systems, components and separate technical units and etc. [8].

Before year 2016, these activities were carried out by the Control and technical Inspectorate.

*Main sectors where it works: agricultural and forestry vehicles.

Regulatory framework:

Law on Registration and Control of Agricultural and Forestry Equipment;

Ordinance No 7 of 28 December 2017 on the procedure for approval of the type of agricultural and forestry vehicles, systems, components and separate technical units for them;

Ordinance for amending and supplementing on Ordinance No 30 of 29 December 2005 on approval of type of new wheeled and chain tractors, their trailers and interchangeable towed machinery;

Regulation (EU) No 167/2013.

Regional Health Inspection (RHI) implements state health policy on the territory of the respective area. The RHI is a legal entity on budget support - a secondary order with budget by the budget of the Ministry of Health. RHI is structured in general and specialized administration. The specialized administration includes three Ds as a relation to product market surveillance have D "Health Control". It controls chemicals, detergents and biocides.

The Minister of Health implement control over the activities of RHIs.

Main sectors where RHIs work: chemical substances and preparations products, cosmetics, detergents, biocidal products.

Bulgarian Drug Agency (BDA) is a legal entity with budget support, headquartered in Sofia. The Executive Director is a secondary order with budget by the budget of the Minister of Health. The Agency coordinates its activities with RHIs in the field of control of medicinal products and controls under the scope of Law for blood, blood donation and blood transfusion [9]. BDA is an administration to the Minister of Health, whose competencies, functions and activities are written in three laws:

Law on medicinal products in human medicine, The Medical devices act, and the Law for blood, blood donation and blood transfusion. BDA is MSA of the quality, effectiveness and safety of medicines and medical devices according to the firs two laws. The agency is organized in a general and specialized administration. The specialized administration consists 6 D. Responsible D for market surveillance is "Market surveillance and inspection".

Regional inspectorates of environment and waters (RIEW) are administrative structures to the Minister of Environment and Waters. RIEWs are legal entities under the budget support to the Minister of Environment and Water. The activity of the RIEWs are coordinated by the D "Environment Policies" at the Ministry of Environment and Waters [10]. In carrying out of the functions under the current and subsequent control, RIEWs shall carry out inspections and observations of:
- waste management with regard to those who place on the market products after which widespread waste is generated;
- management of chemicals hazardous and mixtures with regard to the requirements for dangerous substances which are subject to export notification and / or restriction to the production;
- protection of the air with regard to the placing on the market and / or put into service of paints, varnishes and auto retreated products; placing on the market or put into service of substances which deplete the ozone layer or of the fluorinated gases as well as products and equipment containing, using or produced from these substances.

Main sectors where RIEW works: wastes, substances that deplete the ozone layer, some paints and varnishes, and others.

National Plant Protection Service (NPPC) is a legal entity with a head office in Sofia. NPPC is a secondary order with budget by the budget of the Minister of Agriculture and Food. The administrative structure of NPPC includes general and specialized administration. The specialized administration consists of DG Plant Protection, which control and manage the Regional Plant Protection Services. The Inspectorate of the Ministry of Agriculture and Food controls the activities of the NPPC.

The NPPC carries out the activities related to:

- control of plant protection products (PPPs), the testing, authorization, import, production, marketing and use, with aim protection of life and health of humans and animals and protection of the environment;
- control of fertilizers for compliance with indicators declared by producers.

Main sectors where NPPC works: fertilizers, plant protection products.

In Figure 1 is presented a diagram of the institutions, responsible for the MS in Bulgaria.

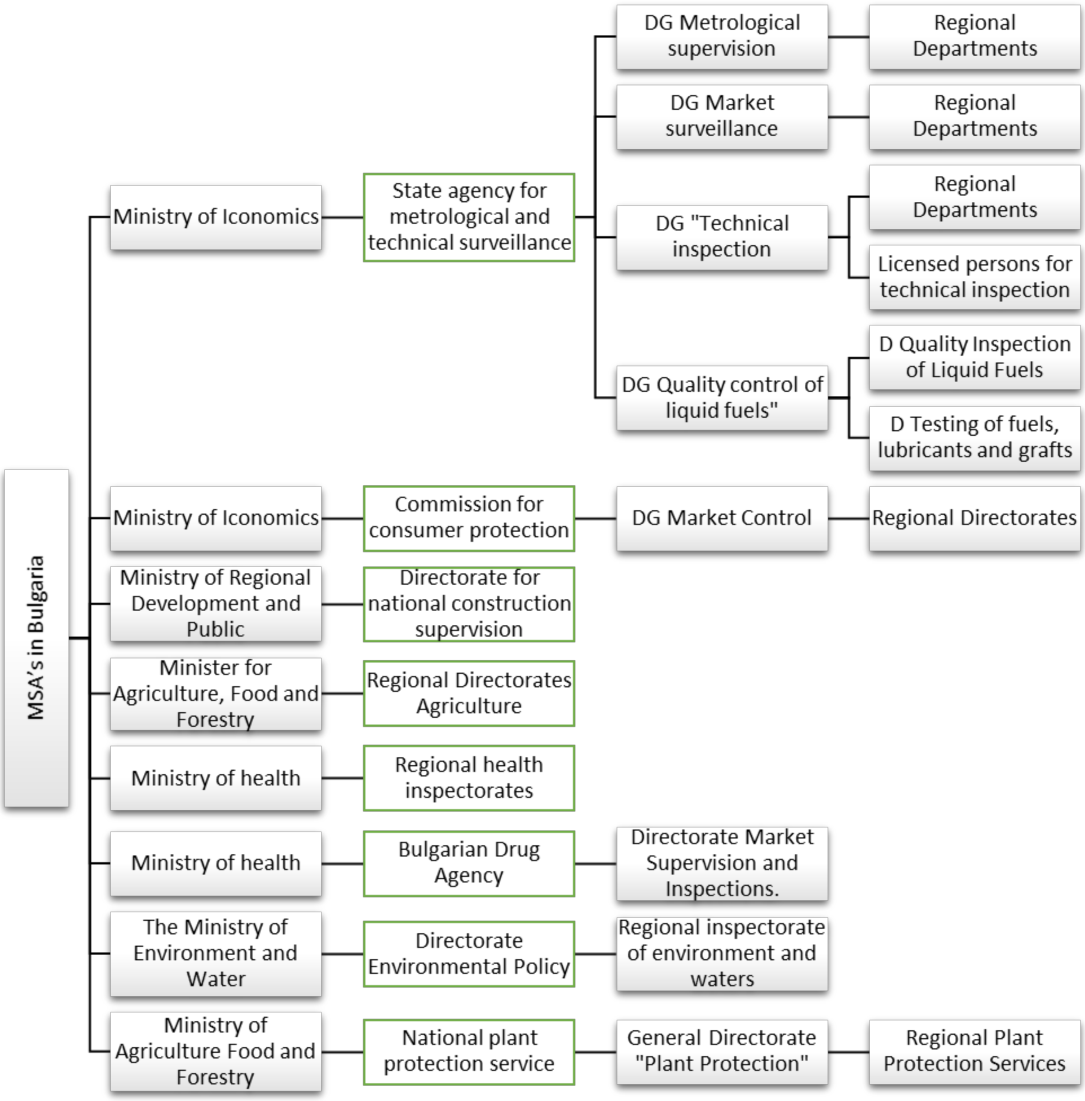

Figure 1: Structure of the regulatory framework of Market Surveillance in Bulgaria

3. STRUCTURE OF REGULATORY FRAMEWORK OF MARKET SURVEILLANCE IN BULGARIA

National legislation about Market Surveillance to products is composed of multiple regulatory acts. Presenting them in an orderly manner reduces the search time of the legislative act and the responsible MSA. Structure of the Bulgarian regulatory framework for market surveillance of products is created (Figure 2) according to the analysis above. It can serve to create a database by which to make different requests for information.

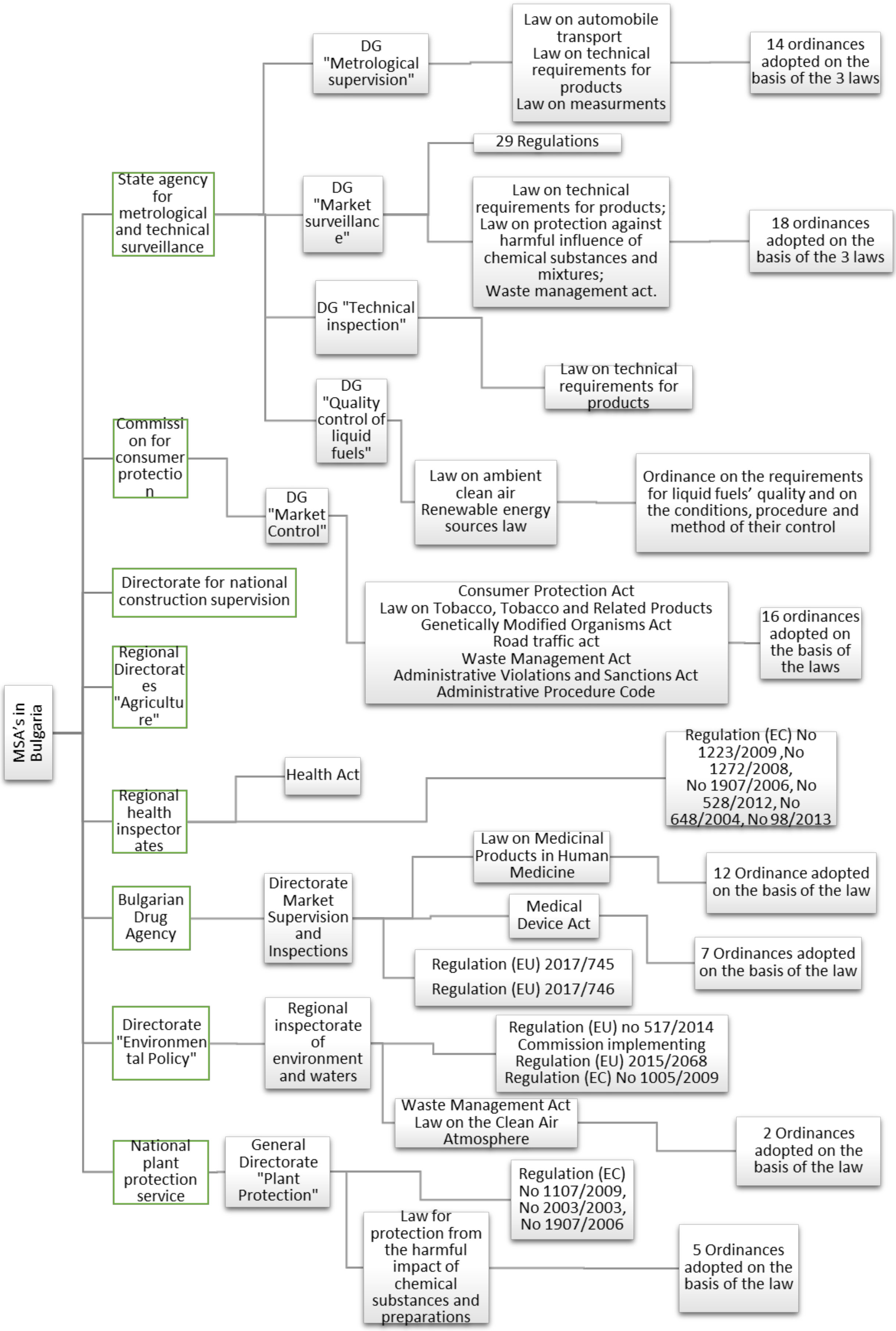

Figure 2: Structure of regulatory framework of Market Surveillance in Bulgaria

4. CONCLUSION

The big legislative nomenclature puts stakeholders in front of a number of trials when implementing legislative acts. The presented analysis and structure of the Bulgarian legislation for market surveillance will enable to the interested economic operators quickly and easily to orientate themselves in the implementation of the normative acts. The analysis and the proposed structure of the regulatory framework like this consisting of MSAs and the applicable product legislation give grounds for further development of a database of different types of products and supervisory MSAs.

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Underground Settlements and Their Bioclimatic Conditions; Santorini/Greece

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ABSTRACT

Bioclimatic design approaches are the origin of today’s sustainable architecture. Using bioclimatic design criteria from urban scale to single building scale make prior cultures settlements and buildings environmentally friendly, ecological, with regard of indoor comfort conditions climate-compatible and energy-efficient. Especially underground settlements are the basic of bioclimatic architecture at the point of organizing the space, forming and creating the interior comfort conditions. Santorini Island is a qualified example for observing bioclimatic architectural conditions with the original volcanic structure and underground dwelling formations. Following a general literature review of underground settlements in the by means of drawings and visuals in space organization, formation (carving), shell formation (covering), daylight and ventilation. Today, bıoclimatic architectural criteria are defined on the samples used as dwellings and bioclimatic references are determined for new constructions.

Key Words: Underground settlements, Underground dwellings, Bioclimatic architecture, Santorini

1. INTRODUCTION

The idea of bioclimatic architecture is closely related to the proper adjustment of the building to climate. That is also one of the characteristics of vernacular building, based on the traditional ways of adopting architecture to the specific climatic conditions. Vernacular architecture is directly linked to the available resources that influence building techniques [1], [2]. Bioclimatic architecture has a connection to nature, as building design take into account climate and environmental conditions to help achieve optimal thermal comfort inside. It deals with design and architectural elements, avoiding complete dependence on mechanical systems, which are regarded as support [3]. A good example of this is using earth potential. Especially underground dwellings and settlements are the basic of the bioclimatic architecture at the point of organizing the space, negative forming and creating thermal comfort conditions indoor.

2. UNDERGROUND SETTLEMENTS AND DWELLINGS

The most representative example of primitive shelter are caves, where mankind sought protection from the severe weather conditions; precipitations, wind, cold, excessive sunlight, high temperature changes, floods etc. it is also known that underground settlements are built for security purposes. Whatever the purpose, the main factor that makes these living spaces, which are constructed on the negative space is the morphological character of the soil. The digging of the land in the accessible nature makes it possible to find the space and the settlements easily. Because of this feature underground architecture normally differs from other ordinarily types (positive spaces) of habitats. Because it is the fact that they provide underground spaces and provide viable voids, in fact they are carved areas [4] and this carving process (description of space) can be continued up or down, right, left, organic or geometric as desired depending on the morphology of the soil. there is a natural expansion, multiplication and flexibility of transformation.

Undergrounds settlements and dwellings are used in our civilizations for thousands of years, examples of this can be found in the city of Derinkuyu-Cappadocia in Turkey [Fig. 1] or the Sassi of Matera in Italy [Fig. 2] and Santorini in Greece [Fig. 3].

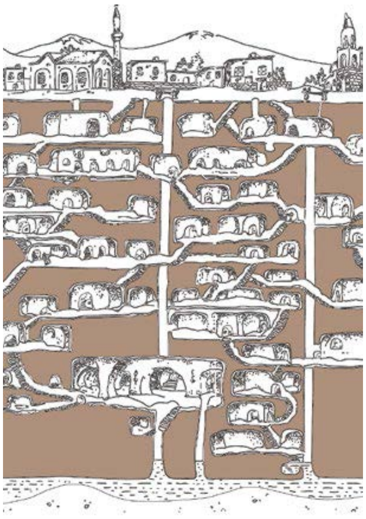

Figure 1: Underground Settlement of Derinkuyu-Cappodocia-Turkey [5]

Figure 2: Underground Dwellings of Sassi-Matare-Italy [6]

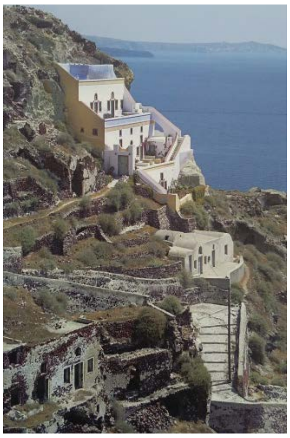

Figure 3: Underground Dwellings of Oia-Santorini Island-Greece [7]

Underground or cave, simple or complex, coupled with above-ground buildings or without them, such spaces have been used for burial and storage, water reservoirs and ice production, industrial activities such as oil pressed and wineries, refuge and dwelling. Their use and occupation in some areas has been almost continuous from prehistory to day [8].

2.1 Basic Types of Underground Dwellings

Underground dwellings and functional spaces (as opposed to nature caves) carry different names and characterizations depending on their specified type and form (subterranean, underground, cave, earth bermed, earth integrated, and earth covered). But they all share one thing in common-they are coupled with the ground in some way, having at least part of their roof under a layer of soil [8]. Historically, underground dwellings can be grouped according to their features in three main general types of solutions (A, B, C) [4], [9];

A- **Cliff cave spaces**, built into the sides of cliffs
B- **Pit cave dwellings**, normaly built on flat land with pit areas open to the sky (in other words Atrium types)
C- **Mix dwellings**, constructed either above ground or thanks to semi- subterranean solution, using cliff and/or pit cave dwelling (in other words Elevational/Facade types)
D- **Hybrid solution**, thanks to earth covered structure [Fig. 4] (in other words Bermed types).

Whatever the type, there are disadvantages that limit design, as well as the advantages that underground settlements provide for space organization and bioclimatic comfort conditions.

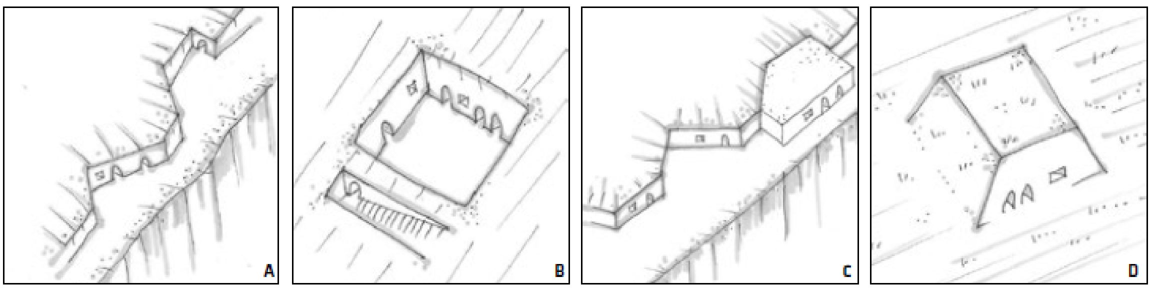

Figure 4: Basic Types of Underground Dwellings (Drawings, V. Crisrini) [4]

2.2. Bioclimatic Advantages and Disadvantages of Underground Dwellings

It is a technique that has been used since ancient times to settle under the earth to be protected from harsh weather conditions. The fact that earth temperature of the subsurface is lower than the ambient air temperature in summer and higher than in winter. This is due to the soil thermal properties which can be applied as a heat capacitor for moderating indoor temperatures [9], [Fig. 5]. Whatever climate it is, this is a great advantage for ensuring thermal comfort indoor.

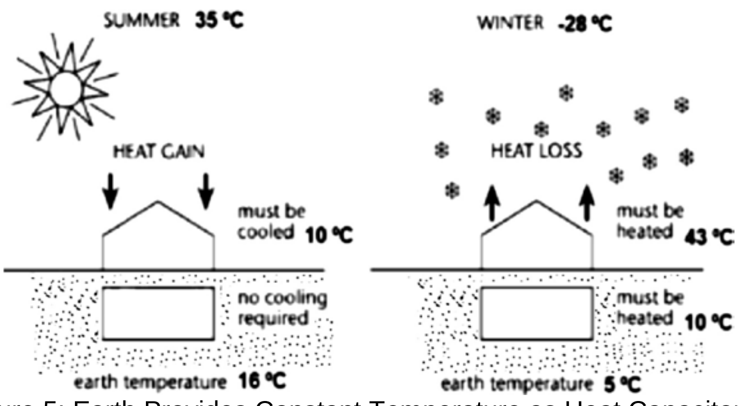

Figure 5: Earth Provides Constant Temperature as Heat Capacitor [9]

Especially in underground settlements and dwellings located in hot-dry climates, the earth was used for cooling rather than heating [10]. The wide application of underground dwellings in hot-dry regions could result from the fact that more than % 30 of the world’s land mass (about 4, 7 million km^2) is situated in hot-dry climate (i.e. between 15^o and 35 ^{o} respectively north and south of the equator) and only %12 of the zones are situated in the temperate climate (about 1, 55 million km2) [10], [11].

Underground dwellings or settlements also have other advantages [10], [11];

- Little disturbance of the surrounding environment and more effective land development,

- Lower building maintenance cost (smaller surface area of exposed building envelopes),
- Better noise and vibration daming (earth dampens well the amplitude of acoustic waves),
- By definition they are less exposed to weather conditions,
- Often are architectonically very interesting,
- Can be enlarged as desired (in negative space),
- And most importantly reduce the energy consumed to heating or cooling.

On the other hand, underground settlements or dwellings have disadvantages in terms of humidity, ventilation, sunlight and water proofing. The important disadvantages is the possible "lack of active or passive ventilation"; usally caused by the unsuitable desing of chimneys, cooridors, vertical shafts and constructive options for air circulation [4]. Another disadvantage is "lack of outside views or limited outside views". This situations firstly creates a lighting problem indoor spaces from bioclimatic conditions. In parallel, it creates adverse psychological effect on the user. Because the surface of the undergrond dwellings opened to the outside are small or limited.

Humidity and water proofing are other interrelated issues for underground dwellings. Especially when ventilation is not sufficient, insulation and water control can not be achieved, indoor relative humidity problems arise [10], [4]. General advantages and disadvantages of underground settlements are briefly summarized in Table 1. In table 2, bıoclimatic conditions of underground dwellings types are evaluated.

Table 1. Advantages and Disadvantages of Underground Dwellings [10]

Advantages	Disadvantages
• Thermal efficiency • Minimal visual impact • Increased open space • Lower noise • Reduced mainterance and operating cost • Safer living environment	• Public acceptance • Lack of outside views • Lack of thermal performance data • Higher excavations and structural cost • Water draginage • Ventilation

Table 2. Bioclimatic Factor of Different Typology of Underground Dwellings [9]

Bioclimatic Factor	**A (cliff cave dwellings) C (mix or elevational type) D (hybrid or bermed type)**	**B (pit cave or atrium)**
Passive solar potential	Excellent	Less effective
Thermal stability	Less effective	Excellent
Natural lighting potential	Excellent	Less effective
Wind protection	Less effective	Excellent
Noise protection	Less effective	Excellent
Visual convenience	Excellent	Poor
Appropriate climate	Effective for temperate	Effective for dry zone

3. UNDERGROUND DWELLINGS IN SANTORINI

The topographic structure and soil diversity of Santorini, the largest marine criterion in the world, has created numerous volcanic eruptions. Due to this structure, geomorphological character and climate conditions are different from other Aegean islands [Fig. 6].

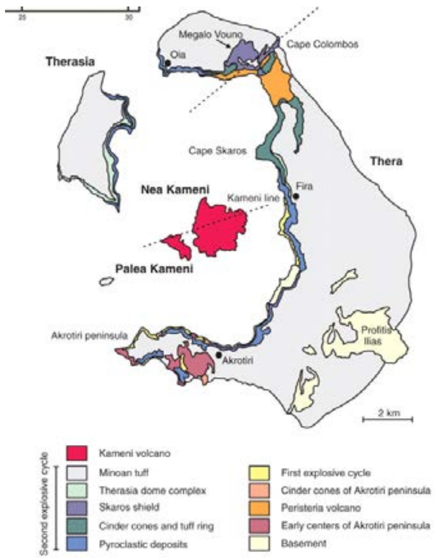

Figure 6: Map of The Santorini Islands Group Formed by Volcanic Eruptions [12]

Santorini, also known as Thira (Fira), is located on the southern most border of Greece's Kiklad islands group. In the island group of 73 km^2 surface area Thira and Thirassia are also living. With its 13 settlements, Santorini has an important place in the world tourism industry with traditional underground architecture typical of the island, natural beauty with volcanic character, blue flagged seas and underwater riches [13]. The need to protect the volcanic land from carved character, climatic conditions and pirate attacks ensured the formation of underground settlements throughout the island [15]. In Santorini also forms cave houses at the base of traditional architecture. There are cave houses of about 1000 years in the island [14], [Fig. 7].

Figure 7: Cave Dwelling in Santorini [13]

3.1. Climatic Conditions in Santorini

Santorini, with its intense sun, high humidity, harsh winds and low precipitation, is one of the two names that show the Mediterranean climate [15] and the desert climate (hot-dry) in the Aegean [16]. Santorini is a rich in sunshine and as poor in water. Average annual temperature is 22 C^o. The hottest month is July and the coldest month is January. Mean ambient temperature exceeds 20 C^o during four month only; daytime temperatures can go much higher due to solar radiation. Humidity is fairly high even in summer due to the seawater mass and for the same reason seasonal temperature fluctuations are rather limited generating mild winters and summer. The relative humidity is around %65 and rainfall is rare during summer. At the same time, Santorini is a windy island all year long. Winds usually come from the north quite strongly (especially in winter) although the ones from the south can be fairly severe too [15], [Fig. 8].

Greek island as warm places, the Santorini climate is rather cool during several months, and comfort table conditions can be improved by the intense solar radiations- but also worsened by the forceful winds. Mean ambient temperature and humidity in Santorini lie within the comfort zone for most of the year, but with a substantial period on the cold side [15], [Fig. 9]. These hard climatic conditions are transformed into liveable habitat and unique architectural identity thanks to the bioclimatic advantages of underground dwellings.

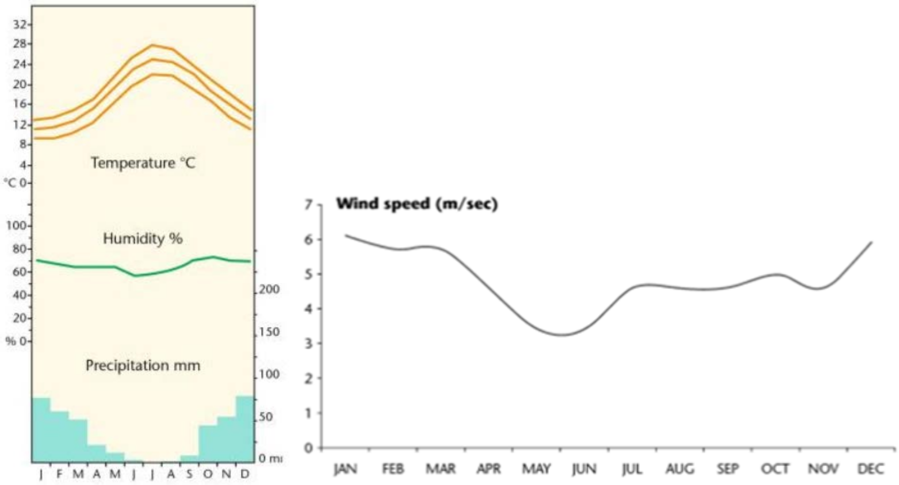

Figure 8: Temperature, Humidity, Precipitation and Wind Speed in Santorini [15]

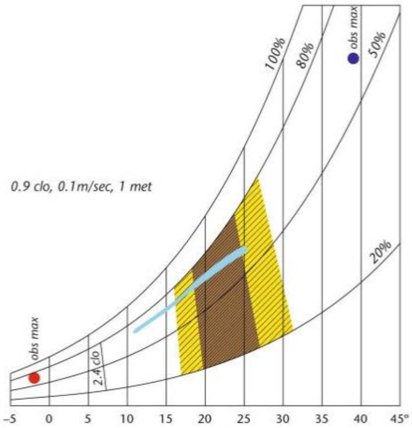

Figure 9: Comfort Zone of Santorini [15]

3.2. Space Organizations and Forming

It is seen that the architectural identity of Santorini developed by terracing on top of each other in accordance with the topographical structure in order to start from single simple cave dwellings [Fig. 10]. The settlement consists of narrow streets, steep ramps and stairs, consisting of A and C typology that is cliff cave and elevational/facade dwellings. The dwellings that start from the ground and extend to the ground with a vaulted structure open a terrace or front courtyard to the outside (Aegean Sea view), [Fig. 11], [Fig. 12]. The shape of the simple cubic geometry of the character Santorini gives a unique architectural identity [15]. The outward to inside transition seen in the space organization also provides the privacy requirement.

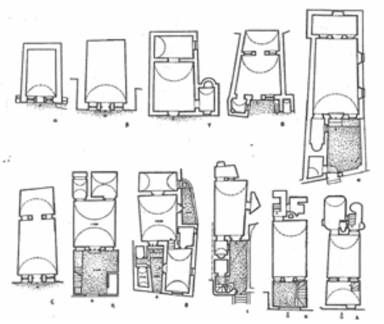

Figure 10: Development of plan typology from simple to complexity [17]

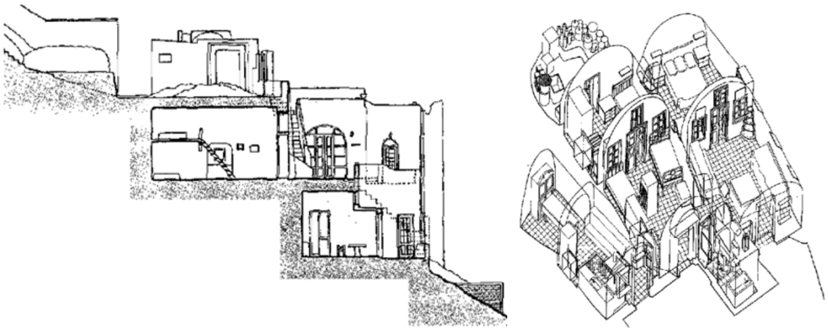

Figure 11: Sapece Organizations and Section of Underground Dwellings in Santorini [15]

Figure 12: General View of Oia/Santorini [7]

There is no water supply in Santorini. Therefore, the roofs have insulation made of earth (Theran) and they are flat, in order to collect the rain water. Cisterns are a nature component of dwellings. Architectural form and provide water protection.

3.3. Daylight, Ventilation, Humidity and Heating

In the houses that can be used for daylight and weather owing to the fronts facing the terraces as it moves towards the deep, the rate of lighting and ventilation decreases. The typical clerestory above the door lets the warm air escape, also letting in daylight to the maximum depth possible. This is supplemented in some cases by chimneys through the ground above that admit air and light in to dark and unventilated room [15]. However, due to the intensity of radiation throughout the year, the interior comfort was be balanced by shading effect as it brings with it priority of protection from hard wind and sun. Artificial lighting is inevitable for dark places.

In full or semi-excavated dwellings where the earth layer is used as insulation; İts contact to the dwelling’s walls helps to eliminate the heat from the building. In winter, the building’s contact to the ground limits the heat losses towards the cold environment. The lack of humidity in the ground of these areas does not permit the appearance of a humidity problem in the building’s interior [18], [Fig. 13]. But especially in excavated vaulted spaces, lack of heating and limited ventilation triggers condensation [15].

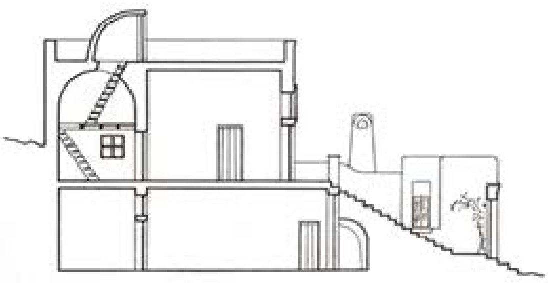

Figure 13: Semi-Excavated Dwelling Section [18]

4. CONCLUSION

One of the unique examples of underground settlements, Santorini offers dwelling examples that can provide bioclimatic comfort conditions with passive methods owing to the carved and highly insulated volcanic Theran soil. In the study, it is seeming that the general advantages and disadvantages envisaged for underground settlements are valid for Santorini dwellings. In Table 3, it was determined that there are differences in passive solar potential and daylight availability with humidity issues evaluation for the general island **A** and **C** type dwellings. It is predicted that the **C** type facades may increase in these potentials due to the surface increase in dwellings, while limited facades of **A** type dwelling passive solar potential and daylight. On the other hand, in **C** type dwellings there is a mass formation with a vaulted structure over the ground and it is stated that this creates a particularly negative effect on humidity [18]. In short, indoor humidity balance of A type houses is more tolerant and humidity problem is less. Ventilation is an important problem in both types of dwellings, but use of chimneys is more advantageous than clerestory.

Santorini was built in harmony with the expectations of today's sustainable architecture, such as topographic compatible settlement, thermal comfort, low-cost construction, rainwater collection, and opening to unique Aegean landscapes. Santorini architecture, hard climatic conditions are balanced by bioclimatic, offers the same features that can be sustained today.

Table 3. Evaluation of bioclimatic factors for underground dwellings in Santorini

Types / **Bioclimatic Factors**	**A** **Cliff cave**	**C** **Elevational/Facade type**
Topographic compatible	Excellent	Excellent
Passive solar potential	Less effective	Moderate
Thermal efficiency	Excellent	Excellent
Nature lighting potential	Poor	Moderate
Wind Protection	Moderate	Moderate
Noise protection	Excellent	Excellent
Rain water collection	Excellent	Excellent
Visual convenience	Excellent	Excellent
Humidity problem	Poor	Moderate
Ventilation	Less effective-with clerestory Excellent-with chimney	Less effective/with clerestory Excellent-with chimney

As a matter of fact, Santorini, known as the lost Atlantic city of Plato, was declared as "a traditional settlement of conservation" through the original vernacular architecture after the CIAM conference held in 1929 under the leadership of Le Corbusier, and it was decided to protection the original style of the architectural identity of the island [15]. Today, many tourism facilities and other buildings are built with this conservation understanding. In this way the island's general appearance and vernacular architecture are protected.

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An Overview of Byzantine Science and Its Contributions

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ABSTRACT

Late Antiquity and Byzantium periods are not mentioned frequently in the history of science. The root of modern science often refers to the Hellenistic Era out of the Classic Eras, in which most of the inventions were invented. Hellenistic science tradition, in the first century of the Roman Empire period, continued its existence but after the 3rd century, it entered a period of regression. In the first few centuries of the Orthodox Roman Empire (Byzantium) - the direct heir of the Antiquity culture- one cannot come across many inventions; however, one can come across translations of ancient pieces as well as commentaries on aforementioned translations. In addition, some counter ideas were put forward. While these studies were coming to an end from the early 7th century, Islamic civilizations were rising, becoming forefronts for many fields in the 9th and 10th centuries. Even though the scientific breakthrough in the East encouraged the Byzantine scientists, their works were limited to mainly translations and commentaries, which continued in the Late Byzantine period, despite the revitalizing attempts in some periods. Byzantine manuscripsts are considered to be the greatest evidence of ancient and Byzantine science today, and they are important for the preservation and transmission of knowledge also as resources for works whose originals have been lost. They also helped -with Arabic, Persian, Syriac manuscripts- the Latin West find the ancient culture which is the basis of Renaissance.

Key Words: Middle Ages, Byzantine, science, technology

1. INTRODUCTION

During the Classical period of Antiquity (BC 5 -4 century) in the Mediterranean region, art, philosophy, and literature reached a high level. But, it is the Hellenistic Age (BC 4-1 century) that is associated with the beginning of science, which, in terms we understand today, refers to the presentation of scientific theories and the pursuit of systematic methods to answer aforementioned scientific theories with regard to making sense and understanding nature. The Hellenistic tradition continued in the Roman Empire period. On the other hand, Late Antiquity is considered to be the time period where scientific advancement ended due to the approach towards science. The history of science in the Middle Ages is roughly the history of science of the Islamic civilizations and later the story of how the knowledge that formed the root of the Renaissance movement transferred to the West. The Byzantine Empire (330-1453) is rarely mentioned in this story. One reason may be because of the fact that Byzantines offered little to the advancement of science in terms of new or progressive improvements. Yet, this may be because of the fact that there is a lack of archeological data and resources regarding this too. It is also important to mention that there are other reasons for why history and archeological interest in Byzantine started at a later time. Here- at least for a short time- the aim is to highlight the various additions to Western science by presenting a holistic view of this important civilisation from the Balkans to Eastern Mediterranean that was governing from the Late Antiquity to the Middle Ages.

The largest data source for this topic comes from manuscripts. In fact, history of science was mainly written using manuscripts. Besides, although some manuscripts are duplicates and some are reminiscent of current ones, there are also many lost writings as well as lost knowledge. Unfortunately, archeological data is limited and indirect. It is mostly technological and mechanical products that act as sources for materials and location production. Out of these, only limited pieces were found, which causes problems when analyzing pieces. Wall paintings, icons, and illuminations on manuscripts are more reliable sources. Architectural monuments are great sources for deducting their time period’s architectural design, engineering, building technology, and material knowledge.

2. LATE ANTIQUITY

From the early AD 4th century until 7th century, just like nearly every area except faith, education and science continued following ancient tradition. In this period, cities like Athens, Alexandria, Constantinople, Beirut, Antioch, Gaza, Ephesus, and Edessa built academies, which followed the above-mentioned traditional doctrine. There was a university at Constantinople- built during either the reign of Constantine or Theodosius II. The university offered courses in philosophy, law, geometry, arithmetic, astronomy, medicine, and music [1] [2].

Although such advancements gained momentum in the Capital, anti-movements began in other cities. The death of Hypatia, mathematician daughter of Theon the mathematician, by Christians against paganism in AD 415 marks the end of ancient science [3]. Another similar event is the termination of the academy and lyceum in Athens by Emperor Justinian in 529. The same emperor built a library with 120.000 works. The library is joint to the aforementioned university [2].

With the rise of Christianity, a new thought that supported that the earth was flat with water enclosing from the top and the bottom started becoming topical, stemming from beliefs from an earlier period. This theory was supported by the Church of Syria, Cyril from Jerusalem (c. 360), and Diodorus Bishop of Tarsus (? – 394), who declared the Greek system as against religion [4].

Proclus (412-485) combined Aristoteles’ cosmology and Ptolemais’ system to create a new earth theory. Tied to Neoplatonist tradition, Dionysius likened Plato’s soul hierarchy to angel like creatures. He also likened the Church’s hierarchic structure, creating a similarity between the hierarchy of creatures of God [4].

At the beginning of the 6th century, there was a revival in the scientific world in Alexandria due to scientists such as Simplikios, Iohannis, Philoponos, Eutokios of Askalon, Anthemios of Tralleis, and Isiodoros of Miletus- all students of Ammonius Hermia. Simplikios wrote commentaries on Hipparchus’ motion under gravity and Aristoteles’ works. Simplikios’ works are the only source for Hipparchus’ lost works [3]. A mathematician and a philosopher, Eutokios, wrote a commentary on Apollonius of Perge’s *Conics*, which was about geometry. Eutokios dedicated his work to Anthemios, whom he most likely worked alongside [5], [6]. He also wrote a commentary on Archimedes’ *On the Sphere and Cylinder* and dedicated it to Ammonius. Other works of Eutokios include *Planes in Equilibrium* and *Measurement of the Circle*. John Philoponos, whom was declared a heretic by the Church, wrote commentaries about Aristoteles as well as texts about mathematics and astrolabes. Philoponos’ theories on gravity and impetus are considered the first to disagree with the theories of Aristoteles [7].

Two *mekhanikoi* Isidoros of Miletos and Anthemios of Tralles, owe their fame to the Hagia Sophia, which they worked as architects. Less known Isidoros, edited Archimedes’ works and wrote a commentary on Heron’s *On Vaulting* treatise [3]. A text belonging to one of his students depicts Isidoros inventing a compass for drawing parabolas [5]. Parts of writings of Anthemios of Tralles which is mentioned in various works such as Paulus Silentiarius’ *Ekphrasis*, Procopius’ *De Aedificiis*, and Myrina of Agathias’ *Historia,* have reached today [8], [9], [10]. In *On Incredible Devices*, there is a part about how an ellipse can be drawn using sun rays falling on a certain angle, which is similar to Apollonia of Perge’s principles. Although Archimedes is the first to write about burning mirrors, Diocles writings still prove to be right. Anthemios, who writes about the same subject, is often declared the inventor of burning mirrors or the focal property of parabolas, but, when compared with the text of Diocles, it becomes obvious that either due to the method or the content, Anthemios’ work is not above Diocles’ work [10], [11], [12]. Anthemios created a steam engine to scare his neighbour; he used the steam power to mimic earthquakes, and he also used mirrors to simulate lightning and objects [8] [13], that make simulation of thunder. As a result, some researchers claim that he invented those whereas others claim his works are mostly based on Hellenistic sources. Maier writes that Anthemios invented the principle of the steam engine [14].

A Neo-Platonist philosopher, Priscian of Lydia’s work on tides, which is considered a complete source for ancient information.

Some Hellenistic works unknown in Alexandria, were familiar for scholars raised from Alexandrian school. According L. Russo, “probably when the cultural center of gravity shitted from Alexandria to Byzantium –where Anthemius and Isidore, among others, worked – scholars became acquainted with works preserved in the East which had never been part of the Alexandrian tradition”

[3]. Cultural exchange with Eastern countries outside the Empire increased when philosophy academies in Athens were closed down, causing Simplikios, Damascus, Priscian of Lydia to accept the offer of Chosreos I, the Sassanid king [3].

3. MIDDLE AGES

Although troubling times had already started during the period of Emperor Justinian (527-565), those times also marked the beginning of a dim era in science and education, like art, architecture, and philosophy. At first, new world views and changed attitudes towards religion impacted the approach towards science, followed by the almost isolation of the rationalist movement of the ancient eras- letting education fall into the hands of the Church. The end result of this change can be viewed in two examples. The first refers to Phokas (602-610) closing the university in Constantinople, after the academy at Athens, and the second refers to Leo III (718-741) closing a restored university by Heraclius [2]. Arabs got hold of Beirut, Alexandria, Antioch, and Edessa in the 7th century, following the rise of Islam; so that some of the manuscripts in education and scientific institutions of these cities, have been lost and some of them have been passed down and protected by the Arabs.

Gifted by the Byzantium Emperor Constantine V to the Frankish King Pepin the Short in 757, the water organ is the earliest known musical instrument in the Middle Ages. Although not in the sense of scientific and technological activity, the water organ plays an important role in displaying the importance of Byzantine in continuing the Hellenistic cultural heritage and transferring it to the West. The *hydraulis* with its original Greek name, it is the first percussion instrument that was designed scientifically. Ctecibius of Alexandria is thought to have invented the water organ in BC 4th century. It was described by Vitruvius; there are archeological evidence that shows the *hydraulis* was used during the Roman Empire period [3].

Greek fire, composed of saltpeter, sulfur, and charcoal, is a type of weapon that was devised by adding potassium nitrate to already existing flammable materials. It also has ability to become its own oxygen source, followed by the ability to burn under water. According to historian Theophanes (AD 670-672), it was invented by the engineer Kallinikos during the reign of Emperor Constantine IV. Its formula is present in Marcus Graecus’ Arabic quotation written in the 8th century. Black powder (saltpeter, sulfur, and naphta) was later made by making changes in the formula of Greek fire. Although the Chinese are often credited with the invention of black powder, the earliest Chinese source of black powder dates to the middle of 9th century [15]. In addition, even though there are records of Greek fire as early as the 5th century [16], it is widely accepted that it was invented by the Byzantines in 7th century and later brought to Europe.

While Byzantine Empire was suffering losses in all aspect, the expansion of Islam caused a new civilization to rise in the East. With the fall of Alexandria into the hands of the Arabs, the Islam world gained a treasure chest of knowledge, which they spread to the rest of the world. In the 8th century, during the reign of the Abbasid Empire, scientific activities began and in the 9th century, during the reign of Caliph Al Ma’mun, intensive education and research institutes, libraries, and observatories opened, causing the civilization to become the center of scientific knowledge [3] [17]. The Arab domination took over the most of the Byzantine land, East Mediterranean, North Mesopotamia, and North Africa and the were not indifferent to the art, science, and architecture of these regions. Chinese, Indian, Ancient Greek works were collected and translated to Arabic, in this way the preservation of the knowledge is provided. The greatest contributors to this movement were Abbasid Caliphs al Mansur (754-775) and Harun Rashid (763,766-809). Al Mansur sent a messenger to the Byzantium Emperor Leon, requesting manuscripts. Gibbon writes that agents at Armenia, Syria, and Egypt collected Greek treatises [18]. Textile, paper, metal, and ship technology advancement fastened when the Islam world met Hellenistic science. Automata and gear mechanisms were technological products of particular interest in the East, from the 8th century.

The Islam civilisations continued to flourish in the 10th and 11th century. The Arab control over the Iber peninsula and Sicily helped Europe meet with this civilization and divert its attention to the East. Spain, where different religions such as Muslims, Christians, and Arabs lived together. The scientists from other cities of Europe were coming here, they learned Arabic, translated texts into Latin, and introduced them to the Western world [19].

The involvement of Muslims in science and philosophy was not limited to manuscript translations from Arabic, it also covered advancements in mathematics, astronomy, and maritime [17]. Unlike the Byzantium Empire, the Islam world never crossed paths with pagans or paganism, never associated danger with pagans or paganism, and never had prejudice against pagans or paganism, which greatly helped Muslims benefit from the social sciences and medicine knowledge of the pagans.

Byzantine Empire entered a new era in the 9th century, leaving behind its trouble. It gained a new identity by partially leaving behind its ancient traditions. This revival affected certainly by the Islam world is reflected to scientific activities. According to Gibbon, the Islam world's agenda included wanting to take over the art of the Byzantine Empire, which caused Byzantines the desire of competition. [18]. On the other hand, there was an attitude towards science and education. The uncle of Michael III (856-867), Caesar Barlas, opened a school at the Magnaura Palace after emulating Baghdad. He also put Leo the philosopher in charge of the school, but the church was against Leo. Claiming that a thorough education will not only not benefit the state but also increase expenses, Basileos II (976-1025) closed the school. In the 11th century, General Kelaumenos, authour of *Stragegicon* argued that the bible and a minimal amount of logic was enough of an education [2].

In Constantinople, lots of pieces were published including scientific texts during the 9th century. Some pieces were able to reach today due to Byzantine versions. For example, *Quadrature of the Parabola* by Archimedes was copied by Leo the mathematician in Constantinople, only to enter Sicily in the 12th century- later entering the library of the Vatican. Although it remains lost today, its copies were made in the 15th century in Italy and France [3]. This is a typical example of how ancient knowledge moved to the West.

Works of Theophanes Kontinuatos, Loe Grammatikos, Simeon Magister and Konstantinos VII works -all belonging to the 10th century- talk about automata decorating the Throne of Solomon in Magnaura palace in Constantinople. But they do not talk about the method. These are singing birds, roaring lions and moving beasts in trees. Sources show that automata were made for Theophilos in the 9th century before Constantine VII, but these were destroyed by Mikhael I [20]. They were also built in the around the same century in the East. In fact, there are records that show a guild for automata builders. Although it is unknown whether automata were first created by the Byzantines or the Abbasids, the earliest dated descriptions are dated by Philo of Alexandria and mostly Heron of Alexandria. The pastoral look and effect that automata seemed to be fairly oriental may reflect the presence of Orient fashion in Constantinople at this time, perhaps also expressing abundance and prosperity.

Byzantines followed suit in the 11th century, translating Arabic texts like the Europeans. Living in the 11th century, Symeon Seth, encyclopaedist and physician wrote three scientific treaties on physics, astronomy, and diet. He also translated the Indian story *Khalila wa Dimna* from Arabic to Greek. All three of his treatises are dedicated to emperor Michael VII Doukas (1071-1078) [20]. In the introduction of the translation, it is written that the treatise was resurrected by Alexios I (1081-1118) [21].

Although there was increased movement of translations from Arabic to Hebrew and from Greek to Latin in the 12th century, Byzantine scholars mainly produced translations and scientific texts focused on astrology and several pieces of poetry along with an explanation by Ptolemaios. Prodromos wrote an astrological poem, an explanation of Aristo's categories, and Gramer. In addition, Isaac and Iohannes Tzetzes are two brothers. An astrological poem carrying Isaac's name is thought to belong to Iohannes, whom also has poems about Aristoteles and Ptolemaios. Iohannes Kamateros wrote two astrological poems [19].

The plundering of Constantinople during the IV Crusade in 1204, which ended with the conquest of city by the Latin up until 1261, was a great destruction that could not be compensated for the Byzantine Empire. In addition to the monuments, the works of art and the manuscripts were also brutally destroyed or lost and some of them have been taken to Italy [22]. During this time, educational activity in the Capital stopped as well and moved to centers such as Nicaea, Trebizond, and Thessaloniki.

Although the capital city was not able to recollect its political power, it improved its power in terms of cultural and intellectual activities during the Palaiologoi dynasty, which continued until the invasion of the Turks in 1453. Humanism, antiquity revivalism and anti-organizations against these movements gained power during this time. Andronikos II (1273-1332) carried the university to the Hagios Iohannes monastery at Petrion and reorganized it [1]. It was one of the best universities in Manuel II’s reign (1331-1425) during the Middle Ages with students from Armenia, Georgian, Slav, and Italian. Other than that university, there were also private education institutions such as a school at Chora monastery [2].

In the first half of the 13th century, Byzantines started translating the works from Latin to Greek. However, Byzantium needed the help of the Western world to discover its own root. The texts have lost many of their original properties due to the various translations they went through from Greek to Arabic, from Arabic to Latin, and from Latin to Greek once again. In this century, there are no known records of important scientific work of Byzantine scholars. In the 12th century, due to the translations of Adelard of Bath, a mathematician, philosopher, and natural scientist, the Indian number system learned by Europe, a century later, introduced it to Byzantine by Maximos Planudes [19].

Constantinople once again became the cultural center of the world in the 14th century, setting scene to a revival in art and intellectual activities. Parallel to this, there were advancements in scientific works but not all of them were on the same level. This century, for the purpose of the Byzantine history of science plays an important role in translating Persian texts into the Greek language, causing the Ancient and Medieval Islamic world to reach towards more robust translations than the Western world. On the one hand, there was a Western influence from Italy, France, Cyprus, and Rhodes, while on the other hand there was a flow of knowledge from Constantinople to Italy followed by to all of Europe, which would later trigger the start of the Renaissance movement. In addition to economic relationships, colonies in Geneose at Constantinople, Venice, and Pisa also helped strengthen this movement.

Manuel Moskhopoulos, who was alive during the time of Andronikos II Palaiologos (1282-1328), was the student of Maximus Planudes. Although he is famous for being an author and philologist, he also has works on science. He criticized Greek works in grammatical terms and wrote a dictionary. With the request of Nikholas Rhabdas, he wrote a piece on Magic Squares in 1315. The history of this work is based on the origin of China, which is unknown as it is early history. Moskhopoulos’ work probably originates from Persian origin, but its passage to Europe has been through Italy, spreading from here [23]. Born in Izmir (Smyrna), Nicholas Rabdas worked in Constantinople. He has received mathematics retention based on Indian rules. He has two letters on geometry that still exist today. Iohannes Pediasimos worked as archivist during the reigns of Andronikos II (1282-1328) and Andronikos III (1328-1341). His work on geometry and surface areas is based on Heron of Alexandria’s work. A book on music, a book on Kleomedes' astronomy, and some additional works on grammatical analysis are some of his works.

Theodoros Metokhites, belonging to a high ranking family, is a high bureaucrat, scientist, intellectual individual who lived between 1260 and 1332. He was well educated, served in various positions of the state, and rose to the level of *mezason* [24]. The most famous work of Metokhites is the Kariye Mosque (Chora Monastery Church) in Constantinople. The Emperor Andronikos II undertook the restoration of the Chora, Monastery which was destroyed during the Latin invasion, in 1315 or 1316 after the appointment of the Metokites by the palaceologist as the "chief" of the monastery at that time [25]. The mosaic panel on the main door, which opens from the inner narthex to the naos, is described the presentation of the model of the church to Jesus, by Metokhites. He spent the last years of his life in the Chora Monastery, where he "transformed into a treasure of innumerable kinds of books". The first two of Metokhites' poems *to Himself* were written to celebrate the restoration of the monastery. They are valuable sources of Chora's 14th century cconstruction. The manuscripts have reached today and are protected at Bibliothèque Nationale at Paris [26]. Metokhites became familiar with the philosophers of the ancient world and produced works in various scientific fields and most of his works based on Hellenistic sources [19].

Gregoros Khioniades, an astronomer, mathematician, geographer, and physician, went to Iran with the help of Trebizond’s Emperor, Iohannes II Komnenos (1280-1297). In Tabriz, he started working at the palace in Mongol Ilkhans. He returned with many texts in Arabic and Persian to Trebizond and later to Constantinople [27]. His works on Persian astronomy was effective in Byzantine [19].

The astronomical works of Isaac Argyros and Theodororus Meloteniotes, whom both lived in the same century, stem from Persian sources. Isaac Argyros (c.1300-1375), a monk, mathematician, and astronomer, who was also the student of Nikhephoros Gregorios, wrote pieces about Euclid’s first six books and a commentary about Ptolemaios along with a book about surface measurements inspired by Heron of Alexandria. In addition, he also wrote pieces about astrolabes and how to find the square root. He found a method to find the date for Easter from the beginning. The astrological works to find the dates for religious celebrations as well as holy days fastened in the first half of the 14th century in the time of Alexios II (1297-1330) in Trebizond [19]. This situation might have occurred as a result of close contact of Trebizond with Persia, due to its location, while Constantinople was under the Latin occupation.

The most famous scientific work of Theodoros Meliteniotes, who was a member of one of the esteemed families of Constantinople, is *Astronomical Tribiblos,* which was inspired by the works of Klaudios Ptolemaios, Theon, and various Arabic sources. The allegorical poem entitled "On Temperance" which carries influences of Western poetry of the time, is important in that it shows relationship between the Italian and Byzantine humanists and the effect from the West to the East [28].

It is known that scientific work ended in the 15th century. In this time, Europeans were attracted to Byzantines because of the fact that Byzantines knew Greek. Although there was a decrease in the flow of knowledge through books into the Western world, it continued. Aurispa, a trader of manuscripts, returned with 238 book after he visited Constantinople in 1423 [3]. Some new ideas, such as building a parabolic dome instead of a hemisphere, which are evident in architectural designs in Europe, coincide with this time.

4. CONCLUSIONS

Up to this point, specific examples from the main educational and scientific activities and technological products in the Byzantine Empire are listed chronologically. Most of these are based on pieces from ancient works, which were shaped by previous or contemporary Anatolian, Mesopotamian, Egyptian, and Asian civilisations. Although the Byzantium Empire carried certain traditions from the antiquity, at least traces of it, they were not able to take care of their science and technology heritage as well as advance it. Nonetheless, Byzantium written sources that are known today, which are not repetitions but rather commentaries as well as counter ideas, show that the interest in science has never totally abandoned. This interest was impacted by the political situation in the Empire along with the advancements in other mediaeval civilizations. The aim of Byzantines to obtain information, to reach written texts, and to translate was certainly not due to the want to transfer such knowledge to the Latin West.

In the early centuries of the Middle Ages, Islamic civilizations started to rise, and they also became the source for old and new knowledge for Byzantium along with Europe. Acting as two different cultures, the Chalcolithic Latin West and the Orthodox world, in which Jews and Muslims interacted, became the reason for transferring and enriching the knowledge. The fact that theoretic works were documented in manuscripts, which are easy to move, without doubt made this movement easy.

While researching the roots of modern science, one must understand the developments that occurred during the Renaissance at Europe. On top of that, one must also look at the complex history of the Middle Ages of the Mediterranean region as a whole picture to understand the factors that caused the Renaissance. The transfer of Byzantine scientists and their works in Europe after the conquest of Constantinople in 1453, causing art and science to expand, or ancient sources on the hands of Byzantines, or reign of Arabs over Andalusia do not be singular reasons, this is a network of relations end events, and a process. Probably, new additions will be in today’s search based on written sources for the history of science and technology, by founding new concrete remnants which will be evidence of practical application of theorical knowledge.

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Quizzes and Formative Self-Assessment

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ABSTRACT

The purpose of this paper is to provide assistance to the traditional assessment, as an important aspect of teaching, especially when the number of students is large. The evaluation of the students in the right time increases the quality of teaching and learning. With the diffusion of e-learning, the on-line assessment has become a trend. It is based on a Computer Assisted Assessment (CAA), which is powerful for the automation of this important part of the learning process. In this paper, the use of quizzes, available in any e-learning platform will be discussed, Self-assessment returns to a challenge for the student, which increases the quality of knowledge. Self-assessment is not used to measure the learning outcomes as part of the summative assessment, but to improve the learning process through it. This is conducted through formative feedback. The design of quizzes requires a detailed analysis of formative feedback in cases of true and false answers.

Key Words: quizzes, on-line assessment, self-assessment, formative feedback.

1. INTRODUCTION

The Computer Assisted Assessment (CAA) offers the possibility to construct more complex items than can be made with paper and pencil, such as incorporating audio-visual materials, using various systems of semiotic representation or different registers of the verbal language. Throughout paper-based assessment transformation to an online format, it is fundamental to think about the pedagogical implications that the online assessment requires in terms of formulation of the questions, to provide the student with feedback, to storage and report the data related to the student’s interactions [1].

We examine the different types of computer assisted assessments for both the student and the teacher: summative, formative and diagnostic assessment. We also examine the benefits of using quizzes as a useful resource for student learning. The central point of the quizzes is the self-assessment training that they offer. Self-assessment is part of a path that serves to guide, grow and correct himself.

2. TYPES OF ASSESSMENT

The CAA packages are designed to work in different modes. Each of them has a different goal and can offer a different level of detailed feedback for the student, enabling him to reach the correct answer or to investigate why his response was not correct. Therefore, there are three main categories of test: summative, formative and diagnostic assessment [2].

Summative assessment is generally carried out at the end of the course and it is used to gather proof about the actual level and quality of knowledge and skills achieved by the student. Summative assessments are often used to determine if the student has learned what he was supposed to learn after attending a course and if he can be admitted to the next education level. Summative assessments are also formal contribution to the student’s final grade.

Formative assessments are generally carried out through the course and their main goal is to provide the student with feedback about his actual level of knowledge or skills. Formative assessments come often in the form of self-assessment, helping the student to evaluate his own work and to recognize his strengths and weaknesses. There are different reasons why formative assessment can be employed: it can help the student to consolidate the learning on a course material (e.g. exercises after the lectures) or to check his preparation in view of an examination (i.e. as simulation of a formal assessment). Formative assessment can be also a mean to practice, in order to stimulate learner’s thought and reasoning (or to explore deeply some concepts) as well as a mean to provide feedback about the student' progress (this can be used by the teacher to update the course syllabus and organization).

Diagnostic assessment can be carried out at the beginning of the course to define students' previous knowledge and skills and to identify students' strengths and weaknesses. This knowledge permits the teacher to calibrate his course on the students' needs and to help students to achieve the instructional goal of the course. Although its purposes are different from those of the two other types of assessments, it can be carried out either as an examination or as a training test and, hence, we will consider only formative and summative assessments.

3. ASSESSMENT MATTERS

3.1 What is self-assessment?

The definition of self-assessment that focuses on the formative learning that it can promote: "*Self-assessment is a process of formative assessment during which students reflect on and evaluate the quality of their work and their learning, judge the degree to which they reflect explicitly stated goals or criteria, identify strengths and weaknesses in their work, and revise accordingly*" [4].

3.2 Why self-assessment?

The evaluation of students' progress in learning is important to the learning process.

Self-sufficiently: The possibility of automatic assessment and feedback offered by the selected-response items makes their implementation particularly suitable in e-learning platform. These features are very helpful when the assessment involves large groups of students, such as undergraduates, because they allow to equip the student with learning experiences which should be unaffordable in traditional settings. For instance, it is possible to assign weekly tests to provide the students with feedback on their comprehension of the face-to-face lectures or of the materials set delivered in the past week, or periodic quizzes with feedback on their comprehension of key concepts introduced during face-to-face courses [5]. It is evident that the automatic assessment and immediate feedback are indispensable requisites for the feasibility and the sustainability of such activities. Anyway, we want to underline the fundamental role of the tutor, which remain indispensable, even if he changes the place and the time of his intervention. He is no more the one who intervenes when the individual student interacts with the activities, but he is the one who oversees suitable designing of the items for the quizzes and his tutorial activity is made concrete in planning convenient proper feedbacks, according each possible answer (correct or not). The great importance of the *formative feedback* to improve the learning, makes the new role of the online tutor fundamental even when closed quizzes are used.

Flexibility**:** The students can tailor training activities according a chosen level of dimension and difficulties. For instance, to make a quiz with a little number of random questions, it is possible to construct a sequence of quiz of growing difficulties so, to allow the students to face the difficulties gradually. This impacts on the affective aspect too, as the student has the possibility to do activities by avoiding the frustration which can derived from too many failures.

Challenge**:** From the viewpoint of the self-assessment, the possibility to repeat continuously the quiz appears fundamental. This can be useful to improve student's knowledge and at the same time to reduce the need of tutoring [2]. On the other hand, the possibility to give immediate feedback can motivate the student to go on and improve his marks, repeating continuously the quizzes. Moreover, to this end the computer assisted assessment offers to the student the reporting tools able and useful to monitor his progress, as an added value with respect to the paper and pencil assessment: each student should have the opportunity to look at his reports and to make comparison between his outcomes and the ones of his classmates, in observance of the privacy laws.

Responsibility and independence: self-assessment can promote the student' responsibility and independence.

Self-efficacy: for the student having immediate feedback on some side of their learning can have a great effect, the so-called sense of self-efficacy. The ability to try, to do and to make mistakes without the judgment of someone else can help some students to grow safer and to develop a more positive attitude towards their product.

Metacognitive monitoring: quizzes allow students to have a good calibration for their knowledge. Students, repeating the quizzes, familiarize with the meaning of the contents and can recover what they need, improving metacognitive observation [6].

3.3 The formative self-assessment

The spreading of e-learning has led to the use of online assessments, which consist in computer assisted assessment (CAA) delivered on a local or distant server and gives powerful tools to automate an important part of the learning process. We discuss the use of module *Quiz,* available in any e-learning platform. It allows to set up various questions with close-answers (multiple choice, true/false, fill-in blank) and to have automatic evaluation. They certainly have some huge drawbacks: for instance, in the case of mathematics learning, they do not stake all the competencies, such as to construct a strategy or a text, and they allow the use of improper strategies, such as to take a wild guess of the right answer to deduce clues from the form of the given distractors. Anyway, we argue that work can be done to limit such drawbacks and make the use of quizzes become a helpful learning resource for the student.

First of all, we assume that our quizzes aim to self-training and *formative* self-assessment, because this is the reason that we use assessments: not to measure the learning outcomes (summative assessment) but to improve the learning process during its progress. So, it is not proposed at the end of a learning path, but it is integral part of the process and it is of use to guide, to develop, to adjust and to improve it. To this aim, the role of the feedback given to the student put it on a key position, because it becomes the main tool for making concrete a proper teacher’s guide to improve the learning process. Therefore, we talk about “formative” assessment [3], which provides the student with that information such as hints, recovering materials, suggestions for further work, institutionalization of learning acquisitions, and so on. Therefore, to make the feedback effective through the quizzes, it is not sufficient to set up the questions so that the computer just checks whether the answer is correct or not, but it is necessary that who oversees creating the quizzes should pay much attention to provide feedbacks helpful to explain the errors or to foster the students to think about why their choice is wrong or to suggest further work to fix the required knowledge. Then the design of a quiz requires a depth analysis of the computer provided feedbacks in case of wrong answers. Finally, we note that our purposes are achieved better when the assessment does not give back any overall mark, in order to focus the student’s attention on his strengths and weaknesses.

4. AN OVERVIEW OF THE QUIZZES

4.1 The features of the quizzes

The construction of a quiz requires first to have well defined its aim. In our case, as already said, our aim is self-training and self-assessment. The classical parameters to evaluate a quiz are *validity, reliability, practicality, washbacks.*

The ***validity*** is the property of a quiz (or even a single item) which stakes the competencies which are designed to stake.

The ***reliability*** is the property of a quiz whose outcome is not influenced by external or occasional factor.

The ***practicality*** is the possibility to construct, use and evaluate a quiz without an excessive waste of resources of all the people involved in the whole process.

The ***washbacks*** derive from the fact that inevitably any form of assessment influences and steers teaching and learning. This is why the quizzes also should avoid steering (even indirectly and unintentionally) towards kinds of dubious teaching/learning practices, such as focusing on contents only or neglecting the aspects related to semiotic representation and language [8].

In this case we are interested in the use of self-training and self-assessment. The four parameters just illustrated are all important, since it is needed to avoid addressing the users’ efforts towards wrong directions, to supply with warped information on their preparation and to steer their subsequent study in an improper mode.

4.2 The limits of the close-ended questions

Many doubts are placed on the actual capability that the close-ended questions have to assess learning outcome. Anyway, a growing number of studies confirm that such capability can be improved as more attention is posed for the analysis and the development of the items [1]. To this aim, it is strongly recommended, that who develop CAA quizzes, are properly trained and that the items are peer-reviewed and tested before the students' use. Anyway, it is beyond argument that the close-ended item does not stake the capability of setting out a solving strategy for a problem based on the only reading of the text, nor the capability of producing a text to describe or motivate the raised strategy.

The difference between a closed-ended question (for instance, multiple choice question) and the corresponding open-ended question (for instance, brief essay) highlights how poor and unproductive is the setting of one who identifies an item of a quiz with its content. Below follows an example.

Multiply choice version

The algebraic complement of the a_{23} element of the matrix is:

$$A = \begin{pmatrix} 2 & -3 & -4 \\ 0 & 5 & -2 \\ 8 & 1 & -3 \end{pmatrix}$$

- o - 26
- o 26
- o - 44
- o 44
- o - 52
- o 52

Open-ended version

Which was the algebraic complements of the a_{23} element of the matrix?

It is evident that the two items, even though they refer to the same content, involve completely different competencies. The multiple-choice version supplies implicitly with various information (for instance, that the answer is an integer number) and requires at most some check, while the open-ended version requires anyway some modeling of the problem. Moreover, there is a general evidence of the fact that the selected-response items leave more opportunities to random answer (possibility after the exclusion of the less plausible cases) or to answers that make use of inferences on the distribution of the distractors.

Since the close-ended items (or, at most, numerical ones) have great advantage to the practicality, as they allow the student to get immediate feedback and assessment without the need of a tutor, the key points consist in finding ways to construct close-ended items which require to stake competencies and forbid or point out improper strategies [6].

4.3 Structure of the items

From the above discussion derives the need for an accurate analysis of what an item actually requires, beyond the classification of its content. It is evident that the item which just requires the application of an algorithm for selecting one of a set of options, does not necessarily require the competencies apparently involved. Then, there is the need for designing items which:

- require the careful reading of the text,
- require the modelling of the problem situation,

- discourage improper strategies.

All this can be realized by means of continuous variations of the assignment, with careful choice of the distractors and with the systematic insertion of the option "other", which should be the right one in an appropriate number of occurrences. It should be considered that, in contexts where a simple algorithm is available which allows to get an outcome by direct application to a set of data, the request of reconstructing the data given the outcome, encourages processes much more complex than the simple request of directly finding the outcome from the data [8].

Multisemioticity

The quizzes allow multisemiotic activities, even if the multisemioticity of the text should be explicitly planned, and it can require some supplementary efforts. According to O'Halloran [7], we consider three groups of semiotic systems:

- the verbal language,
- the symbolic notations,
- the figural representations.

The role of the verbal language is central for various reasons: it is reflexive (it is able to talk about itself), it is able to classify the reality, even in approximate and informal way, it constructs the human experience and makes it communicable, it articulates the various voices of a culture, it allows the use of a broad range of linguistic varieties.

The role of symbolic notation in mathematics is subtler and more debated, whose fundamental function consists in describing systematically the corpus of the mathematics knowledge, supporting the decidability of the concepts and the calculability of the processes.

The role of the figural representation is much discussed, which stakes processes, cognitive and not, not simply modelled.

5. CONCLUSIONS

This work would support the assumption that close-ended questions can be used in a meaningful way for the formative self-assessment and thus, the quiz module available in e-learning platform can be a powerful tool for supporting mathematics learning, not only at level of contents but also at a deeper level such as comprehension.

Finally, we want to propose some recommendations regarding important issues to be tackled in order to seriously start thinking to the use of quizzes in learning mathematics:

- *Dynamicity of the quizzes.* For multiply choice and multiple answer quizzes the randomization of the choices can be introduced. So, for instance each time the quiz runs, the system randomly chooses 3 options among 20 stored ones, allowing to generate different instances of the same questions. This way, the student can exercise with the same questions more times and the risk of plagiarism is reduced if two students exercise at the same time, with the same questions.
- *Use of quizzes to personalize the learning path.* Tailored resources can be delivered to the students according to the quizzes outcomes. A first example can be the Moodle activity 'Lesson', which allows to insert some check questions at the end of contents. If the student is successful in quizzes, he is addressed to further contents, otherwise to some recovery activities. More sophisticated personalization can be allowed if a knowledge and a student models are available: in this case quizzes guide the selection of the next resources to be delivered, based on the information of the student's knowledge and learning preferences.

The use of self-assessment has become a fundamental tool from the point of view of the formative assessment, and it can also help the student to monitor his learning progress.

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Healthcare Standardisation: Boosting Interoperability and Enhancing of Quality, Safety and Security

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ABSTRACT

Modern healthcare sector is a complex sector and rapidly advancing due to achieving interoperability at different types (e.g. legal, organisational, semantic, technical) and because of its assets' diversity and their interdependencies; highly qualified personnel of a wide range of expertise and disciplines, infrastructures, equipment, devices, tools, systems, ICT, data collection-exchange-processing, physical and other networks, clinical and testing laboratories, methods, processes, patients, treatments variables, logistics, drugs, reagents and other materials, ethics, protection of personal data, constitute a huge mosaic of data and systems where their standardization of quality, safety, security and interoperability ensures the provision of reliable health care services to individuals, to societies and member states, and thus the prosperity at European and international level.

The healthcare and medical devices sector, however, suffers from fragmentation of the Digital Single Market, which prevents the industry, consumers and healthcare practitioners to take full advantage of the benefits provided by emerging innovative and digital technologies. Standards are innovation-friendly, market-driven tools that are the outcome of a transparent, consensus based, inclusive, results-driven, dynamic system built on partnerships with all industry and societal stakeholders. Harmonised and mutual agreed standardization and conformity assessment requirements ensure trust, efficiency, effectiveness, understanding and communication for the benefit of all the involved actors. At European and international level standards like EN 15224 and EN ISO 13485, for the healthcare quality management systems and for the medical devices quality management systems, respectively, they shield the sector from all kinds of internal and external threats and contribute to strengthening the common market and its competitiveness.

In the paper the requirements of the two standards are presented, the experience gained by audits in national level, the benefits and the challenges arising during the certification process, the needs and trends emerged internationally and the way forward in accordance to the scientific achievements, the digitalisation and the policy making are summarized.

Key Words: Healthcare, Standardisation, Medical devices, Risk Management, Security, Interoperability.

1. INTRODUCTION

There are too many Management System Standards, which can be implemented in the activities related to the Health Care Services. Out of them, it looks that two standards are particularly developed for the Health Care industry. Both are based on the well-known International Quality Management System Standard, ISO 9001 [3]. As they address different areas, it is good to describe separately the aims, principles, rationale and history of these two standards. The first, is a very well-known, international Quality Management System for Organizations in the Medical Devices: ISO 13485 [1]. This standard is mainly used by Manufacturers of Medical Devices, but is also used by other organizations involved in the life cycle of medical devices: installation, service, support, raw material, calibration etc. [4, 6, 7]. The second, EN 15224, is a European Standard (that is, issued by CEN, recognized only in Europe), which is based on the international quality management system ISO 9001 with particular requirements for Healthcare services [2].

1.1. European Legislation for Healthcare

Following specific requests – called 'standardization requests' or 'mandates' – from the European Commission, CEN and CENELEC develop European Standards that support the

European legislation in a number of domains [11]. The mandated standards are called 'Harmonized Standards' and their references and titles are published in the 'Official Journal of the European Union'. On 5 May 2017, the European Commission published the new EU Regulations in the field of medical devices in the Official Journal of the European Union [12]:

- Regulation 2017/745 on Medical Devices
- Regulation 2017/746 on In Vitro Diagnostic Medical Devices.

In the field of medical equipment, CEN and CENELEC were mandated by the European Commission to develop Harmonized Standards in support of the following EU Directives [10, 11]:

- Directive 93/42/EEC on Medical Devices
- Directive 90/385/EEC on Active Implantable Medical Devices
- Directive 98/79/EC on In vitro Diagnostic Medical Devices.

The Harmonized Standards published in the Official Journal in support of the above three medical Directives.

Moreover, the following mandates from the European Commission to CEN and CENELEC in the field of medical equipment are currently ongoing [12,13]:

- M/023 - Mandate for CEN/CENELEC concerning the development of European Standards relating to medical devices (complemented by M/295)
- M/295 - Standardization mandate to CEN/CENELEC concerning the development of European Standards relating to medical devices (complements M/023)
- M/252 - Standardization mandate to CEN/CENELEC concerning the development of European Standards relating to in vitro diagnostic medical devices
- M/467 - Standardization mandate addressed to CEN and CENELEC: modification and completion of EN 60601-2-52 to prevent entrapment of children and of adults with an atypical anatomy in medical beds and entrapment of children in medical cots.

1.2. European Standardisation for Healthcare

Safe access to healthcare for patients is a basic right nowadays. That is ensured through putting on the market medical devices that meet strict safety requirements as laid down in the three EU Medical Devices Directives – namely, the Medical Devices, Active Implantable Medical Devices and In Vitro Diagnostic Medical Devices Directives [6,7]. Moreover, it is also of paramount importance that the integrity of the patient and of his health data is protected at all times. Interoperability of health information systems between all the actors and devices who handle and process health data is a guarantee that this requirement is achieved. Through their more than 20 Technical Committees dedicated to healthcare, CEN and CENELEC develop European Standards setting safety, quality and performance requirements for medical devices that are put on the European market [10]. A large number of those standards enable manufacturers to make their medical products compliant with the European legislation in the medical sector, for the ultimate benefit of all European citizens. In addition, CEN/TC 251 ‘Health informatics’ is a Technical Committee specifically dedicated to the development and provision of European Standards ensuring interoperability of health information systems throughout Europe, with systematic harmonization with the international environment.

Each CEN and CENELEC Technical Committee in the domain of medical equipment develops European Standards according to a well-defined, dedicated scope. CEN and CENELEC therefore cover a wide variety of medical topics, ranging from electrical medical equipment, syringes, ophthalmic optics and dentistry to air ambulances, in vitro diagnostic medical devices and sterilizers. The relative CEN and CENELEC Technical Committees are [10, 11]:

- CEN-CLC/TC 3 - Quality management and corresponding general aspects for medical devices
- CEN/TC 55 - Dentistry
- CLC/TC 62 - Electrical equipment in medical practice
- CEN/TC 102 - Sterilizers and associated equipment for processing of medical devices
- CEN/TC 140 - In vitro diagnostic medical devices
- CEN/TC 170 - Ophthalmic optics
- CEN/TC 204 - Sterilization of medical devices

- CEN/TC 205 - Non-active medical devices
- CEN/TC 206 - Biological and clinical evaluation of medical devices
- CEN/TC 215 - Respiratory and anaesthetic equipment
- CEN/TC 216 - Chemical disinfectants and antiseptics
- CEN/TC 239 - Rescue systems
- CEN/TC 251 - Health informatics
- CEN/TC 258 - Clinical investigation of medical devices
- CEN/TC 285 - Non-active surgical implants
- CEN/TC 293 - Assistive products for persons with disability
- CEN/TC 316 - Medical products utilizing cells, tissues and/or their derivatives
- CEN/TC 362 - Project Committee - Healthcare services - Quality management systems
- CEN/TC 367 - Project Committee - Breath-alcohol testers
- CEN/TC 403 - Aesthetic surgery and aesthetic non-surgical medical services
- CEN/TC 414 -(Disbanded) Services in Osteopathy
- CEN/TC 424 - Project Committee - Care services for cleft lip and/or palate
- CEN/TC 427 -(Disbanded) Services of Medical Doctors with additional qualification in Homeopathy
- CEN-CLC/JTC 16 - CEN-CENELEC Joint Technical Committee on Active Implantable Medical Devices.

Published Standards which are widely known in the European market and used by organisations in the healthcare sector are the following ones per CEN/TC [10,11]:

CEN/TC 362
CEN/TR 15592:2007**,** Health services - Quality management systems - Guide for the use of EN ISO 9004:2000 in health services for performance improvement
EN 15224:2016, Quality management systems - EN ISO 9001:2015 for healthcare

CEN/TC 403
EN 16372:2014, Aesthetic surgery services (CEN/TC 403)
EN 16844:2017+A1:2018, Aesthetic medicine services - Non-surgical medical treatments

CEN/TC 414
EN 16686:2015, Osteopathic healthcare provision

CEN/TC 424
CEN/TR 16824, Early care services for babies born with cleft lip and/or palate

CEN/TC 427
prEN 00427001, Services of medical doctors with additional qualification in homeopathy.

European Commission provides via the European Innovation Partnership website a whole section of standardisation documents which contains a complete overview of the present situation of European and International standardization in the topics related to Active and Healthy Ageing (AHA), covering standards, technical reports and technical specifications, but also guidance documents, industry standards, databases and scientific methodologies and tools [13].

Last but not least, through 34 national members active in eHealth standardization, CEN and CENELEC have a strong European network with global outreach through ISO and IEC that can provide the framework for Europe to capture global market opportunities. The European Standardization System is a unique asset for Europe that with the support and engagement of the Commission and the EU institutions will develop the needed standards for eHealth to the benefit of European citizens, healthcare providers and businesses.

The ability to exchange health data depends on the availability of appropriate infrastructure including security and directory services. These need to be incentivized as necessary enablers of a regional, national or European eHealth IT infrastructure. Here, the future work of CEN-CENELEC/TC

8 ‘Privacy management in products and services’ and CEN-CENELEC TC/13 ‘Cybersecurity and data protection’ will be crucial for developing the necessary standards addressing the lack of interoperable solutions and practices, trustworthy IT solutions, and data protection requirements [10, 11]. In Europe, there are common variables driving the need for interoperability, including population demographics, the increasing complexity of healthcare due to chronic diseases, and —as shown by the survey data— a range of common operational factors such as cost, quality, safety and efficiency [12]. There are multiple layers of interoperability, ranging from the pan-European level down to national, regional, organisational, departmental, and system levels. However, each level has its own additional set of drivers, creating some unique characteristics at the country level and significant differences among organisations. In accordance to the study entitled “*Strategic Interoperability in Germany, Spain & the UK - The Clinical and Business Imperative for Healthcare Organisations”, implemented on 2014*, all the countries are facing cost pressures, but their differing approaches to funding hospitals puts pressure on different areas of their respective healthcare systems. Reported budgets vary widely, but because the definition of interoperability varies, and it is rarely itemised in budgets, it is difficult to compare these results. A clear finding from the study is the need to create more awareness of the value of strategic interoperability at all levels, among both IT and managerial staff [12, 13].

2. HEALTHCARE MANAGEMENT STANDARDS SYSTEMS

2.1. EN ISO 13485 Medical Devices - Quality Management Systems– Requirements for Regulatory Purposes

International Standardisation Organization (ISO), issued the first standards for Medical Device manufacturers in 1996, as ISO 13485 and ISO 13488. At the time, each of the two standards followed the requirements of the then available ISO 9001 and ISO 9002 (the first including requirements for Design and Development of product, the second not), with additional particular requirements for Medical Devices. Not many manufacturers in Europe, decided to implement the requirements of these standards, as in the mid-90s, the main European Directive for Medical Devices (MDD 93/42/EEC) was still in transition for implementation, and the In- Vitro Diagnostic Medical Devices Directive (IVD 98/79/EU) was adopted in 1998 with a transitional period of three years. Also, in European Community, CEN had adopted the corresponding European Standards (EN 46001 and EN 46002), based exactly on the same principles. It was after the release of the ISO 9001:2000 (the principle of process approach), allowing exclusions from the requirements of the standard, that the “separate” versions of standards were discontinued.

The ISO 13485:2003 was issued (3 years after release of ISO 9001:2000), after a lot of consultation of “interested parties”, including standardization authorities from all continents. Only in 2016, the Standard was revised, aiming to become a really “Regulatory Standard” worldwide.

In Europe, CEN adopted the ISO 13485/13488:1996 in 2000 (after 5 years), the revised ISO 13485:2003 was adopted in 2003, and the last revision ISO 13485:2016 was adopted by CEN the same day, in March 2016, as EN ISO 13485:2016.

The difference in ISO 13485 and EN ISO 13485 (since 2012) is quite important for all manufacturers looking to place their devices on the European Union Market: this standard, is “harmonized” to the three Directives, which the framework for evaluation of Safety and Effectiveness of Medical Devices, labelling with CE marking and placement on the market [1,4]. As the Requirements of the standard remain unchanged, there are three set of Annexes in the EN ISO 13485:2016 (in a European Forward), correlating each of the three Directives’ requirements to the ISO 13485 requirements [1]. This, provides a “presumption of conformity”: if a Manufacturer fulfils a requirement of EN ISO 13485, it is supposed that the Manufacturer fulfils also the corresponding Directive requirement.

The EN ISO 13485 is structured in eight paragraphs of which the 4th, 5th, 6th, 7th and 8th are requirements' paragraphs [1]:

1 Scope
2 Normative references.
3 Terms and definitions

4 Quality management system
4.1 General requirements
4.2 Documentation requirements
4.2.1 General
4.2.2 Quality manual
4.2.3 Medical device file
4.2.4 Control of documents
4.2.5 Control of records
5 Management responsibility
5.1 Management commitment
5.2 Customer focus
5.3 Quality policy
5.4 Planning
5.4.1 Quality objectives
5.4.2 Quality management system planning
5.5 Responsibility, authority and communication
5.5.1 Responsibility and authority
5.5.2 Management representative
5.5.3 Internal communication
5.6 Management review
5.6.1 General
5.6.2 Review input
5.6.3 Review output
6 Resource management
6.1 Provision of resources
6.2 Human resources
6.3 Infrastructure
6.4 Work environment and contamination control
6.4.1 Work environment
6.4.2 Contamination control
7 Product realization
7.1 Planning of product realization
7.2 Customer-related processes
7.2.1 Determination of requirements related to product
7.2.2 Review of requirements related to product
7.2.3 Communication
7.3 Design and development
7.3.1 General
7.3.2 Design and development planning
7.3.3 Design and development inputs
7.3.4 Design and development outputs
7.3.5 Design and development review
7.3.6 Design and development verification
7.3.7 Design and development validation
7.3.8 Design and development transfer
7.3.9 Control of design and development changes
7.3.10 Design and development files
7.4 Purchasing
7.4.1 Purchasing process
7.4.2 Purchasing information
7.4.3 Verification of purchased product
7.5 Production and service provision
7.5.1 Control of production and service provision
7.5.2 Cleanliness of product
7.5.3 Installation activities

7.5.4 Servicing activities
7.5.5 Particular requirements for sterile medical devices
7.5.6 Validation of processes for production and service provision
7.5.7 Particular requirements for validation of processes for sterilization and sterile barrier systems
7.5.8 Identification
7.5.9 Traceability
7.5.10 Customer property
7.5.11 Preservation of product
7.6 Control of monitoring and measuring equipment
8 Measurement, analysis and improvement
8.1 General
8.2 Monitoring and measurement
8.2.1 Feedback
8.2.2 Complaint handling
8.2.3 Reporting to regulatory authorities
8.2.4 Internal audit
8.2.5 Monitoring and measurement of processes
8.2.6 Monitoring and measurement of product
8.3 Control of nonconforming product
8.3.1 General
8.3.2 Actions in response to nonconforming product detected before delivery
8.3.3 Actions in response to nonconforming product detected after delivery
8.3.4 Rework
8.4 Analysis of data
8.5 Improvement
8.5.1 General
8.5.2 Corrective action
8.5.3 Preventive action
Annex A (informative) Comparison of content between ISO 13485:2003 and ISO 13485:2016
Annex B (informative) Correspondence between ISO 13485:2016 and ISO 9001:2015

2.2. Principles and Rationale of EN ISO 13485:2016

The basis of EN ISO 13485:2016, is the “older” version of ISO 9001:2008. In all paragraphs of sets of requirements (from Ch. 4.1 to Ch. 8.5.3), there are particular requirements for Medical Devices [1]. The key aspects of the EN ISO 13485:2016 compliance, can be summarized in the following (though the format and expressions maybe different in the text itself) [1]:

1. Applicability. This standard is applicable to all organizations involved in one or more stages of the life-cycle of a Medical Device.
2. Applicable regulatory Requirements. Any organization subject to implementation of EN ISO 13485:2016, shall identify and comply with all applicable regulatory requirements (related to the safety and performance of the medical device and declared in the standard, in all jurisdictions of operation)
3. Requirement for risk – based approach for the processes of the Organization. This requirement is based on the criticality of processes, related to the safety and performance
4. Effectiveness of the Quality Management System, in supporting provision of Safe and Performing Medical Devices, and compliance to applicable regulatory requirements.

2.3. EN 15224 Quality Management Systems – EN ISO 9001:2015 for Healthcare

Starting with the Donabedian Model (introduced by A. Donabedian, Univ. of Michigan) in 1966, the Bamako Statement (African Ministers of Health in Mali, 1987), and several models by WHO (Geneva, Swiss), the evaluation of Healthcare Quality, is still evolving in terms of parameters, tools, methods and criteria.

EN 15224 is a European Standard (issued by CEN), providing the requirements for the application of the Quality Management System standard ISO 9001:2015 in Healthcare Services (current version EN 15224:2016). It started as a “guide for use of EN ISO 9001:2000” in 2005, so at that time it could not be evaluated and audited for Certification, until 2012, when it was re-issued as a “requirements” standard, based on the requirements of EN ISO 9001:2008. As a European Standard, (that is, not an ISO standard), it has particular requirements in almost all chapters of ISO 9001 [2,3]. In its current version, this European Standard incorporates the major principles of global practice in the assessment of Quality in Healthcare. Clinical pathways, diagnostic and therapeutic protocols, clinical practise guidelines, risk assessment, cost effectiveness are to be considered in designing, implementing, maintaining and improving a Healthcare Quality Management System.

The EN 15224:2016 standard is structured in ten paragraphs of which the 4th, 5th, 6th, 7th, 8th, 9th and 10th are requirements' paragraphs. Moreover, five Annexes provide informative clarifications for better understanding and implementation of the management system requirements [2]:

1 Scope
2 Normative references
3 Terms and definitions
4 Context of the organization
4.1 Understanding the organization and its context
4.2 Understanding the needs and expectations of interested parties
4.3 Determining the scope of the quality management system
4.4 Quality management system and its processes
5 Leadership
5.1 Leadership and commitment
5.2 Policy
5.3 Organizational roles, responsibilities and authorities
6 Planning
6.1 Actions to address risks and opportunities
6.2 Quality objectives and planning to achieve them
6.3 Planning of changes 34
7 Support
7.1 Resources
7.2 Competence
7.3 Awareness
7.4 Communication
7.5 Documented information
8 Operation
8.1 Operational planning and control
8.2 Requirements for products and services
8.3 Design and development of products and services
8.4 Control of externally provided healthcare processes, products and services
8.5 Production and service provision
8.6 Release of products and services
8.7 Control of nonconforming outputs
9 Performance evaluation
9.1 Monitoring, measurement, analysis and evaluation
9.2 Internal audit
9.3 Management review
10 Improvement
10.1 General
10.2 Nonconformity and corrective action
10.3 Continual improvement
Annex A (informative) Clarification of new structure, terminology and concepts
A.1 Structure and terminology
A.2 Products and services
A.3 Understanding the needs and expectations of interested parties

A.4 Risk-based thinking and systematic clinical risk management
A.5 Applicability
A.6 Documented information
A.7 Organizational knowledge
A.8 Control of externally provided healthcare products and services
Annex B (informative) Other International Standards on quality management and quality management systems developed by ISO/TC 176
Annex C (informative) Correlation matrix EN 15224:2012 to EN ISO 9001:2015 to EN 15224:2016
Annex D (informative) Quality requirements and quality characteristics in healthcare
Annex E (informative) Guidance for process approach in healthcare
E.1 Background
E.2 Processes and workflow in general
E.3 Clinical Processes
E.4 Analysis and management of clinical processes
Bibliography.

2.4. Principles and Rationale of EN 15224:2016

Main emphasis in EN 15224 is the Clinical Risk Assessment, which the Organization must evaluate, in order to develop the Quality Management System in a way to minimize the frequency and impact of such risk, thus providing optimum management of patients /people addressing Healthcare facilities for support EN 15224 provides the framework of a QMS dedicated to Health care services, by clearly stating eleven (11) quality principles in the Healthcare [2]:

1. Appropriate, correct care (evaluation by healthcare professionals, risk-based approach).
2. Availability (within reach of patient, as required).
3. Continuity of care (“flow” of services, from referral to investigation, treatment, rehabilitation and follow-up).
4. Effectiveness (activities increasing the probability of POSITIVE outcome as compare to other management, or no management).
5. Efficiency (maximize the ratio “positive outcome” over “resources used” – expressed also as “cost effectiveness”).
6. Equity (same management for same needs – irrespective of any background)
7. Evidence/knowledge based care (activities and management based on scientific evidence, medical knowledge, best practices)
8. Patient centered care including physical, mental, social integrity (“personalized care”, considering patient’s values, preferences, physical/mental integrity)
9. Patient involvement (information, consultation, consensus, participation in decisions – as applicable)
10. Patient safety (identification, mitigation, control and monitor of risks- processes with no harm increase effectiveness and efficiency).
11. Timeliness /accessibility (due time re: sequence of activities based on patient’s assessed needs).

In this respect, all processes (even non – clinical processes), must be analysed in terms of possible clinical impacts for the subjects under consideration. As an example, maintenance of facilities infrastructure, purchasing, Heating, Ventilation and Air-Conditioning (HVAC) management processes, can easily be identified as processes with a potentially critical clinical impact.

3. CERTIFICATION IN HEALTHCARE SERVICES

3.1. Accredited certifications in Healthcare services – EN ISO 13485:2016

EN ISO 13485 accredited certification should be a smooth process, due to the many years of experience with this standard across the Medical Device Manufacturers worldwide, and the use of this certification as a “regulatory requirement” in several jurisdictions. Still, the last revision of this standard, has some “grey” areas of concern. It was adopted in March 2016 (after the launch of the recent release ISO 9001:2015 in September 2015), but its structure, is based on the old structure – the ISO 9001:2008 format. (This is an exception of the rules of ISO, after the decision that all new/revised Management Systems standards, shall follow the then launched High Level Structure, with 10 Chapters of Requirements for all standards). There is a very good reason for this exception though: a great effort has been realized for years, and significant changes to the new version have been approved. These changes reflect a “Global regulatory environment” for Medical devices. They incorporate much of the particular regulatory requirements of major stakeholders, with mature and well-developed requirements related to Safety and Performance of Medical Devices (like EU, USA, Canada, Japan, Australia, Brazil and many others) [4, 6, 7].

In European Union, the current status is a bit “complicated”: The version EN ISO 13485:2016 is based on the format of ISO 9001:2008, and not on the High Level Structure. The European Forward, includes three sets of Annexes, correlating the EN ISO 13485:2016 requirements, to the three EU Directives’ requirements. The EU Directives have already been repealed by two new Medical Device Regulations (MDR), currently in transition period. So, what is to expect in the (near) future? Possibly, a revision of ISO 13485 to the High Level Structure, and adaptation by CEN. Then, a revision of EN (only) ISO 13485, by May 2020 (end of transition period for MDR 745/2017, repealing two of the Directives), in order to provide correlation of compliance with the MDR requirements. Then, another revision by May 2022 (end of transition period of IVDR 746/2017), for the same reason [8].

Therefore, accreditation bodies and certification bodies have also a lot of “donkey work” in order to catch up with these “changes”, and sometimes even manufacturers, regulators, auditors, administrators, are “lost” in this paper work of editions, versions, regional revisions etc. This, does not reflect what the main aim is: a “global” version of a Medical Device Management System Standard. (As far as the actual CONTENT of requirements is concerned, this globalization is not challenged, though. And this is the good part).

In 2016, there were over 29,500 accredited certificates for ISO 13485, with 50% of them issued in Europe, and a growth of 13% vs 2015 (data from the official ISO Survey 2016) [9, 10].

In Greece, the estimated certificates for 2017 are around 320 [10], the majority being trading and service Companies (approximately 50 manufacturers of MD). Just for comparison it is good to point out that the ISO Survey 2016, gives a figure of 361 accredited certificates in Spain (a country with 4X the population of Greece and 6,3X the GDP of Greece), and a figure of 89 certificates in Portugal (a country with similar population and GDP with Greece), [9, 10]. One of the reasons is the fact that public tenders in Greece usually request certification to EN ISO 13485. As a result of this situation, the manufacture and trade, installation, service/maintenance of Medical Devices in Greece, follows very good standards, providing good quality devices in the Healthcare providers. On the other hand, it has a negative impact in terms of time and direct costs to the organizations involved. The following Table 1 shows the number of the certified ISO 13485 management standards systems (MSS) in European countries between 2004 and 2016 and the figure 1 shows the worldwide trends and performance.

Table 1: Certified ISO 13485 MSS systems by country and by year in Europe [9,10]

ISO 13485 - Europe													
Year	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Country	**1307**	**2828**	**3574**	**7049**	**7463**	**9008**	**11034**	**10515**	**12232**	**13203**	**12884**	**12366**	**14705**
Andorra											1	0	0
Austria	46	71	68	140	158	160	137	197	128	238	314	212	202
Belarus			5	6	3	5	5	6	4	3	7	10	7
Belgium	13	12	75	76	79	99	112	123	143	173	212	194	220
Bosnia and Herzegovina			1	2	2	2	1	1		0	1	2	2
Bulgaria	2	2	2	5	5	10		17	36	39	48	46	60
Croatia	1	1		6	10	13	16	15	17	22	24	30	38
Cyprus			2	2		3	1		1	0	2	2	4
Czech Republic	18	54	65	221	199	131	183	164	195	305	266	269	262
Denmark	10	19	7	56	76	113	119	111	156	126	122	128	145
Estonia	2	2	7	2	3	3	5	9	9	10	14	10	11
Finland	6	6	20	188	31	86	50	67	104	135	71	85	109
France	144	153	518	709	709	788	865	1035	945	1046	1058	1400	1097
Georgia			1							0	0	0	0
Germany	177	824	699	2204	2651	3019	3291	3438	4140	3909	2886	2508	4107
Greece	5	5	26	31	32	49	61	50	72	334	89	116	317
Hungary	15	12	27	37	36	45	58	69	92	98	96	92	86
Iceland	2	1			1	4	4	5	5	5	12	20	5
Ireland	19	33	84	95	116	121	155	159	193	148	131	102	137
Italy		69	376	1482	1112	1109	1881	1346	2052	2124	2667	2635	2980
Latvia	1	1	3	1	1	8	1	5	3	6	6	14	13
Liechtenstein			2	4	7	6	12	7	16	17	22	16	20
Lithuania		2	1	2	1	1	8	7	7	9	12	16	18
Luxembourg		2	3	3	6	7	5	7	8	7	10	12	17
Malta		1					1	1	2	3	3	1	3
Monaco			2		3	1	1	4	2	2	3	2	3
Montenegro				2	2	2				0		0	0
Netherlands	15	31	55	47	91	206	285	336	396	444	226	251	283
Norway	12	10	26	24	26	31	36	45	32	35	39	39	53
Poland	21	25	70	76	76	144	158	154	193	128	181	292	303
Portugal	1	20	22	28	11	17	24	28	38	62	65	68	89
Romania		4	2	9	8	28	56	109	97	96	64	95	113
Russian Federation	2	8	25	28	22	94	114	74	90	98	104	125	122
San Marino, Republic of			1					1	1	1	5	3	5
Serbia			7	9	10	11	30	32	47	53	55	16	52
Slovakia	3	3	9	22	23	66	43	24	50	37	63	77	79
Slovenia	3	4	6	6	5	8	11	13	17	22	30	6	35
Spain	1	7	29	40	57	78	98	124	161	222	331	379	361
Sweden	67	85	177	231	239	284	254	315	266	346	299	183	198
Switzerland	161	367	446	608	728	836	985	695	843	985	1302	1164	955
The Former Yugoslav Republic of Macedonia					2	1		1	3	2	2	0	1
Turkey	12	21	55	52	16	83	86	101	86	92	152	88	94
Ukraine			2	6	5	6	2	5	9	9	8	7	16
United Kingdom	548	973	648	589	901	1330	1880	1615	1573	1812	1881	1651	2083

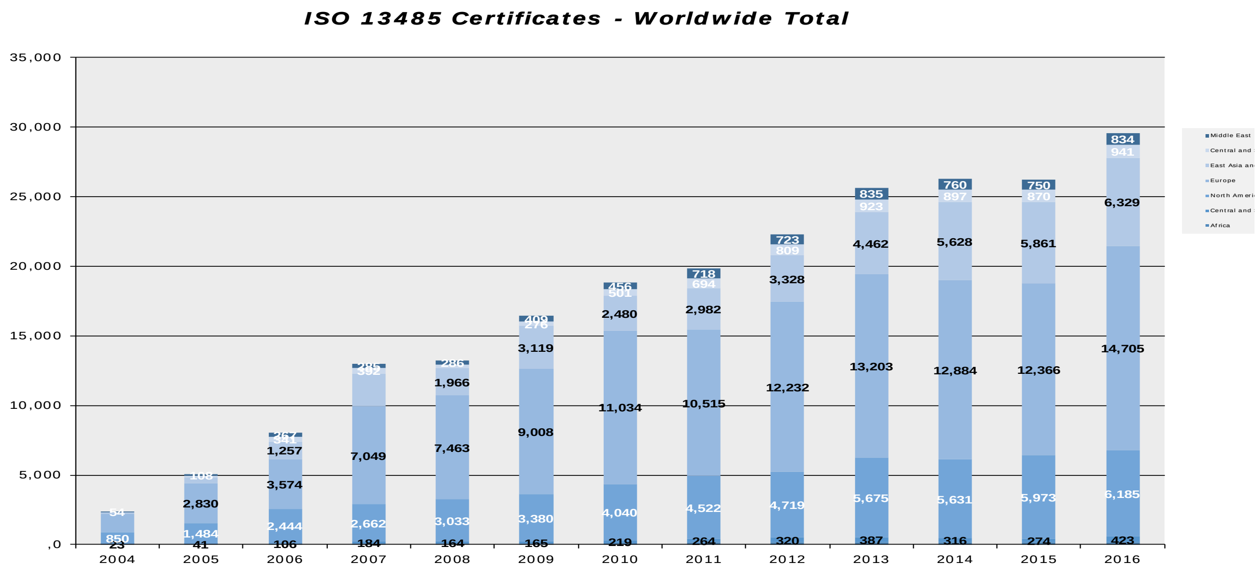

Figure 1: Worldwide trends and performance of certified ISO 13485 MSS, [9, 10]

3.2. Accredited certifications in Healthcare services – EN 15224:2016

This specific standard for Quality Management System in Healthcare, is very new. It was first published in December 2012 for implementation of the EN ISO 9001:2008 in Healthcare, and the revision was published in December 2016, as application of EN ISO 9001:2015 in Healthcare. Therefore, still being in the transition period (until December 2019), accreditations in Greece are valid for the old standard of 2012 [15].

It is estimated that approximately 70 Healthcare facilities have been audited according to EN 15224 in Greece [15]. The driving force looks to be a particular legislation related to licensing of In Vitro Fertilization facilities (and cryopreservation of gametes), but most important is the opportunity of Medical Tourism in Greece: the state-of-the-art facilities, experienced medical and nursing personnel, climate and location of Greece, provides the basis for this, which is supported by a European specific Quality Standard certification [16]. The majority of the certificates are issued to the private Healthcare sector, but also some public hospitals-departments are looking for this certification in order to ensure delivered quality services and increase the attractiveness for joining several research projects [15,16]. It is expected that the departments/clinics/hospitals already certified to EN ISO 9001, will gradually upgrade their Quality Management Systems to comply and be certified to EN 15224. This will increase the confidence of patients for the already very good quality services provided in the Healthcare industry, both for national and international patients.

4. CONCLUSIONS

Summarizing, whether a company is looking to operate internationally or expand locally, EN ISO 13485 Certification can help to improve overall performance, eliminate uncertainty, and widen market opportunities. Companies with this certification communicate a commitment to quality to both customers and regulators.

- Increase access to more markets worldwide with certification.
- Outline how to review and improve processes across the organization. A quality management system not only creates effective communication channels to articulate deficiencies, but it also provides systematic methods for improving processes. Whether it's through quality auditing or corrective action requests, systematic improvement is a benefit of ISO 13485 certification [1,5].
- Increase efficiency, cut costs and monitor supply chain performance. Quality can lead to faster cycle times and better service.
- Demonstrate the production of safer and more effective medical devices.
- Meet regulatory requirements and customer expectations.

The EN 15224 concretized for healthcare promotes the adoption of a quality process approach and a clinical process approach to enhance customer satisfaction by meeting customer and patient's requirements.

In this paper presented the conceptual principles and differences of the two main healthcare management standards systems in European and International level (EN ISO 13485 and EN 15224), their scope and relationship with the legislative framework and the relevant European Standardisation Technical Committees, the general conformity requirements, the auditing challenges and the benefits of the certification process both for the public and private sector and for the state. Aspects like interoperability, privacy management in products and services, cybersecurity and data protection, artificial intelligence, eHealth, biosafety and biosecurity will be challenges of the new era alongside the continuous improvement of services provided to patients by the healthcare infrastructures (private and/or public sector). It's here again that the healthcare standardisation boosting interoperability and enhancing of quality, safety and security for the benefit of societies, the economies and the humanity. The dependencies and the interdependencies of the above factors could be the subject of further research and study.

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Innovation Management: Building the Resilient Organisations of Tomorrow that Sharing Knowledge

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ABSTRACT

The pace of innovation moves rapidly, and fresh knowledge needs to be shared internationally. European and international standardization organisations are developing new standards of innovation management involving key aspects as risk assessment, knowledge management and intelligence in order to strengthen resilience within communities and developing capacity and tools that leverage technological innovations. Innovation management enables organizations to focus on competitiveness and successful performance. Standardization can enhance organizational capabilities in order to be aligned with European and international best practices as well as to develop internal competences, routines and processes that can leverage an innovation journey towards excellence. At national and international levels, evidence demonstrates the importance of standardization, as a body of knowledge, to contribute to business innovation and to increase competitiveness and realization of value.

The European Committee for Standardization (CEN) and especially the Technical Committee 389 "Innovation Management" produced the CEN "Family" of Technical Specifications (CEN/TS 16555) in order to guide European organizations to be aware and to develop innovation as a driver for competitiveness and value creation. At international level, *the* International Standardisation Organisation and in particularr the Technical Committee 279 "Innovation management " is working on the development of the new ISO 50500 series on innovation management which focus on building an innovation culture through managing of intelligence, methods for innovative partnership and intellectual property issues.

As our world becomes increasingly interconnected and complex, new threats also emerge; we become increasingly vulnerable to systemic risks. To reap the benefits of our interconnected and innovative world, we must address and mitigate these risks. Policy makers and societies need to prepare for the inventions that will emerge and disrupt the global economy. This paper summarizes the current trends taking into account the most recent developments and highlights the most important aspects according to the literature review.

Key Words: Innovation Management, Standardisation, Risk Management, Research, Resilience.

1. INTRODUCTION

As innovation becomes more accepted and popular within the new work era, it comes to no surprise that the actual word and focus on innovation has become a critical component for organizational survival. Practically, all the economic growth that has occurred after 1980 is linked with innovations. Innovation is also a common denominator for today's large and successful organizations that have succeeded in creating a competitive advantage over its competitors. These organizations utilizes new knowledge and technology to create new or improve their products and services but also for how the products and services are created and delivered [1]. The big challenge however lies in the difficulty to manage and implement innovation into an organization thus innovation is a complex process with much uncertainty. Unfortunately there is no simple strategy or recipe for an organization to follow to become innovative and for many organizations the innovation process considered as unmanageable. Many organizations today have difficulty in making innovation a part of their work model, which prevents those organizations from developing new skills and strategies to improve the efficiency of their products, services and work-models. Such organizations usually do not survive on the market for long periods of time and eventually becomes outcompeted. Organizations on the other hand that has understood the importance of innovation and are able to manage the complexity of the innovation process has managed to survive and withstand the tough competition on their markets for decades. History furnishes us with several examples of such innovative organizations where Google, 3M and Corning among others are a few in a long list [1].

Many definitions have been given for the “innovation” by international and European organizations. In accordance to *John Kao [2],* innovation is the capability of continuously achieving a desired future. “*What I have learned is that innovation-creating what is both new and valuable- is not a narrowly defined, technical area of competence. Rather, innovation emerges when different bodies of knowledge, perspectives and disciplines are brought together*” [2]. The CEN/TS 16555-1:2013 defines as innovation the implementation of a new or significantly improved product (good or service), or process, new marketing method, or new organizational method in business practices, workplace organization or external relations [3]. Moreover, the same TS defines as innovation management system (IMS), the set of interrelated or interacting elements of an organization to establish innovation policies and objectives as well as processes to achieve those objectives [3].

There are two main initiatives of standards related to Innovation. Two families of standards are particularly developed for Innovation Management. Both are in alignment with the well-known International Quality Management System Standard, ISO 9001 and the ISO 31000 for the Risk Management. The first family, it consists of the CEN/TS 16555 with its seven parts. This document is not intended for the purpose of certification. It is a European standardization document, a Technical Specification (TS) that is, issued by CEN, recognized in Europe [3,4,5,6,7,8,9]. The second family, is the ISO 50500 series of standards which is under development and consists of six documents [17]. ISO 50501 is the standard on Innovation Management System and has not been clarified to date if it will be a standard of requirements or for guidance.

1.1. European Legislative framework for Innovation

Innovation is vital to European competitiveness in the global economy. The EU is implementing policies and programmes that support the development of innovation to increase investment in research and development, and to better convert research into improved goods, services, or processes for the market [12].

As highlighted by EU Industrial Policy, industry is crucial for EU competitiveness and innovation is a key factor in this regard. Industry accounts for 80% of Europe's exports. Some 65% of private sector research and development (R&D) investment comes from manufacturing [13, 14]. Therefore, industrial modernisation in Europe must be broad-reaching and include:

- the successful commercialisation of product and service innovations
- the industrial exploitation of innovative manufacturing technologies
- innovative business models

Studies show that those companies who prioritise innovation are also those who experience the highest increase in turnover (Innobarometer, 2014) [10]:

- Some 79% of companies that introduced at least one innovation since 2011 experienced an increase of their turnover by more than 25% by 2014.

Small and medium-sized enterprises (SMEs) are a particular target for innovation policy. The smaller the company is, the more it faces constraints to innovation or to the commercialisation of its innovations.

- Some 63% of companies with between 1 and 9 employees declared having introduced at least one innovation since 2011, compared to 85% of companies with 500 employees or more.
- Some 71% of companies with between 1 and 9 employees encountered difficulties commercialising their innovations due to a lack of financial resources, compared to 48% of companies with 500 employees or more.

New growth opportunities come from providing new products and services from:

- technological breakthroughs
- new processes and business models
- non-technological innovation and innovation in the services sector.

These must be combined with creativity, flair and talent, or innovation in its broadest sense.

The latest Policy Communication (June 2014) sets out the European Commission’s priorities for innovation. In this context, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs [15,16]:

- supports innovation development in priority areas and in SMEs, mainly through Horizon 2020

- fosters the broad commercialisation of innovation in the EU including Public Procurement for Innovation, Design for Innovation, Demand-Side Policies for Innovation, Public Sector Innovation, and Social Innovation
- develops sector policies to modernise the EU’s industrial base and accelerate the market uptake of Key Enabling Technologies such as Workplace Innovation
- monitors innovation performance and innovation uptake in order to identify developments that require policy changes. Key methodologies include the European Innovation Scoreboards, Innobarometers, Business Innovation Observatory
- improves regulatory conditions for innovation with measures for start-ups, entrepreneurship, access to finance, digital transformation, Single Market, intellectual property and standards.
- supports the development and cooperation of clusters to boost SME innovation.

Innovation Management in the H2020 and FP7 projects aims to monitor and control the process of creating novel outcomes with strong impact. These will be the output of the projects, such as new ideas, algorithms, concepts, methods, products, services, or applications that can be exploited through an effective monitoring and controlling processes [13,14].

1.2. Standardisation for Innovation

On 2013 the European Committee for Standardization (CEN) has developed a new Innovation Management System (IMS) that aims to guide organizations to introduce, develop and maintain a framework for systematic innovation management practices. Establishing such a management system would according to this IMS allow any organization regardless of sector, type or size to become more innovative and to achieve more success with their product, service, process, organizational design and business model innovations. The innovation management system will include all activities that are required for generating innovations on a continuous basis and can be a stand-alone management system or be integrated into the core operations and management of the organization. The IMS comes as a Technical Specification (TS) that is identified as CEN/TS 16555-1 and provides guidance on establishing and maintaining an innovation management system into an organization. The TS is best suited for small and medium-sized organization since particular attention has been given to the needs of small and medium-sized enterprises during the development of this Technical Specification.

Countries, such as France, Portugal, Spain, UK, and Brazil have developed national standards on innovation management related topics. They have contributed to an increasing awareness at companies and institutions concerning innovation. However, these national standards have different focus and different approaches. Within Europe a first harmonisation of standards for innovation management system has been achieved with the CEN TS 16555-1 [11].

The European Committee for Standardization (CEN) and especially the Technical Committee (TC) 389 "Innovation Management" (**CEN/TC 389**) produced the CEN "Family" of Technical Specifications (CEN/TS 16555) in order to guide European organizations to be aware and to develop innovation as a driver for competitiveness and value creation [11]. At international level, *the International Standardisation Organisation and* in particular the Technical Committee 279 “Innovation management“ is working on the development of the new ISO 50500 series on innovation management which focus on building an innovation culture through managing of intelligence, methods for innovative partnership and intellectual property issues [17].

The aim of the CEN/TC 389 is to deal with standardization of tools that allow companies and organizations to improve their innovation management, including all kinds of innovation and all the related aspects, as well as the relations with R&D activities. Six Subcommittees and Working Groups run under the CEN/TC 389 “Innovation Management” which produced the following seven Technical Spesifications per CEN/TC Working Group [11]:

Table 1: CEN/TC 389 Working Groups and their TS deliverables

CEN/TC 389/WG 1 Collaboration and Creativity Management	CEN/TS 16555-5:2014 Innovation management - Part 5: Collaboration management CEN/TS 16555-6:2014

	Innovation management - Part 6: Creativity management
CEN/TC 389/WG 2 Innovation Management System	CEN/TS 16555-1:2013 Innovation Management - Part 1: Innovation Management System
CEN/TC 389/WG 3 Innovation Self-Assessment Tools	CEN/TS 16555-7:2015 Innovation management - Part 7: Innovation Management Assessment
CEN/TC 389/WG 4 Design Thinking	CEN/TS 16555-3:2014 Innovation management - Part 3: Innovation thinking
CEN/TC 389/WG 5 Intellectual Property Management	CEN/TS 16555-4:2014 Innovation management - Part 4: Intellectual property management
CEN/TC 389/WG 6 Strategic Intelligence Management	CEN/TS 16555-2:2014 Innovation management - Part 2: Strategic intelligence management

In international level the **ISO/TC 279** is the authorised TC for Innovation Management and main scope the standardization of terminology tools and methods and interactions between relevant parties to enable innovation. Seven standards are under development [17]:

- ISO/AWI 23249 "Innovation management - idea management"
- ISO/CD 50500 "Innovation management -- Fundamentals and vocabulary"
- ISO/DIS 50501 "Innovation management -- Innovation management system", Guidance
- ISO/NP TR 50502 "Innovation management – Assessment", Guidance
- ISO/DIS 50503 "Innovation management - Tools and methods for innovation partnership", Guidance
- ISO/AWI 50504 "Innovation management -- Strategic intelligence management", Guidance
- ISO/AWI 50505 "Innovation management -- Intellectual property management".

Where AWI = Approved Work Item, CD = Committee Draft, DIS= Draft International Standard, NP= New Work Item Proposal, TR= An approved Technical Report.

The majority of the palyers represented on ISO/TC 279 are from Europe. Greater involvement from the developing countries is actively encouraged. As South- and Latin-America and Asia are growing regions in regards to infrastructure and economy and hence depends heavily on innovation, it is strongly recommended to encourage the participation of these regions [18]. .As of today, the committee gathers 48 countries and 6 international liaisons with international institutions (WIPO, WTO, OECD, CERN, World Bank and EPO). As innovation management is a new but key subject, and that subject will gain recognition and adoption in all sectors of the economy, member countries and liaison participation in ISO TC 279 is expected to increase. Manufacturers, services, small, medium sized enterprises, users of the standard, research institutions and government will be encouraged to be represented into the TC 279. It is noticed the necessity to establish a liaison with the CEN/TC 389 "Innovation management" and the ISO/TC 176 "Quality Management [19].

2. CEN/TS 16555 INNOVATION MANAGEMENT

2.1. CEN/TS 16555 family of Standards for Innovation Management

The European Innovation Management family of CEN/TS 16555 has been underway since 2008, and as such it incorporates a lot of the elements which are believed to constitute current best practices on innovation management. The family consists of seven Technical Specifications [10]:

- CEN/TS 16555-1:2013 Innovation Management - Part 1: Innovation Management System
- CEN/TS 16555-2:2014Innovation management - Part 2: Strategic intelligence management
- CEN/TS 16555-3:2014 Innovation management - Part 3: Innovation thinking
- CEN/TS 16555-4:2014 Innovation management - Part 4: Intellectual property management

- CEN/TS 16555-5:2014 Innovation management - Part 5: Collaboration management
- CEN/TS 16555-6:2014 Innovation management - Part 6: Creativity management Creativity management
- CEN/TS 16555-7:2015 Innovation management - Part 7: Innovation Management Assessment).

2.2. CEN/TS 16555-1:2013, Innovation Management - Part 1: Innovation Management System

The CEN/TS 16555-1:2013 Technical Specification provides guidance on establishing and maintaining an innovation management system (IMS) [3]. It is applicable to all public and private organisations regardless of sector, type or size. This document provides guidance on: - understanding the context of the organisation; - establishing the leadership and commitment of top management; - planning for innovation success; - identifying and fostering innovation enablers/driving factors; - developing the innovation management process; - evaluating and improving the performance of the innovation management system; - understanding and using innovation management techniques. By using this document, organisations can increase their awareness of the value of an IMS, establish such a system, expand their capacity for innovation, and ultimately generate more value for the organisation and its interested parties. The innovation management system outlined in this document follows the PDCA structure (plan-do-check-act), so it can be integrated within other standardised business management systems existing in the organisations, e.g. EN ISO 9001, EN ISO 14001, etc. The CEN/TS 16555-1:2013 is structured in eleven paragraphs, namely [3]:
1 Scope
2 Normative references
3 Terms and definitions
4 Context of the organisation
5 Leadership for innovation
6 Planning for innovation success
7 Innovation enablers/driving factors
8 Innovation management process
9 Performance assessment of the innovation management system
10 Improvement of the innovation management system
11 Innovation management techniques.

In this paper is not intended to set out in detail all the paragraphs of the above CEN/TS 16555 seven parts neither the chapters of each CEN/TS 16555 part, rather than significant selective sections.

Innovation is a key driver for the success of organizations. The aim of the CEN/TS 16555-1 is to guide organizations to introduce, develop, and maintain a framework for systematic innovation management practices, an Innovation Management System (IMS). Establishing such a management system would allow organizations to become more innovative and to achieve more success with their product, service, process, organizational design and business model innovations. This would foster organisation’s results, value and competitiveness. Implementing an innovation management system provides several benefits to an organisation, for example, it [20,21]:

- enhances growth, revenues and profit from innovations;
- brings fresh thinking and new value to the organisation;
- proactively captures value from better understanding of future market needs and possibilities;
- helps identify and mitigate risks;
- taps into the collective creativity and intelligence of the organisation;
- captures value from the collaboration with partners for innovation;
- motivates employee involvement in the organisation and fosters teamwork and collaboration.

An innovation management system includes all activities that are required for generating innovations on a continuous basis, regardless of the organisation’s size and it builds, amongst others, on the following:

- context of the organisation;

- leadership for innovation and strategy;
- planning for innovation success;
- innovation enablers/driving factors;
- innovation management process;
- assessment of the performance of the IMS;
- improvement of the IMS;
- innovation management techniques.

Figure 1 provides a conceptual overview of the innovation management system that is outlined in CEN/TS 16555-1:2013 Technical Specification.

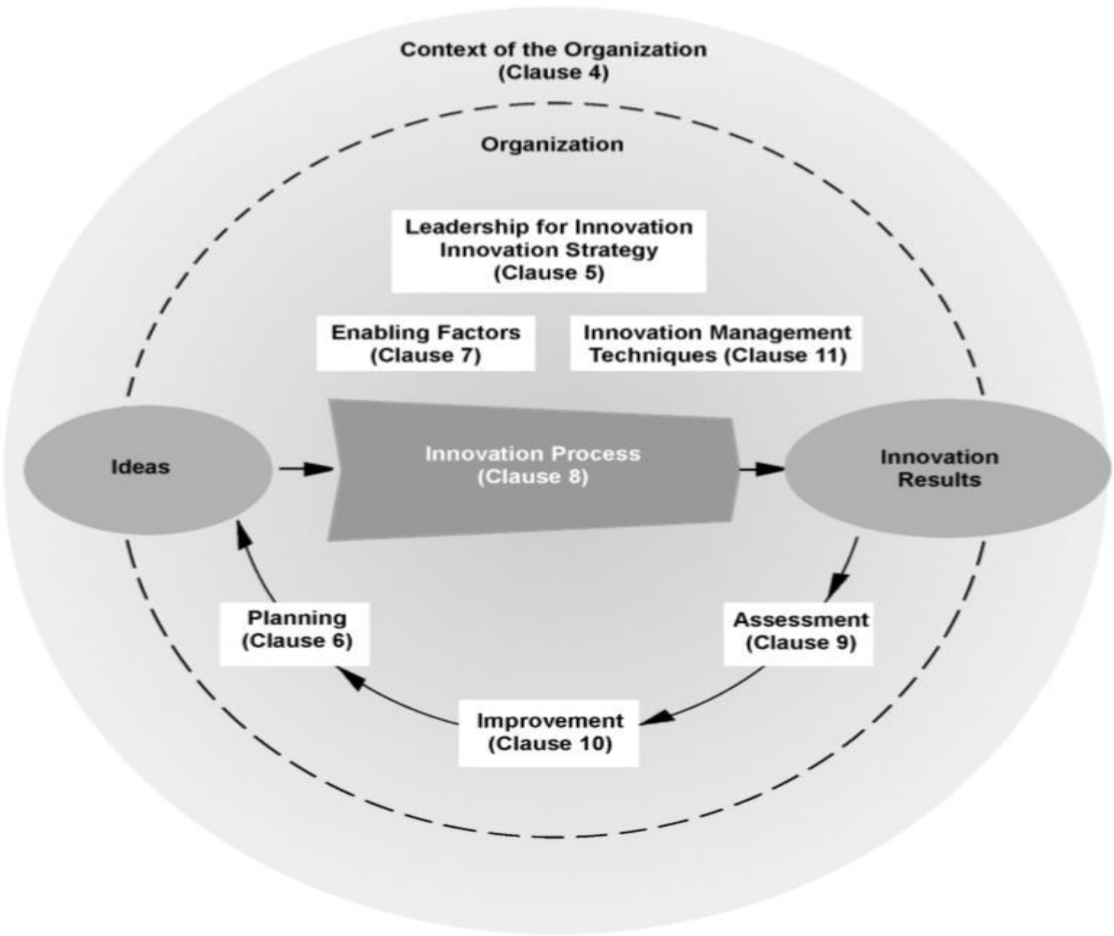

Figure 1: Key elements covered by this innovation management system [3]

The innovation management system can be a stand-alone one or can be integrated into the core operations and management of the organisation to ensure innovation objectives are delivered and performance is measured and improved. During the development of this Technical Specification, particular attention has been given to the needs of small and medium-sized enterprises.

The CEN/TS 16555-1:2013 Technical Specification provides guidance on establishing and maintaining an innovation management system (IMS). It is applicable to all public and private organizations regardless of sector, type or size. In particular provides guidance on:

- understanding the context of the organisation;
- establishing the leadership and commitment of top management;
- planning for innovation success;
- identifying and fostering innovation enablers/driving factors;
- developing the innovation management process;
- evaluating and improving the performance of the IMS;
- understanding and using innovation management techniques.

By using CEN/TS 16555-1:2013, organizations can increase their awareness of the value of an IMS, establish such a system, expand their capacity for innovation, and ultimately generate more value for the organisation and its interested parties. The innovation management system outlined in the CEN/TS 16555-1:2013 follows the PDCA structure (plan-do-check-act), so that it can be integrated within other standardized business management systems existing in organizations, e.g. EN ISO 9001, EN ISO 14001, etc.

2.2.1 Organization of the roles and responsibilities

There are two main responsibilities presented in CEN/TS 16555-1:2013 that must be defines by the organization in the context of IMS, and these are: responsibilities for the specific innovation projects, and general innovation management. The responsibilities can either be assigned to a structured unit, a team or even a single person in the organization depending on its structure and how big it is. Here are some responsibilities that should be included in the general innovation management: ensuring effective and efficient innovation management according to the recommendations of this technical specification, operational planning development, innovation process initiation and driving, the innovation project responsibilities can be assigned for every innovation project and when it is needed, subcontracting of external experts for specific tasks or projects where a gap in internal expertise is identified can be included, innovation project coordination, reporting of progress and performance to top management [3].

2.2.2 Competence

Some of the organizations important tasks presented in CEN/TS 16555-1:2013 are:

- Decide what competences are needed for a person who is working with innovation activities and development of them.
- Be sure that they are competent persons with appropriate education, are trained and have experience.
- Where applicable, take action to get the competence that is necessary, and evaluate how effective these taken actions are.
- Keep improving the skills and capabilities that are essential to enhance the innovation performance [3].

2.2.3 Awareness

Three things a person who is working under the organization's control must be aware of and have motivation for according to CEN/TS 16555-1:2013 and they are:

- How important innovation is for the organization
- Vision and strategy of innovation

How important their contribution is to make the IMS more effective, including benefits of improved performance [3].

2.2.4 Communication

CEN/TS 16555-1:2013 says that internal and external communications that are relevant to the IMS should be established by the organization, taking into consideration aspects as what to communicate, when, to- and by whom, the provision of communication channels and the intended feedback [3].

2.2.5 Documented information

According to CEN/TS 16555-1:2013 documented information determined by the organization as being necessary for the effectiveness of the IMS and the evidence of its performance should be included in the organizations IMS. When appropriate, the documentation should be created, identified, shared, updated, stored, controlled and protected. The identification, update, confidentiality of the documented information can be the same that those required in that system if the organization has implemented a management system [21]. Reasons like size of the organization and its type of activities, number of innovation projects, the complexity of processes and their interactions, the competence of persons etc decide how much the extent of documented information for an IMS can differ from one organization to another [3].

2.2.6 Strategic human resources

A strategic approach to human resources should be included in the IMS according to CEN/TS 16555. The human policy should [21]:

- foster creativity, learning and dissemination of knowledge
- Implement job design that allows variation, challenges and open interactions
- Encourage open interactions, trust, diversity and tolerance
- Provide procedures for employee contract ensuring appropriate incentives for innovation
- Encourage participation and representation in the innovation process of persons in the organization when appropriate
- Allow persons access to relevant information from management.

Employee involvement and co-determination is subject to different laws, regulations and social partners' agreement [3].

2.2.7 Intellectual property and knowledge management

A policy for the intangible assets and management should be defined by the organization according to CEN/TS 16555-1. It should even provide a structure for management of internal-and external knowledge and the level and means of protection. It's benefit for the organization is that it can make such knowledge accessible for individuals involved in innovation projects and processes. Research of historical and current IP (intellectual property) in the public domain can be an important source of ideas, avoiding duplication and providing inspiration [3].Some of the rules that should be included in the policy are [21]:

- establish awareness of what the consequences of infringement of third parties IP are
- Establish responsibilities for managing IP
- Establish the importance for the organization to obtain freedom to operate and manage/control risks related to its IP
- If necessary, provide training [3].

Having a system for managing IP and knowledge in the organization is possible. If they have it, then the organization needs to be coordinated with the IMS so that interaction between IP management, the knowledge management and the IMS can arise in order to be effective as the factors that enable innovations [3].

2.2.8 Collaboration

According to CEN/TS 16555-1 a policy for internal- and external collaboration should be defined by the organization. Collaboration within the organization should be fostered so that ideas and knowledge can be shared across different persons, groups and units by:

- dissemination of challenges and stimuli for ideas and problem solving
- Encouraging persons and groups to collaborate to develop ideas and share knowledge. Collaboration and networking with external organizations can help identify ideas, costumer needs, knowledge and partners, to help with both problem solving and exploitation of ideas. Opportunities can be defined by:
- activity listening and adopting ideas from customers, suppliers and other parties
- Joining knowledge transfer networks, professional bodies and trade associations
- Collaborate with- or commissioning universities and innovation support services to assists with idea generation and development.

Consideration should carefully be given to the IP ownership when collaborating [3].

2.2.9 Innovation process

According to CEN/TS 16555-1 the organization should establish a detailed innovation process covering all relevant steps from gaining insight about a problem or opportunity to successful launch. The innovation process is highly dependent on such aspects as the type of innovation, the kind of organization or the internal structure. So there are many ways to proceed [3]. The innovation model presented in the TS includes the following steps:

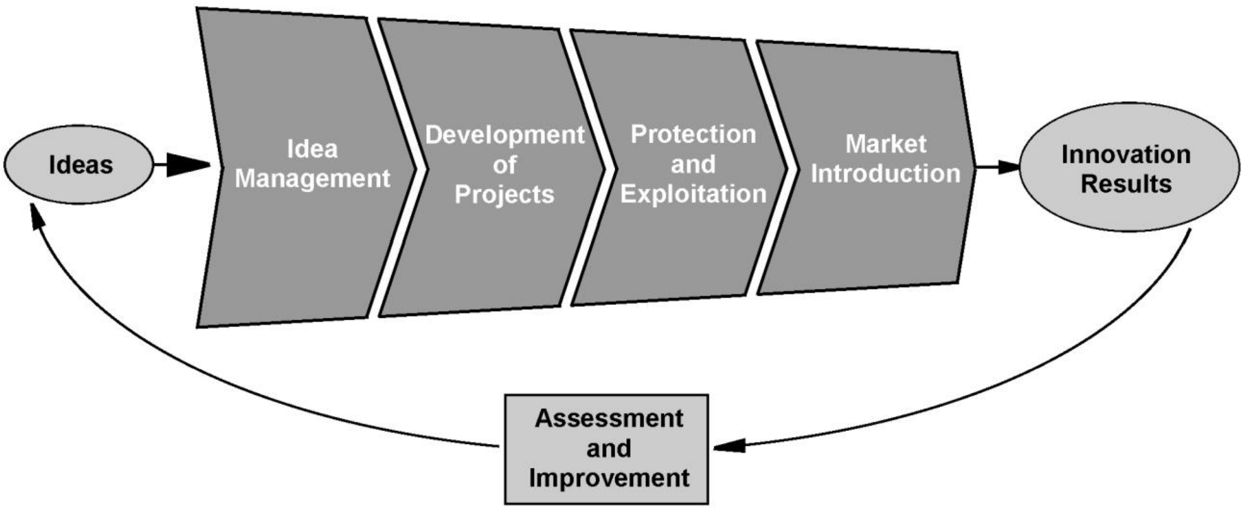

Figure 2: The innovation model as presented in CEN/TS 16555-1 [3]

2.2.10 Assessing the result of the innovation process

According to CEN/TS 16555 series, there are two types of results of the innovation process for the organization; financial- and non financial results. The organization should specify what, how often, against what and by whom results should be assessed. The organization should define indicators to assess innovation results. Financial indicators for innovation results can include: *profit growth rate, revenue growth rate, cost savings for organization and clients, growth in operational margin and return on innovation investment.* Non financial indicators can include: *number of ideas put through the innovation process, market share, efficiency of processes, brand awareness and reputation, impact in the number of employees as a result from innovations, intangible assets and ecological and social sustainability as a result from innovation* [3].

2.2.11 Performance assessment of the innovation management system

According to CEN/TS 16555-1 the organization should determine the indicators, methods for monitoring and criteria for evaluating, at least for:

- the innovation strategy
- The deployment of innovation enabling/driving factors
- The innovation process and its results [3].

It is essential that the performing of the assessment is regular, that's because of the need to ensure a deeper understanding of diverse dimensions of innovation management, and the continuous improvement of the performance of the IMS. The frequency of the IMS assessment depends on two aspects: dynamics of the environment which the organization works in, and how ambition the organization is to improve the performance of their innovation management more. It's recommended that the organization perform internal controls in addition to other assessment methods to check the performance of the implemented IMS in the organization. It would be possible to integrate this internal verification of the IMS with the internal audit of the general management system if the organization has a management system implemented [3]. To ensure the organizations IMS's continuing suitability and effectiveness, it is recommended that top management review it. The reviewing should include consideration of the following: *the status of actions from previous top management reviews, changes in external and internal context that are relevant to the IMS, information on the performance of the IMS, opportunities for continual improvement* [3].

2.2.12 Improvement of the innovation management system

According to CEN/TS 16555-1 the suitability, or effectiveness of the IMS should continually be improved by the organization, through the use of the innovation vision and strategy, leadership, objectives and planning, innovation enablers/driving factors, assessment of the performance and top management review. The deviations must be identified by the organization to help it eliminate the underlying causes by establishing corrective actions, or establish improvement actions for improving of the efficiency and the results of the IMS. To be able to eliminate the weaknesses that are identified as well as to enhance the identified strength of the IMS, a roadmap that includes measures is recommended to be defined. It is essential to communicate the improvement measures and successes within the organization which are appropriate to external interested parties. This helps stimulation of learning and continuous improvement within the organization [3].

3. ISO 50500 FAMILY OF STANDARDS FOR INOVATION: THE INTERNATIONAL PERSPECTIVE

The ongoing Digital Transition requires the companies to rethink their Innovation Management. For this reason, the International Organization for Standardization (ISO) is about publishing a new standard about Innovation Management that will surely shake the market dynamics. Indeed, when it comes to Innovation, each organization has its own culture but in those times of open-innovation, players must find a common path to collaborate. The ISO 50501: Innovation management – Innovation management system – Guidance", aims to deliver a backbone for Innovation by referencing tools, methods and good practices. This manifest is based on seven core principles [18,19]:

- Realization of value
- Future-focused leaders
- Purposeful direction
- Innovation culture
- Exploitable insights
- Mastering uncertainty
- Adaptability/transformation of the organization.

3.1 ISO 50501 Innovation Management System (ISO/DIS 50501 "*Innovation management -- Innovation management system"*, Guidance)

The ISO 50501 is structured in ten paragraphs (introduction, scope, normative references, term and definitions, context of the organization, leadership, planning, support, operation, performance evaluation and improvement). The standard proposes a guide to reach the next level of Innovation Management in covering the key insights [20]:

- Understand the context of the organization and the integration of the global Management System
- Establish the leadership and commitment of top management
- Plan for innovation development
- Identify and foster innovation enablers/driving factors
- Deploy the innovation management process
- Understand and use innovation management tools and methods
- Spread innovation culture
- Assess the performance of the innovation management system and update it if necessary

From a macro perspective, ISO 50501 will be set in different organizations, thus will spread common terms, tools and methods for Innovation in every sector of the economy. This will then allow multiple ISO 50501-aligned parties to collaborate more easily on innovation topics. For this purpose, the ISO 50502 is proposing three levels of performances for Innovation Management: Existence, Efficiency and Effectiveness. Finally, the question is not really: why? but how to adopt the ISO 50501 standard. More effective and recognized innovation, less risk, a common basis for collaboration: these are the ISO 50501 standard deliverables.

3.2 ISO 50502 Innovation Management Assessment (ISO/NP TR 50502 “*Innovation management – Assessment*”, Guidance)

In that purpose, the ISO 50502 (Innovation Management Assessment) will propose the key principles to perform this self-assessment. The main principles of ISO 50502 is expected to be [20, 21]:

- Add value to the organization
- Challenge the organisations objectives and strategy
- Motivate and mobilize for organizational development
- Be timely and encourage a focus on the future
- Allow for context and promote the adoption of best practice
- Be flexible and holistic
- Be an effective and reliable process

Despite the transformation that will require the adoption of the standard, it will bring key values to the innovation process and the entire companies’ organizations. Internal first, the processes formalization will increase the work efficiency while decreasing the risk of failure. External then, simply because the ISO 50501 is a guarantee of professionalism which will improve your brand, increase your competitive advantage and facilitate Public/Private innovation funding. The ISO 50502 deliverables could be:

- Existence: is a system present and what is its level of maturity
- Efficiency: does it produce results in a timely & cost effective manner?
- Effectiveness: does it help the organization learn and achieve more/better results?

These three levels of performances will enable partnering companies to understand where they stand respectively and to take the corresponding measures for improvement and alignment in their collaborative innovation process within the common ISO 50501 management system. As such, the ISO 50501 standard can also act as a prerequisite to clusters of companies for collaborative innovation and R&D. That is the reason motivating the ISO/TC 279 to publish first the ISO 50503. Moreover, complying with the ISO 50501 will enables your organisation to highlight its Innovation Management policy and consequently apply with legacy to public funding. For instance, the European Union is already considering the ISO 50501 as a performance indicator for Innovation management and to better allocate funding from the program “Horizon 2020” [14,16]. More generally it will become more and more challenging for a non-complying company to join a collaborative innovation program where the others are complying. The last one in the row may just stand at the door even though it may have the best expertise, just because it may compromise the whole innovation process.

3.3. ISO 50503: Tool and Methods for Innovative Partnership (ISO/DIS 50503 “*Innovation management - Tools and methods for innovation partnership*”, Guidance)

These standards are still at different draft stages by the ISO/TC 279, yet the first standard to be released in 2018 should be the ISO 50503 (Innovation management – Tools and methods for innovative partnerships). The other standards should follow until 2019. ISO 50503 will provide guidance on methods and tools that the collaborating partners can use to achieve a successful interaction and outcome. Indeed partnership is becoming increasingly widespread in innovation. Organizations can achieve much more as a result of partnership than acting alone. However, failure to manage it correctly can result in a waste of time and resources. To improve the governance of the partnership, all the stakeholders should be aware of the parameters that must be addressed to increase the chances of success and reduce the waste resulting from failure. Innovation Partnerships are developed to create value for each partner working together towards an innovative outcome. The ISO 50503 standard (Tools and methods for innovative partnerships) will come soon and some tools already exist to implement it in practice such as collaborative smart platforms. This collaborative smart platforms are purposely designed to support innovative commercial or technical partnerships through an intuitive process addressing [20]:

- Innovation management ownership
- Intellectual property and data management
- Value creation targets and measurements
- Limitless scenarios elaboration
- Digital twin mastering uncertainties
- Modelling for collaborative trust and easier adoption.

3.4. ISO 50504: Strategic intelligence management (ISO/AWI 50504 “*Innovation management -- Strategic intelligence management*”, Guidance)

Technology watch has been identified by ISO TC 279 experts as a key tool in the framework of innovation management systems. Indeed Strategic intelligence provides an improved access to and management of scientific and technical knowledge, as well as better information on its application context and timely understanding of the meaning and implications of the changes and novelties in its environment. This standard will provide guidelines to facilitate the scanning and analyzing process of the organization environment in order to support decision making at all levels within the organization, fostering the implementation of stable strategic intelligence management practices [20]. This document is still in early stage of development, the call for experts is open. Interested experts are asked to contact their national standardization office to take part in the development of the standards

3.5. ISO 50505: Intellectual property management (ISO/AWI 50505 “*Innovation management -- Intellectual property management*”)

An efficient management of intellectual property creates an interesting backbone to protect and increase the competitiveness of an innovation project. This standard will propose guidelines for supporting the intellectual property within innovation management. It aims at addressing the following topics of IP management at strategic and operational levels [20]:

- How to build an IP strategy of an organization to support business and innovation strategies?
- How to setup IP management in innovation process?
- Which IP tools and methods and how to implant them in innovation process?

This document is still in early stage of development, the call for experts is open. Interested experts are asked to contact their national standardization office to take part in the development of the standards.

Often restricted to digitization and internet of things (IoT), the ISO 50501 standards remind us that innovation, before connecting things together, needs to connect people together through an efficient and secured collaborative processes. That is where the ISO 50501 and collaborative tools such as collaborative smart platforms come together to enable companies to play collaborative in their digital transition. However, what really will be done with the ISO 50500 family standards is it something that the general public will get to know during the consultation period and after the completion with the official issue of the standards which is expected in late 2018 and early 2019.

4. CONCLUSIONS

The pace of innovation moves rapidly, and fresh knowledge needs to be shared internationally. European and international standardization organisations are developing new standards of innovation management involving key aspects as risk assessment, knowledge management and intelligence in order to strengthen resilience within communities and developing capacity and tools that leverage technological innovations [15]. Innovation management enables organizations to focus on competitiveness and successful performance. Standardization can enhance organizational capabilities in order to be aligned with European and international best practices as well as to develop internal competences, routines and processes that can leverage an innovation journey towards excellence [17]. At national and international levels, evidence demonstrates the importance of standardization, as a body of knowledge, to contribute to business innovation and to increase competitiveness and realization of value.

As our world becomes increasingly interconnected and complex, new threats also emerge; we become increasingly vulnerable to systemic risks. To reap the benefits of our interconnected and innovative world, we must address and mitigate these risks. Policy makers and societies need to prepare for the inventions that will emerge and disrupt the global economy. This paper summarizes the current trends taking into account the most recent developments and highlights the most important aspects according to the literature review. Innovation and integration of international knowledge and the associated flows in ideas, products, services and people are likely to continue to provide significant opportunities for progress. All innovation actors can work together in the direction of thisat mission will best succeed with respect to deliver competition, productivity, growth, jobs, social inclusion and sustainability. As Europe has always been a world-leading inventor, innovation management is a key enabler for its future [14].

The need for Innovation Management has become an imperative in developed nations in order to respond to the rapid change and consequent threats which organizations, nations and the world are facing. Developed nations will benefit from a standard which gives their organizations direction for developing radically new products and services. Emerging nations are seeing the need for Innovation in order to move beyond resource based economies and reduce the economic gap between themselves and developed nations [17]. A harmonisation with standards from other regions and countries would increase the effectiveness and the resilience of international programs supported by international organisations. The impact of international programs for better innovation management will become more comparable and hence more transparent.

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The Calibration and Standardization of the Digital Scale with Computer Communication

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ABSTRACT

This article describes the production of a digital scale which will be used to evaluate the weight of objects. The digital scale, which communicates with the computer, is created using the ‘Load cell’ element, the sensor HX711, the 8-bit display MAX7219 and the microcontroller Arduino Uno. The calibration and standardization of the digital scale in this article is based on the classical method and on the method of interpolation calibration for known weights of the same value or different values. The comparison of these methods of calibration which affect directly the accuracy of the values, is part of this article. The experimental measurements show the efficiency of both methods of calibration according to the standards, as well as their specifications.

Key Words: Load cell, HX711 Weight Sensor, Arduino Uno, Weight Measurement

1. INTRODUCTION

This article describes the production of the digital scale which will be used to give a value to the objects according to the base scheme portrayed in the first image and the Fritzing diagram [1] portrayed in the second image. In Figure 1, there are shown the modules of the measuring system and the communication between them, while on Figure 2 there is the connection diagram or the electronic connection scheme between these modules.

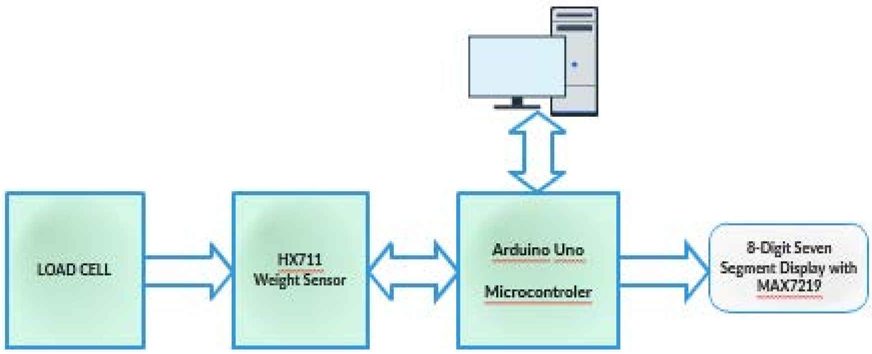

Figure 1: Base scheme of the digital scale

The digital scale, which communicates with the computer through the USB port, is produced with the help of the ‘Load cell’ element, the weight sensor HX711 [3], the 8-bit display MAX7219 and the microcontroller Arduino Uno [2], portrayed in the image above Figure 1.

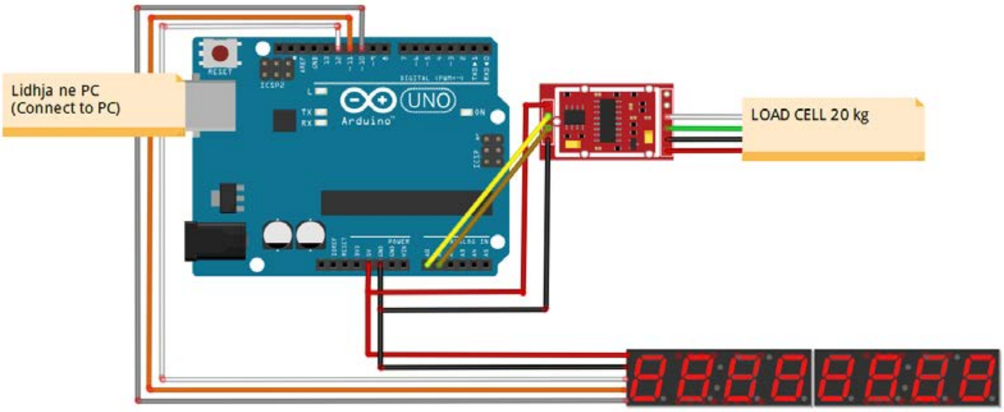

Figure 2: The Fritzing diagram or the electronic connection scheme

The ‘Load cell’ element represents the weight sensor [3 - 4]. The electrical connection scheme of this element is depicted in Figure 3 [5].

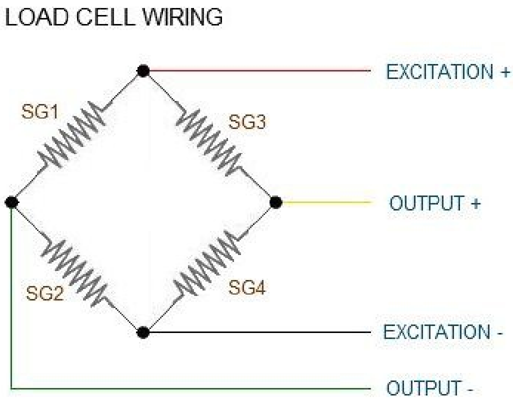

Figure 3: The electric bridge scheme of the weight sensor element

Physically, the weight sensor sends an electrical signal, in mV range, to the port (Output+, Output-), which is in proportion to the force applied on the element. Due to this principle, we can build weight-measuring equipment, and many other hydraulic/ pneumatic elements which are used for measuring other physical dimensions. The active forces deform this element causing electrical resistance changes to the elements of the bridge in Figure 3. Resistance changes in both sides of the bridge cause voltage change in these resistors. Consequently, it would cause an electric voltage in the output port which can be changed depending on the weight. Mathematically, the output signal depending on the resistors SG1, SG2, SG3, SG4 and the known input signal is illustrated as below [6]:

$$V_{out} = \left(\frac{R_{SG3}}{R_{SG3} + R_{SG4}} - \frac{R_{SG2}}{R_{SG1} + R_{SG2}}\right) V_{in}$$

The output voltage of the ‘load cell’ element, illustrated in Figure 3, changes depending on the active force. Given that these changes of the voltage are very low (mV) it is necessary for another gadget to strengthen these signals. For this reason, the ‘load cell’ element will not connect directly to Arduino Uno but instead it will connect to a HX711 module which is used to carry out the reinforcement process of the electric voltage from an mV range, to a range of maximum 5 V.

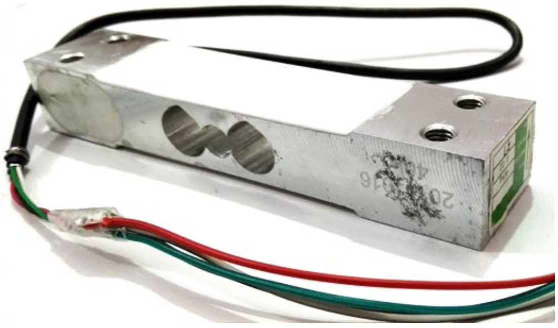

Figure 4: ‘Load Cell’ element, weight sensor

The module is simultaneously a signal converter from an analogue to digital (A/D) with a 24-bit precision, a large integration scale, and quick replies for every signal change [7]. Along with its’ excellent performance, it is quite cheap. This is the reason why it is used exceedingly in the industry. Output voltage is in the 30-mV range and input voltage is in the 5 V, 10 V (or a maximum of 15 V) range. Generally, the sensitivity of the bridges is in a 1-3 mV / V range. In the Figure 4 and Figure 5 it is displayed the ‘load cell’ element (20kg) and the Analog/Digital HX711 module [8].

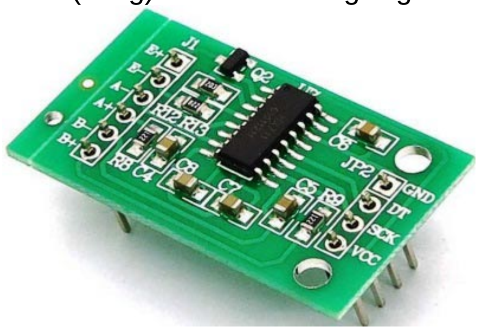

Figure 5: Amplifier Module, analogue/digital HX711

The communication with Arduino Uno [1 - 2] is realized by the analogue ports A0, A1. The DT pin (Data I/O Communication) is connected to the analogue port A0 and the SCK pin (Serial Clock Input) is connected to the A1 port [9].

The 8-bit 7-segment display MAX7219, which is illustrated in Figure 6, will be used to perform the calibration of the scale and to display the weight value of the object which is placed to be evaluated.

Figure 6: 7-segment display MAX7219

The scheme of the 8-bit 7-Segment MAX7219 display is shown in Figure 2. The display of information in each of the 7 Segments is realized individually through 3 conductors related respectively to the digital gates. CS in D10 pin, CLK in D11 pin, DIN in D12 pin [10 - 11].

The weight-of-object evaluation system, after connecting the modules together with Arduino Uno according to the basic scheme given in Figure 2, will be ready to be used only when it has been calibrated according to standards. This is accomplished using weighing stones with known values. The calibration process is a very important process because it would have a direct impact on the accuracy of estimating unknown weights.

2. CALIBRATION OF THE MEASUREMENT SYSTEM

In this material we will describe two calibration modes as:

a. Standard calibration

b. Interpolated calibration

The calibration and standardization of the system will be carried out according to the scheme shown in Figure 7. Unlike the basic scheme shown in Figure 2, in Figure 7 we have added a button labeled 'calibration' which will specifically serve for the calibration process.

Standard calibration consists of a process that would be described in several steps:

1. After the calibration button is pressed, the display shows the message "Put the known weight stone 0.100 kg" (the message in the digit 'Kal: 0.100 kg').
2. The weight stone is set and the calibration factor is changed until the value measured in the monitor is as close to the known value as possible (in the case of a value of 0.100 kg).
3. The system goes to work to evaluate unknown weights.

The interpolating calibration consists of a slightly different process that would be described below:

1. After the calibration button is pressed, the display shows the message "Put the known weight stone 0.100 kg" (the message in the digit 'Kal: 0.100 kg').
2. The weight stone is placed and the calibration factor is changed until the monitor shows the measured value as close to the known value as possible (in the case of a concrete value of 0.100 kg) and this process is repeated using stones with a weight of 0.236 kg and with 0.500 kg. The process can be further repeated with other stones to get a more complete picture.
3. Eventually, when we want to close the calibration process, the 'q' or 'e' button is pressed on the keyboard to close the calibration section.
4. The system goes into work to evaluate unknown weights based on several calibration factors.

For both calibration cases, for each value (calibration with 0.100 kg, 0.236 kg, 0.500 kg etc.), a large number of readings (measurements for the value of the known object) are performed to finally calculate an average value as accurate as possible, which should be very close to the known value. For any value displayed on the computer and the digital display, regardless of the method, about 20 readings of HX711 are performed and the average value is calculated from them. So, each measurement value is the result of an averaging of 20 measurements.

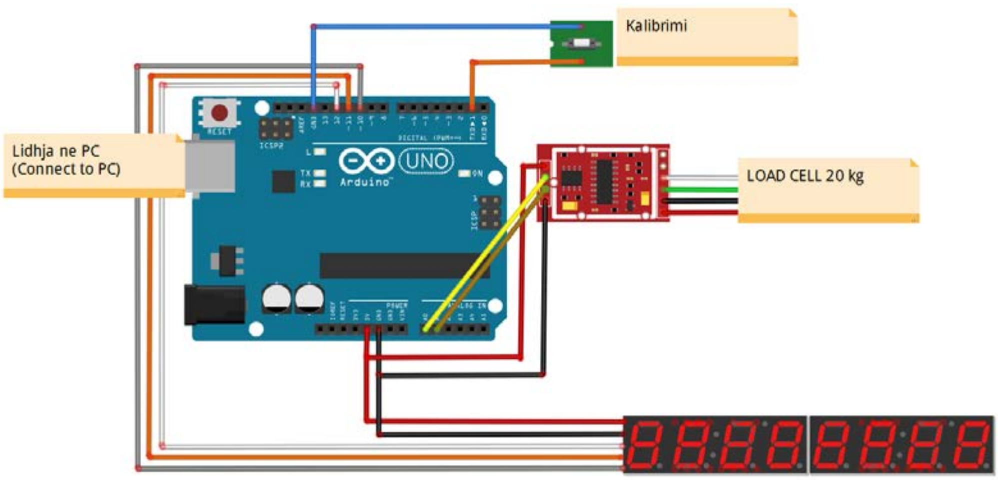

Figure 7: Basic scheme for calibration and standardization of the weighing system

The calibration and standardization process is related to the determination of a coefficient called the calibration factor. For each known weight during the calibration process we define a calibration factor.

The program built on Arduino Uno by elaborating the information provided by the Load Cell & HX711 performs two separate processes: system calibration and weighing of unknown weights. Modules in the program that carry out these tasks are provided below:

Calibration module and standardization of the weighing system (calibration)

```
int a=1;
while(a<=2){
if(Serial.available()){
char temp = Serial.read();
if(temp == '+' || temp == 'a')
        calibration_factor += 10;
else if(temp == '-' || temp == 'z')
        calibration_factor -= 10;
else if(temp == 's')
        calibration_factor += 100;
else if(temp == 'x')
        calibration_factor -= 100;
else if(temp == 'd')
        calibration_factor += 1000;
else if(temp == 'c')
        calibration_factor -= 1000;
else if(temp == 'f')
        calibration_factor += 10000;
else if(temp == 'v')
        calibration_factor -= 10000;
else if(temp == 'g')
        calibration_factor += 100000;
else if(temp == 'b')
        calibration_factor -= 100000;
else if(temp == '1')
        calibration_factor1 = calibration_factor; // calibration factor for known weight number 1
else if(temp == '2')
        calibration_factor2 = calibration_factor; // calibration factor for known weight number 2
else if(temp == '3')
        calibration_factor3 = calibration_factor; // calibration factor for known weight number 3
else if(temp == 't')
scale.tare();           //
else {
if(temp == 'e' || temp == 'q')
goto out; }
    }
    scale.set_scale(calibration_factor);
units = scale.get_units(numberOfCalc);
Serial.print(units, 6); Serial.println(" kg");
Serial.print("\t calibration_factor \t");Serial.println(calibration_factor);
  }
out:
```

The primary module in calculating unknown weights (measurement process)

```
void loop()
{
  scale.set_scale(calibration_factor);

double measure = scale.get_units(numberOfCalc);

Serial.print("Weight from calibration factor : \t");Serial.print(measure,4);Serial.println(" kg");

  String str = String(measure, 4);
lc.clearDisplay(0);
writeStringWeight(str);

  scale.set_scale(calibration_factor1);
double measure1 = scale.get_units(numberOfCalc);
Serial.print("Weight from calibration factor 1 : \t");
Serial.print(measure1,4);Serial.println(" kg");

scale.set_scale(calibration_factor2);
double measure2 = scale.get_units(numberOfCalc);
```

```
Serial.print("Weight from calibration factor 2 : \t");
Serial.print(measure2,4);Serial.println(" kg");

  scale.set_scale(calibration_factor3);
double measure3 = scale.get_units(numberOfCalc);
Serial.print("Weight from calibration factor 3 : \t");
Serial.print(measure3,4);Serial.println(" kg");

if(digitalRead(SW_Port)==0){
calibrateClassic();
  }
}
```

3. RESULTS

Figure 8 gives a photograph of the built weighing system (while working).

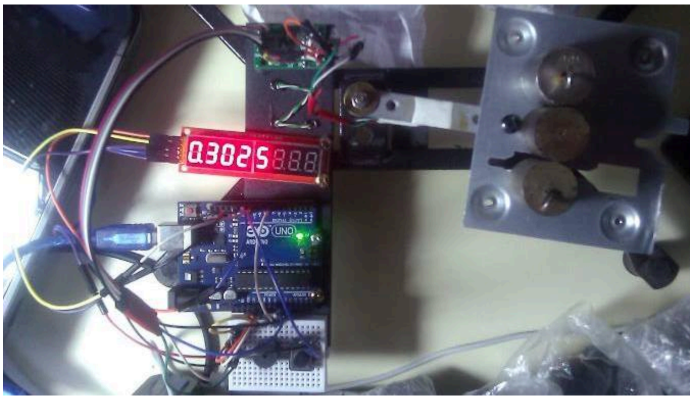

Figure 8: Experimental Weighing System

Results from the calibration process for the three known weights 0.100 kg, 0.136 kg, 0.236 kg and 0.500 kg are as respectively:

Calibrating...Please Wait...

Without weight		--
0.000363 kg	calibration_factor	-101945.00
-0.000471 kg	calibration_factor	-101945.00
…		
Weight 0.136 kg		--
0.136913 kg	calibration_factor	-101875.00
0.136442 kg	calibration_factor	-101875.00
0.137256 kg	calibration_factor	-101875.00
0.137629 kg	calibration_factor	-101875.00
…		
Calibration process: Pesha 0.236 kg--		
0.237083 kg	calibration_factor	-102175.00
0.236907 kg	calibration_factor	-102175.00
0.237612 kg	calibration_factor	-102175.00
0.236543 kg	calibration_factor	-102175.00
0.237377 kg	calibration_factor	-102175.00
0.236377 kg	calibration_factor	-102175.00
0.237543 kg	calibration_factor	-102175.00
0.237162 kg	calibration_factor	-102175.00
0.236989 kg	calibration_factor	-102275.00
…		
Calibration process: Weight 0.500 kg		--
0.500412 kg	calibration_factor	-102302.00
0.500178 kg	calibration_factor	-102312.00
0.500167 kg	calibration_factor	-102324.00
0.500079 kg	calibration_factor	-102302.00
0.501219 kg	calibration_factor	-102301.00

0.500968 kg calibration_factor -102302.00
New calibration: -102275.00

-101875.00 weight 0.100 kg
-102275.00 weight 0.236 kg
-102302.00 weight 0.500 kg End Calibration

The measurement results for the known weights of 0.136 kg, 0.303 kg and 0.500 kg are given below:

Without weight ---
Weight from calibration factor 1: 0.0002 kg
Weight from calibration factor 2: 0.0002 kg
Weight from calibration factor 3: 0.0006 kg

Weight from calibration factor: -0.0003 kg
Weight from calibration factor 1: -0.0002 kg
Weight from calibration factor 2: -0.0005 kg
Weight from calibration factor 3: -0.0002 kg

Weight from calibration factor: -0.0000 kg
Weight from calibration factor 1: -0.0008 kg
Weight from calibration factor 2: -0.0005 kg
Weight from calibration factor 3: 0.0000 kg

Weight from calibration factor: 0.0001 kg
Weight from calibration factor 1: 0.0001 kg
Weight from calibration factor 2: 0.0000 kg
Weight from calibration factor 3: 0.0006 kg

Weight 0.1362 kg ---
Weight from calibration factor: 0.1369 kg
Weight from calibration factor 1: 0.1365 kg
Weight from calibration factor 2: 0.1369 kg
Weight from calibration factor 3: 0.1368 kg

Weight from calibration factor: 0.1369 kg
Weight from calibration factor 1: 0.1365 kg
Weight from calibration factor 2: 0.1364 kg
Weight from calibration factor 3: 0.1366 kg

Weight 0.302 kg ---

Weight from calibration factor: 0.3123 kg
Weight from calibration factor 1: 0.3150 kg
Weight from calibration factor 2: 0.3046 kg
Weight from calibration factor 3: 0.3020 kg

Weight from calibration factor: 0.3045 kg
Weight from calibration factor 1: 0.3054 kg
Weight from calibration factor 2: 0.3037 kg
Weight from calibration factor 3: 0.3048 kg

Weight 0.500 kg ---

Weight from calibration factor: 0.5014kg
Weight from calibration factor 1: 0.5000 kg
Weight from calibration factor 2: 0.5012 kg
Weight from calibration factor 3: 0.5019 kg

Weight from calibration factor: 0.5011 kg
Weight from calibration factor 1: 0.5013 kg
Weight from calibration factor 2: 0.5018 kg
Weight from calibration factor 3: 0.5019 kg

4. CONCLUSIONS

The calibration and standardization of the digital scale in this paper is performed according to the classical method and according to a new interpolating calibration method for known weights of the same value or different values. The comparison of these calibration methods, which directly affects the accuracy of the measured value, is part of this material. Experimental measurements show the efficiency of both calibration methods according to standards as well as their specifics. The experimental results for both cases show that for the selected equipment the results are almost the same.

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Interpreting the Defects of the Iron Age People in Hesiodos with the Present Architecture

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ABSTRACT

Within the scope of the Symposium on Education and Training, our main theme in this study is to reflect defects the iron noble, was as mentioned fifth among of human descends that involved in Hesiod’s work (*Woks and Days*) who lived in the 8th century and he was remembered the pioneer of the didactic epic troupe. The reflections of these defects will be presented with some visual examples from Turkey especially Thrace. It will be emphasized negative approaches to the construction of old-modern architecture at the present day and things that lead unhappy human image who grow up and live in a bad place.

As a part of the architecture education, our goal is to reveal that while the people build new how to lose the meaning of the value of the old and well-preserved architectural remains and respect for the nature and to show how urban life, full of architectural constructions, breaks the bond of the people with the nature and their culture.

The reason for causing us to this work is that “consuming” way of human beings has only distinguished and the nation and local cultures have been lifted in the last years. In parallel with these also system of education has turned into a work in this understanding particularly in the countries, are rapidly weakening the as economically.

Key Words: Hesiodos, iron lineage, architecture, unconsciousness, negative view.

1. INTRODUCTION

The main content of our work can be compared the things what Hesiodos said about the mentality of the people of Demirsoylu, he said the fifth descendant, who was born in Western Anatolia, 2800 years ago, with the mentality of Anatolian people about historical places. Thus, in this period in which all kinds of places are passed by the architects, it is possible to show what our architectural knowledge neglects and architectural rent causes the dangerous degeneracy of country's own originality and culture.

Today, because of the enormous restoration of Turkish architecture, especially in industry, it disrupts the natural silhouette and aesthetic of the city. This situation vitiates the urban people and damages the nature especially in terms of garbage and sewage. So, on the occasion of the symposium, this devastating situation that is result of deficient education and reflects to the architecture will be presented with visual examples in the countries with a rich history and culture, such as Turkey.

In ancient times there are two great poets for the west of Anatolia and Greece. Homeros and Hesiod. If Herododos is considered, these bards lived in the century of B.C. IX. But the period’s Hesiodos lived was settled after a century or two from Homer [1]. It is also striking that these two important poets are of Anatolian origin. Because it is likely that Homer is from Ionia Smyrna; ıt seems that Hesiodos, the well-known pioneer of the didactic epic type, also came from a family, because of destitution, migrated to the side of Helikon mountain in north Greece from Kyme (İzmir-Aliağa) in Aeolia (Mytilene and west Anatolia Balıkesir-Edremit [1, 2]. He expressed in his epic named Ergaikai Hemerai (Jobs and Days).

In archaic age, important events were shaped as a tune by the poets who were regarded as the strength of the social memory because of the correct transmission. So many things were kept in memory. The words of the poets were considered divine. Because they got strength from the muse, and so often their predictions were justified. The poets who emphasize that nature is the greatest teacher have shaped the religion and thought [3, 4, 5, 6]. These have enabled the creation of "ideas" for people. Thus, myths were formed and pioneered the formation of a nature-based philosophy.

Hesiodos, in his work, named Ergai kai Hemerai, addressed to his brother Perses, he referred to the struggle for life of man in everyday life. This situation informs us about the concerns, customs, and tools of the people of that period. Hesiodos, in a point of his work where he approached agricultural labour for living human and nature, discoursed everymen. According to this, the immortals created the first human race from the gold. In countless blessings, they live on its own soil in a comfortable, delightful way. They were dying like sleeping. When they died, they became a good gin, protected the land and the people.

After that, the immortals created a second generation of thuds. They had tallness and minds. But when the adult age came, they were getting into trouble because of madness. In that they didn’t know what the measure was, they didn’t count the immortals. So, Zeus, the god of the place and the god, was angry and buried in the ground these disrespectful creatures. These were also underground gin. Then Zeus created a third line from bronze. They were very strong. Their work was to get out of control attack and kill. Their hearts were like stone. They were spreading fear where they went. Everything was from bronze. They went to the other world due to their self. Zeus created another generation. This generation, was more fertile, correct and gallant, created the heroes of the semi-gods. These are the braves that came before us in these lands. Some of them died during wars. For some, Zeus gave away a life on the other side of the world. They are living in those happy islands. Indeed, today's island life is more peaceful.

Finally, when it comes to the fifth lineage of human beings, the poet Hesiod says:

Thereafter, would that I was not among the men of the fifth generation,
but either had died before or been born afterwards.
For now, truly is a race of iron,
and men never rest from labour and sorrow by day,
and from perishing by night;
and the gods shall lay sore trouble upon them.
But, notwithstanding, even these shall have some good mingled with their evils.
And Zeus will destroy this race of mortal men also
when they come to have grey hair on the temples at their birth (6).
The father will not agree with his children,
nor the children with their father,
nor guest with his host,
nor comrade with comrade; nor will brother be dear to brother as aforetime.
Men will dishonour their parents as they grow quickly old,
and will carp at them, chiding them with bitter words,
hard-hearted they, not knowing the fear of the gods.
They will not repay their aged parents the cost their nurture,
for might shall be their right:
and one man will sack another's city.
There will be no favour for the man who keeps his oath
or for the just or for the good;
but rather men will praise the evil-doer and his violent dealing.
Strength will be right and reverence will cease to be;
and the wicked will hurt the worthy man,
speaking false words against him, and will swear an oath upon them.
Envy, foulmouthed, delighting in evil, with scowling face,
will go along with wretched men one and all.
And then Aidos and Nemesis (7),
with their sweet forms wrapped in white robes, will go
from the wide-pathed earth and forsake mankind
to join the company of the deathless gods:
and bitter sorrows will be left for mortal men, and there will be no help against evil [7].

As it seen, what the poet emphasizes here is that mankind is increasingly insensitive to his own descent and self. Also, people act cruel to others and steal food. The conscience and the oath became worthless. These destructive troubles will bring the end of human race.

We shall reconsider Hesiodos' words because of living the traces of the iron age. When we look at today's perspective above lines, it seems that the troubles not come from the gods but from the capitalist and imperialist mentality that is in the effort of monopolization the world's permanent resources. In spite of a handful of companies takes the gods' place, the sense of life, most people maintain to it, is parallel to the poet's lines.

In our time, it is often expressed the word freedom for the people, there are no folk who don't feel pain. Though people's skin, language and religion are different, the pain they have is the same.

which kind of relation of the architect is there with these words? Everything has an interest in human mind. For thirteen thousand years, since leading a sedentary life; human who abuses the god to his false, takes the roots, abilities and place of human being's place. Architecture that built the places for the people, was first craft for thousands of years. Until recently architects were getting respect from. There are precious architectural structures preliteracy and after literacy in Mesopotamia, Iran, Egypt, Libya, Tunisia, Greece, islands and Italy including Anatolia. These architectural, engineering and aesthetic wonders architectures enlighten ıt's age, give us main ideas and have been provided the inspiration for new constructions by moving down the ages. Since archaic age, it is continued master-apprentice relations in plainness Butit could be seem it's effect until recent period. Most importantly, almost all of these structures are nature identical.

Therefore, in our study, when we go around the neglect of the historical architectural structures that give identity to the city from the Ottoman and Anatolian geography, we see the destructive human characteristics of the poet Hesiodos. Because today, these destructive human writes off historical structures. In fact, this mentality is seen in many parts of the world.

First of all, we should emphasize these: While the Ottoman structures in the Balkans, especially during the nineteenth century, were demolished, probably no one made a sound [8]. The Ottoman architecture in the Balkans wasn’t an imposition. Many Balkan people in the palace had dignitary. Most of them were architectural structures that were built under the administration of the Ottoman Empire and with financial support of Ottoman. It is a rich culture with a high level of material and architecture.

However, for 200 years, capitalism, which is the corporate state of imperialist understanding, has been monopolized the culture, education and technology in the world for almost 100 years. Especially it caused the destruction of the richness of Anatolian history which is unique. Moreover, in this situation, education was made unfit, folks who turn into consumption and imitation. These societies are constricted under the "global" umbrella and stack them up with migrations. Meanwhile, it is showing that uncontrolled migrations caused subversives in lots of areas. European is most insusceptible place for these problems It is so happy to have the power to destroy life sources.

Today, because of this negative level of knowledge and culture and the events in Balkans, we can understand that it wasn't reacted to this ignorant destruction of a century ago. However, in 2016, it is a big shame not to criticize the mentality that has destroyed Uruk, the first cities of the world, by İŞİD. Not a whole world, but Iran, Egypt, Anatolia, Greek, Roman, Bulgarian, Balkan and Russian architects and archaeologists must chew up this situation.

Figure 1: Uruk country, 6.000 years, İşid demolished (İnterrnet access 12 June 2018)

In the place where human life is devalued, "destructiveness" manifests itself in the architect. Undoubtedly this is because of bad politics and bad education. Therefore, it is a very serious destruction that people do not know the history of their place and they are strangers to historical places. Yet while the new architecture kills ancient and contemporary architecture, it kills history and nature, restricts the free thought, makes breathing difficult and makes people disidentification. It is difficult to say that this is because of unconsciousness. On the contrary, it appears to be 'a trick in planned' for the dominance of the future.

Figure 2: Historical Armenian houses of GERMÜŞ VILLAGE, in Urfa the center of the eastern commerce) through Damascus and Aleppo. This village gives identity to the city. But these houses can fall into disuse

Figure 3: Historical mosque named ULU CAMİ in Urfa, gives the identity to the city. The bottom of the mosque wall can be built concerete pavement

Figure 4: Historical house ALİ KILIÇ in Urfa, gives the identity to the city. Stove pipes and electricity cables can be passed through the window of the house

Figure 5: A skyscraper in the heart of the historical city of Urfa.it seems to be a threatening element for the city

Figure 6: Thrace-Edirne; dreary situation of a house, gives the identity to the house

Figure 7: Thrace Kırklareli: dreary situation of Maria's burial place who is ave of Hagia Sophia church in Vize

Throughout the history, despite the negativity, there is a respect in our geography for the cemeteries and the dead. But tombs in Turkey are demolished because of "avarice" and artefacts smuggled abroad especially to America and Europa.

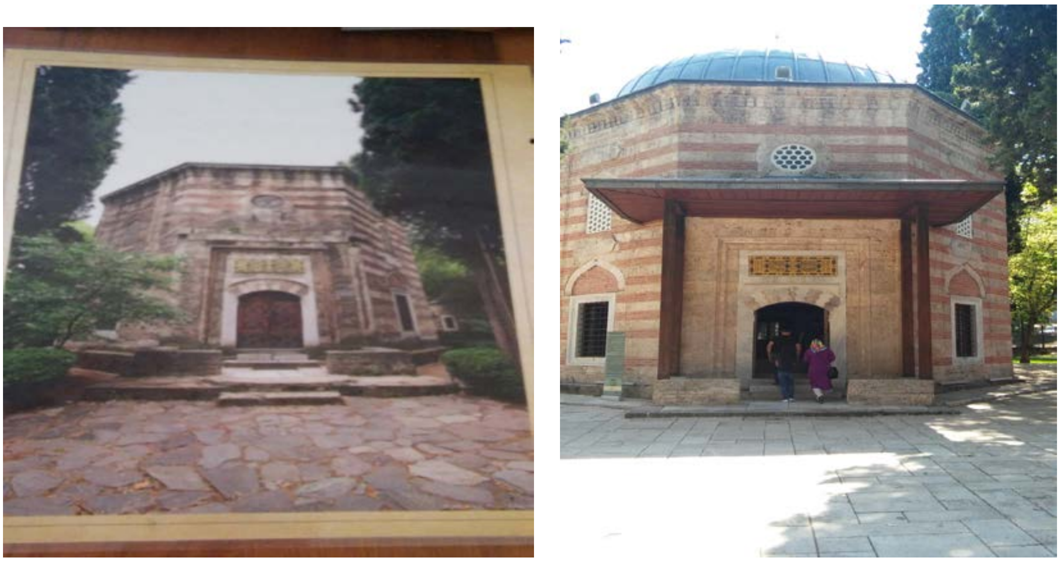

Figure 8: Marmara-Bursa: Without considering the architectural history of Şehzadeler Tomb, it can be easily played with its style and added new form. However, this is a narrow history of architecture

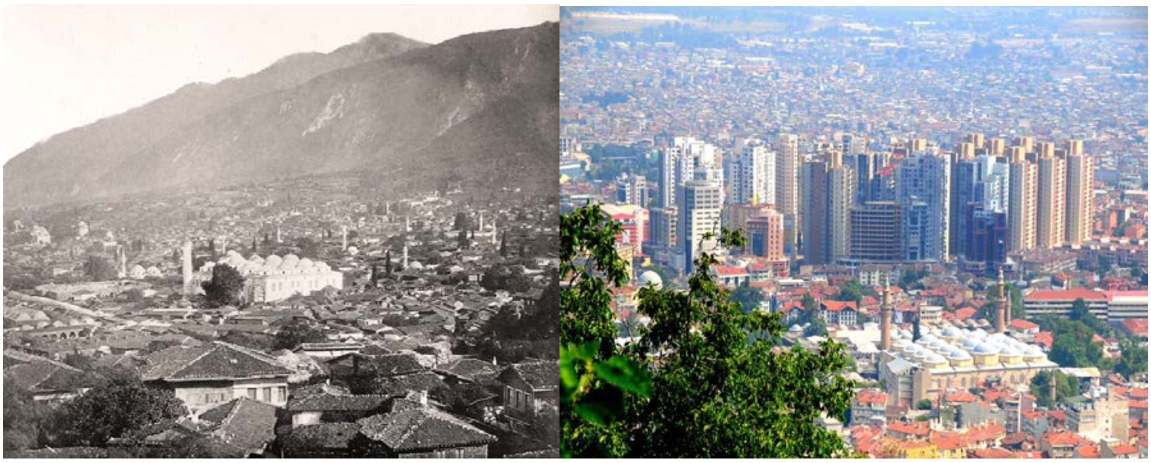

Figure 9: Bursa old and today

Figure 10: Black Sea - green Rize: Dreary situation of the greenery and a house, gives an identity to the city centre

In fact, since the history, Anatolia have been valued water, land, trees and animals. Their killing has been gone down like a lead balloon. Importantly, throughout our history, customs and laws have been developed so that they do not come to bad ends in terms of living spaces:

For example, in terms of Anatolia, where cleanliness is considered to be identical to religion, foundations, aiming to provide municipal services such as lightening and cleaning the streets and gardening in some cities, were established in Seljuk period (12th century). For example, Ahilik culture says that butchers, hurt the animals, and the hunters, left the broods parentless, must not be given 'fütüvvet [9].

As a continuation of this understanding, it was tried to give importance to the forests during the Ottoman rule. In relation to this, during Tanzimat Period (19 century) it was not allowed to be cut and destroyed centuries-old trees and cypresses in the tombs. Guide books were sent to the units to prevent them [10].

Moreover, in the city consciousness of the Ottoman Empire, instead of being burned and demolished the architectural elements and built areas of the city, it is provided to be used by fixed and amended. So, the old buildings of the city were living.

As a matter of fact, in the Ottoman Empire, where fires were a great danger, attention was paid to be not destroyed old features and functions of this place (house, hot spring, shop etc) for not being warping and violation of right according to the regulations that reflects the traditional and protective concept of urbanism. and the new building was built in such a way that it would not cut the neighbouring house light. If there was a problem, he was referred to the testimony of his people. Thus, the rights of the places were protected. All these practices were a measure of development that was right and dependent on the past [11].

As a result, countries, have the fund of history, need to look at what they have destroyed while opening to new horizons. In our times when nature and resources are consumed quickly and badly, these new horizons gnaw at the sky and land which is common to all living things, namely nature. Unfortunately, these mistakes are made by architects and engineers for the rent. In other words, the mood of humanity, lived in in this setting is parallel to Hosiodos's words he said 2800 years ago.

It is being driven by authorities to live in bad environments. The mood of the people who grow up in this environment is parallel to what Hosiodos said, 2800 years ago. As a result, in the education and building, architecture should pay sufficient attention philosophy, historical and local cultural accumulation, and most importantly, nature and natural resources.

2. THE BEAUTIES GIVEN BY THE SAMPLES

Figure 11: Marmara-Bursa; CUMALI KIZ

Figure 12: Istanbul Bosphorus Salacak: It was built in 1790 by Tırnakçızade who is horn and hoof trader, built on the Byzantine palace residences here. Çürüksulu Yalısı

Figure 13: Bosphorus Kuzguncuk: Baştımar ve Arapzadeler Yalıları was built in 18.century

Figure 14: *Bosphoruss: **Debreli İsmail Hakkı Paşa Yalısı:** B*uilt in the 1880s, this yacht is one of the best-preserved mansions, both inside and outside, although it has a few fires.

Figure 15: Thrace–Edirnei: Maintaining local wine-making tradition, which is a city culture

Figure 16: Thra-Kırklareli: A restaurant in Balkaya. Here power generation with the old-style

Figure 17: Thrace - Kırklareli: A house, its garden an open-air museum, was made with local goods in Vize

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Introducing Standards as Guidance for Indoor Climate In the Conservation of Cultural Heritage in Albania

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ABSTRACT

Nowadays there are different approaches in terms of conservation of cultural heritage, while a specific European standardization activity in this field of conservation is essential to acquire a common unified scientific solution to the problems relevant to the cultural property. The cultural heritage monuments are exposed to weather and influence of various environmental parameters. Physicals, chemicals and biological factors interact with constitutive materials inducing changes both in its compositional and structural characteristics. A certain aspect of matter transformation is due to the metabolic activity connected with the growth of living organisms. A scientific approach is essential for the conservation of cultural heritage as a preliminary basis that will ensure effective planning of ordinary and extraordinary maintenance works, as well to assure their efficacy and durability. The scope of EN 15757:2010 is to establish standards in the field of the processes, practices, methodologies and documentation of conservation of tangible cultural heritage to support its preservation, protection and maintenance and to enhance its significance. In this paper we are focused on standardization on the characterization of deterioration processes and environmental conditions for cultural monuments in Albania (both church and mosque, primarily, but not only), with regard to indoor environmental climate conditions (temperature, relative humidity) very helpful with regards of conservation, restoration, repair and maintenance. Two old churches of St. Marry in Bishqethem Lushnja, dedicated to Christ’s ascension, and the St. Nicola Church in Shelcan Elbasan with its spectacular interior completely covered with frescoes by Onufri that belongs to 15th century were considered as case study within current paper. ...file provides a template for writing a paper for 14th International Conference in “Standardization, Protypes and Quality: A Means of Balkan Countries’ collaboration”, September 21 - 22, 2018, Tirana, Albania.

Key Words: cultural heritage, conservation, church, EN 15757:2010.

1. INTRODUCTION

This European Standard is a guide specifying temperature and relative humidity levels to limit climate-induced physical damage of hygroscopic, organic materials, kept in long-term storage or exhibition (more than one per year) in indoor environments of museums, galleries, storage areas, archives, libraries, churches and modern or historical buildings [1]. In this paper are presented the standards requirements following EN 15757:2010 [2] for the conservation of the indoor environment of the cultural heritage in Albania. The scope of EN 15757:2010 is to establish standards in the field of the processes, practices, methodologies and documentation of conservation of tangible cultural heritage to support its preservation, protection and maintenance and to enhance its significance [3]. The conservation and restoration of art works in Albania has been considered as an interdisciplinary approach [4], [5]. The particularities of post byzantine churches and other religion monuments as mosques has been highlighted, while the importance of mural frescoes and other artworks is seriously threaten by the influence of environment and biological factors [6]. The scientific research on bio-deterioration of works of art is known for over several decades, while in the last decades the surveys and proposals for adequate conservation techniques of monuments have significantly advanced [7]. It was demonstrated that the preference of microorganism for some category of substrate is related to their susceptibility [8], [4], [9], [10], [11]. During the past decade studies reveal that in post byzantine churches of Albania fungal attacks appear when improper conditions of maintenance, humidity variation exist and other environmental factors for the churches [6], [8]. Similar surveys confirmed the same results [12], [13].

Figure 1: The location of St. Marry and St. Nicola churches

The determination of the temperature and relative humidity ranges, which are optimal for preservation, is not simple due to the variety and complexity of the materials the objects comprise. Temperature has a direct effect on preservation but also an indirect effect as it controls relative humidity of the air. The changes and fluctuations in temperature and relative humidity should be considered from a static point of view of allowable levels or ranges and from a dynamic point of view, i.e. rate of change, duration of cycles and frequency at which cycles are repeated should be taken into account. Deterioration is often of a cumulative nature and may be exacerbated by the number and the intensity of the individual environmental hazards. Changes and fluctuations of temperature and relative humidity cause non-recoverable physical changes in materials although this is not always perceptible to the human eye. Vulnerability to deterioration mechanisms may increase with ageing. The same temperature and relative humidity fluctuations may generate different effects depending on the type of object and its age.

The Post-byzantine churches of Albania are used as a case study with the objective to identify opportunities and challenges with contemporary European standards for cultural heritage [6], [8]. By combing a qualitative study of how indoor climate control is managed with a discussion of the use of existing outcome-oriented EN standards in churches we outline both the organizational and technical contexts in which standards are to be implemented in Albania. We hypothetically apply the recommendations given by EN 15757:2010 in couple of churches located in different climatic zones of Albania starting from Mediterranean lowland (Adriatic coast) and continental one. This exercise is made to identify the strengths and limitations of an advanced positive outcome-oriented approach.

The European standard EN 15757:2010 Specifications for temperature and relative humidity to limit climate-induced mechanical damage in organic hygroscopic materials describes a methodology to establish allowable fluctuations based on the historical climate. It is based on the assumption that objects in the collection have adapted to their environment and that by limiting deviations from the historical climate there will be less risk for further damage [2]. In contrast to many other standards targeting the preservation indoor climate, it is exclusively focusing on mechanical damage in organic hygroscopic materials. The method to establish allowable relative humidity fluctuations in EN 15757:2010 is based on the climate history of a specific building. Rather than specifying a constant target level for the whole year or season, this method is based on a moving seasonal average around which variations should be limited.

2. MATERIAL AND METHODS

The old church of St. Marry in Bishqethem Lushnja, dedicated to Christ’s ascension, is one of the important post Byzantine churches, located in village of Bishqethem, of the south-western part of Myzeqeja, near the city of Lushnja (40°51'38" N 19°39'45" E).

The St. Nicola Church in Shelcan Elbasan with its spectacular interior completely covered with frescoes by Onufri and belongs to 15th century (41°3'40"N 20°8'3"E). It became a Cultural Monument of Albania in 1948. The temperature and relative humidity data were collected from the archival data of Institute of Geo-Science Tirana. Further on experimental tests through temperature and humidity were determined using data loggers from selected walls of both churches. Air temperature and relative humidity were measured every 30 min and processed to obtain average, maximum, and minimum monthly data.

The EL-CC-2 Cold Chain Humidity and Temperature Data Logger were used for measuring and recording temperature and humidity with internal sensors. The device has own capacity of storing 65,200 total readings onto non-volatile internal memory, non-replaceable battery with 12 months typical battery life.

3. RESULTS AND DISCUSSIONS

Ones we discuss the factors that are directly connected with degradation of indoor environment of the post-byzantine churches it will be worth to take into account several case studies and experience of the surveys that suggest some basic principles that correlate the degradation with the temperature and humidity parameters: (i) Low air temperatures are not harmful, in themselves, to several cultural heritage monuments objects, while high ones they can be favourable for chemical degenerative processes [14]; (ii) The fluctuation in Temperature of the air film in contact with the object, induces a thermal stress in that, causing expansion, increases damage if the object is made of different materials; (iii) The Relative humidity affects the changes in size and shape of objects and the chemical and biological processes. In particular, all the organic materials capable of absorbing water such as wood, ivory, leather, paper increasing when relative humidity increases and shrink when it decreases, with consequent variations in weight, deformations, breaks fibber, cracks and fissures; (iv) Values of relative humidity greater than 45%, can favour different reactions, including metal’s corrosion, dyes' discoloration on cottons, linens, wools, silks and the weakening of organic fibbers (textiles and paper), in the presence of light especially; (v) Values of relative humidity above 65%, with temperature values higher than 20 °C, favour the development of moulds and accelerate the half-life of many harmful insects [15], [6], [8].

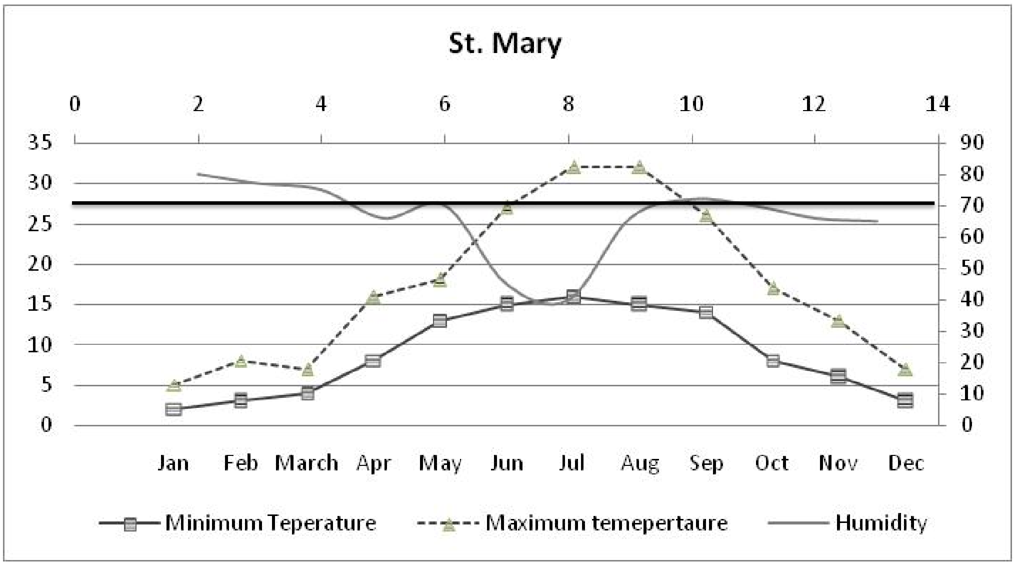

Figure 2: Allowable band of RH fluctuations according to EN 15757:2010 in St. Marry church. RH data from the period 1 January 2017 to 31 December 2017 in St. Marry church

The figure 2 shows temperature and relative humidity over a year in St. marry church. It is characterized by moderate to high short term variations and substantial seasonal variations of relative humidity in an interval between 35% and 81 %. The temperature is kept at a minimum of around 3 °C and during summer time it is raised to around 34°C.

The outdoor and indoor climate during winter in combination with comfort requirements makes it unfeasible to comply with the standard recommendation to avoid relative humidity above 75% in order to reduce the risk for biological and mechanical damages. The only viable option for maintaining relative humidity below 75% would be to an increase of temperatures. Humidification would cause secondary risks associated with condensation in the building envelope. Therefore, the limits of relative humidity in this case would be in between 60 and 45%. These data and recommendations are in line with negative records of church frescoes degradation [6], [8]. Both phenomena are well correlating among them, while specific construction elements need to be incorporated including insulations and roof recovery.

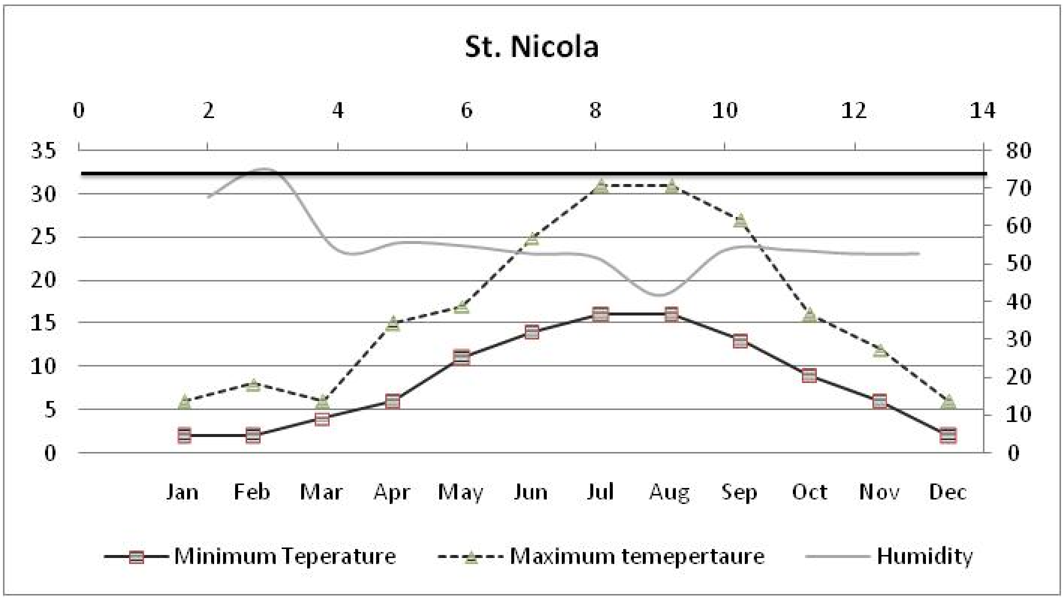

Figure 3: Allowable band of RH fluctuations according to EN 15757:2010 in St. Nicola church. RH data from the period 1 January 2017 to 31 December 2017 in St. Nicola church

In case of St. Nicola church, the oscillations of relative humidity values is in range of 47-75%, while temperatures oscillations among minimum and maximum values 3 to 13 °C. The values are in line with EN 15757:2010 requirements and this correlated well with state of frescoes and other construction materials of the church.

Following “Leijonhufvud *et al*. 2018” [1], the EN 15757:2010 is focused on relative humidity and T-fluctuations in relation to mechanical damages. The historical climate is used to come up with an allowable band for short term fluctuations which reduces the risk for further damage to hygroscopic materials. In case of Albania there is a need for more accurate climate data analyses with contexts of long time series. Having in mind the differences in climate conditions in Albania (Mediterranean lowland and continental upland), application of the EN 15757:2010 standard might have own implications. The application of EN 15757:2010 does only require small changes to the indoor climate, but a sophisticated control system is needed, which need further financial means.

The Law on Standardization No. 9870 establishes the rules and procedures for the development of all national standardization activities and the establishment and functioning of the General Directorate of Standardization. General Directorate of Standardization is responsible to develop, adopt, approve, implement, and publish Albanian standards in all fields. It is also responsible to transpose and publish European and international standards.

4. CONCLUSIONS

The particular problem which was considered in this paper is how scientific knowledge and best practices regarding indoor climate control should be shared to a local communities and users in order to undertake proper management and conservation of cultural heritage. The use and preservation of the religion monuments and not only, as well as the financial cost and indoor climate particularities are all drivers for halting further degradation of valuable cultural monuments.

A major problem regarding the use of standards in old churches and mosques is the significant diversity between individual churches, sometimes even when they belong to the same period as post-Byzantine one due to geographic location with Albanian territory.

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The Universal Design Approach in Barrier-free Shopping Centers: Evaluation on Selected Examples

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ABSTRACT

The equal opportunity to access enclosed and open spaces as well as social, cultural and economic environments for all individuals of society is within the scope of fundamental rights and freedoms. It states in the World Health Organization's World Disability Report of 2011 that more than one billion people, representing 15% of the world's total population, are physically handicapped. According to data provided by the Turkish Statistical Institute (2012), individuals with disabilities constitute 12.29% of Turkey's population. Therefore, in arranging the physical environment and transportation systems, the creation of spaces (open or enclosed) reflecting universal design standards, should be considered from the very early planning and design stages for the sake of not only urban life quality but also of social justice.

Today, there is a tendency of combining shopping with recreational activities, particularly when different products are gathered in a single center and offered to consumers. In this context, it is deemed important that shopping centers (malls) that host numerous events in its stores of different categories, cinemas-theaters and entertainment venues should be accessible based on international physically handicapped design criteria, while taking into account all segments of society, including the physically handicapped. It is required to design these spaces without barriers so that physically handicapped consumers can decide independently to conduct shopping and leisure activities. The aim of this study is to examine the suitability of architectural and outdoor design of shopping centers, which are rapidly increasing in number, for physically handicapped users who constitute a significant portion of society.

In this methodology, accessibility design standards were examined and a list of criteria was prepared. These criteria have been compiled from the standards developed by combining the requirements set by the Americans with Disabilities Act (ADA), the United Nations (UN) and the Turkish Standards Institute (TSE). The cited list of criteria includes; access to shopping centers, parking areas, entrances-platforms and ramps, as well as horizontal and vertical circulation (elevators and ramps), wet spaces (e.g. lavatories), furniture and building environment details. This case study was conducted on selected shopping centers in Istanbul (Galleria and Axis), whereby the importance of the universal-inclusive design perspective on said of shopping center structure examples was documented.

Key words: Disability, Shopping, Universal Design, Design for Everyone

1. INTRODUCTION

Disability is a part of being human that can include processes that are either hereditory or else occured later. The disability concept is a factor that has existed ever since Man has been around. Throughout people's lives, they may experience the possibility of temporary or permanent physical disability that occurs during childhood, pregnancy, old age or any accident. According to 2010 world population data published in the World Health Organization's World Disability Report of 2011, more than a billion people, representing 15% of the total population, were physically handicapped [1]. In the "2008-2009 Action Plan" prepared by the European Union Commission, it states that the number of people with disabilities and in need of care would double by 2050 [2].

The temporarily or permanently physically handicapped population mentioned in the Action Plan brings about the differentiation of needs. With genetic disabilities also comes certain challenges. However, the temporary disability situation that individuals experience in certain parts of their lives ensures we become aware of the importance of fulfilling their daily living needs. The introduction of a set of rules and design criteria geared towards the use of buildngs and open living spaces (streets, squares, etc.), in access to transportation and information, and even all the goods to be used, is an important issue in terms of basic human rights.

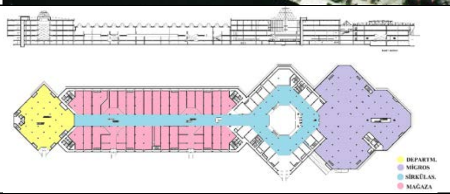
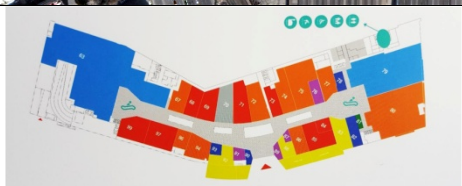
Both the United Nations’ report aimed at the equal opportunity of social conditions for the physically handicapped [3] and the convention on disability rights [4] state what being physically handicapped within the scope of human rights and emphasize legally binding sanctions. For the physically handicapped, taking part in all aspects of life (social, cultural and professional) is possible as long as the physical space they inhabit is accessible and functionably designed. That’s why physical environments need to be arranged in a way that is capable of handling the use and accessibility requirements of the physically handicapped from the planning and design stage onward. One of the most significant concepts on the agenda in recent years is “universal design”, which calls for making spaces more accessible and functionable for the physically handicapped. In essence, while the universal design approach upholds the philosophy that the whole can be used equally by everyone without the need to adapt to the physical environment, it not only give importance to the physically handicapped, as well as achieving an outlook that considers everyone.

Nowadays, arrangements regarding the physical accessibility of our existing living environment have not been keeping abreast with legislative developments, the increased number of scientific publications, as well as the large number of meetings and decisions taken. The purpose of this study is; to explain the concept of disability and universal design (design for all) which encompasses everyone, as well as to examine the indoor and outdoor features of Malls, as per the standards of the physically handicapped. In terms of the design criteria (standards) laid out for Malls, it put forwards just how functional they are for the physically handicapped, by selecting the oldest and newest examples in Istanbul.

2. MATERIALS AND METHODS

The material of the study is comprised of the outdoor and indoor spaces of two different Malls that are open to the public in Istanbul. In addition, other materials constitute literary sources related to the research field and the topic, legislation related to buildings and outdoor space regulations of Malls, as well as observations pertaining to accessibility standards and the physically handicapped use of the built environment. The subject of research is comprised of the utilization of Malls from the aspect of the physically handicapped. In this context, a checklist regarding the use of Malls by disabled persons was prepared by using these materials. This criteria list was compiled from the standards set by the American Disability Act [5], United Nations [3,4,6], and the Turkish Standards Institute [7]. An assessment was made with metioned criteria at the Galleria and Axis Malls, which were selected as the sampling areas. The importance of universal-inclusive design was highlighted by means of two mall building examples taken up in this study (Table 1).

Table 1. Selected Shopping Centers [URL 1, URL 2]

Sample	**GALERIA**	**AXIS**
Satellite view		
Plan		
Location of Building	Ataköy-Bakırköy / İstanbul	Bayrampaşa-Eyüp / İstanbul
Date opened	01.10.1988 (Renovation 2010)	18.05.2016
Design Team	Hayati Tabanlıoğlu	Aykut Mete, Fatih Aşcı, Yasemin Karakaya, Cem Postalcı (Team Project Mimarlık)
Area	80.000 m^2	125.000 m^2
Description	The Galeria is located on the south side of the Sirkeci-Florya shore road, which is a major transportation hub. As Istanbul’s first shopping center, the building is comprised of 4 main blocks with 5 floors. The shopping areas are the Galeri floors long blocks and the square blocks to the left. The courtyard block on the right is a food & beverage area (yellow-pink). The square block at the far right of the structure forms a (purple) market chain. The structure’s support system is reinforced concrete carcass. The roof of the square food court is comprised of the space frame system. The octagonal spaces with diameters up to 5 meters of the gallery section in the long block of the structure’s middle section ensures the interior of the structure take advantage of natural light. There is an adjacently positioned two-storey car park linked with bridges to the side entrances at the rear facade of the structure. The building was renovated in 2010.	Axis is located next to the Bayrampaşa Metro Station, which is an important transportation focal point. As one of the last Malls constructed in Istanbul, Axis Mall has a direct connection to the metro line. The linear-shape structure has different blocks varying between 5 - 7 floors. The structure’s first five floors are shopping space. Situated on the 3rd floor of the structure, the glass-block roof provides the food court with natural lighting. The structure’s support system is reinforced concrete carcass. There are LED lines along certain sections of the outer facade that change colors at night. A warning sign that states for everyone to gather in the middle space during any emergency situation is found over the facade.

3. DISABILITY AND URBAN LIFE

Disability is a human state that is either inherited or else occured later on. The World Health Organization’s (WHO) definition of disability is; Deficiency or failure in fulfilling “normal activities”, expressed as movements, tasks and abilities that are expected from an individual's body [8]. These days, the daily activities of the physcally handicapped need to be rendered suitable for them to access the environment where they live and to remove the physical barriers in order for live equally and together with other urbanites, without becoming dependent on other people. In this context, the rights and freedoms of the physically handicapped are constantly keep in the headlines and studies to improve pertinent regulations are being conducted in developed countries. This issue is defined in the European Urban Charter as; cities are obliged to provide everyone with equal utilization opportunities to the greatest extent [10]. The physically handicapped are accepted as an integral part of the community by enacting countless regulations regarding accessibility for he physically handicapped in developed nations. Design concepts for all stages of life have been dealt with laws such as "The Americans with Disabilities Act" (ADA)-1990 in the U.S.A., the "Disability Discrimination Act"-1992 in Australia, the "The Act Concerning Support and Services for Persons with Certain Functional Impairments" (LSS)-1993 in Sween, the "The Act on Buildings Accessible and Usable for the Elderly and Physically Disabled"-1994 in Japan, the "Disability Discrimination Act (DDA)"- 1995 in England [11], all of which express the design concepts aimed towards the physically handicapped (the physically disabled, elderly, children, pregnant mothers, etc.) (Figure 1).

Figure 1: All stages of life with differences [URL 3]

According to the Statistical Institute data 12.29% of the population is made up of individuals with disabilities In Turkey [12]. As with the rest of the world, important regulations regarding disability legislation have been imposed and standards have been developed in Turkey. 13, 14]. However, although it can be said that solutions that evoke the philosophy of 'universal design' have been foreseen in the related standards and legislation, problems still persist in the real world due to inadequate sanctions and inspections [15, 16, 17]. One reason for this is that the awareness and a change in mindset that needs to take place in every part of society has not happened 18, 19, 20].

4. THE CONCEPT OF UNIVERSAL DESIGN

Universal design is an approach geared towards creating environments that can be utilized and cohabitated by one and all. It is an understanding that emerged in the post-World War II era with the increase of physically handicapped people around the world, aiming to implement regulations for their participation in urban life. With this point of view, the "barrier-free-design" concept first emerged in regulations implemented in the 1950's. Laws and pertinent standards were implemented in the 1970's. Put into practice, this approach was expressed in literature as "accesible design" [21, 22]. By the 1980's, the concept of 'universal design' began to be implemented as a design concept that embraced everyone's use without allowing for any discrimination in all design aspects (in the arrangement of the built-up environment.

These days, while various phrases such as "inclusive design" or "design for all" are used in different countries for "universal design", both concepts emphasize the idea that the environment is to be used by everyone. Generally, the idea of universal design identifies with the idea of equality for "everyone" and "non discriminatory" design within the proposed theoretical framework [23].

The phrase, "design for everyone" was first used by American architect, Ronald L. Mace in 1985. In 1991, the creator of the idea "Design for Everyone", Mace, along with Hardie and Place, wrote and published a book entitled "*Accessible Environments: Toward Universal Design*", in which they stated that universal design was the "designing of all products, buildings and outdoor areas to ensure the use by as many people as possible, (non-disabled/disabled) [24]. In 1989, Mace laid the foundations for a North Carolina State University campus building that was to be named the Center for Universal Design in 1996. In 1997, the center developed seven essential principles as a guide for everyone's design work and render the concept of "universal design" understandable. [25, 11]. These principles guide the design process, assist in the evaluation of existing or new designs, and allow students and designers to recognize the universal design concept [15]. These principles are stated in Table 2.

Table 2. Universal design principles (Source: The Center for Universal Design, NC State University, 1997)

Principles	**Definition**
1. Equitable use	The designs should be usable and purchasable for everyone with different skills,
2. Flexibility in usage	Designs should provide flexibility in usage and be able to provide options for the user,
3. Simple and Intuitive Use	Design should respond to the different reading levels and language skills of the user and be easily understandable,
4. Perceptible information	The design should be perceivable independent from environmental conditions and the user's emotional abilities,
5. Tolerance for error	The design should minimize the possible bad consequences and dangers of accidents or involuntary actions,
6. Low physical effort	The design should minimize the possible bad consequences and dangers of accidents or involuntary actions,
7. Size and space for approach and use	The design should minimize the possible bad consequences and dangers of accidents or involuntary actions,

5. RESEARCH FINDINGS FOR THE DISABLED STANDARDS OF SELECTED MALLS

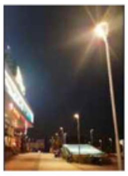
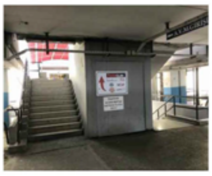
Nowadays, when gathering different products in one center and offering them to consumers, people tend to combine their shopping combined with recreational activities. In this context, while Malls host various activities such as shops in various categories, cinema-theater and entertainment venues, it is important to have accessible buildings (based on international disability design criteria) that take account the physically handicapped together with all segments of society. When in fact, it is necessary to design accessible and barrier-free spaces so physicaly handicapped users can shop and spend leisure time independently.

Ensuring that all users benefit equally from the opportunities both inside and outside the building, should be amongst the priority rules in the design process of an accessible Mall. In designing accessible Malls; the provision for carrying out all architectural and outdoor space arrangement required for Malls should be ensured within the scope of designing accessible and unhindered cities. In this context, outdoor and enclosed car parks, building entrances and doors, horizontal and vertical circulation elements, such as elevators, escalators and ramps, and entertainment areas (cinema, etc.), toilets and all indoor venues belonging to the Mall need to be accessible for the physically handicapped. It is important that all surface texture and materials inside and outside the building conform to the disabled standards. In taking into consideration the universal design standards for the physically handicapped; the criteria compliance list for Malls is provided in Table 3. The criteria list was compiled from standards set by the American Disabled Law, the United Nations (UN) and the Turkish Standards Institute (TSE).

Standards have been defined with the dimensions of peripheral accessibility into the building and interior accessibility. Mentioned criteria were turned into findings through measurements, as well as the assessent of observations (Table 3, 4).

Table 3. Peripheral Accessibility Into the Building (Open spaces) [5,6,7]

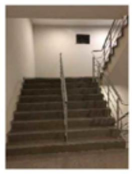
ACCESSIBILITY STANDARTS		GALERİA MALL		AXİS MALL
PERIPHERAL ACCESSIBILITY (OPEN SPACES)				
Proximity to public bus stops and pedestrian crossings	✓		✓	
Accessible main entrance	✓		✓	
Accessible secondary entrance	✗		✓	
Firm, stable, and slip resistant footpath	✓		✓	
Guide strips on the pavement	✓		✗	
Not level changes on pavement	✓		✓	
Contrast colors on the pavement	✓		✓	

Sufficient lighting	✓		✓	 
Parking (Parking lot and garage parking)				
Parking lot- building entrance relation (10-25m distance/ TS 12576)	✗		✓	 
Garage parking disability access	✗		✓	
Sufficient parking dimensions for disabled Distance for two parking: 1.20-1.40 m	✗		✓	 
Sufficient parking numbers	✓	1000 car/ 20 disabled parking	✓	774 car / 24 disabled parking
Visible direction signs (symbol-written-illuminated)	✗		✗	
Sufficient parking lighting	✗		✓	
Convenience parking pavement	✗	Concrete	✓	Epoxy
Open spaces / Entrances and doors				
Existence of straight entrance/entrance with staircase	✗		✗	

Maximum riser height and tread width (h=15cm, t=30cm) (TS 12576)	✓	 	✓	 
Ramp existence with staircase	✓		✓	
Convenience ramp slope (8%)	✓		✓	
Landing usage in long ramps	✓		✓	
Landing usage at the start and end of the step	✓		✗	
Convenience height handrails (80-90cm)	✓		✓	
Top and bottom extension at ramps	✗		✗	
Convenience of pavement material	✓		✓	
Convenience signing and symbols usage	✗		✓	

Guide strips for visually impaired	✓ 	✗ 
Manual door or pivoted door beside the revolving door (min.90 cm)	✓ 	✓ 
Glass door safety band	✗	✓
Doorhandle hight (90-100cm)	✓	✓

Table 4. Accessibility in Indoor Spaces [5, 6, 7, 26]

ACCESSIBILITY STANDARTS	**GALERİA MALL**	**AXİS MALL**
INTERIOR SPACE / VERTICAL CIRCULATION ELEMENTS		
Staircases		
Maximum riser height and tread width (h=17cm, t=30cm)	✓ 	✗ 
Handrail both sides	✓	✓
Handrail height (h=95cm)	✓	✓
Extension of handrail (h=45cm)	✓	✗
Guide strips usage at the start and end of the stair	✓	✗

Elevators				
Adequate manuevering space and waiting area in front of the door	✓		✓	
Adequate space inside the elevator cab (min.172.5x137.5cm)	✗		✓	
Adequate door width (min. 91.5cm)	✓		✓	
Automatic door	✓		✓	
Handrail (h=85-90cm)	✗		✓	
Emergency button	✓		✓	
Folding seat	✗		✗	
Tactile and illuminated buttons (lateral approach max. 137cm, frontal aproach 122cm)	✓	 	✓	 
Audio alarm system	✓		✓	
Guide strips in front of the elevator	✓		✗	
Interior spaces / Horizontal circulation				
Firm, stable, and slip resistant ground	✗		✗	

Guide strip	✓		✗	
Column sphere safety barrier	✗		✓	
Corridors				
Corridor width min.1.20cm	✓		✓	
Interior space specifications				
Natural lighting	✓		✓	
Artificial lighting	✓		✓	
Seats and benches	✓		✓	
Waste bins (h=90cm)	✗		✗	
Signage include directional signs, information bollard and symbols	✓		✓	

Cinemas

		
Accessibility in to cinema hall	✗	✓
Adequate door clearance	✓	✓
Ramps usage in the hall	✗	✗
Dismountable seats for disabled people in the halls	✗	✓
An adequate number of wheelchair spaces	✗	✓
Disabled WC	✗	✓

Toilets

		
Minumum dimensions (150 x 150 cm)	✗	✓
Door width (w=100cm)	✗	✓
Existence of smart door	✗	✓

Grab bar (h=70-80cm)	✓		✓	
Mirror height above the floor max.90cm, mirror top height max.190cm	✗		✗	
Trash bin	✓		✓	
Toilet paper height (min.43 cm, max.48 cm)	✓		✗	
Water closet height above the floor (min.43 cm, max. 48 cm)	✗		✓	
Bidet nozzle height (min.43 cm, max. 48 cm)	✓		✗	
Doors open to outside	✓		✓	
Emergency button	✓		✓	

5. CONCLUSION

Malls need to be a group of accessible buildings (based on international disabled design criteria) that have a high concentration of shopping and recreational activities, and take into account the physically handicapped as well as all segments of society. These venues must be designed to be accessible and barrier-free to make it convenient for physically handicapped users to make their own decisions, and take care of their leisure time and shopping. With the checklist acquired from different standards, the use of the Galleria Mall and the Axis İstanbul Mall, which were constructed at different times (1988 and 2016, respectively), by the physically handicapped was examined in this study. When an assessment of the findings was made it was found that the Axis complied with most of the required standard, but despite the fact it underwent a complete renovation in 2010, it was found that the Galleria did not comply with most of the standards. In terms of universal design rules, Axis, which has been built in recent years, bears the characteristic of being a more accessible and user-friendly than the Galleria.

In conclusion, if malls, which have recently become important living spaces, are architecturally designed in compliance with accessibility criteria, but the vicinity and even the entire periphery lacks accessibility, then the accessibility of the designed structure doesn't mean anything. What's important is the barrier-free design of the entire vicinity along with the buildings.

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Standardizing Internal and External Quality Assurance in Vocational and Higher Education: Opportunities and Challenges in Small States

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ABSTRACT

However one defines state 'smallness', the small states perspective is quite limited in the HE literature. Nevertheless, state 'smallness' is far from being an insignificant reality internationally. 56% of Commonwealth member countries have a population of less than 1.5 million. More than a quarter of the 28 member states of the EU, including Malta, have a population of 3 million or less. Four of the five current EU candidate countries, all in the Balkans, have populations of less than 5 million each. Kosovo, Croatia and Bosnia-Herzegovina also fall within this or even stricter size parameters.

The literature on the impact of state 'smallness' on education policy has shifted over the decade from a predominantly deficit perspective to one of resilience and anamorphism. This paper explores how the perceived limitations of size in one small state, Malta, have been reframed into opportunities for innovative approaches with respect to its national QA framework. The harmonisation of internal and external quality assurance standards for both vocational and higher educational provision, which is still a distant utopia at EU level in spite of efforts up to 2014 in this direction, was achieved first in Malta in 2015 because, rather than in spite of, its small size.

Small can be beautiful, but it does have its own unique challenges. This paper goes on to discuss the experience of the first three years of implementation of the Maltese National QA Framework. This has been mixed, for reasons that relate mainly to the near-hegemonic positionality of state educational institutions, and the 'monopolistic' proximity of quasi-independent regulatory authorities to the rest of the state. Both are characteristics of educational provision and governance in small states.

The paper concludes with lessons that can be learnt for the standardisation of quality assurance in vocational and higher education in small states.

Key Words: quality assurance, small states, Malta, further and higher education

1. INTRODUCTION

However one defines state smallness [1], [2], the small states perspective is quite limited in the HE literature [3], [4]. Indeed, the small states perspective itself is only as old as the space age [3]. However, state 'smallness' is far from being an insignificant reality. 56% of the 52 members of the Commonwealth have a population of less than 1.5 million (Sultana ibid. p.6). More than half the member states of the UN have populations of less than 10 million, whilst 28 have 500,000 inhabitants or less [5]. The European Union has 8 states, including Malta, with a population of 3 million or less. Four of the five current EU candidate countries, that is Albania, the former Yugoslav Republic of Macedonia, Montenegro and Serbia, are Balkan countries with populations of less than 5 million each. Kosovo, Croatia and Bosnia-Herzegovina also fall within this or even stricter size parameters.

The literature on the impact of state 'smallness' on policy, including with respect to education, has shifted over the last decade from a predominantly deficit perspective to one of resilience and anamorphism [6]. Elsewhere [7], [8] I have discussed how the perceived limitations of size in one small state, Malta, a founding member of the European Higher Education Area (EHEA) and an EU member since 2004, have been reframed into opportunities for innovative approaches with respect to the national quality assurance framework that was set up in 2015, the first to cover both vocational and higher education.

This paper will discuss the experience of these first three years of implementation, which have been mixed for reasons that also relate to small-state characteristics of the disproportionate, near-hegemonic positionality of state educational institutions, and the 'intimate' [9] proximity of quasi-independent regulatory authorities with the rest of the state.

This paper is based on part of my doctoral research [6]. Data was gathered through the perusal of relevant legislation and parliamentary debate, relevant documentation of the University of Malta, referred in this paper as the University, and 15 semi-structured elite interviews, one of which, M4, is referred to in this paper. M4 is a senior academic administrator at the University of Malta. M4:14, for example, refers to the 14th utterance in M4's interview.

2. THE CONCEPT OF STATE SMALLNESS

The first part of this paper discusses the concept of 'state smallness', which engenders the "absolute conditions within which the Maltese mind has to operate" [10], also referred to in the literature as the inherent context [11] or constrictions [9] of small states. Amongst these are: **Smallness**, **Intimacy** and **Monopoly.**

Small states are forever being measured and measuring ourselves against much bigger, more powerful and influential neighbours. Malta has been in a continuous state of being-as-colony for almost all its recorded history of over two millennia, as the cumulative "invention by the global of the local as native" [9]. Smallness leads to a reductionist perspective of policy development and implementation by a process of "exaggerated personalism" [12], the identification of policy with one person or a small group of promoters and implementers, allowing for its trivialisation in the tug-of-war of competing ambitions and agendas.

In Intimacy the healthy separation between public/professional and private is blurred and one's private space shrinks. This atmosphere breeds dissimulation, a guardedness that one can never be completely divested of without the fear of negative consequences. Reference [6] has described how the multiple intermeshing levels of networking in a small island community – what Bray called "multiplex relationships" [2] – act as an inverse social panopticon, within which the inhabitants feel that they are 'already known' and have no real anonymity.

The conditions of Smallness and Intimacy underpin Monopoly. Monopoly, which is equivalent to Sutton's "government pervasiveness" [12], refers to the ubiquitousness of the state apparatus in everyday interactions, and therefore the shift in the balance of power that effects all spheres of life: "Small state government is characteristically weighty and omnipresent and, as a result, omnipotent" [9]. Warrington highlighted the effects of the intricate juxtaposition of Intimacy and Monopoly:

> politics and government intrude into daily routines, concerns and perceptions of ordinary folk. (…) Elected and appointed officials stand at the cross-roads of public and private affairs, at once bureaucrats and kinsmen, the agents of impersonal authority and brokers, confidants and *habitues* within informal affective networks [13].

The 'absolute conditions' or 'inherent context' of small states are certainly not unique to Malta, but are a characteristic shared by many similar states across continents and regions. Over the last decade or so the discourse has moved from the 'predicament' engendered by this status to the opportunities therein [14], [15], [16], [17], [18], [19]. As reference [13], asserted: "it is necessary to look beneath the carapace of dysfunction and other 'so-called' characteristics, at the internal dynamic of micro-states." Reference [18] called this the anamorphic perspective, since head-on the situation of small island states may look distorted and deficit-based [1], [20] and thus requiring external support, but if percieved from a different angle reveals hidden harmonies and potential.

Reference [11] developed the concept of resilience in the context of the economic well-being of a small state that addresses its inherent vulnerablity due to increased exposure to external events. The concepts of resilience and anamorphic perspective may allow us to perceive that small states can have the capacity to turn unpalatable limitations into opportunities for growth. So, while as discussed reference [9] referred to Intimacy, reference [21] referred to Managed Intimacy:

> Small-state inhabitants learn to get along, like it or not, with folk they will know in myriad contexts over their whole lives. To enable the social mechanism to function without due stress, they minimise or mitigate overt conflict. They become expert in muting hostility,

> deferring their own views, containing disagreement, avoiding dispute, in the interest of stability and compromise. (…) Not simply the small size of the state but the complexity and durability of most relationships fosters sophisticated modes of accommodation [21].

Bray also observed that "the multiplex characteristics and need for managed intimacy in small states may be forces for conservatism, but they may also provide social cohesion and links that promote innovation" [2]. As examples, Bray referred to the positive potential of Smallness: all the senior administrators involved in tertiary education can meet in one room; and Intimacy: personal connections can facilitate the opening of new tertiary institutions or the reorientation of existing ones. As reference [22] pithily put it: "Small *can* be beautiful".

However it was Sultana himself who sounded an important note of caution with respect to claims about the effects of 'scale' on small states, since such effects can also be found in other contexts such as remote and rural regions and communities, and to some degree may also be shared by large states. He took the more cautious position that: "scale is nevertheless a useful prism through which to look at social realities, and potentially valuable in understanding social dynamics and processes in particular contexts" [22]. Reference [13] described the micro-state as first of all a *condition*, rather than a juridical entity or conditional to sovereign statehood.

The small state reality is therefore inherently dualistic, with patterns of "tensions and ambiguities, opportunities and constraints that, taken together, describe the micro-state" [13]. Reference [23] considered this dualistic perspective to be applicable to a general typology of island governance: "Complexity, not simplicity; diversity, not uniformity; contingency, not predictability; these should be the watchwords when examining islands".

3. SMALL-STATE IMPLICATIONS ON EQA

This dualistic perspective has also marked the development of Malta's National Quality Assurance Framework for Further and Higher Education [24], and its implementation in the attendant external quality audits (EQA) mechanism [25]. As indicated by reference [2], Malta's micro size allowed for quick and effective networking between the key stakeholders, and considerations of economies of scale militated in favour of having an overarching framework that was sufficiently broad to encompass both further and higher education. For aspirational reasons the vocational education providers agreed to a framework that converged around and adapted the European Standards and Guidelines [26] that have been developed at European level for tertiary provision [7]. Malta's three major state further and higher education institutions, which are the University, the national vocational college MCAST and the Institute of Tourism Studies (ITS), underwent their first external quality audits (EQAs) in 2015 under the same regime based on Malta's QA Framework.

Since these were the first EQAs in Malta, the entities themselves were intimately involved in the development of the EQA protocols and procedures, which endeavoured to promote the development of a quality culture whilst ensuring the rigour of an independent international-standard educational audit. On the one hand, the principle of public dissemination of the EQA reports was retained, as one way how the state could bring pressure to bear on monolithic institutions such as he University to make the necessary changes to improve its provision. On the other, measures were introduced to allay institutions' fears of the possibly negative publicised judgements. In Malta's EQA system the outcomes are not conflated in one overall judgement; rather, a judgement is made on a four-point scale [25], for each of the 11 Standards of the National QA Framework. Another important innovation was that the EQA report includes the official reaction of the hosting entity, indicating the way forward following the EQA recommendations. The intention was that in this way the entity would be seen as participating in the EQA pro cess, not simply submitting passively to it.

This accommodation, another example of small-state dualism mentioned earlier, was possible due to the positive aspects of small size. However, as the author of Malta's QA Framework and the person in charge of the development and implementation of the EQA standard operating procedures, I can report that this was also an anamorphic strategy to allay the real danger that these state entities, through their near-hegemonic positionality within the "multiplex relationships" [2] in Maltese society, could effectively block or neutralise any potential threat emanating from the EQAs – a not unfounded fear, as we shall see.

The undertaking of these EQAs was generally considered positively by the stakeholders of the three institutions involved [27] – this data was gathered before the EQA reports were published. Some important lessons were learnt [28]; [27]: with respect to the judgments of the EQAs, there was a need to standardize their interpretations, whilst at the same time reiterating that judgments could not be compared across different categories of entities. The Standards and operating procedures needed to be adapted for different categories of providers, and for programme-level EQAs.

However, once the EQA reports were issued they garnered a very different reaction from the three hosting institutions. Whilst the MCAST EQA produced a clean sweep of 'meets Standard' judgements, the University received one 'exceeds Standard' judgement, four 'meets Standard' judgement with the rest being 'needs to improve' judgements. The EQA report for ITS was the most negative: it indicated three 'needs to improve' judgements and seven 'does not meet Standard' judgements.

The ITS and the University protested strongly at these judgements, and the resulting discussions postponed the publication of the EQA reports. Although the EQA SoP [25] indicated that the EQA report was to be published within approximately six months of the audit, the reports of these first three EQA reports were published about a year after the respective EQAs. Although the original proposal, the formulation of which I was also involved in, was to publish the EQA reports in the media and foreground them on the website of the National Commission for Further and Higher Education (NCFHE) on the same lines as the practice by other national QA agencies, in the end the NCFHE opted for no media announcement, a preliminary explanatory meeting *in camera* with the media and simply placing the documents on its website without any indication of this on the website landing page itself. Up to the end of 2016 they were tucked under a section that would be accessible only to QA cognoscenti, for all intents and purposes invisible to the general public. A link to the EQA report on the landing page of the NCFHE website was only established when the change in NCFHE leadership in 2017.

Along with the EQA Reports, the NCFHE published an explanatory note that was intended to address the objections that had been raised by the hosting institutions. It emphasized that the judgements for any one institution were: "*sui generis* and cannot be compared with those conducted on any other educational institution. All entities are measured against established criteria, rather than against each other" [29]. The NCFHE was: "extremely conscious that it is breaking new ground in Malta, where a culture of accountability and sensitivity to constructive criticism has still to take root" (ibid.). The explanatory note also underlined that although the three EQAs were pilots (in that the hosting institutions received significant support in preparation for their EQAs and the judgements of the final reports kept in mind that these were the first EQAs in Malta), they were "fully-fledged external quality assurance audit(s)" (ibid.).

The reaction of the three participating institutions can be gauged by their public response to the published audit results, and by their written response that was incorporated as Chapter 4 of the respective published EQA report. MCAST, the national vocational college, immediately issued a public declaration of satisfaction with the result, stating that: "the whole external audit process has also been a learning experience for us and will help us focus on improving the service we offer our students" [30]. Even before the MCAST audit report had been made public, it was used by the Education Minister to justify the extension of MCAST's self-accrediting status to cover the conferment of Master's degrees [31], although the EQA report had judged MCAST as a vocational college rather than a tertiary education technical institution [32].

ITS, on the other hand, did not issue any public statement or reaction to the audit report itself. In its written response as part of the audit report itself, the ITS disagreed with the EQA outcomes, not because it contested the findings but mainly on the grounds that the judgements had not given sufficient cognisance to its efforts to improve services [33]. However, the audit did have a profound effect on ITS. It led to a root-and-branch review of its operations and programmes, and significant investment in new premises [34]. In its Follow-Up Report issued one year after the publication of the Audit report, the NCFHE commended the ITS for its comprehensive and in-depth review of structures, processes and procedures which effectively and comprehensively addressed the lacunae and issues that had been raised in the EQA [35].

The University also did not issue a public statement. In its written response as part of the audit report the University (which as we have seen had been an active participant in the preparatory and implementation phases of the national QA mechanism for further and higher education) criticized aspects of the preparation for the EQA and the way it was conducted [36]. The NCFHE also issued a Follow-Up Report for the University which detailed the measures taken by the University to address the Audit report recommendations. This shows that the EQA results did impact the QA mechanisms of the University: for example, it reconstituted and revamped its Quality Assurance Committee [37]. However for a number of recommendations the University did not provide a remedy or a solution, but simply re-stated its extant procedures and services, thereby effectively underlining its disagreement with the original findings of the EQA. [38]. Yet the NCFHE accepted the whole package of actions and commended the University for its response to the issues raised by the EQA report.

4. INSTITUTIONAL AGENCY IN CONTROLLING THE EQA NARRATIVE

The reactions to, and the manipulation of, the EQA Reports and their aftermath provide fascinating insights into the complex choreography of power and influence between the state, including the NCFHE, and the three educational institutions who hosted the EQA. MCAST, with a near-hegemonic position in national vocational provision, did not reject or try to discredit its EQA results because they were considered to be positive for the institution. But as we have seen, these results were partially leaked before their publication and instrumentalized beyond their original remit to justify MCAST's expansion that was in direct competition to the University, which could partly explain the negative reaction of the University to its own audit results.

ITS is the sole education provider in its sector, but it is much smaller size in relation to MCAST and the University (it caters for about 500 students as opposed to about 11,000 by each of the other two). It also has relatively much less complex multiplex networking in terms of its alumni, its lecturers and its links to the state and civil society.

The University, on the other hand, has by far the strongest network links of the three. It has a history of over 400 years and was formally set up as a university in 1769 [39] It has historically provided Malta's professional class, and today is an omnibus provider that caters for most full-time graduate studies in Malta. Through its lecturing ranks, its consultancy and advisory services and its outreach activities it is inextricably intermeshed with the state, successive governments and civil society. To give two examples of this complex interlinking that leads to the small-state characteristic of Intimacy, its Chancellor, the highest (non-executive) officer in the University with the functions of a Chairperson, was and has remained a professor at the University and thus nominally accountable to the Rector, who is accountable to the Chancellor. At least since 1983 all but one Ministers of Education also had lecturing duties at the University whilst in office.

The University therefore provides the most interesting study of the interplay of power and agency in this micro-state, Malta; and is the focus of the final part of this paper. This interplay is articulated in the ownership, manipulation and partial subversion of national quality assurance mechanisms. Its positionality in Maltese society has meant that until relatively recently, its approach to quality assurance was quite *laissez-faire*. One reason is that throughout its history it has been subject to State Monopoly in the form of extensive external inspection and control [40], [41], [6], which if anything became even more intrusive after Independence in 1964. In the 1970s and early 80s the University went through several upheavals which were intended to break the hegemony of the ruling classes, expand the range of University courses and make them more responsive to national economic needs, and increase access to working-class students [42].

This stranglehold on the university was broken in 1987, when the incoming government reversed the erstwhile excessive state interference and emphasized the University's autonomy [43]. In 1990 the University commissioned the Warwick Higher Education Group to develop its strategic plan. The Group concluded that "performance monitoring is undertaken neither in teaching nor research, neither centrally nor at faculty level" [44] and that "there is an unwillingness in the institution as a whole to do anything about the problem" (ibid. p.17). It recommended the setting up of an independent academic review committee to monitor academic programmes and research in the university (ibid. p38). It was only in 1996 that the University set up its first Quality Assurance Committee (QAC) [45]; but this first QAC was far from the Warwick recommendations. An internal University committee commented that measures introduced by the QAC "(have) not achieved the desired level of QA" [46]. The QAC's internal QA audit, the first undertaken by the University in 2000, was criticised in Parliament as being a "ritualistic" exercise, "simply to tick the box and do the paperwork" [47]. The University Students' Council also believed that QA at the University was weak: "It is nowhere near the level we would like to see" [48].

This *laissez-faire* attitude changed with the overhaul of the Education Act in 2006 [49] that for the first time introduced quality assurance objectives at all levels of educational provision [6]. The quality culture heralded by the 2006 Act had a coherent ideology across all sectors: the onus of ensuring quality in teaching and learning was on the providers through their internal developmental processes; the external oversight through inspections and audits was justified inasmuch as it supported these internal processes. 2006 also saw a new University administration, which actively supported government in these reforms. The advice by the new University leadership to the government with respect to the 2006 Act was that the University needed to have an external driver to support the Rectorate to make the necessary changes in quality: "Had the Education Act changes not been made as they were it would have been more difficult for the University to convince people to do the necessary changes. (...) I once told (a Ministry official): if you don't do it I will have to invent it exists!" (M4:14).

At the same time the University was also inspired through and driven by contemporary QA developments at the European level, including the Bologna process. Its participation in international events allowed the identification of trends coming the University's way. This gave its leadership stature within the University to assert its arguments about the need to strengthen QA: "but if you say – let's try this because everyone else is doing it (…) those who are not doing it will be forced to do it" (M4:16). It was in this spirit that the University participated fully in the developments of an overarching national QA framework and attendant EQA mechanisms, as discussed.

This change in the perspective of the University with respect to QA can be compared with reference [50]'s developmental phases of QA, as indicated in the table below:

Table 1. Comparing the QA Development of the University of Malta with Bollaert's Developmental Phases of QA [50]

Bollaert's developmental Phases of QA [50]	**Management and organisation Processes [50]**	**Results***	**QA development of the University**
Phase 1	Quality is the result of purely individual commitment.	Quality is variable.	***Laissez-Faire*** From 1988 to 1996 *(from refounding of University)*
Phase 2	There is the beginning of thinking in processes.	Quality is the result of a beginning systematic approach.	**Persuasive Trust-Building** From 1996 to 2006 *(from setting up of first QAC)*
Phase 3	The organisation is managed professionally.	Quality is guaranteed.	**Centralised Compliance** From 2006 *(rigorous approach to QA)*
Phase 4	The organisation as well as its management is systematically renewed.	Quality is continually improved with innovation.	
Phase 5	The organisation is outward-oriented and strives for excellence.	Quality is recognised by externals as excellent and thus an international example.	

The QA mechanisms of the University since 2006 have been characterised by rigorous centralised compliance with respect to the validation and review of new and current programmes, and the consideration of students' feedback [51]. Thus, the University can be currently considered to be in Bollaert's Phase 3.

5. DISCUSSION

Reference [52] explored the pressures of rationalisation and compliance that organisations face, in a reconsideration of Weber’s famous metaphor of the Iron Cage [53] by which he described the irreversible momentum of bureaucratisation in industrial society. They distinguished between three isomorphic processes: coercive, mimetic and normative. Coercive isomorphism occurs when the organisation is under formal or informal direct pressure, whether through legislation or through persuasion, to change and conform. Mimetic isomorphism is the process by which organisations themselves seek to model themselves on their peers to address uncertainty. Normative isomorphism is driven by issues of professionalization and stems from the desire of the members of the organisation to legitimate their occupational autonomy.

Using this taxonomy, the QA developments at the University since 2006 may be said to have been subjected to mimetic and normative isomorphic processes rather than coercive ones, since this isomorphism was informed by significant agency on the part of the University, made possible because of its particular positionality as the sole state university with deep traditions in a small island state. This positionality allowed for the filtering and manipulation of both international globalising and local pressures, so that the University could undertake and control its own form of isomorphism and enjoy a degree of insulation from external pressures.

Considering Bollaert’s and DiMaggio and Powell’s categorizations from a small-state perspective, the reaction of the University to its 2015 EQA results can be said to be due to these being perceived as yet another form of state Monopoly threatening coercive isomorphism, implying a loss of a measure of the control that the University had gained since 1987 on its processes and procedures. Indeed, the concept of Monopoly itself as developed by reference [9], that was limited to the power and influence of the state over small-island society, may need to be revised to take into account the agency of institutional stakeholders such as the University that have a *de facto* near-hegemonic national positionality. This positionality means that the Intimacy that underpins Monopoly, as discussed earlier in this paper, does not only emanate from the state and impinge on the University, but works also in the opposite direction. As we have seen, in the case of the 2015 EQA results the counter-Monopolistic agency of an institution such as the University was strong enough to mitigate the state’s potential Monopolistic effects.

The challenge that the University faces after the EQA results of 2015 is whether its post-Audit response will be a continuation of Bollaert’s Phase 3, or whether it will have the capacity to use the EQA results as a basis to develop its QA culture further in terms of quality enhancement in line with Bollaert’s Phase 4.

Malta’s case study of the aftermath of its first EQAs for its institutional further and higher educational providers has important lessons for other small states. There certainly is potential for rapid policy development and implementation in terms of QA through small-state anamorphic resilience. However, the dualistic nature of the small-state ‘condition’ is such that the neither the Monopolistic tendency of the state, not the counter-Monopolistic agency of national educational institutions with whom they are enmeshed in multiplex networks, should be underestimated.

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Safety of Life Through the Emergency Exit. Implementation of Emergency Stairs in Existing Buildings and Typology of Their Construction

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ABSTRACT

With the changes of the system after the 1990s in Albania began a change of democracy leaving traces in the architecture and urban planning of the country. Freedom gained after the collapse of communism was abused, as the public interest was violated and ignored at the same time. During this period there was a degradation of the quality of urban environments. This favored an urbanism disorder, illegal constructions for business purposes, illegal constructions for residential.

In the years 1995-96, we had a renaissance of architecture in Albania, especially in Tirana where the population was bigger, the construction of multi-storey buildings for intentional housing. Although this massive construction was accompanied by progress in the construction area, construction style and building materials techniques, buildings are still far from meeting construction criteria for evacuation or emergencies. The focus of the study is the establishment and implementation of emergency stairs as a necessity not only for new buildings but also for existing ones, so minimal measures must be taken to anticipate this risk that may come from the emergencies. Establishing emergency stairs, materials used for anti-fire doors, or even the materials that are used for buildings construction. The implementation of these criteria is mandatory for the European Union countries where we want to be part of.

Key words: Demographic changes, Multi-store, building, emergency scale, criteria.

1. INTRODUCTION

Focus on study, creation and implementation of emergency stairs in buildings constructed before and after communism. The preparation of this study is a long-term research effort in the field of standards implementation, especially in pre and post communist buildings. The purpose of the study is to analyze the patterns of different housing, to enable the introduction and implementation of emergency stairs, to mitigate this phenomenon that every day threatens the lives of residents living in these dwellings. The study conducted through a case the study has served to highlight the critical issues for a renovation of residential buildings and to identify different mounting cases. The speed with which these dwellings have been built, the low construction cost has made constructive that these apartments do not provide many opportunities to realize such implementations.

2. OBJECTIVES

Analysis, evaluation, and consideration of existing problems affecting the construction of such buildings, possible directions to the realization and improvement, interventions and performance of these buildings.

Almost all residential buildings, that were built 25 years ago [1], have no exit or emergency stairs for rescuing residents in an emergency case. This is one of the main elements of security, in the absence of which, in many cases have caused many victims. Although is in the current law that every 2-storey building is obliged to make emergency evacuation stairs, many buildings have not applied it. Any kind of building is obliged to take fire protection measures either through external emergency stairs or through other forms on the internal stairs. Emergency exit stairs both in old and new buildings are totally absent from the buildings, making the situation more difficult in firefights. Builders, during the construction, neglect these security measures. Emergency stairs are indispensable for the safety of residents living in those buildings. Point two of Article 27 of Law 8766

"For Fire Protection and Rescue" [2] states that projects for all types of buildings should include fire protection and rescue projects. According to a questionnaire organized for the study of this phenomenon many residents had a bitter experience in this phenomenon. From a constructive point of view, during the study of the typologies of buildings constructed during this period, in the examples taken in the study we have noticed that the buildings do not have enough space to construct or implement an emergency stair. One of the most important aspects is the study is the place where the scale is to be installed, because the path must end in a safe and widespread place where it is possible to group the evacuated.

3. THE SOLUTION

Depending on the types of buildings and the number of people present in it. The only possibility is to cooperate and their connection with the outside of the building or to the inner spaces without affecting public space.

Case study 1.

- **The total external ladder [3]**

The building that we have taken under study has been built in 1976 upon request of Executive Committee of the Durres district. It has been constructed with volunteer work by the employees in need of the dwelling of the Durres sea port. The building includes 3 floors, with 2 residential floors and one storey floor being commercial units. During the period that was built, were not designed emergency stairs [4].

Figure 1: South facade

Figure 2: West facade

- **Existing plan**

Looking at the structure and analyzing the flux movement, we draw to the conclusion that the only solution for the emergency stairs, without affecting the individual spaces and without disrupting the structure and facade of the building, it is intended to build a staircase with a metal structure with a pitch of 2m, Fire door REI with 120 cm dimension, it is considered fire resistant, with automatic closing and opens in the direction of the flux, the gate and the wall must be isolated [5].

Based on the applicable law, emergency stairs must fulfill the criteria of European standards.

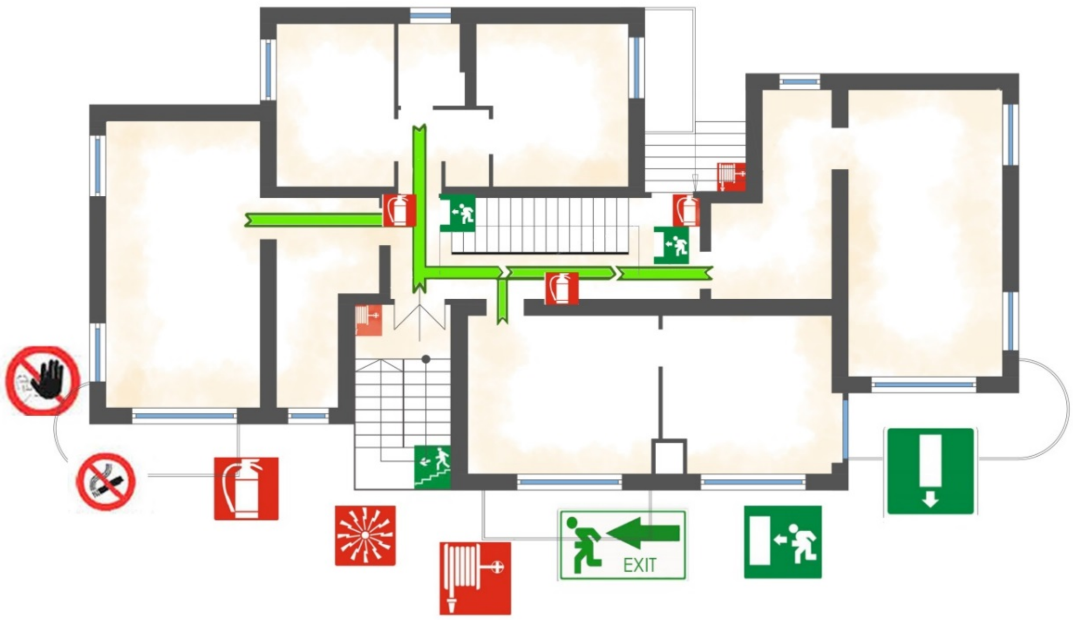

Figure 3: The streets of the exodus [6]

- On the Exodus Roads including the stairs and exit gates, security signs are clearly visible.
- Exit doors are marked with appropriate markings indicating: DOOR FIREWOOD-KEEP CLOSED.
- There are no obstacles in the exit corridor.
- The door with the slip opening system is marked with SHUTTLE TO OPEN.
- Security signs should show.
- Follow the escape routes.
- Emergency Stair indication.
- Identification of emergency port.
- Identification of the position of the alarm equipment.
- Identification of [fire extinguishing equipment position.
- The corridor width should be sufficient in relation to the number of inhabitants measured at the narrowest point of passage:

$$L\,[m] = A\ 50 * 0.60$$

- Where A = represents the minimum nr of people present on the floor.
- 0.60 Width in sufficient means to pass a person.
- 50 shows the max number of people.
- The maximum length of the corridor to the exit point should not exceed 60m from the nearest gate.
- One door for every 50 people in a 1.20m wide corridor [7].

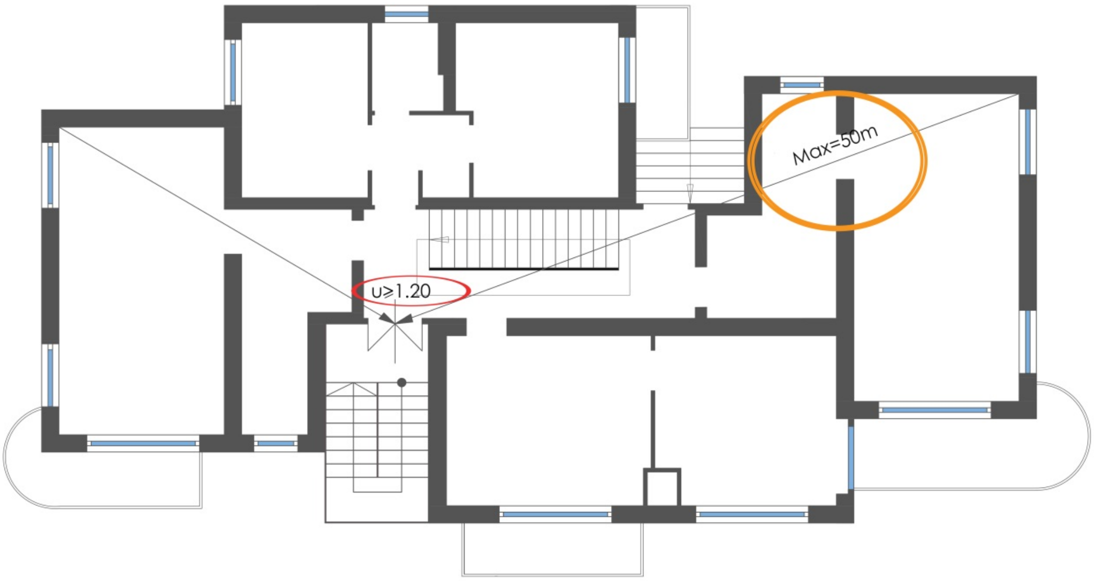

Figure 4: Maximum length of the corridor

Figure 5: Signals used in the streets of the exodus

Figure 6: Door Rei 60 [8]

- REI 120 door;
- REI 60 are fire resistant airtight doors. Which means:
- R = resistance;
- E = airtight;
- I = insulation;
- The REI 120 demonstrates that these three above-mentioned criteria will be respected at 120min, so 2 hours after the fire blast;
- The numbers used after the REI code express the time in min during which fire resistance should be guaranteed [8].

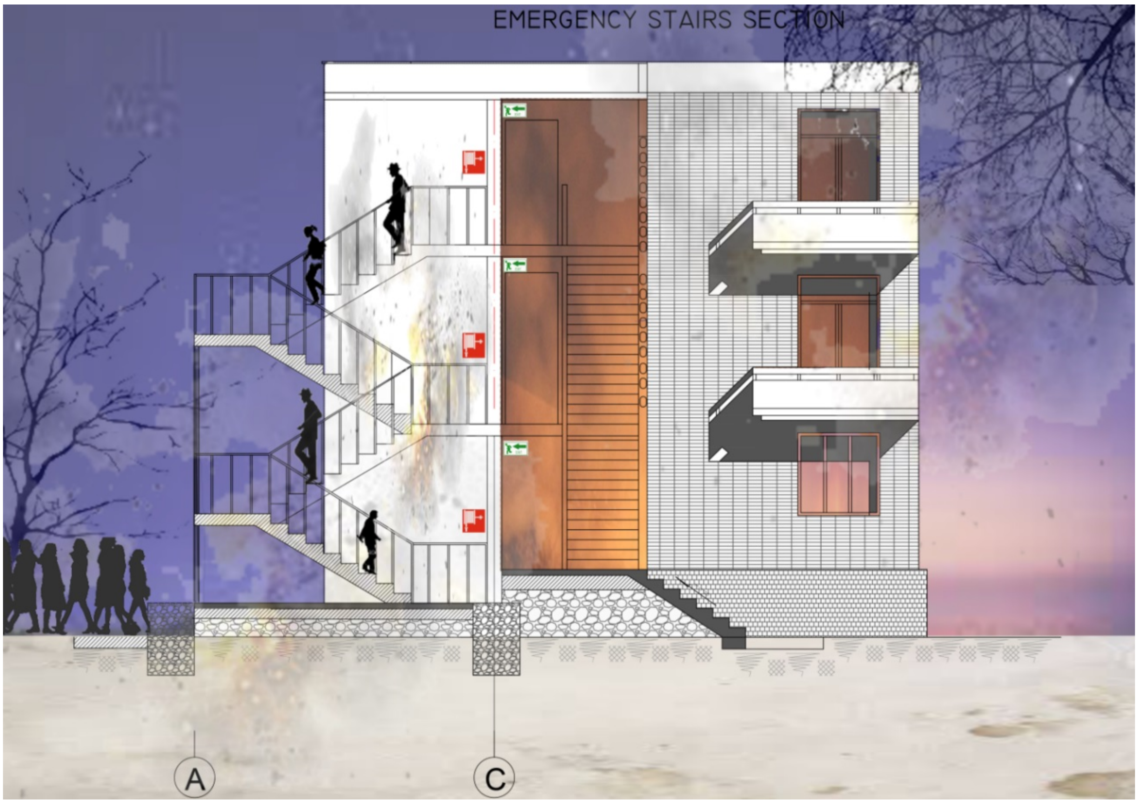

Figure 7: Technical view of emergency stairs

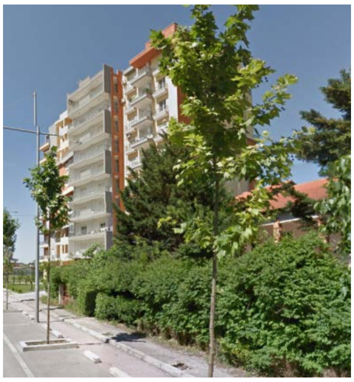

Figure 8: South facade

Figure 9: West facade

Figure 10: North facade

Case study 2.

With the change of system, after the 90s, the state of architecture and urbanism was an expression of the transition of the city. During this period there is an extreme degradation of urban environment quality. The inflow from other cities caused the construction business to flourish as a result of the urgent need for housing. The only solution was the construction of multi-storey buildings, the result: high-rise buildings with low construction costs. As a result, the building without any proper standard. In these buildings it is difficult to build an interior ladder as this is what is being studied and starts in the genesis of the design of the building. And the external ladder does not offer the opportunity because without having control of the respective structures the space of exploitation of the territory has been exploited above 45%.

- **Having urban spaces**

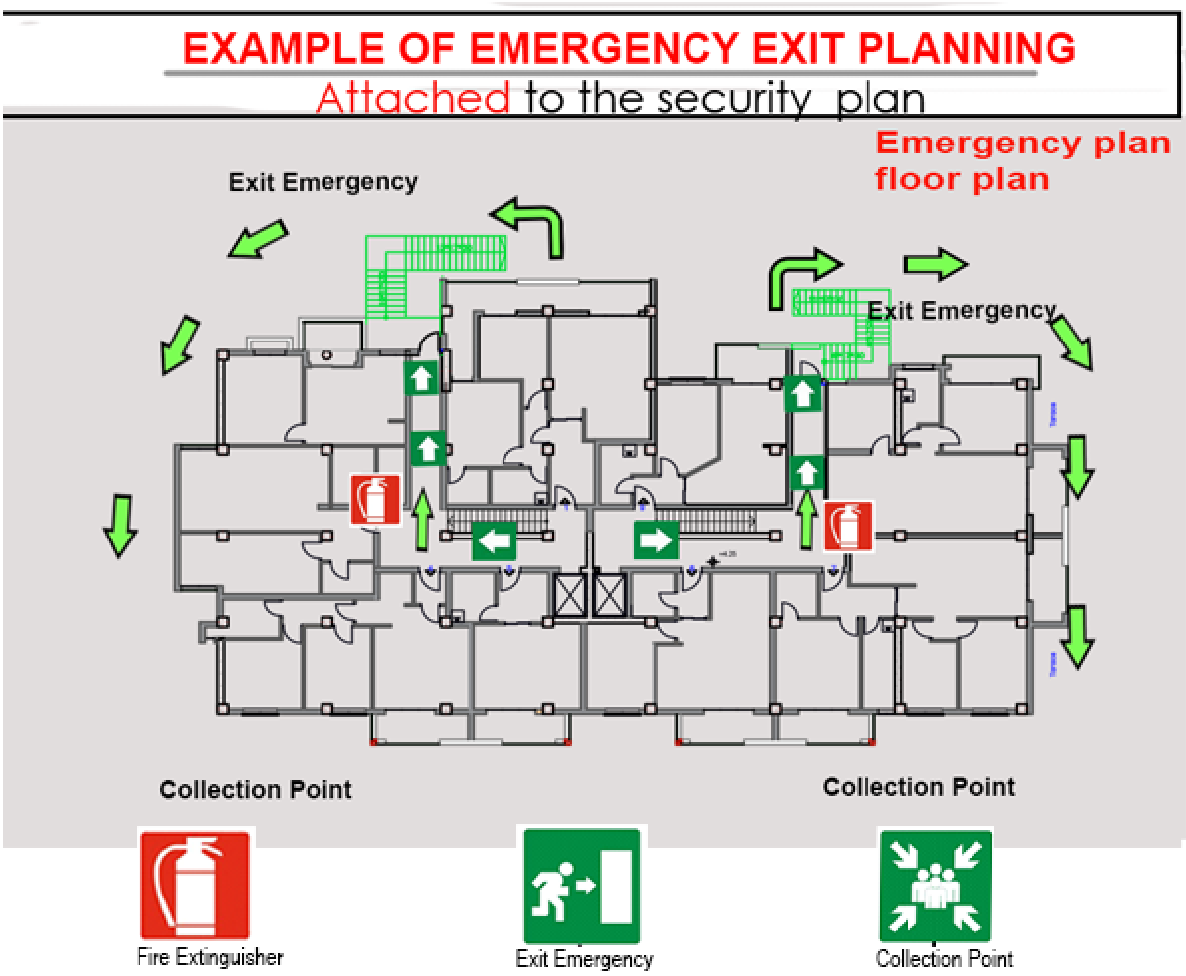

Figure 11: Example of emergency plan, signalling and emergency [8]

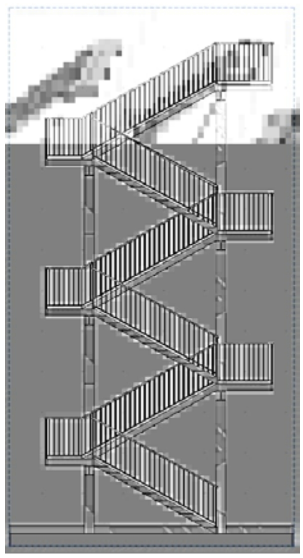

Figure 12: Stairs implementation

Figure 13: Stairs with iron construction [7]

- Geometric characteristics of the emergency scale.
- Ramp -min 3-degree -max 15-degree.
- Max a = 17cm.
- Min p = 30cm.

- The outer degree is constructed of a high parapet m = 1.20 [9].

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The Challenge of Education about Standardization in Albania

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ABSTRACT

In this period when Albania is preparing to start the phase of negotiations for EU membership, it is essential to increase awareness and spread of knowledge about standardization as well as education related to standardization. Some initiatives have been developed and launched in European countries, but in Albania there is still no serious effort in this regard. The need to introduce standardization education in these conditions is imminent. Education about Standardization (EaS) is teaching pupils, students, CEOs, managers, employees in business, and life-long learners the subject of standards and standardization.

The purpose of this article is to provide insights into standardization education , to make a review of proposed standards curricula and to analyze whether there are curriculum standards on standards.

This paper on Education about Standardization highlights the benefits of standardization and education about standardization in the same time also we define and explore the relevance and inpact of higer education and standardization on the management of knowledge between generations within the current workforce.

We have found a great gap between the needs for supporting the integration challenges and the current level of implementation of education on standardization, which can be overcome from the experience of different European countries. The growing number of initiatives and activities of the last three years shows that this is the moment for education for standardization. Our paper provides a structured approach to using this moment to develop and further implement standardization education.

Key Words: Standardization, education, national standardization.

1. INTRODUCTION

Standards on products, processes, services, systems and their conformity assessment are globally covered by International Standardization Bodies, like ISO and IEC. International standards are based on the principles set out in the World Trade Organization's "WTO Agreement on Trade Barriers". At the entry of this agreements is claimed [1]:

- Significant contribution by international standards and conformity assessment systems to improving the effectiveness of product realization;
- To ensure, however, that the technical rules and standards, including... the requirements for conformity assessment procedures do not create unnecessary barriers to international trade;
- Contribution of international standardization in the transfer of technology from developed to developing countries;
- Developing countries may face particular difficulties in formulating and implementing technical standards, standards and conformity assessment procedures with technical conditions and standards.

ISO standards are an important instrument of technology transfer. They are perfectly applicable in every country.

Education about Standardization (EaS) is teaching pupils, students, CEOs, managers, employees in business, and life-long learners the subject of standards and standardization. The level of education has to be carefully tailored to these target audiences. It may include the use and benefits of standards, the strategic importance of standardization for business competitiveness, and European integration, how to implement standards in businesses and how to participate in standardization to influence the content of future standards.

Knowing and being able to apply the standards is a requirement for all professions. These are tools for the regulation, but also an expression of the state of the art. Standards facilitate commercial exchanges by facilitating and eliminating technical barriers to trade. For companies, standards are therefore strategic tools that can open, develop, regulate or close the access to a market. The benefits of participating in standardization committees are numerous, such as for example:

- Influence the contents of a standard,
- Enhance and protect companies' activities and products,
- Acquire a better understanding of the actors of the market (competitors, partners, customers, users, authorities, conformity assessment bodies) and anticipate and develop future requirements for the market,
- Encourage innovation,

The need for students to be engaged with the standardization field is important for a range of stakeholders: for students' future employment; for employers to maintain the quality of their workforce; and for society in general, which depends on the quality provision provided by standards. This need has been identified by a number of standards bodies.

The strategic importance of standardization and the benefits of active involvement in standards work need to be incorporated into curricula to a greater extent in order to introduce prospective specialists and decision-makers in industry, politics and society as a whole to standardization at an early stage. Professional and vocational training courses and academic programmes alike should incorporate standardization in their curricula, in every field without any distinction because when we look more important in a field we simply express our ignorance in other areas. One prerequisite for this is the development of strategies and action plans for an increased integration of standardization in higher education.

2. THE NEED FOR EDUCATION AND TRAINING IN ALBANIA

Standardization is a strategic asset for companies, industry sectors, countries and regions. To excel in standardization, proper education and training are needed. The International Federation of Standard Users, IFAN, observes that while standards are becoming 4 / 17 increasingly important, many companies and other stakeholders take insufficient advantage of them. All level of decision-makers in public administration and private business need to understand the economic benefits of standardization. Standardization should be perceived as strategic tool to strengthen professional performance and to drive the economy, innovation and thus the competitive positioning of each enterprise. Employees of public and private organizations should be trained to use standards as means to strive for performance excellence. These opportunities are not seized because of a lack of awareness of the importance of standards. A next reason is insufficient ability to transform awareness into relevant actions.

Education is the solution to both of these. This applies both to formal education at different levels (from secondary schools up to universities), continuing professional development and in-training (life-long learning). We observe a growing awareness of the need for standardization education and training but so far there is a huge gap between the education and training activities actually in place, and the quantity and quality of these activities needed by industry.

Participants in standardisation may have more or less clear ideas about what they need to be able to achieve their goals. The result is that standardisation activities are carried out in a rather primitive way, no matter whether company standardisation, standardisation in consortia, or formal standardisation is concerned [2].

But this is not considered a problem as long as the people involved, mostly technicians, do not know that improvements are possible, and insights have been developed already. Unknown, unloved. 'The market' hardly asks for standardisation education (or research), in some technical areas with an exception for education concerning the application of certain standards. In the United States, the Accreditation Board for Engineering and Technology specified that students in technical education must have a 'major design experience' that includes the use of 'engineering standards and realistic constraints'. Some standardisation experts, in academia as well as standards bodies, stress the importance of standardisation education and take initiatives in this area [3].

The importance of standardisation is growing; reasons for this have been listed by De Vries, followed by a listing of problems related to the existing standardisation practice [4]. Some of these problems might be solved or partly solved if participants would have been better educated. So, the preliminary conclusion may be that there are good reasons for considering the possibilities of standardisation education in order to be able to underpin decisions on offering education, if any, in this area.

Based on the Stabilization and Association Agreement and in the continuation of the integration process, we have the obligation to adopt 100% of the European harmonized standards (supported by European regulations and directives). The community and Albania shall gradually establish a free trade area for a period of a maximum ten years starting from the entry into force of this Agreement, in accordance with the provisions of this Agreement and in accordance with the provisions of GATT 1994 and the WTO.

The free movement of goods and services is one of the most important chapters of the stabilization and association takeover. According to this agreement, Albania will establish a close cooperation with the EU countries to contribute to Albania's growth and growth potential. Such collaboration would strengthen the existing broader links. Particular attention should be paid to measures that should encourage cooperation among member states. Following the signing of this Agreement, Albania will enter into negotiations with the countries that have already signed a Stabilization and Association Agreement with a view to signing conventions and bilateral conventions on regional co-operation, the aim of which is to increase the scope of cooperation between the countries concerned. The main elements of these conventions are:

- political dialogue;
- the establishment of a free trade zone between the Parties, in accordance with the relevant WTO provisions;
- Mutual concessions related to employee movement, placement, provision of services, current payments and capital movements, as well as other policies related to the movement of persons to an extent equal to that of this Agreement;
- provisions on cooperation in other areas that are or are not covered by this Agreement, and in particular in the field of Justice and Home Affairs.

These conventions will contain provisions for the establishment of appropriate institutional mechanisms. Albania shall sign these Conventions within two years after the entry into force of this Agreement. Albania's readiness to sign such conventions is a prerequisite for further development of relations between Albania and the European Union. Albania will launch similar negotiations with other countries in the region as these countries have signed a Stabilization and Association Agreement [5].

The education implementation program on standardization in Albania should have the following main actions:

1. Defining the need for training and education for standardization. For this purpose, a survey on training and education on standardization in our country will need to be carried out, which will determine the needs of the pre-university, university, public, central and local, private operators etc. [6].
2. A steering committee in which university and other parties of special interest were to participate [7].
3. Developing an action plan with the goal of including standards in UN-curricula, staff training, organizing an awareness campaign, public and private operation, etc. [8]

Based on the experiences of other countries it is very important for Albanian:

- to promote and apply the standards, it is imprerative to implement standards education on university study programs.
- in addition to awareness campaigns, training etc, for the implementation of standards is very important their use by the public administration to make the evaluation of the performance of tourism operators.
- the establishment of certification scheme for tour is an important instrument of voluntary regulation that support the legal framework of the field [9].

3. ISSUES TO BE ADDRESSED IN RELATION TO STANDARDIZATION

To identify the different standardization education and training needs, it is important to target, for each actor of an enterprise, the interaction of standardization with their activities. In this section we give three cases which need required implementation of standards with degrees of knowledge necessary for the topics related to standardization [10].

a. Laboratories

A fundamental goal of laboratory is that laboratory results will be comparable or standardized and be independent of the laboratory where the testing was performed. Routine measurement procedures that are traceable to the same system of reference standards should produce numerical values for clinical samples that are comparable regardless of time, place, or laboratory generating the result. Standardization of laboratory measurements is key for providing accurate and reliable results. The reference standard in this case is SSH EN ISO / IEC 17025.The scheme of the standardization of laboratories resembles a pyramid. At the beginning there is a standard for all laboratories and then there are standards for each specific test that is carried out in the lab.

Responsibilities related to standardization

- Apply in the test process the relevant standards for the products, services, processes, etc.,
- Apply in the tests procedures the requirements needed by the regulations and standards on products, services, processes,
- Identify and apply conformity assessment systems and regulatory requirements,
- Facilitate the implementation of management systems (Sustainable and social responsibility, quality, energy,…) and continually improving their effectiveness.

Necessary knowledge

Substantial knowledge of:

- the content of relevant standards,
- the value of compliance with standards in a competitive world marketplace.

Good knowledge of:

- compliance with standards and regulations for the different marketplaces.

Some knowledge of:

- the value and methodology of obtaining business knowledge about the development and use of standards and regulations.

Skills that are gained

- Identification and implementation of standards and technical regulation per area and/or project,
- Understanding how to participate in the standardization process.

b. Sales

In sales, standardization has numerous benefits: it helps manage sales people; control the quality of sales activities; and enables automation. It also makes it easier to introduce new sales people to your organization, create supporting materials and replicate your processes.

Responsibilities related to standardization

- Presenting to their customers the regulations and standards that are applicable on the market,
- To convince customers that the products or services are performed in accordance with regulations and international/European standards,
- Communicate information about standards and regulations needed by the market to the marketing team.

Necessary knowledge

Substantial knowledge of:

- key standards and regulations present on the market and product range,
- the need to comply with standards and regulations for the different marketplaces,
- the value of compliance with standards in a competitive marketplace,

- the value and methodology of obtaining business knowledge about the development and use of standards and regulations,
- why sustainable development should be taken into account in the strategy of a company in a moving world marketplace with limited resources.

Skills

- Identification of the relevant standards and technical regulations that cover the area,
- Ability to relate sustainable management systems to the marketing of products or services.

c. *Industry*

Standardization, in industry, the development and application of standards that permit large production runs of component parts that can be readily fitted to other parts without adjustment. Standardization allows for clear communication between industry and its suppliers, relatively low cost, and manufacture on the basis of interchangeable parts.

Responsibilities related to standardization

- Identify the role of standards and regulation in the development of products, services, processes,
- Understand the use of conformity Assessments systems.

Knowledge necessary

Substantial knowledge of:

- the content of relevant management system standards (quality, environment, safety and others if applicable in the company),
- the need and the value of compliance with standards in a competitive and regulated marketplace.

Good knowledge of:

- quality, environment, safety (and others if applicable in the company) management systems.

Some knowledge of:

- the value and methodology of obtaining business knowledge about the development and use of standards and regulations.

Skills

- How to apply quality, environment and safety management system processes in production,
- Identification of product standards and technical regulation per area

IV. BACKGROUND IN EDUCATION AND THE STANDARTIZATION EDUCATION IMPLEMENTED

Universities are able to award qualifications autonomously and there is no nationally agreed curriculum. The educational focus is on student learning rather than on the teaching with the defined learning outcomes having a central role in defining the course, the teaching and assessment practice and the level of the teaching. The development and delivery of qualifications and programmes are subject to quality agreements [11]. Table 1 shows how much education for standards is included in Albania.

Table 1. Descriptors defining levels in Albania

Albania education	Knowledge	Skills
High school	The high school program does not get any lessons in terms of standards education.	-

Bachelor's degrees	Higher education curricula do not offer specific standards related to standard education, except in a sporadic case when students need to study individually when they need to become part of individual work such as course assignments or diploma thesis.	Specific problem-solving skills required in course assignments or diploma thesis.
Master's degrees	Factual and theoretical knowledge in broad contexts within a field of work or study.	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study.

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Indicators are very worrying, which indicates how immediate is the introduction of education on standards. So, the preliminary conclusion may be that there are good reasons for considering the possibilities of standardisation education in order to be able to underpin decisions on offering education, if any, in this area.

If the standardization community is to succeed in raising the field's status among educators, a combination of barriers must be overcome.

One problem is that students often perceive standardization to be a dull topic, leading them to choose other courses as electives. Meanwhile, teachers may be reluctant to cover standardization because they are unfamiliar with key issues or unaware of their importance. Instructors may focus on subjects perceived as more popular with students, and they may avoid standardization because curricula are already overloaded with other topics. A workshop organized in 2006 by International Cooperation for Education about Standardization (ICES) concluded that improving standardization education is dependent upon three main factors [12]:

- National policies,
- Resource availability,
- Close cooperation between industry, standards bodies, academia and other educational and governmental organization.

Developing and deploying a national standardization education strategy and policy is a fundamental prerequisite for a systematic approach. This strategy may broadly address a range of educational areas, or it may be limited. It may specify in detail exactly what will be done and by whom, or take a global perspective. The broader and detailed the strategy, the more standardization education activities are in place in a country.

Typical elements of a successful national approach include:

- An inventory of educational needs,
- Formation of a steering group in which the most important stakeholders are represented (industry, standards bodies, governmental and educational organizations),
- An action plan -One or more devoted staff members, able to make multi-year commitments (so funding is a prerequisite),
- Development of curricula and materials,
- A train-the-teachers programme,
- Promotional activities,
- Performing education,
- Evaluation.

Activities can start with one or a few teachers from a limited number of schools and then expand. A plan for teaching practitioners is also needed [13].

The proposed teaching contents are gathered into 6 modules based also on English experience:

- *Module 1*: Examples in everyday life to raise a general awareness about the existence and importance of standards (e.g. paper sizes, country codes, book codes, credit card exc.),
- *Module 2*: Factual/fundamental contents to raise a general understanding of main concepts,

- *Module 3:* Academic/theoretical aspects to learn and develop academic aspects of standardization, particularly standardization within disciplines such as business administration, engineering, services, etc.,
- *Module 4:* Case studies to learn about the impact of standardization in business practice (e.g. ISO 9001 quality management, ISO 14001 environmental management, standards enabling compliance with legal requirements, etc.),
- *Module 5*: Skills related contents to learn how to carry out a standardization-related task. They mainly provide communications skills about chairing and moderating a meeting and managing consensus and negotiation also across different cultures,
- *Module 6*: Application of specific standards to learn how to implement or use specific standards.

The following Table 2 shows possible topics of teaching materials for Modules 2, 3 and 6. Some examples for Module 1 and 4 are listed above and of course, they are open to unlimited permutations. Module 5 is deemed to be linked to post-formal education and it is beyond the scope of this element of the policy [14].

Table 2. Proposed framework for education about standardization in Albania.

Educational Level	Why- learning objectives	Operators	What-Contents		How-methods
			Main content	Subsidiary content	
Primary education	Awareness	Government NBSs	Module 1 simplified. -Examples	Module 2 simplified fundamental	Quiz Game Draws Leaflet Brochures
Secondary education	Awareness/ Understanding/ Technical knowledge for specific well-defined domain.	Government NSBs	Module 1 Examples Module 2 Fundamental Module 3 Academic	Module 6 simplified Standards	Quiz Game Leaflet Contest Handbook Video Internet sites
Vocational education	Awareness/ Understanding/ Technical knowledge for specific well-defined domain/ Theory/	Government NSBs Various	Module 1 Examples Module 2 Fundamental Module 4 Case study	Module 6 Standards	Contest Handbook Video Internet sites Teams Project Presentation Case study Workshop
Higher education	Understanding/ Specialized knowledge/ Theory/ Interaction between innovation and standardization	Universities Government NSBs	Module 2 Fundamental Module 3 Academic Module 4 Case study	Module 6 Standards Module 1 Examples Module 5 Skill set	Contest Handbook Video Internet sites Teams Project Presentation Case study Workshop

V. CONCLUSIONS

Many people that get involved in standardisation in their professional life lack the (standardisation) education that would enable them to carry on that task in a professional way. In general, neither regular nor continuing education pays attention to standardisation in a systematic way, though there are exceptions, especially in some specialist technical areas. In order to be able to investigate standardisation education we have combined (knowledge of) standardisation practice and academic reflection with the area of (regular and continuing) education. The purpose of standardisation education appears to be to disclose the standardisation phenomenon in a way the student can understand it, and to act with students in a way that they get accustomed with standardisation, get knowledge about it and are equipped for using this knowledge in standardisation practice. In academic teaching the knowledge may be also applied in further research on the standardisation issue.

Standardisation education should primarily be continuing education. We have analysed for which categories of students, reaching from primary schools to universities, standardisation should be part of the regular curriculum. Standardisation courses with a well-structured order from start to finish should be completed with reference works for which the Internet can be used. It is suggested to develop curricula and reference works in co-operation between academia, standardisation bodies, business experts and experts from other organisations, such as governmental and consumer organisations.

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Regulations Regarding Indoor Air Quality

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ABSTRACT

People spend most of their time in interiors. Expectations of comfort in living spaces are becoming increasingly important. Indoor air (IAQ) can be contaminated with internal and external pollutants. It is emphasized in various researches that when the level of pollutants exceeds a certain level and it causes physical or psychological effects on human. Many legal regulations play a decisive role in the regulation of indoor comfort conditions, the determination of indoor air quality and the negative effects of pollutants on human health.

The standards and regulations established by different institutions and organizations that determine the limit values are considered as priority in determining the indoor air quality as it is in every area. Initial work on comfort conditions and indoor air quality started with determining the amount of fresh air per capita in the 19th century. In the researches carried out, the amount of fresh air required by human metabolism was determined, and then the amount of air required for the structures was determined. Before the 19th century, the IHK had a second plan due to easy access to energy resources and cheap energy. With the energy crisis in the second half of the 19th century, energy costs increased steadily. In proportion to the population growth in the world, the growth movements in the economy; environmental problems brought to the agenda. Increase in environmental pollution; the protection of the natural environment and the need to increase investments in this direction. Natural resources, which were not included in prices in the past, have been included in the price system for less pollution. With the emergence of private costs, a competition market has emerged. The economic dimension of indoor air quality; Costs are expensive, external dependency, low varieties and special certificate programs are affecting heavy conditions. Insulations applied for the protection of energy resources have increased the air impermeability of the buildings. Reduced ventilation causes increased air pollution in the indoor environment. Therefore, research on IAQ has gained momentum and increased the need for legislation related to domestic air quality.

As for IAQ, ASHRAE, EPA, OSHA, DIN, ISO have recorded important information by working together. Countries have determined limit values according to their climate and sociological characteristics. It is aimed to make an assessment about the international status of indoor air quality by considering the current standards and regulations in force in this study.

Key Words: Indoor Air Quality, Indoor Air Quality Standards, Standardization, Limit Values.

1. INTRODUCTION

One of the most basic requirements of human beings in modern society is to maintain their lives in healthy and comfortable spaces [1]. Today, people who move away from the natural landscape live in artificial environments. One of the important atmospheric parameters in the artificial environment is the air quality in the building [2, 3]. The pollution level in the indoor environment is generally higher than in the outdoor environment. Therefore, the indoor environment has a big influence on human health.

WHO's emphasis on improving public health and quality of life is increased the scientific interest in indoor air quality (IAQ) [4, 5]. WHO is published a report called "The right to healthy indoor air" [6]. In this report, a healthy indoor air quality is defined as the air in which pollutants aren’t found at harmful concentration levels and at least 80% of the users don’t feel any dissatisfaction with the air quality [7].

In the buildings, dangerous materials caused from building materials, interior equipment or human activities such as heating, cooking, etc., can lead to a wide range of health problems and even be fatal [8]. WHO reports that about 7 million people died in 2012 as a result of exposure to air pollution [9]. According to the estimates, this rate is increasing nowadays [10]. In this regard, the WHO Public Health, Social and Environmental Determinants of Health Department is considered air pollution as the world's greatest environmental health risk. About 50% of deaths in underdeveloped and developing countries are related to indoor air pollution [9].

Air pollution is an environmental effect that is constantly affecting society, and often exposed unknowingly, during the person's life. In particular, the presence of odourless and colourless contaminants isn't noticed and this signs are emerged in the long term [1]. The health effects of environmental air pollution are proven on a large scale with many comprehensive experimental and epidemiological approaches. The studies are generally about the controlled exposure of pollutants to the users, long-term and short-term effects, possible diseases, personal sensitivities and exposure levels [11]. Depending on the characteristics of pollutants and personal factors, the body systems and various parts, especially the respiratory system, are affected by indoor air pollutions [5]. In buildings with intensively used such as office and industry, the performance of employees and business efficiency are negatively affected by indoor air quality [12, 13]. Due to health conditions or ages, indoors air pollution in special environments such as housing, care homes, hospitals, nurseries etc. is particularly affects groups of people who are particularly vulnerable [14].

Pollutants includes the particulate matter, biological substances (fungi, mold, pollen, etc.), chemical compounds (sulphur oxides, carbon oxides, ozone, nitrogen oxides and radon, etc.) and volatile organic compound (VOC) (benzene, formaldehyde and trichloroethylene, lead compounds, etc.) [5, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27]. One of the indoor pollutants is tobacco smoke [28]. Due to the harmful chemicals they contain, tobacco smoke affects the health and comfort conditions of both users and passive smokers. Tobacco is used in 30-50% of the world. This situation means that exposure to Environmental tobacco smoke-ETS is high, especially for the elderly, children and other non-smokers [29].

Occupants are exposed to these indoor pollutants depending on their concentration [3, 9, 29, 30]. In order to protect human health, many institutions and organizations, especially WHO, carry out studies. This scope of study is evaluated the organizations and legal regulations working on IAQ.

2. ORGANIZATIONS WORKING ON INDOOR AIR QUALITY

Many legal regulations is played a decisive role in the regulation of indoor comfort conditions, the determination of indoor air quality and the prevention of the negative effects of pollutants on human health. The first study on the conditions of comfort and indoor air quality is started with the determination of the amount of fresh air per person in the 19th century. In the investigations, the amount of fresh air required for human metabolism and the building is determined. With the energy crisis that emerged in the second half of the 19th century, research on the IAQ is rapidly increased. In the last 15 years, the important efforts are made to control air pollutant emissions such as power plants, factories and automobiles. Thanks to these studies, the negative factors that affect the health and comfort of the users is discussed [31].

Standardization in terms of air quality includes the adjustment of terms and definitions, air sampling, measurement technology and reports on characteristic data [32]. Today, there are a number of organizations which are working to improve the information, set priorities and targets about IAQ [33]. Organizations such as ASHRAE, EPA, OSHA, WHO, DIN, and ISO are conducted important work in order to provide various legal research, monitoring, standard setting and environmental protection for IAQ.

Founded in 1894, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is a global organization that develops human comfort in a built environment with sustainable technology. The organization focuses on building systems, energy efficiency, indoor air quality, cooling and sustainability. The ASHRAE 62, 62.1 and 62.2 standards for indoor air quality have widespread use in many countries [34].

The World Health Organization (WHO) was established in 1948 to provide a healthier environment for all [35] and today, WHO has 194 member states and more than 150 offices. The organization is identified nine atmospheric pollutants in closed environments in Europe and established the first guidance on IAQ [8].

Established in 1970, the United States Environmental Protection Agency (EPA) 's goal is to protect human health and the environment. The organization's work is taken as reference by many countries and institutions. EPA also helps governments and communities to set national standards that they apply to their own regulation [36].

In 1970, Occupational Safety and Health Administration (OSHA) was established with the Law on Occupational Health and Safety to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance [37].

Also, important steps are taken to protect people of tobacco smoke, one of the major pollutants. In 1973, the first state to introduce comprehensive legal regulations is Arizona in America. Then in 1998, smoking was banned in all indoor areas in California. In 2004, Ireland was the first country to introduce smoking ban in all enclosed areas on a national scale. In the Netherlands in 2004, in Italy in 2005, in France, in Germany and in the Czech Republic in 2008, the smoking ban was implemented [38]. With the participation of seven countries (Colombia, Djibouti, Guatemala, Mauritius, Panama, Turkey and Zambia), 17 comprehensive smoking ban are enacted in 2008. With these comprehensive smoking bans, 154 million passive users worldwide are protected from the harms of tobacco smoke. Some of these countries have smoking ban at national level or only a minimum level of protection is provided in some public places or workplaces in these countries [39].

In 2013, the European Commission was published a "Cleaner Air For All" report and was emphasized that countries should set a comprehensive strategy on indoor air quality in this report [40]. Today, the regulations for indoor pollutants are available in many countries many European countries, such as France, Germany, the Netherlands, the United Kingdom, Belgium, Finland, Austria, Portugal and Norway for environmental and comfort assessments [33].

In addition to the organizations, international standardization communities such as DIN, ISO, BSI, EN, CEN, established by some countries such as Germany, the United States and the United Kingdom, are prepared a number of legal regulations related to indoor air quality. International standards ensure that products, services and systems have first-class features. Today, these communities are established legal arrangements that are becoming internationally accepted through joint studies. Technical committees such as the International Organization for Standardization (ISO) and the European Committee for Standardization (CEN) are undertaken the development of specific methods for the measurement of indoor space. The standards that is established by the organizations, examples and analyses of indoor pollutants, determines the limit values of the pollutant concentration and the amount of fresh air, explains experiments and measurement methods about IAQ.

The GREENGUARD Environmental Institute (GEI) was established by the American National Standards Institute (ANSI) in 2001. The Greenguard Organization determines the benchmark values of chemical emissions that are released from building products in indoor and sensitive areas such as nursery, school. In addition, each country in relation to IAQ prepares standards and declarations according to their climate and sociological characteristics, for example ‘The Building Bulletin’ in the UK, ‘RSECE’ in Portugal, ‘The Blue Angel’ in Germany, ‘Regalement Sanitaire Departmental Type-RUSDTYP’ in France, and ‘Danish Building Code’ in Denmark. Table 1 gives the countries and organizations working related to IAQ.

Table 1. The Organizations working on IAQ according to countries [42]

Country	Organization	Country	Organization
China	AQSIQ, SEPA	Canada	Health Canada
Hong Kong	HKSAR, HKEPD	US	ACGIH, ASHRAE, IDPH, NIOSH, OSHA, TDH, US EPA
Japan	MHLW		
Korea	KEITI	Belgium	AIVC
Kuwait	Kuwait, EPA	Finland	FiSIAQ
Malaysia	DOSH	Germany	MAK
Singapore	Institute of Environmental Epidemiology. SIAQG	UK	HSC
Australia	NOHSC	Worldwide	WHO

Many organizations are set various limit values to determine the amount of clean air required for human comfort, the limits of air pollutant concentrations and the allowable exposure times depend on many criteria such as the function, type, size of the environment. In Tables 2 and 3, limit values of the amounts of pollutant gas and PM substances in the countries are explained according to the data of the organizations given in Table 1.

Table 2. Pollutant gases and average limit values according to countries [42]

Country	Pollutions and their values (average)					
	CO	CO_2	Formaldehyde	NO_2	O_3	SO_2
China	10 mg/m^3 as 1–h	1 000 ppm as 24–h	0.08 ppm (100 µg/m^3) as 1–h	240 µg /m^3 as 1–h	0.16 mg/m^3 as 1–h	0.5 mg m^3 as 1–h
				80 µg/m3 as 1–y		
Hong Kong	<8.7 ppm (10000 µg/ m^3) as 8–h	800 ppm as 8–h	<0.025 ppm (0.03 mg/m^3) as 8–h	21 ppb (40 µg/m^3) as 8–h	25 ppb (0.050 mg/m^3) as 8–h (Excellent)	
	<1.7 ppm (2000 µg/m^3) as 8–h	1 000 ppm as 8–h	<0.081 ppm (0.1 mg/m^3) as 8–h	80 ppb (150 µg/m^3) as 8–h	61 ppb (0.120 mg/m^3) as 8–h	
Japan	20 ppm (23 mg/m^3) as 1–h	1 000 ppm 2a	0.08 ppm (0.1 mg/m^3) as 0.5–h			
	10 ppm (11.5 mg/m^3) as 24–h					
Korea	25 ppm (29 mg/m^3) as 1–h	1 000 ppm	0.1 ppm (120 µg/m^3) as 8–h	0.05 ppm (100 µg/m^3) as 1–y	0.06 ppm (0.120 mg/m^3) as 8–h	
	8.7 ppm (10 mg/m^3) as 8–h					
Kuwait	30 mg/m^3 as 1–h	0.5% as 1–h	0.12 mg/m^3 as maximum	0.2 mg/m^3 as 1–h	0.235 mg/m^3 as 1–h	
	10 mg/m^3 as 8–h	0.14% as 24–h		0.1 mg/m^3 as 24–h	0.2 mg/m^3 as 8–h	
Singapore	10 mg/m^3 as 8–h	1 000 ppm as 8–h	0.1 ppm (120 µg/m^3) as 8–h		0.05 ppm (0.100 mg/m^3) as 8–h	
Australia	9 ppm (10000 µg/m^3) as 8–h	30 000 ppm as 15–min	2 500 µg/m^3 as 15-min		0.1 ppm (0.210 mg/m^3) as 1–h	0.20 ppm (570 µg/m^3) as 1–h
	34000 µg/m^3 as 8–h working day	5 000 ppm as 8–h working day	0.08 ppm (100 µg/m^3) (as short–duration)		0.08 ppm (0.170 mg/m^3) as 4–h	0.02 ppm (60 µg/m^3) as 1–y
US	35 ppm (40 000 µg/m^3) as 1–h	30000 ppm as 15–min (Short–term)	76 ppb as 1–hr	5 ppm (9 400 µg/m^3) as 15–min	0.05 ppm (100 µg/m^3) as 8–h	5 ppm (13 mg/m^3) as 8–h
					0.08 ppm as 8–h	0.14 ppm (365 µg/m^3) as 24–h
Canada	25 ppm (29000 µg/m^3) as 1–h	3 500 ppm (Long Term)	0.1 ppm (123 µg/m^3) as 1–h	0.25 ppm (480 µg/m^3) as 1–h (Short–Term)	0.12 ppm (0.240 mg/m^3) as 1–h (Short–Term)	0.38 ppm (1 000 µg/m^3) as 5–min (Short–Term)
	11 ppm (13 000 µg/m^3) as 8–h		0.04 ppm (50 µg/m^3) as 8–h	0.05 ppm (100 µg/m^3) as 8–h (Long–Term)		0.019 ppm (50 µg/m^3) as 8–h (Long–Term)
	3 mg/m^3 as good	900 ppm as good	0.05 mg/m^3 (good)		0.050 mg/m^3	
	8 mg/m^3 as satisfactory	1 200 ppm as satisfactory	0.1 mg/m^3 (satisfactory)		0.08 mg/m^3	
Germany	60 ppm as 30–min	10 000 ppm as 1–h	1 ppm (1 230 µg/m^3) as 5–min		Carcinogen (no maximum values established)	0.5 ppm as 8–h
	30 ppm as 8–h	5 000 ppm as 8–h	0.3 ppm (369 µg/m^3) as 8–h			1 ppm (never to be exceeded)
UK	11.6 mg/m^3 as 8–h	15 000 ppm as 15–min	2 ppm (2 500 µg/m^3) as 15–min	200 µg/m^3 as 1–h	100 µg/m^3 as 8–h	0.133 ppm as 1–h
	35.0 mg/m^3 as 8–h	5 000 ppm as 8–h		40 µg/m^3 as 1–y	0.05 ppm (Maximum)	0.048 ppm as 24–h

Table 3. PM average limit values according to countries [42]

Country	Pollutions and their values (average)			
	$PM_{2,5}$	$< PM_{2.5}$	PM_{10}	Total Suspended Particles (TSP
China	0.6 mg/m^3 as 8–h		0.15 mg/m^3 as 24–h	
Hong Kong	600 $\mu g/m^3$ as 8–h (Excellent Class)		20 $\mu g/m^3$ as 8–h (Excellent Class)	
	3 000 $\mu g/m^3$ as 8–h (Good Class)		180 $\mu g/m^3$ as 8–h (Good Class)	
Kuwait	3 ppm			0.23 mg/m^3 as 24–h
				0.075 mg/m^3 as 1–y
Malaysia	3 ppm as 8–h		150 $\mu g/m^3$ as 8–h	
Singapore	3 ppm (refer to toluene)		150 $\mu g/m^3$ (in office)	
Australia	500 $\mu g/m^3$ as 1–h		90 $\mu g/m^3$ as 1–h	90 $\mu g/m^3$ as 1–y
Canada	200 $\mu g/m^3$ (Comfort Level)	100 $\mu g/m^3$ as 1–h (Short–Term)		
	500 $\mu g/m^3$ (Building Standard)	40 $\mu g/m^3$ as 8–h (Long–Term)		
	200 $\mu g/m^3$+ outside air concentration			
US		3 mg/m^3 as 8–h (Ceiling Level)	10 mg/m^3 as 8–h	15 $\mu g/m^3$ as 8–h
		65 $\mu g/m^3$ as 24–h (Exposure)	150 $\mu g/m^3$ as 24–h (Exposure)	
		35 $\mu g/m^3$ as 24–h	150 $\mu g/m^3$ as 24–h	
		15 $\mu g/m^3$ as 1–y	150 $\mu g/m^3$ as 24–h	
		5 mg/m^3 as 8–h	50 $\mu g/m^3$ as 1–y	
		0.06 mg/m^3 as 24–h	150 $\mu g/m^3$ as 24–h (Exposure)	
		0.015 mg/m^3 as 1–y	150 $\mu g/m^3$ as 24–h	
		65 $\mu g/m^3$ as 24–h (Exposure)	50 $\mu g/m^3$ as 1–y	
Finland	200 $\mu g/m^3$ (maximum value, S1)		<20 $\mu g/m^3$ as 8–h	
	300 $\mu g/m^3$ (maximum value, S2)			
	600 $\mu g/m^3$ (maximum value, S3)			
	87 ppb (200 $\mu g/m^3$) as 8–h (Excellent)			
	261 ppb (600 $\mu g/m^3$) as 8–h (Good)			
Germany			4 mg/m^3 as 8–h	
UK	300 $\mu g/m^3$ as 8–h			
Worldwide		25 $\mu g/m^3$ as 24–h	50 $\mu g/m^3$ as 24–h	
		10 $\mu g/m^3$ as 1–y	20 $\mu g/m^3$ as 1–y	

3. THE PLACE OF INDOOR AIR QUALITY IN SUSTAINABLE BUILDING CERTIFICATION SYSTEMS

There are many certificates in the world which show attitude as green building, ecological structure, quality indoor air and renewable attitude and used voluntarily. The most common ones are certificated systems such as GBC (Green Building Challenge), LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), GREENSTAR, BEES (Building for Environmental and Economic Sustainability), CASBEE Environment Efficiency), SBtool (Sustainable Building Tool-Canada), and simulation models such as ECO-QUANTUM, ECOPROFILE, LCAid. Today, the share of indoor air quality is important in the green building certification systems put forward in the context of sustainability. Indoor air quality is graded under a different category (Socio-Cultural and Functional Quality / Area Quality) in the DGNB, while being treated as a separate category in certification systems such as LEED, BREEAM and CASBEE[43, 44,45, 46, 47, 48].

Table 4. Evaluation of indoor air quality in certificate programs [43, 44, 45, 46, 47, 48]

Certificate System	Indoor Air Quality Assessment	
LEED	Categories	Indoor Air Quality
	Credits	17
	Weights	%15,5
BREEAM	Categories	Health and Comfort
	Credits	22
	Weights	15%
GREEN STAR	Categories	Indoor Air Quality
	Credits	17
	Weights	20%
DGNB	Categories	Environmental Quality
	Credits	15
	Weights	22,50%
CASBEE	Categories	Indoor Air Quality (Q1)
	Credits	12
	Weights	40% of Q score
SbTool	Categories	Indoor Air Quality
	Credits	%21,6

4. EVALUATION OF IAQ RELATED REGULATIONS

The legal regulations introduced to improve indoor air quality generally focus on the analysis of ventilation and pollutants. Ventilation is often one of the most applied and most preferred techniques. An efficient ventilation system distributes fresh air where necessary, allowing the pollutants to disperse and reduce their concentration in the fields where they are used [5]. In the buildings, besides the passive methods that are used for efficient natural ventilation to provide a healthy indoor environment, also air cleaning technologies are being developed [21].

The standards and regulations which the limit values are determined and established by different institutions and organizations play a priority role in determining the indoor air quality. They act as an audit mechanism in determining appropriate control strategies. In this context, the indoor air quality has been evaluated with reference to the ASHRAE 62 (1999), ASHRAE 62.1 (2013), ASHRAE 62.2 (2013), ISO 16813 (2006) and ISO 16814 (2008) standards.

ASHRAE's first ventilation standard 'ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality' was put into effect in 1973. It was later revised in 1981, 1989 and 1999 respectively. This standard does not take into account thermal comfort requirements and requirements while considering chemical, physical and biological contaminants that may affect air quality. Acceptable indoor air quality; the diversity of sources and pollutants in the interior are influenced by a range of sensitivities in the population and many other factors that can affect the perception and acceptance of indoor air quality (such as air temperature, humidity, noise, lighting and psychological stress).

Therefore, even if the requirements of the standards are fulfilled the necessity, indoor air quality may not always be provided at all buildings [49].

The ASHRAE 62 standard is divided into two categories as ASHRAE 62.1 (Ventilation for Acceptable Indoor Air Quality) and ASHRAE 62.2 (Ventilation and Acceptable Indoor Air Quality for Low-Rise Residential Buildings). ASHRAE 62.1, which was put into effect in 2001, is the continuation of ASHRAE 62. It has been revised in 2005, 2007, 2010 and 2013 respectively, and the current version is now 2016. It applies to single or multi-family housing and transportation vehicles (aircraft) and can be applied to new and existing buildings. The standard defines the requirements for design, installation and maintenance, ventilation and air cleaning systems. Standard explains multi-zone systems and summarizes selected air quality guidelines. It describes the minimum physiological requirements in the respiratory air and provides information on national principles on CO_2, O_3, PM_{10}, $PM_{2.5}$ and Ozone. However, the standard does not offer specific ventilation rates to separate smoking or non-smoking areas [50].

ASHRAE Standard 62.2 provides ventilation and acceptable indoor air quality in low rise residential buildings. While the Standard is available 3 or less floors and single-family or modular houses, it is not available for structures such as hotels, motels, nursing homes, dormitories or jails. The standard describes the conditions whether ventilation needed or not for whole building. The required mechanical ventilation rate is determined according to the calculated additional air flow. By measuring the air tightness of the building shell, the necessary mechanical ventilation rate is set. The standard also provides information on the effectiveness of fans, local air flow rates, climate data and air equipment for mechanical ventilation [51].

'EN ISO 16000 / 1-39: Air in closed environment' standard, consists of 39 special sections. The standard 'ISO 16813 / Building environment design - Indoor environment - General principles' was last reviewed in 2017 and the standard 'ISO 16814 / Building environment design - Indoor air quality - Methods of expressing the quality of indoor air for human occupancy' also was last reviewed in 2014 and is used up to date.

ISO16813 is valid at new construction and building environment design with existing buildings. In the ISO 16813 standard, design process, development of design criteria and assistants and cost evaluation are discussed. The standard aims to provide constraints on sustainability issues from the first stage of design. At the same time, it evaluates the proposed design for interior air quality, thermal comfort, acoustic comfort, visual comfort, energy efficiency and HVAC system controls at every stage of the design process [52].

The ISO 16814 standard is applied in the design of new and existing buildings or building systems. It is especially preferred for commercial and institutional buildings that do not have any mechanical and natural ventilation. This standard applies to commercial parts of these buildings, not to residential buildings, industrial buildings and hospitals. In the standard, methods of IAQ expression and design process are explained. However, a specific method is not suggested here, it refers to published standards and available methods in the guidelines. Information was given on ventilation, sources of indoor air pollution, control and emissions provided from building materials. It has also been emphasized that alternative or additional control measures, such as air-cleaning devices, must be considered in the presence of certain types of pollutants [53].

5. CONCLUSION

This study emphasizes the importance of indoor air quality and provides information on the work and legal regulations of countries around the world on indoor air quality. The ASHRAE and ISO standards dealing with indoor air quality have been generally evaluated. The ASHRAE 62, ASHRAE 62.1 and ASHRAE 62.2 standards address more, air conditioning and clean air volume. It gives advices on the determination of the amount of indoor pollutants and the removal of pollutants from buildings. ISO 16813 and ISO16814 more specifically provide suggestions for effective ventilation during the design phase and focus on environmental pollutants resulting from building materials.

The countries of the world accept different limit values locally. The differences in assessment criteria for protecting human health on a global scale differ in terms of unit and process are took attention. Although the standard specifies numerical data to protect human health, a product label for the environmental pollutant impact of building materials is not recommended. Such a labeling system will be an important criterion for the user to select environmental products and human health sensitive building products. It may also be suggested that the energy efficiency labeling systems in buildings are organized as healthy building labeling systems to include indoor air quality.

Works in this area are an important step in understanding the importance of indoor air quality and in ensuring the applicability and control of standards and regulations.

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Role of Standardisation for Developing Single European Market

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ABSTRACT

The goal of the paper is to clarify the process of standardization and the role of standards in design, production and placing industrial products on the Single European Market (SEM). The essence and characteristics of SEM, rules for free movement of products are observed. Approaches to remove technical barriers are considered: principle of mutual recognition and technical harmonization through traditional and new approaches. Ensuring these approaches is implemented through the EU legislative framework.

The role of standardization in the EU legislation for SEM is considered. The connection between legislation, standards and CE marking is clarified. The specific features of harmonized standards are exposed. The benefits of European standards for developing of SEM are highlighted. The significance of standards for companies and their benefits for business are discussed.

The process of information provision of industrial products with European requirements and norms for safety is presented. The sequence of steps to ensure the free movement of regulated products in the SEM is created.

Key Words: single European market, free movement of industrial products in SEM, EU standards.

1. SINGLE EUROPEAN MARKET

1.1. Characteristics

The Single Market of the EU Member States is the result of the deepening of the economic integration that began in the 1950s with the creation of the three European Communities [1]. In practice, its construction is a complex and dynamic process that continues today. Although integration has reached a very high level of development, this process is not yet fully completed.

The Treaty defines: "The internal market comprises an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured". The concepts of "common market", "internal market" and "single market" are equivalent.

The direction of the creation of the Single European Market (SEM) is a merger of the national markets into a single market, the conditions of which correspond as much as possible to a genuine internal market. Its main characteristic is the assurance of the four economic freedoms. By merging national markets, Member States create a unified space in which goods, people, services and capital move unhindered across national borders. It creates the same conditions for competition and establishes uniform rules for companies and citizens from different Member States. The principles of non-discrimination and national treatment apply. A customs union is created, characterized by the elimination abolition of customs duties in intra-Community trade, quantitative restrictions and measures having equivalent effect.

1.2. Internal market for goods

The free movement of goods is an important priority of the European Union [1], aimed at creating a favorable environment for businesses and consumers. The concept of goods covers a broad spectrum covering energy, industrial products, agricultural products, foodstuffs, etc. A serious obstacle to the completion of the single market is the availability of different technical standards and norms in individual Member States. One producer must comply with different standards across Member States and apply heterogeneous rules in the production, packaging and marketing of production.

Differences in mandatory national standards, technical requirements and norms can be divided into two groups:

Group I - historical differences in the technical parameters, design, chemical and physical composition of individual goods which do not affect the level of protection of the life and health of people, animals, etc;

Group II - Differences in standards resulting from different degrees towards the protection of life and health of humans, animals, security, public order.

In the case of differences from the first group, where safety, public security, etc. are not imposed, the approach is to remove the mandatory nature of the standards and to maximize the application of the principle of mutual recognition of the conditions of access of goods to the market.

In the second group of differences concerning the different level of consumer protection, the EU approach is: Harmonization of mandatory requirements by adopting uniform standards ("old approach") or by adopting uniform minimum mandatory technical requirements and signing agreements between the parties Member States for Mutual Recognition of Certificates of Conformity ("New Approach").

The approaches to removing technical barriers [2] are:

- Mutual Recognition Principle - Goods legally admitted to the market of an EU Member State have the right of access to the internal market of other EU Member States, unless it can be proven that they can be suspended on the basis of the requirements for the protection of life and human health, public order. It acts as long as a Member State does not dispute it and does not introduce specific national mandatory requirements related to the protection of life and health.
- Harmonization of legislation - through legislation aimed to remove technical barriers to trade (convergence of national technical regulations):
    - Detailed harmonization ("old approach") - Harmonization takes place to the smallest details of each product through the same technical specifications.
    - Harmonization is limited to the essential health, safety and environmental protection requirements (New Approach). To demonstrate compliance with these requirements standards may be applied voluntarily.

2. LEGISLATIVE FRAMEWORK FOR THE FREE MOVEMENT OF INDUSTRIAL PRODUCTS

2.1. Decision making in European market

Institutions that create binding legal rules are the European Parliament, the Council of Ministers and the European Commission [3].

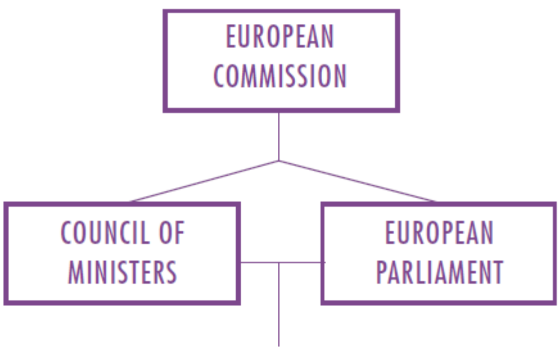

Figure 1: Ordinary Legislative Procedure

The Commission submits a proposal for a legal act in EU Parliament and the Council of Ministers. It follows first and second reading and codecision.

Legal acts of the European Union are:

Regulation - creates a uniform EU right, it is binding in its entirety and directly applicable in all Member States;

Directive - it does not have a general binding effect; it regulates the result, but leaves the national legislator to settle the means to achieve it;

Decision – it is binding in its entirety to those to whom it is addressed.

2.2. EU legislative framework for technical legislation

A new legislative framework was adopted in 2008 to improve the internal market for goods in the EU. It consists of: Regulation No 765/2008 [4] on the requirements for accreditation and market surveillance relating to trade in products; Decision No 768/2008/EC [5] of the European Parliament and of the Council on a common framework for trade in products; Regulation No 764/2008 [6] laying down procedures for the application of certain national technical rules to products lawfully marketed in other Member States.

The purpose of the legislative framework is to improve the functioning of the internal market and to strengthen the conditions for placing a wide range of products on the EU market by: improving market surveillance rules through better protecting consumers against dangerous products; improving the quality of conformity assessment of products through clearer notification requirements for conformity assessment bodies; establishing clear and transparent accreditation rules; clarification the meaning of the CE marking.

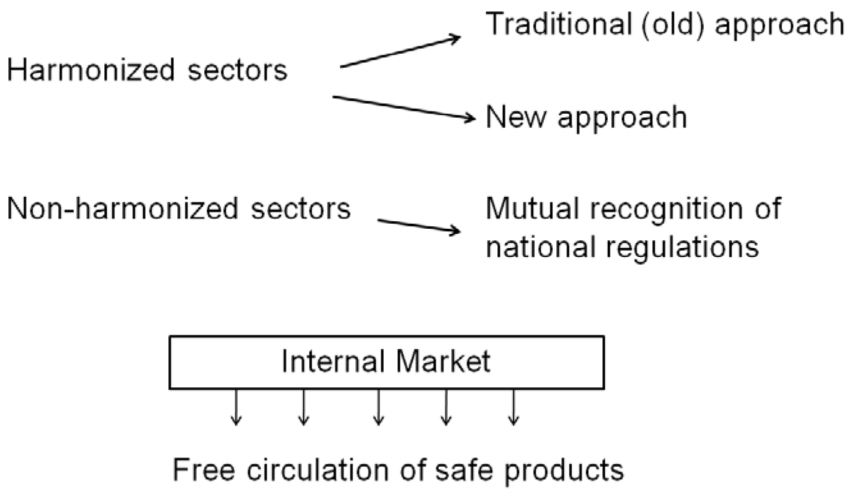

Figure 2: EU legal framework for technical legislation

The key elements for the internal market of industrial products are [2]:

- safety requirements;
- standards which define technical or quality requirements for products or test-methods;
- conformity assessment that estimates compliance of the product with applicable requirements;
- accreditation which ensures the technical competence of the conformity assessment bodies;
- notified bodies are organizations that assess the conformity of the products with the applicable requirements;
- market surveillance which checks the safety of industrial products after being placed on the EU.

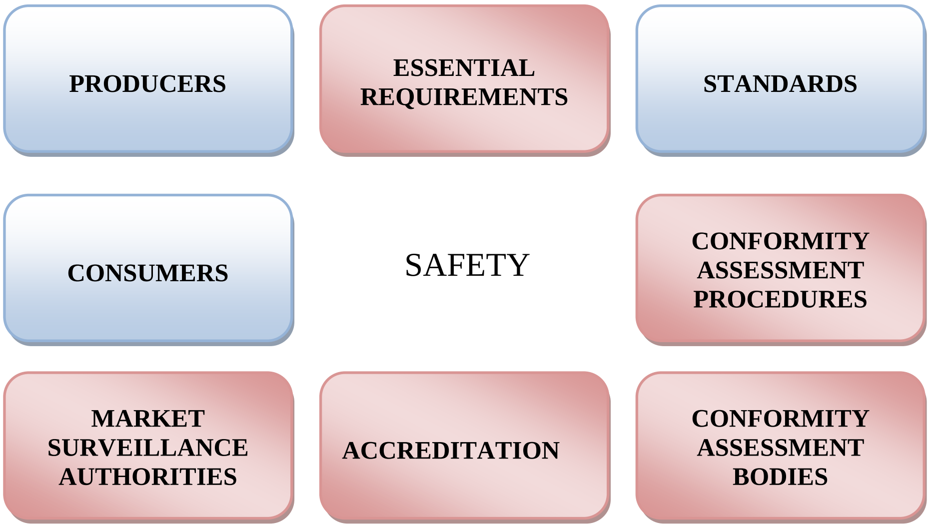

Figure 3: Key elements for the internal market of industrial products

3. THE EUROPEAN STANDARDIZATION IN THE SINGLE MARKET FRAMEWORK

3.1. Principles of a New Approach

The New Approach is a regulatory technique whereby product legislation is restricted to the requirements necessary to protect the public goals of health and safety [2]. Its principles are:

- Harmonization is limited to the essential requirements;
- Only products that meet the essential requirements may be placed on the market;
- Essential requirements are transformed into detailed technical rules through harmonized standards;
- The application of the harmonized standards is voluntary;
- Products produced in accordance with the harmonized standards have a presumption of conformity with the requirements of the Directive.

Figure 4: Harmonization of technical legislation through New approach

3.2. Standards and standardization process

The formal definition of a standard is a “document, established by consensus and approved by a recognized body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context”. Standardization [2] is an activity to define prescriptions for general and repetitive implementation, addressing actual or potential issues that achieve optimal order in a set of circumstances.

The principles of standardization are:

- Taking account of the level of achieved technology, giving priority to international agreements and making use of the results of European and international standardization;
- Consensus - a necessary condition for the development of standards to be adopted and widely used;
- Voluntarily widespread participation of all stakeholders and their balanced representation in the process of developing the standards;
- Transparency at all stages - public discussion of all draft standards;
- Compliance with development and shaping rules - identical at international, European and national level;
- Respect for copyright and usage rights.

Standards are voluntary for the application, but under certain conditions can become mandatory for example, when a normative act refers to a standard; in public tenders; when incorporating standards into contracts; in product descriptions, processes, and services.

When developing the standards, the following conditions are met:

- To have a proven need for a standard - wide support;
- To be applicable - clearly understood and acceptable;
- To be consistent - there should be no duplication of national with European and international standards;
- Being impartial - not giving priority to individual interests;
- To be suitable for verification of compliance;
- To contain clear instructions, such as methods.

The standardization bodies are:

CEN - European Committee for Standardization in the non-electrical field, established to remove barriers to trade for European industry and consumers;

CENELEC –European Committee for Electro Technical Standardization prepares voluntary standards to facilitate trade between countries, reduce conformity assessment costs and support the development of the EU single market;

ETSI - European Telecommunications Standards Institute, a formal organization for European standards, provides access to the single market for products in information and telecommunication technologies.

Harmonized standard is a European standard developed by European Standards Organizations (CEN, CENELEC or ETSI) under a mandate of the EU Commission that maintains the essential requirements of the New Approach directives. It is applied voluntarily.

Manufacturers or conformity assessment bodies may use harmonized standards to demonstrate that products, processes and services are in compliance with EU legislation.

Harmonized standards are published in the Official Journal of the European Union by citing their number and title.

4. THE BENEFITS OF THE EUROPEAN STANDARDS

Benefits for building and developing the EU internal market:

- Removal of technical barriers to trade arising from inconsistencies between national standards;
- Remove multiple national technical descriptions and related test and certification requirements;
- Support legislative measures through New Approach directives;
- Building trust between trading partners;
- Enhance the competitiveness of enterprises;
- Ensure the health and safety of citizens;
- They offer technical solutions to problems and help transfer and disseminate technologies.

Significance of standards for companies:

- Inside the company through using existing solutions; effective work through repeated use of the same solution; using recognized requirements, such as quality; easier control over work and tasks;
- Outside the company through placing products on the EU market; successful realization of the products by meeting the requirements of the customers; creating customer confidence that the product meets the requirements; consistency with an established brand.

Benefits of standards for business: Cost-cutting compliance with the standard; Customer Confidence; Risk Management; Reduced transaction costs; Compatibility of products / processes; Flexibility in the supply chain; Good practices and management systems; Improving speed to the market; Product Acceptance; Managing the life cycle of the product; New Markets; Industry development; competition.

5. SYSTEMATIZATION OF DATA FOR EUROPEAN HARMONIZATION LEGISLATION

Research carried out [7] shows that the significant number of products covered by the Directives of European legislation for harmonization and the enormous amount of harmonized standards pose major difficulties for their definition and application by manufacturers. This situation will be facilitated by creating an appropriate Information System [8] whose construction is necessary to create a primary systematization of the data on the European legislation for harmonization Directives and the related standards.

Systematization is based on the analysis and synthesis of data from the directives and related harmonized standards. The following product grouping and product grouping are proposed:

1) Product group - have common requirements in one directive and one group of standards;
2) Type of products - have the same harmonized standards.

5.1. Information provision of industrial products with European requirements and safety standards

In order to facilitate industrial product manufacturers, the European Commission provides general information and guidance [9] to ensure the free movement of regulated products in SEM. A 6-step scheme is presented, the sequence of which should be taken by manufacturers before the CE marking is given, giving explanations for each step. The process is illustrated in fig. 5.

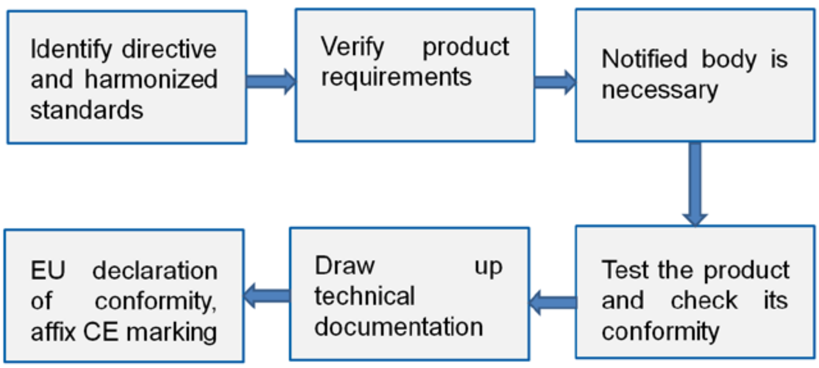

Figure 5: Steps to affix a CE marking to the product

The 6 steps described on the EU site allow for the choice of one Directive, which is not sufficient for manufacturers, as a large part of the products fall under the scope of more than one Directive. In addition, the manufacturer has to define the Directive within which the product falls. The following steps do not specify the essential requirements for a product, but only indicate where they are. From the entire list of standards harmonized with the Directive, the manufacturer must again determine which harmonized standards must apply to ensure compliance with the essential requirements of the Directive within which the product falls.

The proposed scheme provides the manufacturer with information about a particular Directive without facilitating it in: defining the Directives for a specific machine; definition of the essential requirements of the Directives; defining harmonized standards to ensure compliance with the essential requirements of the Directives; determination of safety standards by harmonized standards. Consequently, the establishment of a system with a set of essential requirements and safety standards for specific machines will facilitate manufacturers in the process of assessing and demonstrating machine safety with a view to the exact application of European technical legislation for harmonization.

The analysis made [10] gives reason to identify the following tasks to effectively assist the manufacturers in providing and demonstrating the safety of their products before they are placed on the SEM:

• Definition of groups and types of machines;

• Defining the Directives within which the groups of machines and their species fall;

• Defining the essential requirements for the machine groups of the different Directives;

• Indication of the harmonized standards ensuring the requirements of the Directives;

• Expert establishment and selection of standards from harmonized standards that meet the requirements of the Directives;

• Embedding the sequence of tasks described above into an Internet-based system.

The implementation of these tasks in an information system will help:

• Manufacturers and experts, shortening the time needed to define the Directives in which the product is covered, the required harmonized standards for it, and the relevant standards;

• Training institutions through a detailed description of all the necessary steps in assessing product compliance;

• All persons interested in product safety through expertly defined and systematized knowledge of the correct application of European technical legislation for harmonization.

5.2. Research in the area of technical legislation for industrial products

An approach to information assurance of machines with European requirements and safety standards is presented [11].

Systematization for product groups and standards for them is established.

Two approaches to classification of groups and types of products in regard to Directives are developed.

A study for product group Electric passenger and load passenger lifts [10] is presented involving systematization of applicable essential requirements, harmonized standards and norms of harmonized standards.

The result of expert research is presented in the Expert Information System [11].

The aim i: to develop a formalized description of representation the requirements and safety standards of selected groups of machines in expert information system.

The following tasks are solved:

- research and analysis of directives and harmonized standards related to selected groups of machines;
- formalized description of the expert specified European requirements and standards to selected groups of machines;
- design of a user interface for expert information system.

The proposed expert information system will support:

- Manufacturers in determining the Directives under which their machine falls;
- Manufacturers in establishing the essential safety requirements;
- Shorten the time of manufacturers to choose the necessary harmonized standards for a specific machine, and to determine the appropriate norms of standards;
- Training institutions by indicating all necessary steps in conformity assessment of machinery;
- All persons interested in the safety of machinery, through offering an expert and systematic knowledge of the application of the technical legislation.

Formal description "Product - European norm for safety“[12] is applied through algorithm below:

- Determine the types of products regulated under Directives by analyzing the title and the scope of the harmonized standards under the Directive.
- Study and analyze the essential requirements for the type of product selected by Directive. Specifying the applicable essential requirements.
- Study and analyze other Directives to establish the applicable essential for the type of product requirements.
- Give the decision to meet the essential requirements of the Directives on the type of product - implementation of harmonized or non-harmonized standards or other technical solutions.
- When applying the harmonized standard, non-harmonized standard or other technical solution need to indicate the relation between the essential requirement of the Directive and the related norm of the standard for product type.
- Specify the components of the product type.
- Determine of the relationship between the components of the product type and essential requirements.

Expert determination of product groups covered by directive 2006/42/EC and 2014/33/EU

To create a list of types of products and product groups in the two directives [13, 14] the lists of harmonized standards to the directives are analyzed and two approaches to classification of product groups are applied [105.

- Selection of harmonized standards by a "family" i.e. based on the number of the standard. An example of a series of standards BDS EN 1010, grouped together in "Printing machines and paper converting" which consists of 3 types of machines.
- Selection by the name of the harmonized standard and the respective field of action. The group "Machine Tools" consists of 14 types of machines that are grouped in this way. The title of the group is contained in each of the standards defining the types of machine tools in this group.

Formal description of expert specified European requirements and norms related to the selected groups of lifts

Relevant essential requirements of Directives 2014/33/EU, 2006/42/EC and 2014/30/EU [15] have been identified. The connections between relevant essential requirements of Directives 2014/33/EC, 2006/42/EC, 2014/30/EC and specific norms of the standards are defined and systematized.

Models for information ensuring lifts with the European requirements for safety

The main steps of the process of formalization are presented [12]:

1) Determination of directives covering the product;

2) Analysis of the essential requirements of the directives and links to essential requirements of other directives;

3) Determination of the components of the lift, to which there are safety requirements;

4) Systematization of the essential requirements of the directives and referring to the components of the lift;

5) Review and analysis of harmonized standards referred to the essential requirements of the directive and to the components of the lift;

6) Determination the norms of the harmonized standards relating to the essential requirements of the directive and to the components of the lift;

7) Summarize of the analysed and systematic information and making connections between the essential requirements and/or components of lifts, harmonized standards, norms of harmonized standards

Computer realization of expert information system

The final result of the research is presented in the expert information system [12]. It consists of a database containing data from completed studies.

The results of this study enable manufacturers, designers, supervisors and others interested in assurance the safety of lifts and machines for the European market, to save time by obtaining expert systematic and easily understandable information.

6. CONCLUSION

The article analyses the functioning of the SEM and the conditions for the free movement of industrial products in the EU. The legislative framework for technical harmonization has been studied; the role of standards and the standardization process in the design, manufacture and marketing of products has been clarified. Based on this analysis, research has been done and methods, models and algorithms have been developed to provide industrial products with European safety requirements and harmonized standards. Research has been carried out and an expert information system has been developed to provide lifts with legislative requirements and safety standards. The proposed approach can also be applied to other industrial product groups, to facilitate manufacturers, designers, supervisors with the right choice and enforcement of European legislation for harmonization.

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Digital Commissariat: Mobile Application

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ABSTRACT

The security of the citizens and public order is the fundamental global challenge of every country. Ensuring a secure community environment through policing with the highest standards of performance, creating a contemporary management culture and supporting the most advanced infrastructure, is the mission of the Albanian State Police [1, 2]. Albania is among those countries, working and making noticeable progress, for a safer country, a better public order, businesses and properties, foreign investments and tourists who visit Albania.

Today, thanks to the solutions offered by the mobile technology, anyone can inform/report (in full anonymity) in real time, violation events giving their help in solving the situations.

This project consists on encouraging the citizen to participate on improvement of the civil security, fighting corruption, and strengthening the low. This application was realized aiming "citizen voice to be heard" and that the state police service in response to citizens is improved through the use of technology.

The mobile application “Digital Commissariat” offer the digital police on the hand of the citizens, giving the opportunity to each one to contribute to the country and society where they live: “To watch, to react and to report on every rules and law violation” [3].

Key Words: Digital, information, commissariat, technology.

1. PURPOSE AND EXPECTATION

We all want to minimize as much as possible the case of violation that will allow us to have a more secure public order. The strategic goal of the Albanian State Police is to create a safer environment for the Albanian society, which will bring improvement in the quality of life of citizens, making Albania a desirable place to work and live.

The purpose of the implementation of this application is to provide citizens with the possibility of reporting anonymously or not, on abusive cases or legal violations (wrong parking, illegal building, possession of weapons, corruption cases) via texts and/or images, a violation we all wanted to minimize, to have a better public order.

The strategy of this project is to: “Engage public to contribute on improvement of standards/ conditions of the public order/ corruption/rules and laws.”

The application “Digital Commissariat” is an instrument to enable citizens to denounce at any moment the violation of the law and, “Those who violate the law, must face it”!

The application is an alternative way of denouncing facts or events that constitute abusive behaviour or legal violations. This application does not intend to replace the official legal and procedural means provided by the legislation in the Republic of Albania on the denunciation of legal violations.

Through this application, the citizen has the opportunity not only to denounce, but also to oversee the police action on his denunciation, as well as to watch and follow not only his reporting but also reports of the other citizens.

The application also provides full transparency to the public how the police service responds every case reported.

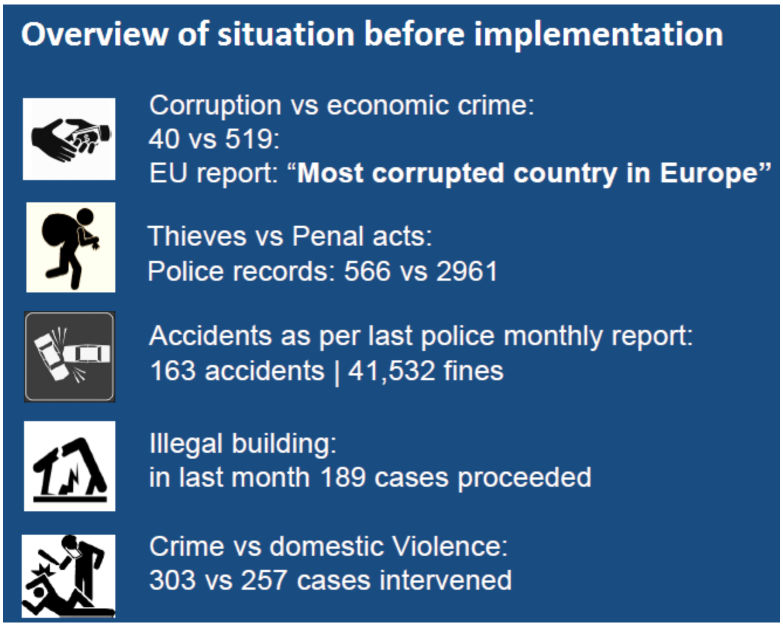

Figure 1: Overview of the situation before implementation

The implementation of this innovative application came as a result of the annual criminal statistics occurring in the Republic of Albania.

2. APPLIED TECHNOLOGY, ANALYSIS AND APPLICATION FUNCTIONALITY

The application “Digital Commissariat”, is provided by the Ministry of Interior in the Republic of Albania, which under its full responsibility, takes the full charge of providing, hosting, management, maintenance and availability of the application to the general public.

The mission of this project is: “Use of technology in order to respond to the public claims on issues of public order and standards through the improved performance of police service.”

2.1. Applied Technology and the Application Download

The application “Digital Commissariat”, is based on a web platform and is offered to all people over the age of 18. The application “Digital Commissariat”, is a mobile application, available for free on the App Store for iOS devices & Play Store for Android OS devices.

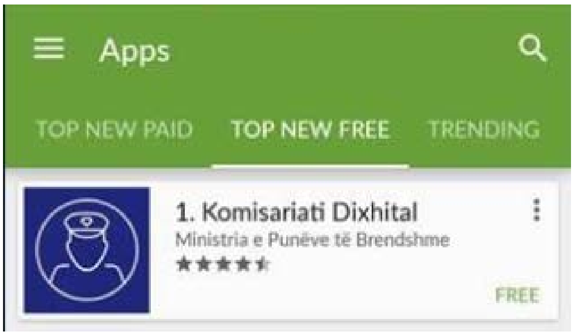

Figure 2: Application download

All photo, video, text reports will be stored on a web portal. This portal will be used only by application administrators and reporting operators.

Figure 3: Categories preview

Application administration will be done on two levels:

Administrator - who controls the entire web portal system

Operators - have the right to view reports and change their status (open / in process / closed), can also put additional explanatory notes on the outcome of the operation.

2.2. Application functionality

The application is organized in a tabular form on a menu with 6 reporting categories. Each of these categories, send to the reporting interface of an event. The other three icons are: "Reports List", "My Reports," "Info".

Figure 4: Categories

The application has 6 reporting categories:

Accident/Wrong Parking, Illegal construction, Corruption, Theft, Possession of weapons, Violence, Complaint. For each of the categories, is required a description of the event and other information about the reported event.

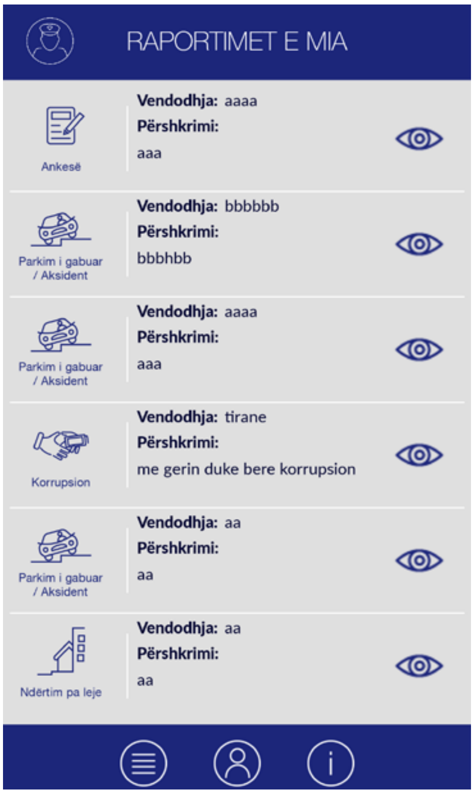

Figure 5: Reporting

The system is able to automatically pick up the exact location of the user performing a report. The application provides the possibility to protect the anonymity both in the reporting person's report and in reporting the person's location by inactivating the GPS of the device when reporting.

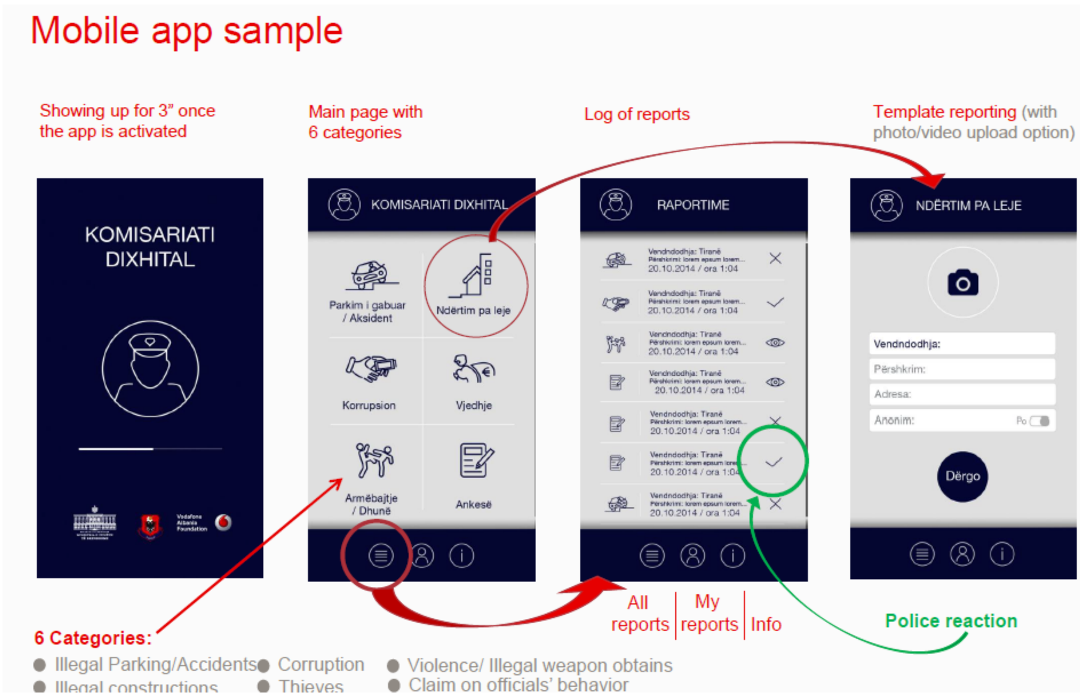

Figure 6: Application Sample

Figure 7: Samples of the whole reporting process

3. PERSONAL DATA PROTECTION

Based on the Constitution of the Republic of Albania and Law, No. 9887 dated 10 March 2008, on "Protection of personal data", all the personal data and privacy are being protected.

The application collects and processes personal data for those people who have reported when the reporting person, chooses to make known the location. The State Police, processes these data to review and follow the reported / denounced practices. The User is personally liable for any false information or denunciations, cases considered defamatory, abusive, threatening, harmful and improper.

Data Processing Principles:

- Data are always used in accordance with applicable legislation;
- The processing of data is made for specific purposes, clearly defined and legitimate;
- In cases where necessary, the data will be updated by taking any reasonable steps to delete or correct inaccurate, incomplete data in relation to the purpose for which they are collected or for which they are further processed

Figure 8: Samples of the whole reporting process

Data retention, correction and deletion:

Personal data will be safely stored, according to the security policies of the hosted hosts, as long as necessary for the purpose of their collection, which will then be deleted.

Each data subject/person has the right to request blocking, correction or deletion of data, free of charge, when it considers that the data about it are not regular, true, or processed and collected in contravention of the legal provisions on protection of personal data.

In case of violation of the procedures of this application, the person has the right to address to the Commissioner for Personal Data Protection [4].

4. STATISTICAL DATA

Based on the reports recorded through the application “Digital Commissariat”, statistical data are drawn in chronological order. Statistical reports can be generated by the system, every day, week, and month according to the reporting categories.

For 2017, the percentages by category are as follows:

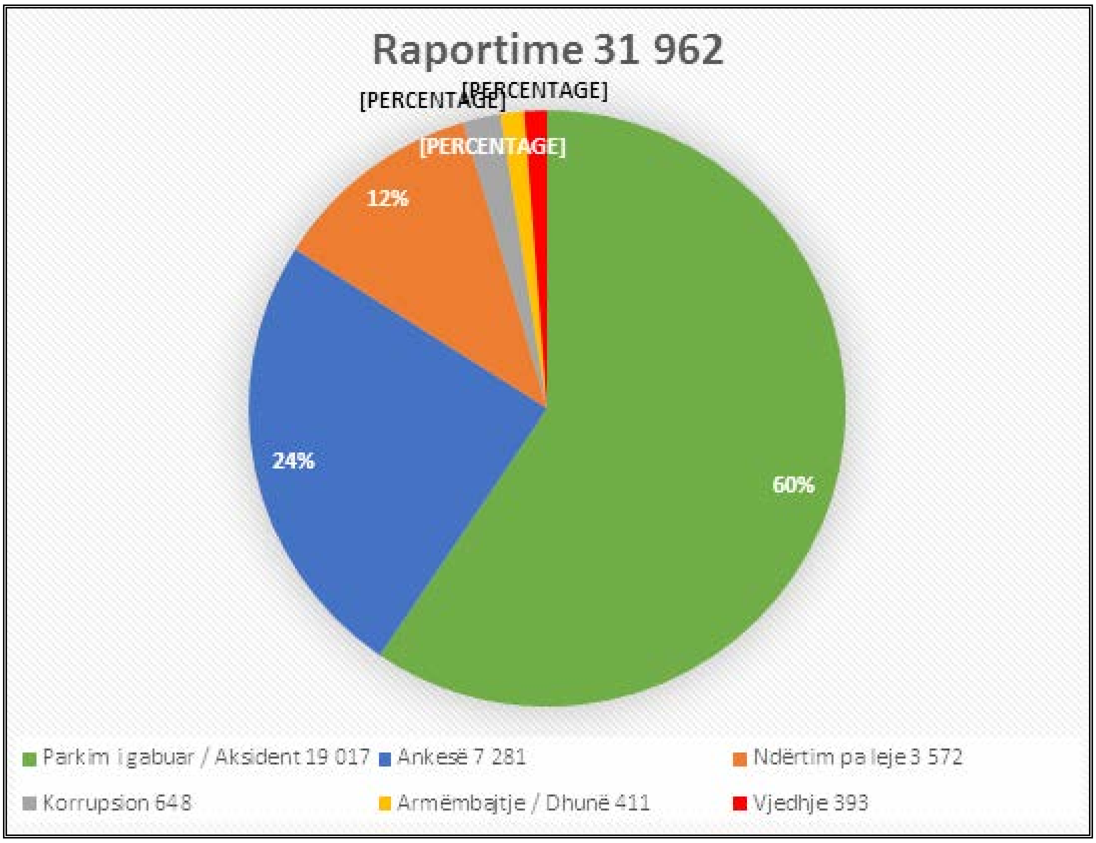

Figure 9: Statistical data for 2017 year

5. CONCLUSIONS

The application “Digital Commissariat”, marked a success story of using the latest mobile technology. It continues to record an increasing number of denunciations by citizens, which are assisted in real time solutions by the State Police.

The application is in continuous process of upgrading to the best level, taking in consideration the suggestions from the citizens and new cases of violations and abuse.

During the system upgrade, feedback will be collected from the client so the system does not have functional or interface deficiencies.

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14th International Conference in "STANDARDIZATION, PROTYPES AND QUALITY: A MEANS OF BALKAN COUNTRIES' COLLABORATION", September 21 - 22, 2018, Tirana, Albania

Standards, Protypes and the Role of the Balkans in the Postindustrial Era

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ABSTRACT

We define the standards as the stable confrontation of often appearing phenomena and the permanent solution of repeated problems. By accepting this, we consider that standards are a natural phenomenon, and as such they have appeared as first by the creation of the planet Earth. After this fundamental consideration we do a historic analysis of the human development in parallel with the evolution of the planet's environment. We point out that the procedure of standardization in nature has 4 levels: 1.The ability of nature's elements to adjust themselves to the environmental changes 2.The ability of nature's living creatures to adjust themselves, by their instincts of imitation and habit, as units to the environmental changes 3.The ability of nature's living creatures to adjust themselves, by their instincts of imitation and habit, as groups to the environmental changes 4.The ability of only humans, from nature's living creatures, to adjust themselves as groups by using their brain, besides their instincts of imitation and habit, to the environmental changes. Following the human race's development, we see that the activation of the human brain, besides his instincts, increased. This kind of human development started having an increasing rhythm after Alexander the Great and his driving of Ancient Greece to the sphere of technology and science. After the Industrial Revolution, has appeared a geometric progression in the rhythm of technology's increasing. The predomination of technology on the human instincts' nature brought a retrogression of the industrialized humans to their primitive stage of units out of groups which would enable them to adjust themselves to the environmental changes. Already at the second age of the Industrial Era, the human technology began to be hostile to the global environment. At the eve of the Post Industrial Era, as the damages from the human technology have spread-out in universe, the desperate need, not only for the human race but for the whole Planet, is the protection of the environment and its natural development. This conclusion projects the main role that the Balkans can have in the human development in the Post Industrial Era: The Balkans, in their greater part, is out of the main stream of industrialization. So, they do not have yet the defects that the industrial technology brought to the human nature and to the natural environment in the Industrialized Countries. If the Balkan countries could be able to form their own protypes, not following the spirit and not being under the influence of the Industrial Countries, they can collaborate by networking and drive themselves and the whole globe to a recovering and development of humans and of the natural environment. In our proposals we state the methodology to achieve this kind of development by the local networkings, instead of the globalization.

Key Words: Industrial Standardization, Quality Protypation, Environment, Networking

1. INTRODUCTION

We declare as the basic principle of our Paper the view that the human race is an integral part of nature. We assume that, after the end of the Industrial Era, the cycle of industrialization has been completed, and humanity has entered another cycle, which has been defined as the "Post Industrial Era". But as the boundaries between the eras are not clear, and the beginning of the next diffuses at the end of the previous one, today we live at the same time the Industrial- and the Post-Industrial Era. This enables us to plan and program scientifically the developments during the coming era, for the first time in the history of mankind,

The works mentioned in the standardization developments to-date, all follow a standardized path in which although they refer to the past, they focus on the latest developments in quality systems. Only some of them refer to the last centuries of the Pre-Industrial Era. Those few however stop their historical retrospection there. In our work we will attempt a historical flashback other than the mainstream; we will be talking about a long time history, both in the past of standardization and in its future.

In this announcement we will also attempt to present a different form of development, designed and planned on the base of the scientific knowledge and the (positive and negative) experiences not only from the Industrial Era, but also from all previous ones. Our work has as a specific subject the development of Europe. Our aim is to demonstrate that the Balkans, as a European region, provides the opportunity for a development where scientific planning and programming can be done in an implementation stage, in parallel with a continuous and ever-lasting feedback.

The Balkans is the only part of Europe that has entered the Industrial Era, following a course drawn by the Industrialized Countries in its ultimate form, that of its regression. In today's phase of this industrialization, in most of the Balkans still dominates the Pre Industrial Era. For these reasons, the Balkans provides Europe with the possibility of pilot applications for a rational development in the Post-Industrial Era, designed and programmed scientifically.

We believe that the Balkan peoples are today able to plan their rational development in the Post Industrial Era, freed from foreign influences and controls. We also believe that the direction of the evolution of the human race is influenced by phenomena and events of the distant past. To scientifically substantiate this position, we will focus our presentation on a historical analysis of the evolutions. Based on the view that the human race is an integral part of nature, the beginning of the scientific analysis of the history of humanity is the beginning of the evolution of the planet Earth.

Technology now provides the ability to acquire theoretical knowledge and information in a time unimaginable to the common human mind. From the theoretical infinity of time of the evolution of the universe, Earth's evolutions stages are among the most recent and of them a very small part. Nonetheless, a historical analysis of the stages of developments on our planet is a huge project, with no apparent end. For this reason, in our work we separate the epochs of evolution of mankind into prehistoric and historical. For the prehistoric times we will refer to a next chapter of our work, briefly, to some basic principles that arise from scientific knowledge about them. However, these principles are crucial for the scientific planning and programming of the Post Industrial Era. From historical times, we will refer to those that preceded the Industrial Revolution, defining them as the Pre-Industrial Era group. We will only refer there to those evidence that the developments during the Industrial Era were determined by the principles and the elements that emerged in all the ages of industrialization.

2. DEFINITIONS AND LIMITATIONS

The paradox of standardization is that, while it is an integral part of everyday’s life, its exact meaning is virtually unknown. Even for those who are actively involved in standardization work such as industrial technique, work’s organization, quality systems, measuring, automation, classification [5], etc., it is problematic to define and delimit the concept of standardization and it is recognized that "as much as you can easily understand what standardization is, it is so difficult to give it a clear and precise definition [7]." As we know, though, from Socrates' dialogues, the greatest teacher of all times asked at the beginning of every discussion among his students to define together with him what would be the subject of the discussion. Following his instructions, we will at first define the subjects of standardization and standards, as well as protypation and protypes, based on our position that there are crucial differences between them two that make it necessary to distinguish the one from the other.

For the definition of standardization and standards, a number of definitions and delimits have been given since the beginning of the Industrial Era. Until today, these terms, which began to appear from the nineteenth century onwards, receive a wide range of definitions and limitations. The term "Standardization" is recent and all the relevant terms (Unification, Normalization, Typung) in their initial use mainly concerned industrial production, the term being attributed to basically characterize Industrial Standardization. However, all definitions have a common historical starting point at the beginning of mass production by industrial methods, already before the 19th century. So, we will refer to them as the Industrial Standards of the Industrial Standardization.

The term Unification was soon then considered to be inadequate for general characterization of the standardization [7] because it only refers to the process of eliminating the "unnecessary variety", following Classification and Coding [3]. This is why these three phases of standardization have been called "Simplification". Unification now defines "that part of Standardization that aims to determine the conciliation characteristics, thus allowing the use of any elements in any set [7, 17]".

The term Standardization was first used in English at the end of the 19th century. It comes from the Latin word standard, which means an established model or rule in the sense of stability. This concept of stability in the Industrial Standardization and the Industrial Standards had then created the idea of a standardization which is narrow, rigorous and has to be defined to the smallest details [6, 17]. Almost parallel was the use of the more flexible term Normalization, derived from the Latin word Norma, which means a rule in the sense of common acceptance of adoption, to which we deliberately assimilate an activity [7].

In German, in addition to the Latin’s origin word Normung, the term Typung (from the Greek word "typos-mold") appeared. The Germans subsequently characterized the integrated product as opposed to Norm, which means the standard part of a construction, so Typung had then a typology concept. The terms Normung and Typung were so used in parallel, in a specialized sense each one: "Normung can be called the standardization of raw materials, as Typung can be called the standardization of the overall construction"[10]. Maybe the German term Typung is the source of the term "τυποποίηση-typopiisi=standardization" in Greek. The term τυποποίηση, however, did not exist until recently either in the Greek dictionaries.

Regarding the term "standard", as standards in Industrial Standardization, are named different items of comparison, regarding the different characteristics of the subject, and depending on its strength, duration or extent of its acceptance and its jurisdiction [5]. Regulations at national, transnational and international level are considered also as standards. Those regulations which are mandatory texts, approved by an Authority that has legislative power, are also considered as standards. They usually aim to protect life, health and physical integrity. As standards have also been defined elements such as Specifications or Technical Regulations. The Technical Regulations are regulations that include or refer to a Standard or Specification. A Technical Regulation may be supplemented by "Technical Instructions" describing, as Standards, one or more ways of applying the rules or making remarks [6].

The "Technically Accepted Methods" are also standards. They apply to production, construction or building systems as “Recommendations” and "Technical Specifications". The Technical Specifications are forms that define the characteristics or requirements of a product or service, i.e. their quality, performance, safety or dimensions, as well as test methods or packaging methods. A Technical Specification may take the form of a "Code of Practice for Implementation"[16]. Still, there are Managerial Standards, Safety Standards, Grading Standards, Terminology standards, Labeling Standards etc. [16].

Products of the Industrial Standardization are also the rules or methods that have the prospect of continuous application. All these Industrial Standards are recorded. These recorded descriptions are also referred to as "Industrial Standards", and they may be descriptions of constructions or products (such as food, pharmaceuticals or materials), or may be statutory, in the form of Industrial- Regulations or -Specifications.

On the question of whether standardization is stable or can vary, as habits and customs can vary from place to place, there is a grading, depending on the standard’s scope. Initially the "Company Standards" for example consider only each factory that forms its own standards. After a good practice they can become "Brunch Standards", which are for products of the same industry brunch. Nowadays the rating reaches up to the "international standards" that have a global reach [16]. As the climax goes higher the standardization is getting less flexible and more stable.

In our work, we adopt as a general definition of standard any attempt to adapt (successfully or not) to any repetitive action. We name Protypes those attempts that prove to be successful. It is actually the method that each element of nature develops to deal with a problem that is often repeated, usually at regular intervals After this concept, we consider that the patterning of protypes is a natural phenomenon, as it exists as a spontaneous action or process in all living organisms, but also in all the elements of nature. It is the natural phenomenon of any element or organism for its successfully adapting to changes in its environment.

Once the element or organism survives the new situation after the changes in its environment, it turns out that the adaptation method it developed was successful and its method is considered as a Protype. Any failed attempt, now, that has a number of iterations stays in the definition of the standard, having only the stability in repetitions. Random processes for both standard and protype definition are defined as "Arbitrary Standardization" and "Arbitrary Protypation" [6, 16]. Today it can be assumed that everywhere in nature there is Arbitrary Standardization and appears by chance when any action is repeated.

For the definition of Protypation, we will first refer to the modeling process for setting limits on human activities and actions to prevent the recurrence of a recurring problem of the past. This form of standardization has protected the first human societies. Having set the limits of the Arbitrary and the, programmed Industrial Standardization, we can set the limits of the human race and define its position in the Earth's environment. Thus, we repeat that we consider the human race as an integral part of the Earth's natural environment. Humans are a unique case of Earth's natural environment, because they are the only creatures who, even partially, plans and programs his environment with the brain which he only has. The human brain and the beginning of its use is the starting point for delimiting the human race in the rest of Earth's natural environment.

As far as the limits of the Balkans are concerned, we must return to the distant past. The current boundaries of the Balkans are essentially defined by the administrative divisions they had over the Ottoman and Austrian empires, which had their sovereignty until the liberation of the Balkan peoples and the formation of their states. However, following the reverse historical course, we find that these limits of the Ottomans and Austrians were inherited from the unified form the Balkans had as part of the Byzantine Empire, which in turn was the successor and heir of the Roman standardization of administrative and geographical divisions. The scientific conclusion of all the above is that from the Roman Empire to the Industrial Age the standardized geographical boundaries in the Balkans were shaped by foreign from the Balkans nations. The origins of both the limit’s setting of the Balkan regions and the current administrative division of the Balkans are in Ancient Rome.

Still, while continuing the reverse historical course and reaching prehistoric times, we find that things were different before the Romans. The boundaries of the Balkans in that prehistoric era were much wider and different, as the small social groups of the Balkan peoples were networked with corresponding standardized social formations of the Middle East, of Asia Minor, the Black Sea to the Caucasus, and with North Africa’s as well as Europe's coasts in the Mediterranean Sea. These prehistoric facts do enlarge the borders of the Balkans with the randomly standardized multidimensional network of peoples that have been preserved over the years. Specifically, this era of multidimensional networking of social nodes of all directions and sizes reaches until the time of Alexander the Great and the creation by him of the first multinational geographical limits of Europe. Since the time of the Macedonian states, the Balkans was part of this broader geographical boundary, but they were its center, with the Greek kingdom of Macedonia.

3.THE HISTORY OF EVOLUTION

The history of human evolution has its origins in prehistoric antiquity with the myths. However, we consider it particularly important for the needs of this work to describe the whole timeframe of the theoretical history of evolutions in the past as well as in the future. We will attempt this with alongside references to the history written down by the humans.

The English term "History" comes from the Greek word "ΙΣΤΟΡΙΑ-Istoria”. In ancient times, prior to the invention of writing, as history was originally defined the stories of ΙΣΤΟΡ-Istor. Istor was the one who narrated only things that he knows. Before the invention of writing, the istors were telling verbally, the history from generation to generation. Thus, the ancient Greek myths were created. Myths corresponding to the Greek ones exist in most peoples of antiquity, narrating, among others, the massive destruction of the planet Earth, which eliminated many forms of life. After that total destruction other, new forms of life were created, and among them the human race.

Modern scientific research in astrology has theoretically, with technical means, recorded the history of evolutions even before the creation of the planet Earth, at the time of our Galaxy’s creation, approaching the infinity. The Archeology has also theoretically recorded, with modern technological means, the history of evolutions since the 2.5 million BC years, which set the beginning of the Paleolithic Age. We can thus have an almost complete picture of the multidimensional spiral of the evolutions.

We consider that both the history of myths and the scientific research, report natural phenomena that are particularly useful for our work. The most basic of all might be that both in the universe and in the development of life on the planet Earth there is a cycle of iterations that are repeated. So, we can assume that they are standardized. As a circle, of course, it does not have a beginning and an end, but the end of a period is at the same time the beginning of another. Thus the recurring circles of the history of evolution form a multidimensional spiral too.

The peculiarity of the multidimensional spiral of the history of evolution, in its standardized circular routes, is that it is intertwined in some segments, due to accidental circumstances of historical events. At this point we submit our view that all the circular routes of the spiral of evolutions exhibit the same standardized phenomenon. This phenomenon is that, like in our Galaxy, there is a long phase where huge amounts of accumulated energy are generated by a gradual condensation of phenomena. At the end of this phase, the accumulated energy causes a sharp explosion of almost zero duration. This huge explosion (Big Bang) randomly spreads various elements over a large area. In turn, these elements are individually shortening as much as they do. In this way, the circular route of this particular part of the spiral closes and a new one begins with innumerable branches and cross branches. At these points of cyclical trajectories, the conditions for evolutions that are decisive for human development were created. For the needs of our work, we will refer to specific such points of coincidence as the focal points for the evolution of the human race.

The scientific research has recorded, classified and codified the theoretical history of the evolution of the Universe and our Galaxy. It has also fulfilled the whole process of recording the history of the developments of Earth since the creation of the planet to this day. In this, the planet Earth is thought to have been formed 4.5 billion years ago. The first form of life appeared 3.5 billion years ago. The first form of life was prokaryotic organisms, such as bacteria. According to the current standardization of scientific research it is considered that these organizations meet the standards of life, because: 1. They could reproduce, 2. They could be fed, 3. They were capable of photosynthesis, thus they could then survive in the natural environment of the Planet. The next level of evolution is presented to animating organisms that develop instincts. These organisms instinctively address the recurring problem.

Right from the beginning water was the basic constituent of the planet Earth, because in the first oceans the first samples of life appeared. The Big Bang that created the Universe 15 billion years ago gave 75% H (Hydrogen) and 25% He (Hellion) as the protein materials for that water. All other elements up to iron (Fe) were created by the Earth itself. The evolutions were completed after the explosion of the so-called Super Nova. Then, with earthquakes and volcanic eruptions, the first land-segments emerged from the sea. That land that shaped the present continents had then, though, other shapes and dimensions.

The standard scientific theory gives the view of today’s Europe, Asia and Africa as united at that time on one land, containing enclosed seas. The scientific name given to that land was "Pangaea". Life has developed in Pangaea from the earliest prokaryotic organisms to an innumerable variety. From the evolutions of plants, aquatic organisms, and amphibian beings, species of reptiles, animals, birds and insects have resulted. All of these forms of life came from organisms that were capable to adapt to the timeless changes of the Earth’s natural environment. So, they could meet the standard conditions of life, as they could be consumed and reproduced.

The standardized theoretical history of the planet Earth’s developments classifies the years which refer to the human race starting with the Paleolithic Age. The years from 10,000 to 3,000 BC are defined as the Mesolithic Age, after the Paleolithic. From 3000 to 2000 BC is defined as the Neolithic Age, from 2000 to 1000 BC, as the Bronze Age, and from 1600-600 BC as the Iron Age.

From all the inconceivable volume of the recorded theory of prehistory, we will keep those reports that concern the beginning of the Paleolithic Era.

With the instinctively repetition of the treatment of a phenomenon or of a problem, the most successful method of dealing with is formed, as the model method. As organisms evolve, instinct subsides, and the developing organism begins to consciously create its own standards. This process of consciously adopting standards is defined as "Programmed Standardization". Respectively, the successful implementation of Programmed Standardization is defined as “Programmed Protypation”.

The living beings of nature display the level of Programmed Standardization that could be described as the first stage of integration. Here the patterns begin to be formed in groups, with the instincts of imitation and habit that all living organisms more or less have. At this stage, each organism, after having developed its own standardized method, with its own standards, imitates and applies steadily and continuously by its habit as its Protype, when it finds that the equivalent method of an organism similar to it is more effective. The more developed the natural organism is, the greater is the extent of imitation and habit. This fact establishes standardization as the most powerful element of nature.

The same standards’-forming process is followed by each living organism during its individual development. Here the mother's protypes pass to the embryo and implant into each of its cells. The maternal protypes, which dominate the early stages of life, are gradually enriched as the environment of the organism expands and at the same time it creates its own development. Following or in parallel with the maternal standards, initially a living organism, adopts the paternal protypes with its instincts of imitation and habit. Then gradually it enriches the protypes of its micro cosmos with patterns from the family, and from the group-genetic-racial environment [13].

In this way, standardization is a lifelong process, renewed and revised steadily and continuously. Following their evolution, nature’s organisms in an unimaginable amount of time, from the beginning of the Earth to the present, have created an evolutionary chain whose last link are the humans. In the human’s development, imitation and habit are not only driven by instincts, but gradually the choice is made with the person’s brain. Thus, as long as the person's environment is expanding in space and time, the participation of the human brain is increasing. Here, only in the human race, appeared the last stage of Programmed Standardization.

Within this immense definition, we distinguish, beside the instincts, the conscious adaptation of especially the humans to any recurrent evolution or phenomenon. We define this conscious adaptation beside the instincts as the human programmed standardization. The programmed standardization of modern humanity is the Industrial Standardization.

Typography (printing), around 1500 AD is considered to be the starting point of Industrial Standardization’s evolution. The Printing, with its standardized elements, showed the way for the production of interchangeable parts and made the mass production of written works possible. With it the human knowledge was disseminated and popularized.

Directives on human activities and actions to prevent the recurrence of a recurring problem of the past must exist in the actions and activities of humans. These directives exist always in the whole nature as limits. When limits do not exist, the results are unexpected natural disasters and surprises of the living beings. The rules of human social groups have defined those limits that have emerged from practical experiences until the Industrial Revolution. These limits were recorded in state or religious laws.

Typical examples are the state-laws of the Ancient Greek Democracies, the religious laws of the Jews (with the 10 commandments) and the Koran of the Muslims. The decisive difference in the rules of the Ancient Greek Democracies from the 10 Commandments of the Jews and the Koran of the Muslims is that the democratic rules were not strict and restrictive, but they had reasonable tolerance ranges, that varied from region to region. In this way, both the Ancient Greek rules and their limits were adapted to developments because they had feedback mechanisms through their democratic processes.

4 HISTORICAL ANALYSIS OF THE HUMAN RACE DEVELOPMENT

As the beginning of the human race is recorded the appearance of the first being standing up, the "Australopithecus Afar", in the Paleolithik Era, at a stage of 6 million years ago in Ethiopia. Then, in Africa again, the construction of simple stone tools was achieved by humans, 4 million years ago. The human species that had constructed them was defined by the scientific research as Homo Habilis. A permanent standing up position is attributed to Homo Erectus, who appeared 2 million years ago and is considered to be the basis of humanoids, like Homo Ergaster.

Homo Ergaster appeared 2 million years ago in Africa, and was more a human than a monkey, as he had: 1. Big brain, 2. Whiteness in the eyes that allowed him more complex facial expressions, 3. Ability to produce more sounds and articulate tones, as the first words, 4. Ability to make more complex tools out of stones and woods 5. Ability to plan and program the ignition of fire. By the standardized scientific research is defined with these elements as the principle of humans’ development, essentially the utilization of the brain, after his upright standing that freed the hands.

Using his brain, Homo Ergaster used fire at will, and with its use: 1. He could cook his food, 2. He could keep him warm, 3. He could be protected of larger beings. These various uses of fire have enabled Homo Ergaster to survive, adjust to his natural environment, and travel far longer. Humans have thus begun to move out of the region of the Pangaea where today is Africa, on the borderlands, where today is Asia and Europe. In the regions of present-day Africa, Asia and Europe, the human race has gone into its next phase of development with the emergence of the kind that the standardized scientific terminology defines as Homo Sapiens. Homo Sapiens appeared by the end of the Ice Age, 200,000 years ago, as nomadic collector.

The development of the current human characteristics has been defined chronologically during the last Glacial Period, from the 70,000 years to 15,000years before. Later, after the improvement of climatic conditions and the temperate prevailing of the climate in regions of Africa, Asia and, from Europe, in the Balkans, the human race starts the development of technology and makes the "Neolithic Revolution", from 8000 BC. to 5000 BC. At this development phase appeared as the Homo Sapiens’ branches, the Homo Heidelbergensis in Western Europe, and the Archanthropos, in today's Petralona of Chalkidiki

During the first centuries of today's geological configuration of Earth, the human race passed from the herds into standardized social ensembles. Human societies then went out of their narrow limits and have built settlements. Following the evolution of the human race, those settlements were networked with a variety of standardized administrative complexes, which in turn were networked commercially or militarily. This has resulted in a random administrative and geographical multidimensional human network. The boundaries of the Balkans in that prehistoric era were thus much wider and different, as the small social groups of the Balkan peoples were networked with corresponding standardized social formations of the Middle East, of Asia Minor, the Black Sea to the Caucasus, and with North Africa’s as well as Europe's coasts in the Mediterranean sea.

The era of multidimensional networking of the Balkans with social nodes of all directions and sizes in Asia Minor, Middle-East, or Mediterranean coast, reaches until the time of Alexander the Great and the creation by him of the first multinational geographical limits of Europe. Since the time of the Macedonian states, the Balkans was part of this broader geographical boundary, but they were its center, with the Greek kingdom of Macedonia.

During the Mesolithic and the early Neolithic Age, after the "Neolithic Revolution", the first systems of agriculture and livestock-breeding have been developed. That had allowed the permanent provision of food and permanent facilities in the temperate regions of the eastern Mediterranean. In these areas the human societies have developed in population and geographically.

Right after the first settlements in Mesopotamia in 3000 BC permanent facilities were created by social groups in Phoenix, Egypt, but also on the Balkan peninsula of Europe, in Greece. In the phase of the creation of the first settlements, humans developed intellectually and created languages. The human genus then began to shape programmed elements of standardization. In these early formations the standard theory defines the beginning of the human civilization.

Programmed Standardization’s subjects were no longer recorded and transmitted only with memory, but now with the speech, the unique property of the human race. The intelligent human, from the very beginning of his civilization, chose the optimal method mentally. With the speech gave it further from generation to generation. Then, as an evolution of the imaging method, humans created standard methods of writing. Standardization has now begun to be recorded, and the knowledge had no time limit for maintaining it.

The development of speech and writing has allowed the social groups of the then-known world to communicate widely with each other by exchanging goods, experiences, knowledge, ideas and theories. In this way, with the communication, networks were created, and the human race arrived with scientific discoveries and philosophical movements at the highest level of its development.

Those first Communication Standards which are still recorded to date, we consider to be a protypes inventory. As a characteristic example of those protypes, recorded by speech and writing in Europe, we mention the ancient Greek myths and Homer's written epics. Such a protypation was applied globally until the Industrial Revolution.

Based on the evolutions in the human development in Europe, the scientific research has today standardized the history of the Old World in the Ages: 1) Antiquity. 2) The Middle Ages, 3) The Renaissance, 4) The Enlightenment and lastly 5) The Industrial Age, after the Scientific- and the Industrial- Revolutions. The origin of the Age of Antiquity is in the Balkans and its history is known mainly by the Ancient Greek myths and the first historical record of the ancient Greek and Roman historians. Scientific Research has separated Hellenic Antiquity (which concerns the Balkans as part of their own history) into the Classical and the Hellenistic ages.

The Classical ages have been crucial to human development, but its history is widely known. In this work we will briefly refer to those developments during the Hellenistic period, which are important, for the standardization, for the industrialization, and for the protypation. In the Hellenistic period, and during the two centuries of Macedonian sovereignty, developments in the Balkans were overwhelming and decisive. The ancient Greek Macedonian state gradually faded from the social system of democracy, which all the Ancient Greek states had, in a primitive form of a monarchic state.

On the contrary, the other Hellenic states, which still extended beyond the Balkans, in East and South, retained forms of democracy and occasionally kept-on forming alliances and conquests with each other, keeping-on by this way the Ancient Greek networking. That system of the Hellenistic period's network, typically under the sovereignty of the Macedonian rulers, was gradually in-whole occupied by the Roman multinational state. The sovereignty of the Romans in the then-known world limitates the starting point of today's Europe. The Roman Era of Europe has consolidated the crucial changes in the Balkans and has shaped its present form. At the beginning of the Roman Empire the Balkans, being part of the global Roman state, were not the center any more.

5 THE HISTORY OF INDUSTRIALIZATION

The historical starting point of industrialization is considered to be the mass production of bricks in 3000 BC in Mesopotamia [17]. Then, utilizing their brains, the Babylonians realized that they could build massive bricks using molds that had fixed dimensions. Until then, the residents of Mesopotamia (from the Greek word meso-potamia/land-between-rivers) used, as building blocks, the pieces of solid clay that arose in the summer with the desiccation and exfoliation of the mud from the flooded areas in the winter. By observing this natural phenomenon, Babylonians were taught the technology of baking clay in the sun, which thus gained high strength. By exploiting their brain in more detail, the Babylonians realized that if they placed the clay in molds with fixed dimensions, they could produce work in a much shorter time than it was required when they used the, closer to the desired dimensions, pieces of dried mud.

Those bricks of 3000 BC are considered to be the first industrial product because: 1) They have fixed dimensions. 2) Their shape and dimensions were standardized by the optimal behavior of the product during the use. 3) They were able to be produced massively. According to this logic, at the beginning of the industrialization of Germany, the scientists there gave to the Industrial Standardization the term "Typung" [10], from the Greek word "ΤΥΠΟΣ-Typos=mold", considering that the fixed dimensions that allowed their mass production were ensured by the molds. This view of the German scientists shows that Industrial Standardization has the same starting point and a parallel route to industrialization.

Mass productions with the contribution of standardization were presented throughout Antiquity. A typical example is the Ancient Greek temples, which exhibit standard rhythms, proportions, standard structural parts and forms [17]. The technology for mass production evolved throughout antiquity with gradually accelerated rhythms and matched with the spiritual development of humans. The today's principle of industrialization, however, is considered to have occurred in Eastern Europe, at the time when the standardized historical analysis has defined the Western Europe as being in Middle Ages.

In contrast to the West, in the united administrative unit of Eastern Europe, which was the Byzantine Empire, prevailed conditions of intellectual and technological development. Unfortunately, this growth was slowed down considerably after the Christian religion's character fall back to fanatic [9]. Only in mainland Greece, the antique worship of the personalized nature still existed. At that period of time, Christian fanaticism went on forcing the Greek cities to conversion [9], and the Orthodox

Byzantines christened the neighboring peoples, mainly of Slavic origin. After that the Orthodox Christian religion was established as the only one in power for the whole of Eastern Europe and gradually became authoritarian. The Byzantine Empire, though, essentially relied on the spiritual and scientific dynamics of the Hellenistic Age. So, its development took now a downward course.

At that point of coincidence of the nodes of the multidimensional evolutionary spiral, however, in the middle of the 9th century, scientific research, technology and education had still a high degree of development in Byzantium, alongside with its territorial and economic one. At that time, in Constantinople, the "Ecumenical Teaching College" was flouring. It was the first university in the world, as it had been founded in the 4th century by Great Constantine as "Pandidaktirion (uni-teaching)", and since then it was active almost uninterrupted until the fall of Constantinople to the Ottoman Turks in 1453.

At this point the coincidence of the multidimensional spiral of evolution, the first split and division of the societies of Eastern and Western Europe came up. It was the "Small Schism" of 867 AD between the Orthodox East and the Catholic West, which came from the demand of Pope Nicholas 1st for primacy over the other 4 Patriarchates. At the same point of coincidence of the 9th century AD there has begun a period of developments in Europe that has shaped the industrialized Europe we know today. The importance of this period and of its role in shaping the industrialized Europe is dramatically devalued. Stressing its key-role, we shall define the ages 8th to 13th AD as a special era of the European evolutions and we will call it “the Crusades Ages”. At the beginning of those Crusades Ages, the first industrial unit in the history of mankind was created in the Byzantine Thema (territory) of Venice.

It all began in 8th. Century in the islands of the Adriatic now designated as the Italian “Regione di Veneto”. The gender of the Venetians had come in the early 6th century AD from the Baltic-sea and Poland to the Roman Empire, and was then established in today’s Lombardy. The Venetians were then pushed to the islands by the Lombardi (Lango-bardi = long-beard) a German race that invaded the Western Roman Empire in 570 AD. When the Lombardi occupied the Byzantine Exarchate of Ravenna in 751, Byzantine refugees were added to the population of the islands, and the Thema of Venice was formed as a Byzantine stronghold and commercial center in Western Europe.

The rapid economic and intellectual development of Venice then, combined with a relative autonomy from the authoritarian administrative system of that time Byzantine state, created the conditions for the technological achievement of an industrial unit. The first industrial unit of mankind was created then by the Byzantine trade and construction unions of Venice, on the banks of the islands’ central canal. There were built workshops, warehouses and commercial units, covering all aspects of shipbuilding and maritime trade.

When Venice evolved from a Byzantine Thema to the first republic of contemporary Europe, the primitive byzantine industrial plant was redesigned and fully organized. Thus, the so called “Arsenale Nuovo” was formed, an industrial complex of mass production and distribution of the Venetian “Serenisima Republic". Arsenale Nuovo was essentially the concentration of the Venetian state-industry, networked into a single unit. We consider this as an Industrial Protype for the Post Industrial Era.

During the period from the 9th to the 13th century AD, the events in Europe have shaped the evolutions of the European industrialization. In Eastern Europe, the Byzantine state despaired to an Eastern-style monarchy as, among other things, the decentralized administrative system of the Themas was abolished at the end of the 10th century AD. The loss of democracy in the socio-economic system affected directly the intellectual and scientific development of Byzantium. Within a few decades, a great deal of scientists and intellectuals migrated to Western Europe, mainly in Italy. At the same time, the state lost its defensive power, the “Akrites” of the Themas, replaced by a mercenary army.

This mercenary army suffered in 1071 a humiliating defeat in Matzikert of Anatolia by the Seljuk Turks, who conquered after that the rich areas of Asia Minor. When the Seljuks (enriched popularly by Asia Minors who changed voluntarily faith to Islam) came to besiege Constantinople, Alexius 1st Komnenos, who was then on the throne of Byzantium, instead of organizing the defense based on the peoples of the Empire, preferred (acting as an Asian monarch) to seek help, in 1095, by the Catholics of Western Europe. Then Pope Urban II organized the first Crusade.

Of the approximately 14 Crusades that followed up to the 15th century AD, the 4th was decisive for the evolutions of the industry in Europe. In 1201 Pope Innocent III declared a Crusade “for the liberation of the Holy Lands”, but truly for the involvement in the internal affairs of the Byzantine state. During that Crusade, on April 12, 1204, the allied Catholic army invaded the Byzantine naval base with the help of the Venetian fleet and took over Constantinople despite the desperate defense of the mercenary troop of the “Varangi”, as the Byzantines called the Vikings of the East.

The unprecedented phenomena that followed and were recorded by both the Orthodox and the Catholics changed the course of Europe's industrial development completely. For three days the Crusaders did any possible crime. The West Europeans of that time committed massacres of all ages and leaves, as well as rapes, looting and destruction of buildings, heirlooms, scientific material etc. What has completely disrupted the industrial evolutions, though, is that the West European countries that participated in the Crusade shared not only the territories and the sublime riches of Byzantium but also its industry. All Byzantine units of industrial production and commerce were stripped. They were then moved to the West, mainly to Italy but also to France, to Flanders (Belgium), etc. Together with the Byzantine production- and commercial-units, the West-Europeans shipped to their countries also the total populations that organized and operated them, striping Byzantium from industry, industrial manpower, and know-how.

With the establishment by the Catholics of the entire Byzantine industry in the West and its operation with the Byzantine know-how transferred by the enslaved Byzantines, combined with the presence of immigrant scientists and artists from the Byzantine provinces, began in Western Europe that what its historians have defined as "Renaissance”. In this way, while the Balkans, as a Byzantine territory dwelt in Middle-Ages, in the Catholic Europe the arts, sciences and socio-economic structures were developing rapidly. This created the conditions for the European Enlightenment, as well as the Scientific- and the Industrial- Revolutions, which define the beginning of the Industrial Era. We emphasize here that without the conditions we mentioned, the European Enlightenment and the Scientific Revolution would not develop, nor would the Industrial Revolution take place.

On the other hand, at the pre-industrial Western European countries existed already standardization elements, which contributed to the rapid development of Europe's industrialization, combined with the know-how and scientific knowledge transferred from the enslaved Byzantium. A main role for Europe’s social models during its industrialization was played by the Enlightenment. The philosophy of Enlightenment liberated Western Catholics from the religious fanaticism.

The basic principle of the Enlightenment was that God and nature is the same thing. This faith has guided the Western Europeans to the position that they were closer to the Greek Antiquity than to Christianity. At that time there was a radical change in Europe on the perception about Ancient Greece from that which the Christians of the Middle-Ages had. In this way, for the first time in human history, there was a revival of human achievements, which were considered to have been permanently lost. In this way the Ancient Greek spirit of Democracy became the spirit of the Industrial Age in the early stages of the European industrialization

As another example, of the existing of standardization elements at the pre-industrial Western Europe, we refer to the pre-processing method used for the Crucks (wood carpets) at the Pre Industrial Era in England [18, p. 15]. Moving on after the know-how of Crucks, British carpenters had built in 1624 a house of pre-assembled wooden frames for a fishing fleet. We know that this prefabrication was transported by English fishermen to America and assembled, dismantled and reassembled continuously at the various fishing spots of their fleet.

Having the English know-how from the Crucks, occurred in the USA massive prefabricated woodwork buildings, after the Industrial Revolution. The first constructions of industrialized building in unprecedented numbers appeared at the influx of gold miners in California at 1848-49 and during the American Civil War. In the Eastern States was developed right after that the industrial production of the "houses of postal orders" and the first houses of self-construction [18 p. 15].

Another important element for the evolutions in industrialization is the "Measuring Standards". The development of Measuring Standardization has been slow in Europe, although the human counting ability has been preceded to the ability of speaking. Although in antiquity the Romans had some rudimentary elements of a uniform standardization of measures and waits, the beginning of the Measuring Standardization in Europe is considered to have taken place in England at 1120, when King Henry 1st designated his arm as a single measurement-unit for his territory, and as subdivisions 45 fingers called then inches

As an outcome of these evolutions, came the "Industrial Revolution". It was so named at the end of the 19th century to separate its techno-economic characteristics and motives from the social motives of the French Revolution The invention of autonomous moving vehicles, using energy generated by steam pressure, is considered to be the starting point of the Industrial Revolution. Although Heron Alexandrephs had built a reaction turbine for water vapor production in the 1st century AD, a first steam engine that transported piston movement was built in 1712 by the Englishman Thomas Newcome. However, as the first locomotive inverter is considered to be the Scottish engineer James Watt. Watt's steam locomotive industrialized as first the textile industry and the building [17].

Industrialization evolved in the years1760 to 1860 in Western Europe through which it had as a common denominator the development of standardization along with the development of the industry. After the first industrial production of iron in 1750 and with the know-how from the wooden prefabrications, the metal industrialized building was developed [16], with best known Joseph Paxton's prefabs such as the “Crystal Palace”. The metal prefabrications were initially huge individual buildings, where for the first-time were applied methods of multiple uses, interchangeability, production’s automation, dimensional consolidation, accuracy, mechanization and unification [18]. Soon then, after the building, all branches were industrialized.

Unification results from Simplification and is accompanied by Interchangeability. The completion of this area was done by the American inventor Eli Whitney. Whitney won a Contest of the US Congress, in the late 19th century, to build 10,000 rifles for the army. He had not only submitted a financial offer, but also a mass production plan that first reported 3 innovations that are considered essential components of Quality Standardization: Drilling by templates (patterns), filing by jigs (guides), milling irregular forms. After the application of Whitney's industrial method began the mass production in the United States.

Another sector where Unification was applied in the US was in the first motorized vehicles, the railways. The railway rails did not initially have the same openings, each wagon- and locomotive-industry had built its axes according to its own specifications and there were differences in facilities all over the USA. Although President Lincoln had set up by decree a 5-foot-foot rail, it was never applied. Only when the producers of railway material met for a long time, they decided to have the uniform dimension of rails at 4 feet and 8.5 inches. Following this producers-decision for Unification, the development of railroad transport skyrocketed, the whole state territory was covered by railroad networks, and the USA became the compact state we know today. The situation in the USA prior to Unification still exists today, though, in countries such as Greece.

In 1875, an International Conference on Weights and Measures was held in Paris, which is considered to be the first formal organization of a congress for standardization. At the International Conference of 1875 the 17 out of the 19 participating countries adopted the “Meter” (the Greek word for measure) as the unit of measurement. They also decided to establish the "International Office of Measures and Weights", with a permanent seat in Paris. The French Government granted land for this purpose in the park of St Cloud, and proclaimed that land as an "International Area". The international center of measures and weights is there, in France, until now.

Along with the timber manufacturing sector, Measuring Standardization has shown significant developments in Western Europe in the brickwork and ceramics construction sector. In England of the 18th century and after the first industrial production of high strength’s bricks there, which gave possibilities for high buildings, the evolutions advanced the development of correlation systems. In the 19th century, had begun efforts to standardize the sizes of bricks in Western Europe and the creating of standardized proportions for on-line production. Then, the "appropriate dimension" was defined by the opening of the human palm, and hence the definition of the "Basic Dimensions" of breadth, height, length. This developed the dimensional "golden rule," to be the length twice the width and the width twice the height plus the joint.

In Western Europe, following the dimensional golden rule, the Measuring Standardization of the walls and the openings was formulated, having as module the standardized brick [17 p. 193]. In order for the Measuring Standardization to be applicable in the construction, a "dimensional organization" was then required to avoid differentiations between the planning, the production and the composition of industrial products. So, from the industrialization in building, came out the "Standardized Correlation" [17 p. 196].

In France of the Enlightenment presented the first elements in the field of Correlation Standards. There, the Secretary of the French Air Transport Committee, Captain Charles Renard, simplified in 1870 the 425 different balloon rope cross-sections in 17 standard sizes, inventing the "Preferred Numbers" which are called in France "Renard Series". In Britain, the English engineer and tool maker Joseph Whitworth, came to a similar discovery, when he recognized in 1830 the need for candles to have perpendiculars to the cross-section of the candlesticks. He had then for the first time defined the “Interchangeability”.

The first, consciously done, step for an interchangeability-method is reported to have been made in the US in 1935 by A.F. Bemis [17 pp. 200-201]. Based on Bemis's book "Rational Design-The Evolving Housing", the "Cubic Modular Method" was created in the United States with a grid. On the basis of the Cubic Modular Method and Bemis' research, the American Standardization Association-ASA and the “Association of Modular Services” developed the Plan A6.2. in 1936. Since then, the production and the logistics of the most American items is done on the basis of the Cubic Modular Method’s application [18], which we believe to be the culmination of the evolutions in Measuring Standardization

Mathematical models and numerical series have evolved in the standardized correlation. This resulted to the "Preferred Numbers" and from them the "Standard Modular Correlation". The most commonly known method of modular correlation is the Modulor of Le Corbusier based on the Golden Section of Ancient Greeks. Most known mathematical series are also the ANSI Z17.1 standards and the Normzahlen of DIN [17 p. 199].

This same J. Whitworth of Interchangeability, in a Paper presented at the British Institute of Civil Engineers, proposed the adoption of unification of the screws’ bolts for the whole of Britain. He is so considered to have given the first definition of “Unification” in Industrial Standardization. The evolution of standardizing the properties of the screws, this most characteristic industrial element, was particularly slow. Only in 1948, at the end of the Second World War and after 30 years of negotiations, the English speaking US, UK and Canada, have decided to adopt common screws shapes for their industrial products. Even today, though, there is no international unification of screws.

General industrialization brought also radical changes to the Western Europe’s socio-economic organization and had two-way influences with socio-economic elements that coincided with the time-point of the multidimensional evolutionary spiral. Here, we will only refer to the English "Fens Act" because it played a decisive role in the development of industrialization. The royal “Enclosure Act”, started at the16th century, had devalued England’s farmers and breeders. The rural peoples of the kingdom, who lost the pastures and the sources of wood, moved to the cities and formed the first industrial proletariat.

In the early stages of industrialization, women and children were the main workforce, as machines did produce without requiring muscle strength. So, the males, who did not want to work as employees of others, became unemployed, while women found work and gradually became independent, changing the English pre-industrial social models.

The 20th century was the Golden Age of Industrial Standardization. Soon after the first applications in mass production in industrial plants, the Industrial Standardization expanded to other areas of human activities. Within a few decades there were no longer any human activities or actions that were not industrially standardized.

After the scientific engagement with industry and standardization at the turn of the 19th century, in the early 20th century all the then industrial-developing countries established standardization bodies with which the rational organization of industrial production and distribution was coordinated [3]. A milestone in this evolution was the 1st World War, which we will call the "1st Industrial War". Prior to the 1st Industrial War, standardization-bodies were established only in Britain and the United States. It is no coincidence that these two countries have played then a leading role in the development of Industrialization, and that they consolidated English as the language of globalization.

For the needs of our work, we list here, in chronological order of their founding, the national standardization institutions of the Industrialized Countries which formed the main stream : 1) United

Kingdom, “British Engineering Standards Association”, 26/02/1901, 2) USA, ”National Bureau of Standards” 3/03/1901 3) The Netherlands, “Central Standardization Committee-HCNN”, 1916 4) Germany, “German Industry Standards Committee-NADI”, 22/12/1917 5) Japan, “Committee of Measures, Weights and Engineering Standards”, 1919 6) France “Permanent Committee on Standardization-CPS”, 1919-20. Industrialization spread out right after the 1st Industrial War in Europe (Western and Eastern with the Soviet Union), USA and Japan [16 pp.22-29].

The then industrialized nations proceeded with their national standardization bodies to the establishment in 1926 of the “International Federation of National Standardization Associations”, known as ISA, an international standardization body "to bring order to internationally expanding chaos by lack of standardization” [16 p. 31]. Gradually, throughout the century, all countries of the world acquired standardization bodies and proceeded to the industrialization, and after the 2nd Industrial War the International Organization for Standardization was founded [11]. It is widely known as ISO, because its founders have put the initials in such an order that they form the Greek word ΙΣΟ=equal, to point out the identity of democracy and standardization concepts.

After these evolutions in industrialization, modern industrial systems were defined as "the complete integration of all structural subsystems and elements into a wider evolutionary process, which takes full advantage of mass production, transport, and industrial assembly methods" [17 p. 18]. We will add to this definition, the industrial methods of reuse and of recycling. All these methods have given a great impetus to the industrialization of the industrializing countries and have increased to an unprecedented extent their possibilities of mass production in the short-term.

6. QUALITY: THE STORY OF AN IDEA

The three general principles of a development in the last stage of the Industrial Era, that of globalization, are: "Improving productivity by improving quality. Reducing costs. Securing markets by competitiveness”. The general target of the Industrialized Countries after following these principles is “to secure and maintain the markets, and so ensure the industrial development and the jobs" [4]. As a result of the applications of such principals and targets from the dozens of today’s Industrialized Countries, is the worldwide astronomical numbers of products and services and the super repletion of the global consumption.

This kind of extreme and total industrialization caused worldwide severe economic and social crises over the last decades [14]. Due to the globalization, these crises have dramatically affected the whole Planet, and caused destruction of the natural environment, poverty and marginalization of entire populations, as well as a number of local wars, actually to secure the, needed for industry, raw materials. With the rapid industrialization of the Planet, and mass production in unprecedented dimensions, unexpected problems and escalating socio-economic crises have resulted. The problems of industrialization are more visible there, where industrialization has taken on the largest extent. In one of them, the USA, was born in the 1920’s the idea of “Industrial Product’s Quality”.

"Quality" has prevailed to refer in the Industrial Standardization for the "Quality Systems" developed in the second half of the 20th century [4]. The term "Quality System" is considered to have been given by the American Dr William Edwards Deming to the statistical control method of the industrial products which was created by Walter Andrew Shewhard and was then completed by him.

The quality systems have revolutionized industrialization. We additionally believe that they also define the transition from the Industrial- to the Post-Industrial Era. However, from the Shewhard-Deming’s method to Juran, Feigenbaum, or Ishikawa, the “Quality Management Systems-QMS” essentially concern the improvement of the quality of the industrial products and services only. Because, though, indirectly and in only a few cases QMS have to deal with quality cases on human issues, we integrate the quality systems at the beginning of the Post-Industrial Era.

At this point, we should make a separation of that Quality which has been formulated in the Industrial Countries, as the culmination of the evolutionary process of Industrial Standardization, from what we believe to be shaped by the through-time evolutionary processes in the Earth's environment. We will define the quality of industrial products and services as "Quality Standardization" and the quality of the environment as "Quality Protypation".

As a prime example of the interconnection of quality with protypation, we mention the first human intervention in the natural environment by designing the technical environment of the cities. It was in 479 BC when the "Father of Urban Planning" Hippodamos (498-408 BC), Architect, Physicist, Mathematician, Meteorologist and Philosopher, undertook to plan the erection of his homeland Miletus after its destruction by the Persians [18]. Hippodamos knew as a socio-economic model the democratic system that all the Ancient Greek states had. In ancient democracies, all citizens were considered equal, within a framework, though, of specific rules. Those democratic rules, however, left room for tolerance that allowed citizens to diversify and develop their skills, everyone in his own sector.

On the basis of these democratic rules, Hippodamus designed an "Ideal City", which had in its center not any land for palaces but land for socio-economic activities of all citizens. Also, on the basis of the model of equality in the rights, equal plots of land were foreseen for all residents, squaring the streets and the land. In every plot that was given with lottery, every citizen could erect a building, of his own liking, however, according to his character and needs. Thus, Hippodamos created the “Kanavos”, the canvas, an important element of the post-industrial Protypation of Quality.

From antiquity to the Industrial Era. The most important field for the environmental quality is “Safety”. At the beginning of the 20th century America, having rich experiences from steam-engines in land and water, achieved remarkable achievements in safety quality. In order for the steam-engines to provide enough power to drive heavy vehicles and ships, huge pressures exerted. The uncontrolled spillage of pressure caused long-lasting accidents, such as the explosion of the “Sultana” steamer on the Mississippi River, with 1,450 deaths. With a view to quality in safety, the American Society of Mechanical Engineers has organized a committee to formulate standard specifications. The “Boiler Code Committee" gave then out a work, on which the “National Boiler Code" was based and the high quality of security in the USA, with all its extensions to occupational safety [1]. There are hundreds of safety standards in the USA today [12].

High quality in this field has been achieved in the USA in areas which are indirectly related to safety, as Interchangeability. After the Baltimore fire of 1904, the need for fire extinguishing interchangeability was perceived. Then the fire units arriving from the neighboring cities remained inactive because their firefighting equipment did not fit. So, in the following years Unification Standards were developed for the fire-fighting equipment by the US National Fire-Protection Association

Until 1924 mass production was made in the USA by unskilled workers who, handling machines in a small part of the production process, had to produce a large number of products with devastating working conditions. Workers were strictly monitored by inspectors to ensure maximum performance. The products were checked by those inspectors to identify defects, only at the end of the production line when they were completed. The whole production and control process were recorded by statisticians to determine employee performance, the quality of the product and the specific production line.

This production and the control system at the end of the production line did not prevent mass production of defective products. In 1924, W. Shewhart, an American Statistics Engineer, carried inspections from the end of the production line within it and trained the workers to check for themselves the products they produced, instead of the inspectors to do it. W. Shewhart's work was developed by Deming, Dodge and Roming. Deming named their work “Standardization of Product’s Quality”.

Schewhard’s revolutionary change in the route of industrialization was that he diverted the inspection process. When Schewhard replaced the inspection of the inspectors by the inspection of those who did the production’s activities, he gave the initiatives to the working citizens. This procedure enacts the needed feed-back of the theory by the experience in praxis and proves who from all those engaged is capable for the specific action, and who not. For the control to be credible, Shewhard’s quality system was designed to train the workers. This proves that he had realised that in order to be able to carry out his duties, the working citizen must have completed the needed information.

Globalization has been established in the 21st century, and the same order of things prevails across the globe. This order of things is written in written rules, as they were throughout the evolution of the human race. As the written rules of globalization are considered to be the standards of international standardization. These international standards are summarized in the final form of Industrial Standardization, the Total Quality Management-TQM

The so named Total Quality Management (TQM) emerged as the last stage of Quality Standardization. The international standards are summarized in the Total Quality Management-TQM. The term “total” still refers though to the industrial product only and nothing else out of that. Additionally, since the beginning of the developments, the quality standardization has been shaped mainly by the English-speaking people with British primacy at the beginning and after the United States.

TQM was first fully implemented by its creator Deming in Japan in 1950 [12]. With the teachings of Deming, as well as of Juran and Feigenbaum, the Japanese industry evolved in the 1950-1960s from the ruins of the Second Industrial War to the world's second economic power. These achievements of the Japanese industry are the result of the planning of the “Japanese Union of Scientists and Engineers-JUSE”, which was founded in May 1946. JUSE knew Deming and his works in the USA, so the Japanese scientists and engineers (and not the official Japanese state) invited him for lectures in Japan. The first lecture of Deming titled “The Statistical Product Quality Administration" was held in August 1950. Since then the American know-how on TQM began to be passed on to the Japanese.

The term “total in TQM still refers, though, to the industrial product only and nothing else out of that. Additionally, since the beginning of the developments, the quality standardization has been shaped mainly by the English-speaking people with British primacy at the beginning and after the United States.The transmission of the American perception of such a standardization of quality became very rapid in the 1950s. Deming travelled to other war-damaged countries too, such as Germany and Greece, in an effort to help them rectify their economies with the development of their industrial production. The Germans, capitalizing in parallel their experience in industrialization, achieved respectively with the Japanese achievements.

The American TQM perception is followed today by all those countries that have so far completed their industrialization. The path of the development of industrialization and of the Quality Standardization had from its beginning many arms, and soon the initiative in its individual sectors was distributed to more industrialized countries. Gradually, though, the democratic spirit was downgraded, as globalisation progressed. The rapid industrialization and mass production at the whole Planet, these unprecedented dimensions of industrialization, resulted the forecasted unexpected problems, escalating socio-economic crises and lack of quality.

7. CONCLUDING ASSESMENT

The problems of industrialization are today all over the world, with the damages to the natural environment and the climatic changes. The scientific theory for the future of Earth makes it clear that humans have brought out damages of such measure to the Planet, that it is impossible for it to recover. It is impossible to bring back the friendly for Homo Sapiens environment, after the results of industrialisation.

Many scientists have investigated the causes of this ongoing system-crisis, including Deming, who wrote the book “Out of the crisis” in 2000. But none of them went back to the roots of the causes of the unprecedented magnitude and duration of the global crisis that are now proven to threaten the survival of the human race on Earth. We will try to follow a methodology that other researchers did not follow. Viewing the current state of humanity and its entire developmental path, we can recognise its distinctive differentiations of today’s humans from their ancestor Homo Sapiens.

The Industrial Man, the "Homo Michanovius" as we shall define him, has virtually abandoned the upright stance as he moves and lives most of the time seated. He no longer lives in societies but on his own, in an artificial world unrelated to the reality of the Planet’s nature. Homo Michanovius is a negligible unit which only attends events, within a huge crowd, like in a herd, with no ability of participation, having a wrong team's illusion. He has drastically reduced his vocabulary, to the point where Homo Michanovius’ younger generations are unable for personal and live communication. Homo Michanovius presents the phenomenon that he cannot even fulfil the preconditions of life, those that even the prokaryotes of prehistory had.

Homo Michanovius also sub functions his brain, because he has a huge variety of mechanical support and tools at his disposal. This evolution has led to the regression of Humanity at a stage far behind Homo Sapiens and Homo Ergaster, even from the most primitive stage. Homo Michanovius has regressed even back from the Australopithecus stage, as he does not feed on himself from the nature, but with mutant agricultural and livestock products whose production chain is disturbed. Still Homo Michanovius does not follow the natural rotation of his diet, depending on the seasons, but is fed with a random switching of all-time products.

Due to these developments of the Homo Michanovius, and of the agriculture and logistics' industrialization, the cost of food products has been heavily burdened by handling costs, while their actual quality has been dramatically degraded. Even greater are the damages that have been caused to the Planet from Homo Michanovius' evolutions. The industrialization of agriculture, livestock and fishing has led to a general overexploitation of the Planet's natural resources. Today it is estimated that Homo Michanovius has already led 70% of the species on the planet Earth to their disappearance.

As far as the Technical Environment is concerned, with the industrialization of building and the over-construction of the Planet, the Technical Environment has overlapped the Natural one in the industrial countries. This development has dramatically altered the climate in the places where humans live and alongside the safety's quality. In Artificial Environment, however, it is not just real estate but also the mobiles. Homo Michanovius' motoring with mineral products, which bring toxic waste, has caused huge damages to the quality of the natural environment. At the same time, the industrial production of such motorized vehicles, which is the key-element of the economies of the Industrial Countries, has increased to a large extent both the number of the means and their encumbrance and alterations to the natural environment.

The main factor, thought, which led the humanity to the lip of extinction, and the Planet to the disaster of its human-friendly environment, is the evolutions which came out from the industrial way of life. The industrial way of life brought the human-living to lose its quality and caused unexpected dangers and disasters. In general, Homo Michanovius' interventions in the natural environment have caused huge disasters on the Planet which are even a risk for humanity's survival.

To find the way to deal with these dangers for the humanity and the Planet, we need to analyze this industrial way of life today and the principles that govern it. The antidote will then be a planning and a programming in the opposite direction. The unprecedented global crisis we experience today is a unique opportunity for the humanity to control random evolutions and plan them by itself as well as to programme its own development. The Homo Michanovius can evolve today into a Homo Postindustrialis by using again his brain and return back to the beginning of the multidimensional spiral of his development.

Homo Postindustrialis has now, though, the precious experiences from the evolution of technology since the time of Alexander the Great, and of the hole Industrial Era, which Homo Habilis did not have. The ever-increasing global crisis at the end of the Industrial Era can work in this way positively for the Post Industrial Era's planning, since humans can now perceive the impassive course of industrialization. Exploiting the imagination of his brain, Homo Postindustrialis can now realize the absolute destruction that industrialization could bring about at its ending, by even the disappearance of the life-giving Sun from the Earth.

Modern humans are ready to design and plan the Post Industrial Era's Quality Protypation after the dramatic negative experiences from the last stage of the Industrial Era. A large number of Industrial Standards are available, which can be used as "negative standards" in the design of the Post Industrial Quality Protypes. With this conception Homo Postindustrialis can find the appropriate method of adapting successfully to the changes in the natural environment by planning after their opposite the Post Industrial Era's Quality Protypation.

Some such useful data of Industrial Standardization are: 1) The negative standard of mass production and logistics by multinational units, 2) The negative standard of lack of essential participation of the citizens in planning and decisions, 3) The negative standard of economic and societal rules determined by a limited circle of participants in the world's establishment, 4) The negative standard of local societies' failure to influence decisions on local economic, social, cultural and scientific development, as well as their quality improvement, 5) The negative standard of global education with the logic of multiplying the Industrial Standardization, 6) The negative standard of transmission of knowledge in strictly standardized frameworks, without the possibility of the individual for a personal processing and adaptations, 7) The negative standard of indirect or even direct enforcement of the Industrial Standardization by the Industrialized Countries, 8) The negative standard of poor information to consumers, which results to their deception.... etc.

Examining the impact that the quality system of Schewhard-Deming has had on humanities development, it comes out that its reflection was consistent with that of the Industrial Revolution. When Schewhard replaced the inspection of the inspectors by the control of those who did the activities and gave the initiatives to the working citizens, Shewhard's system proved to have same characteristics as the system of Democracy of the Ancient Greeks.

If we accept that Total Quality Management refers not only to industry, but to all the activities, actions and environments on Earth, the idea of quality is essentially the same as that of Democracy and Protypation. At first these subjects show the shape of circles, as it should actually be. However, in both the Ancient Greek Democracy and in Schewhard-Deming’s quality systems the circle was not complete. The key-word in the post-industrial Total Quality Management is also control, but the basic factor is who controls whom. In the “Democratic Total Quality Systems” there must be a procedure where the controlled has the opportunity to control the controller and vise versa.

The procedure of Democratic TQM enacts the needed feed-back of the theory, by the experience in praxis, and proves who from all those engaged is capable for the specific action, and who not. In the post-industrial Democracy the last controller is the citizen. A citizen, though, who will have all the needed information. For the control to be credible, as Shewhard found-out, the working-citizen must have completed the needed information.

It proved wise that Schewhard choose to train those who were already working, instead of teaching those to work in future. The information provided by the training is more complete than that of a priory education [4]. Education provides information to the students only on the theory, while the training is done to those who have already some practical experience. Another advantage of training is that it has to keep in touch with all the developments throughout the duration of the relative activity [2]. So, we are talking about a life-long training. In this case all the up-to-now knowledge and experience of the Industrial Countries’ standardization and quality systems can be exploited.

8. PROPOSALS FOR A BALKAN VISION

The citizens of the Balkans can exploit much more effectively the up-to-now knowledge and experience of the Industrial Countries than the peoples of them. Apart from the low level of industrialization, which the Balkan Countries have, apart from the national protypes from the still alive local traditions, the peoples of the Balkans live in the same natural environment where the unique culture of the Ancient Greeks was developed. As we have mentioned, the environment is the key factor for the formation of all living creatures. It determines their evolution and their development or their disappearance, depending on the possibility of adaptation to its changes. Thus, the Balkan people, having as a common environment, the same where the Ancient Greek Democracy was created, could be developed to Homo Postindustrialis, if they succeed their living to adapt to their environment. But if the citizens of Balkans follow the stream of the industrial way of living, alienated from their natural environment, they will evolve also to Homo Michanovius, and disappear.

The modern Balkan peoples, having the same natural environment as the Ancient Greeks, can better understand the unique human protypes that they have created. They can also realise today that the Ancient Greek socioeconomic model of Democracy has not been revived by the Enlightenment, but by Shewhards quality system. Having in mind the quality system principals, the people of the Balkans can, by following their Quality Protypes, surpass the Industrial Era and go straight to the Post Industrial one. However, to complete the process of transitioning to the Post Industrial Era, the Balkan citizens must study scientifically the Archaeo-Hellenic system of Democracy and the industrial quality systems.

In most of the Balkan countries exist pre-industrial circumstances. Because of that, the Balkans are today at an advantageous position, compared to the rest of Europe, which is industrialized. Here, it is easier to develop Quality Protypes for the Post Industrial Era, starting from the pre-industrial stage. The citizens of the Balkan states can imagine their countries without huge multinational production- or logistics-units and without overbuilt urban ensembles. The citizens of the Balkan countries can shape their own socio-economic system, acting in a continuous and lasting feed-back in the planning, programming, practical application and reclaiming of experiences, in parallel with its direct scientific planning and implementation.

Bearing in mind Deming’s slogan that "quality is free, poor quality costs", quality can be measured in the Balkans by the citizens’ sense of its lack thereof. Today, the majority of Balkan people feel a lack of quality in their everyday lives. This can be used in the design of a post-industrial quality system. Main part of this system should be the citizen’s information by life-long training. The Post Industrial education system in the Balkans must be based on a spirit of life-long training. Gathering knowledge and information from such an educational system, the Balkan people could take their initiatives.

Given that an important part of the Democratic TQM systems is life-long training, and given the great need for thorough and in-depth scientific study and research, it is concluded that the first area where the Balkans should focus in the Post Industrial Era is education. In the Balkan countries, a system of education can be developed by the citizens themselves, mainly after the local needs. Such an educational system operates with a dialogue of teachers and learners (as Socrates did), instead of the sterile inculcation of the industrialisation models to the students by the multipliers of Industrial Standardization [8]. In this way the recording and exploitation of traditional protypes will be cultivated. In the Balkans of the Post Industrial Era, the Industrial Standards will not be imposed, but the citizens will be able to personally choose their own Quality Protypes.

The local knowledge can be utilized in the Balkans, through their traditional protypes-models, following thought a scientific elaboration in the educational and research institutions. Additionally, the Balkan citizens, have today the opportunity to learn about the whole range of the Industrial Standardization and take advantage of the positive experiences of it. Acting after the principal of Shewhard’s quality system, the citizens of the Balkan states will be able to directly control their own activities and actions in their local environment. This direct control will allow the Balkan citizens to shape their own rules for their local society and economy. They can also decide for themselves on future developments in their local social and economic environment.

With such an education, the citizens of the Balkan states will be able to directly control their own activities and actions in their own country. This direct control will allow the citizens of the Balkan countries not only to shape themselves, but also the rules for their local society and economy. They can additionally decide for themselves on future developments in their local society and economy. In the Balkans of the Post Industrial Era, at such logic, the traditional rules of the Balkan peoples can provide models from the social networking protypes which they have. These traditional networking-protypes can be utilized in a Balkan post-industrial Democratic TQM system.

Traditional communication channels in the Balkans can also provide quality standards for a transport-network that will be environmentally friendly and will allow citizens to have regular and permanent cooperation and communication with each other. There are also traditional patterns in agriculture, livestock and fishing which, if researched and studied scientifically, will provide post-industrial quality protypes that will harness and enhance the Balkan natural environment.

Business sizes are in the Balkans -over their vast majority- of small to medium-sized ones. However, in the Post Industrial era, small business sizes may have considerable advantages, turning into a model for dealing with them in the Post Industrial Era. As a common denominator of the problems of small businesses, they are considered to be their finances. In the business sector though Balkan entrepreneurs can, with the appropriate training, form networks and so reduce drastically the costs. By their networking with the education-research and training sector, the Balkan SMEs can also achieve the qualitative upgrading of their products and services [4].

The establishment in the Balkans of multidimensional networks of production-handling-consumption, education-research-training and governance at all levels can also be achieved, if they have common Democratic TQM systems. Having common Democratic TQM systems, the Balkans can build multidimensional networks in all sectors of human activities [15]. In this regard, the proposal we table at our 14th Conference is to start the networking of our peoples with a network of the Balkan educational and research institutions. We can start even today with the networking of those Balkan institutions, executives of whom participate in this activity

Our vision for the Balkans of the Post Industrial Era is to create in this region of Europe a model of socio-economic organization where the citizens will cooperate with synagonism and not antagonism. They will use and highlight the natural resources and capabilities of the nature of their close environment and the capabilities of all the citizens. Thus, the Balkans will once again take the lead in post-industrial Europe, working as a European model, like the ancient Greek democracies did.

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Standardized Procedures for the Post-Earthquakes Structures Safety Check on the Base of Collapse Mechanisms Analyses

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ABSTRACT

In the framework of disaster management cycle, the post-earthquake Structures Safety Check (SSC) constitutes a fundamental tool to organize, in a short time, the post event phases (emergency, restoration and recovery), by technical and economic analyses. SSC constitutes a temporary and prompt assessment of the seismic damage on the buildings, based on expert judgment and performed in limited time, by simple visual analysis and collecting information easily accessible. Therefore, it is not a static suitability check and it does not require numerical or test analyses nor it replaces the static and usability test certificates. The SSC aims to verify that the security conditions of the buildings before the earthquake have not been substantially altered due to the damage caused by the earthquake.

In this paper, a prototype of standardized procedure able to assess the post-earthquakes SSC on the base of collapse mechanisms analyses is proposed. It is founded on a logic addressed to estimate possible relationships between the typological vulnerability factors and the potential collapse mechanisms induced by earthquakes.

The procedure is illustrated with reference to the results obtained by the MEDEA ([1], [2]) a tool for damage interpretation in the follow described, and developed analyzing the damage observed on typical Italian buildings by past earthquakes occurred since 1980. In order to show the effectiveness of the approach, the case study of L'Aquila (Italy) is shown.

The procedure is articulated into three sections. The first one contains the identification of the typological features which characterizes the Italian ordinary buildings. The second one contains a catalogue of the main damage observed in the past seismic events on structural and non-structural elements of buildings, associated to possible global and local mechanisms of collapse. The third one is a guide that allows the user to perform training paths designed for safety analyses compiling the official Italian safety form (AEDES, [3]) and eventually expressing evaluations.

The procedure constitutes an educational tool to be used for the training of technicians in charge of emergency checks during the emergency phase (oriented towards the definition of standard evaluation criteria) and / or macroseismic surveys.

The results can be easily adapted to Balkan countries, with reference to the most recurrent buildings typologies and materials of the area.

Key Words: Collapse mechanisms, Seismic structures safety check, Post event phases, Medea procedure.

1. INTRODUCTION

Post earthquake structure safety check (SSC) constitutes the first essential step to adopt after a major earthquake to manage the disaster. The aim of these activities is to quickly inspect and assess the constructions in order to identify which buildings are safe for immediate use mainly in case of subsequent aftershocks, with the aim to inform the habitants about the safety of their houses as soon as possible to prevent secondary disasters. The result of quick inspection provides the basic information to estimate the number of temporary houses and refuge centres necessary for the displaced people.

When a strong earthquake occurs, thousands of buildings may result damaged however new shocks can still occur. Furthermore, the area affected by heavy damage can be so extended that expert engineers are insufficient to make all building safety evaluations within a limited timeframe.

Therefore the success of the inspection depends upon the manner it has been designed and planned in advance.
Indifferent countries, several procedures, able to assess judgments concerning the post-earthquakes structures safety, exist. In the majority of the approaches (Japan, Colombia, USA, New Zealand, Greece), the usability judgement is dependent only on the observed damage, evaluated according to different surveys levels (rapid and detailed). In other countries, instead, the evaluation is correlated with the vulnerability of the building analyzed (i.e., Italy), on the base of structural-typological characteristics, in addition to the observed damage ([4], [5], [6], [7], [8], [9], [10], [11], [12], [13]).
A variety of post-earthquake building inspections are required following an earthquake. Three types are generally considered: the rapid and detailed evaluations, in the earthquake emergency phase, and the engineering evaluations, in the recovering phase [14].
This paper introduces a methodology for post earthquake quick risk inspection of buildings in the emergency phase founded on the collapse mechanisms analyses. It is focused on the identification of criteria and methods able to guarantee an objective evaluation of the damage due to a seismic event on buildings, in order to find out the best correlation between the parameters measuring the seismic action and the impact.
The methodology is inspired by the logic defined by Italian MEDEA tool (Manual for Earthquake Damage Evaluation and safety Assessment), which aims to estimate possible relationships between the typological vulnerability factors and the potential collapse mechanisms induced by earthquakes on masonry and reinforced concrete structures [15].
The logic here described, though a guided path, aims to reduce the level of uncertainty connected to damage definition and the identification the safety assessment during the survey, in the perspective to guarantee the uniqueness of the judgment.

2. THE STANDARDIZED PROCEDURE

The standardized procedure here illustrated, inspired by MEDEA tool, constitutes a useful protocol for the post-earthquakes structures safety check on the base of collapse mechanisms analyses. It can be easily customized for different countries on the base of the analyses of damage induced by past earthquakes.
The procedure is structured so that the user can have a gradual understanding way. In fact, the different sections represent a guided training path able to create in the users, step by step, a sensibility either to understand the typological characteristics of the buildings or to evaluate the damage, which are both very important aspects of the final judgement of safety.
The sections of the procedure concerns the four main aspects described below:

- structural-typological features of ordinary buildings;
- main damage induced by past earthquakes;
- form and the training paths;
- post-earthquakes structures safety check by the safety index (I_S).

2.1. The structural-typological features of ordinary buildings

The first section of the procedure concerns a detailed dictionary of the main terms frequently used in technical and scientific field. The glossary represents a crucial step to define a unified terminology either for the reciprocals comprehension among the technicians or to improve the homogeneity in the structural-typological elements classification and in the damage measuring. Every term of the dictionary is associated to some pictures and graphics, to a descriptive text, and links to other terms in the glossary (Figure 1). Moreover a search of terms alphabetically or by category is possible. The terms are organized into five different categories: a) building and its structural elements; b) structural seismic damage; c) site equipment in the emergency; d) provisional interventions; e) environment.
The second section of the procedure is an archive containing a rich anthology of pictures showing different structural typologies and different levels and types of damages (Figure 2). The picture archive aims to give an essential basic knowledge of the observed damages and typologies in order to improve the capability of interpretation and judgment that the technicians must have during the

post-event inspections that will be tested then in the following sections of the tool. A set of information is joined to every picture of the archive; moreover query either on single information field or on combined ones are possible. This option allows selecting picture subset with specific characteristics, which could result quite useful, for example, in macroseismic survey.

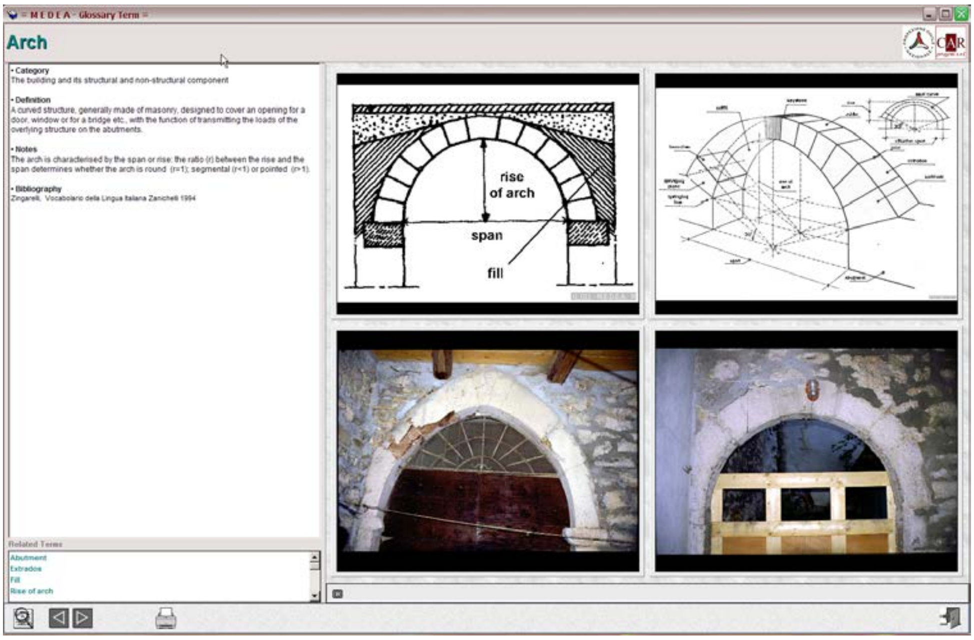


Figure 1: Glossary (every term of the dictionary is associated to some pictures and graphics, to a descriptive text, and links to other terms in the glossary)

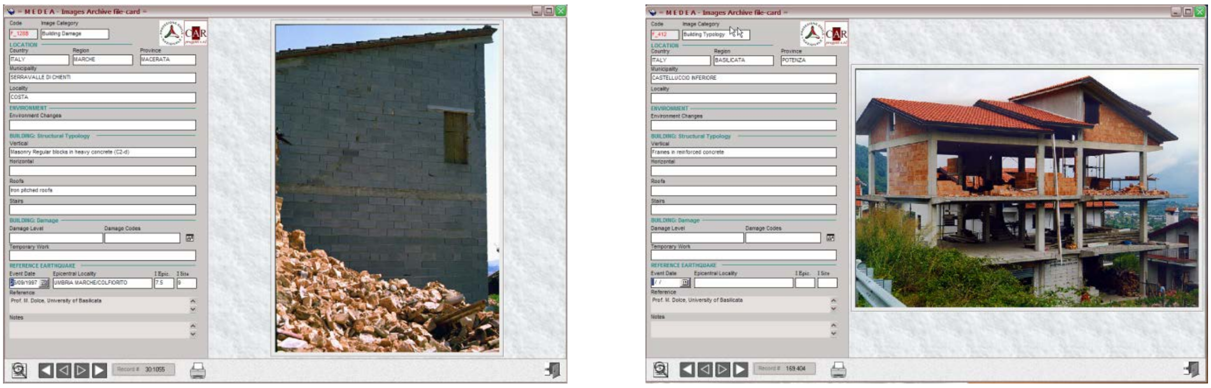


Figure 22: Archive containing a rich anthology of pictures showing different structural typologies and different levels and types of damages

2.2. The main damage induced by past earthquakes

The most important section of the procedure is constituted by a detailed multimedia catalogue of the main damages on structural and no structural elements of buildings.
It represents a further step of fundamental importance in the training of the technicians involved in the safety check in the post event phase. In fact, it supplies to the user a guided path among the basic criteria of the structure behaviour in order to develop interpretation skill on the observed damages.
The damages classification of the vertical structures classes (masonry, reinforced concrete, timber, steel, etc.) is aided by their interpretation as possible collapse mechanisms. Therefore the catalogue is organised on the base of logic rules to address at the most probable mechanism identification.
This section is constituted by three subsections: Collapse Mechanisms Abacus; Damages Abacus; Interactive Training Table.

The Collapse Mechanisms Abacus is an accurate work of synthesis, where the authors try to classify the main recognisable collapse mechanisms for a standard structure. These mechanisms are firstly classified, for each vertical structures class, as:

- **Global mechanisms**: mechanisms involving the structures as a whole and then related to the evolution of the cracks in a sufficient number of elements such that a total compromising of the static and dynamic equilibrium of the structural system is achieved.
- **Local mechanisms**: mechanisms concerned to marginal parts of the structure; their evolution, even if determines the collapse of a single element, generally does not involve the whole structural equilibrium.

For example, MEDEA tool examines the main Italian buildings typologies, made of masonry and reinforced concrete ([1], [2]).
For masonry structures, the "global mechanisms" have been subdivided as follows (Figure 3a):

- **in plane**: these mechanisms occur when the walls of the masonry box, excited by in plan actions in both versus, respond by showing the classical diagonal X cracks, consequent to the formation of diagonal compressive beams. This mechanisms are due to poor tensile strength of the masonry material;
- **out of plane**: damage mechanisms that appear through an out of plane kinematism of one or more walls of the masonry box that, under seismic actions, loses his own original toothing connection between the walls of the facade and the orthogonal ones, possibly aided by the action of thrusting floors and roofs;
- **other mechanisms**: in this category are classified those mechanisms that couldn’t directly be recognized as in plane or out of plane, nevertheless are able to involve the building as a whole, generating the total collapse of the structure (i.e. floor and roof beam unthreading, irregularity between adjacent structures, etc.);

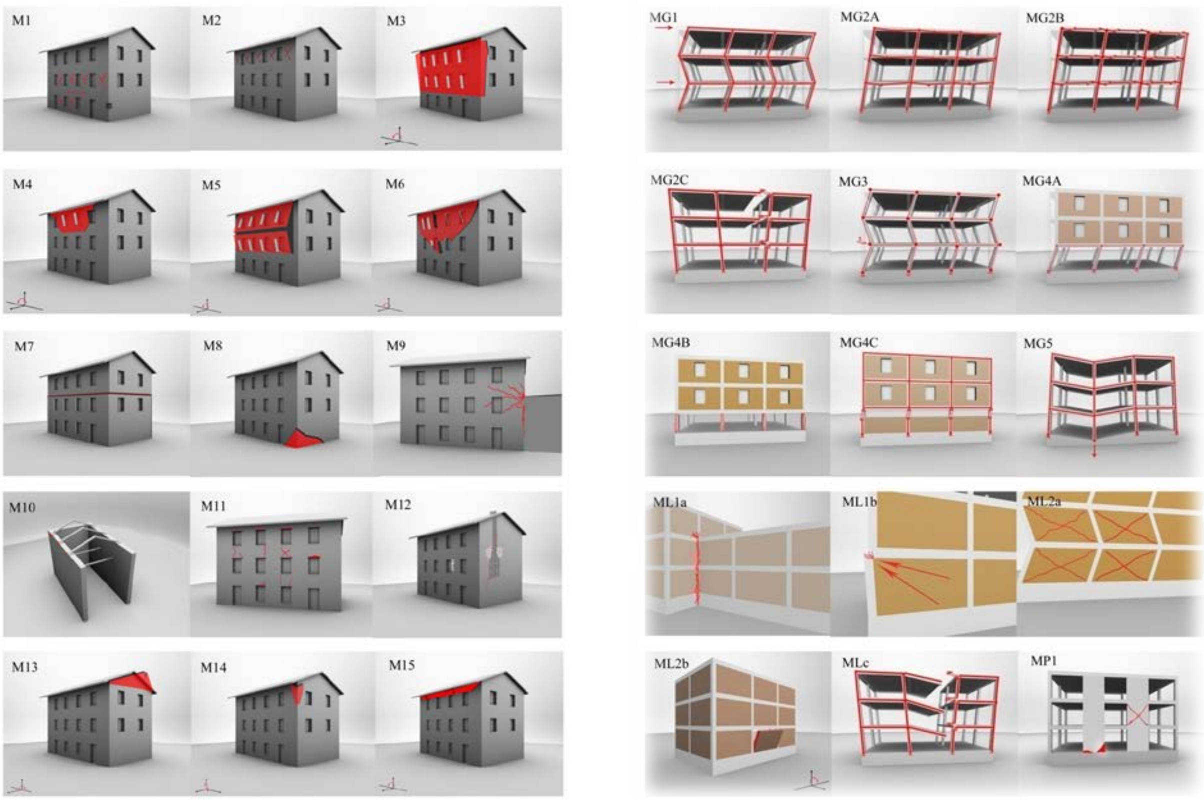
Instead, the "local mechanisms" have been classified as:

- **localized dislocation**: these mechanisms are those, for example, that arise for arch or architrave failure, or in part of the structure characterized by different irregularities, often connected to significant stiffness variations (i.e. non appropriate retrofitting such as R.C. intervention in masonry structure, etc.). The phenomenon generally determines the crumbling and the expulsion of the material in the neighbourhood of the involved part;
- **thrusting elements**: these mechanisms are determined by the action of single elements that produce horizontal thrust on the supporting structures; good examples are the thrusting lements of a roof or the vaults, the thrust action of which is not sufficiently balanced by suitable devices.

For reinforced concrete structures, the "global mechanisms" have been subdivided as follows (Figure 3b):

- **strong beam – weak column**: these mechanisms occurs in buildings characterized by high strength beams against columns with appreciable lower resistance, in terms of their relative ratio compared to the seismic action demand. This causes the arising of plastic hinges in the columns (weaker) instead of the beams (stronger), with the subsequent concentration of inelastic deformation in the pillars. The mechanisms could involve all or several storeys, leading to ruinous collapses as “pancake type”.
- **weak beam – strong column**: these mechanisms occurs in buildings characterized by low strength beams against columns with appreciable higher resistance, in terms of their relative ratio compared to the seismic action demand. The development of plastic hinges in the beams (weaker) prevents from the arising of hinges in the pillars (stronger), therefore the inelastic deformation gather in the beams. The mechanisms could occur for bending in the beams (more ductile), shear in the beams (less ductile) or iron bars unthreading;
- **weak nodes**: these mechanisms occur when the structural frame is characterized by less resistant nodes compared to the actions transferred by beams and columns. The mechanism starts with the arising of diagonal cracks in the junctions up to notable sliding between beam and column. The collapse of more junctions causes the frame lability, the loss of the equilibrium and the subsequent collapse of the whole structure.
- **weak storey**: these mechanisms occurs in buildings with a storey less strength than the others, namely with a demand/resistance ratio significantly different at one level respect to the others. It

usually is due to the lack, at that level, of elements (i.e. infill panels) able to give more strength against the horizontal actions. In these cases, seismic energy is mainly dissipated through the rupture mechanism at that floor;
- **foundation subsidence**: these mechanism occurs when seismic actions involve the foundation level causing a vertical subsidence effects; in these cases the structures show one direction diagonal cracks in the infill panels, tacking out of horizontal alignment in the beams and cracks at the ends, or increasing vertical cracks along the height of the building. In some cases, characterized by high stiffness structural frame and widespread subsidence extension causing, the building could show a rigid rotation or sliding movements.



a) b)

Figure 3: Global mechanisms for: a) masonry buildings; b) reinforced concrete buildings

Instead, the "local mechanisms" have been classified as:
- **structural elements**: in this category are classified those mechanism caused by structural elements producing a localized action in a part of the structure, as the hammering between adjacent buildings, the strut action at the column ends by the infill panels, the floor collapse caused by a large displacements at a junction seat; usually these circumstances are due to a structural deficiency;
- **infill panels or partitions**: these mechanisms are similar to the ones occurring to masonry structures, connected to the poor tensile strength of the material; they could produce in plane or out of plane ruptures,
- **roof collapse**: these mechanisms occurs for the collapse of weak masonry wall supporting the roof or for the thrusting effect in sloping roof.

For R.C. structures, in addition to the previous ones, mechanisms for R.C. walls are classified, taking into account the differences among different structural typologies: single walls (solid or with various openings), double walls, walls/frame.

The collapse mechanisms are summarized in a Damage Abacus, which provides, for each single element (vertical structures, horizontal structures, stairs, non structural elements), a classification of the main damages that may be found by an observed survey.
Every damage type is described by a specific form containing notes, iconographic review showing different damage levels following a predefined scale (Figure 4). The basic idea is to create a tool to assist macroseismic assessment and the surveyors to better compile the sections of the safety form concerning a synthetic evaluation of the damage level for the structural component analyzed.

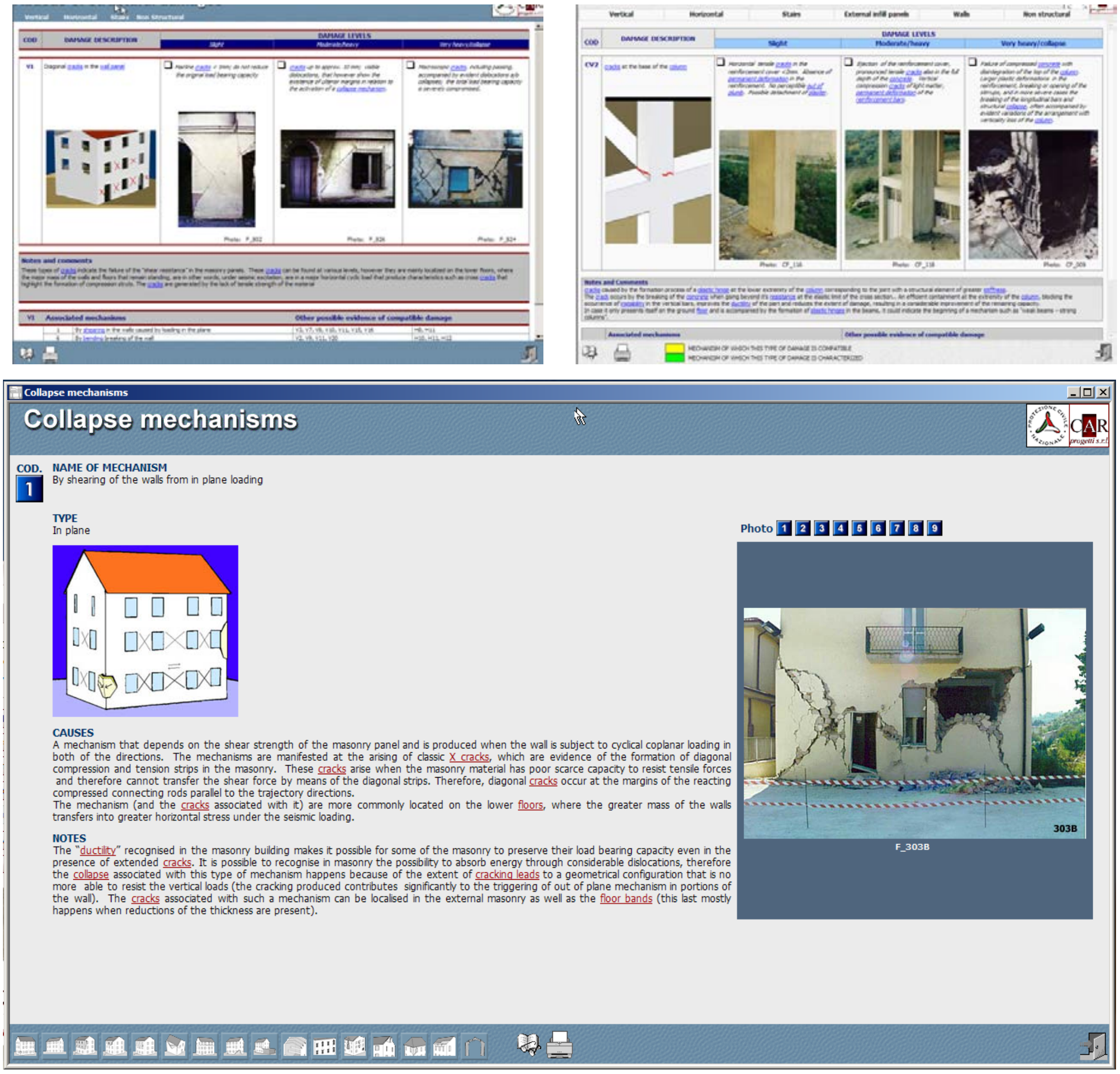


Figure 4: Abacus of structural damage

2.3. The form and the training paths

The procedure contains a training section, in which, by some examples on damaged buildings, the user can perform training paths designed for safety analyses and therefore to express evaluations on different aspects, such as:

- the constructive typology (horizontal and vertical structures), which a vulnerability class can be associated to;
- the damage level expressed both for every single constructive element and for the whole building;
- the safety assessment of the building;
- the possible provisional interventions to be adopted.

Moreover, the tool allows control on the judgement capability achieved by the surveyor.
The procedure furnishes a hypothesis of possible links to other damages on the same examined elements or on those elements of the structure, that could be recognized as compatible with respect

to a specific collapse mechanism. This aspect, though it doesn’t pretend to be exhaustive and strictly irrefutable, it gives a lecture key of the single damage in global terms respect to the response of the whole structural system. This is performed through the analysis in diagnostics key of the whole cracking frame, characterised by different damages, all compatible with respect to a single mechanism. Therefore, the aim is to offer a tool able to drive the analysis of the structure through a step by step process of associations among the exiting damages, in order to recognize them as congruent to a possible global structural behaviour.

In this direction, the interactive training table is developed (Figure 5), where all mechanisms and all vertical and horizontal damages of the catalogue with their own codes are listed. The interactive table, for every damage selected by the user, shows the possible mechanisms congruent to the chosen damage. Therefore, the user could choose a mechanism to investigate and then he can select in multi-choice mode the compatible damage typologies; the tool allows verifying in progress the congruence between these damage typologies and the chosen mechanism.

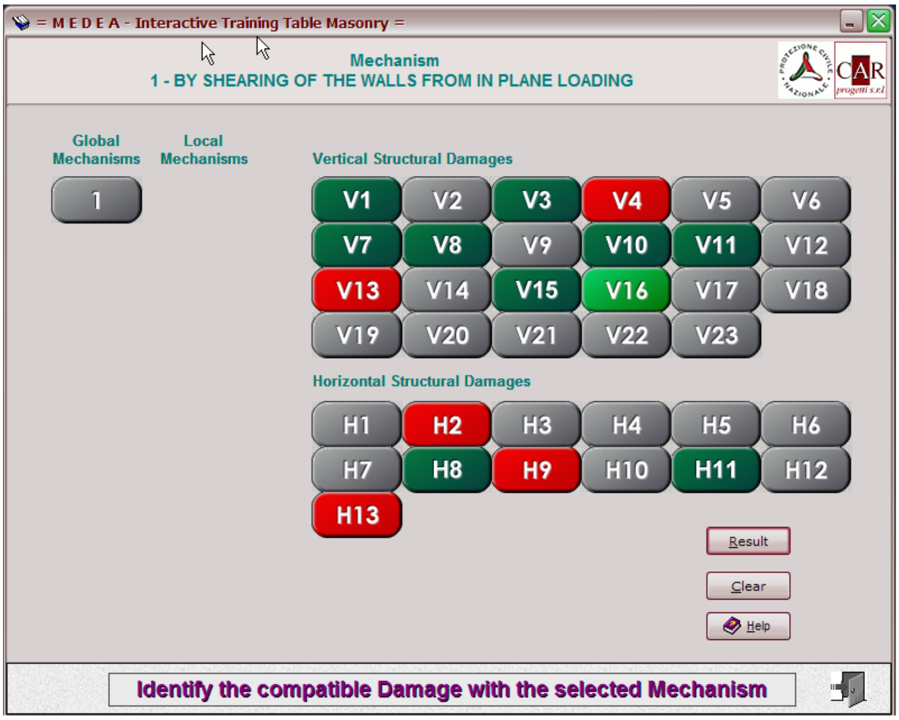


Figure 5: Interactive training table for masonry buildings

2.4. The post-earthquakes structures safety check by the safety index.

The procedure proposes a post-earthquakes structures safety check based on the evaluation, for each building analyzed, of an ad hoc index, called 'safety index' I_S, as the normalization on the maximum possible level of damage associated to the main collapse mechanism of the structure.

The procedure is founded on 'compatibility matrices' that link each possible mechanisms of collapse M_i with each possible damage to the vertical structures V_i. In Table 1, the compatibility matrix for masonry buildings developed in MEDEA [2] is shown.

Table 1: Compatibility matrix for masonry buildings between the collapse mechanisms Mi indicated in Figure 3a (M16: Other) and the damage to vertical structures Vi (i.e., V1 Diagonal trend lesions in the wall; V2 Diagonal trend lesions at the upper levels in the wall; V3 Diagonal trend lesions at the cantonal walls; etc) ([1], [2]).

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23
M1	1	0	1	0	0	0	1	1	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0
M2	0	1	0	1	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0
M3	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	1	0	0
M4	0	0	0	0	0	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	1	0	0
M5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
M6	1	1	0	0	0	0	0	0	1	0	1	0	0		0	0	0	0	0	1	0	0	0
M7	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
M8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
M9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
M10	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0
M11	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
M12	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0
M13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
M14	0	0	0	1	0	10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
M15	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
M16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0

For each building, the collapse mechanisms are detected, and a score is associated to each compatible damage, in the range 0 - 3.
The medium level of damage associated to each collapse mechanism i is estimated as:

$$\overline{Ld_i} = \frac{\sum_{j=1}^{n} Ld_{ij}}{k_i} \tag{1}$$

in which:

- $Ldij$ is the level of damage (from 0 to 3) of the damage j in respect to the mechanism i;
- n is the total number of possible collapse mechanisms;
- k_i is the number of the observed damages compatible with the mechanism i.

An appropriate calibration of the value is also done exploiting the maximum value of the scores associated to the compatibilities damage of mechanism i, so the level of damage associated to the mechanism i is:

$$Ld_i = \frac{\overline{Ld_i} + Ld_{max}}{2} \tag{2}$$

in which $Ld_{max} = Max(Ld_i)$.
To each mechanism of collapse is associated a coefficient of importance C_I which is proportional to the potentiality of the mechanism to a rapid generation of the collapse of the building. Aim of its definition is to distinguish local collapse to the global collapse.
So the P_i index, which represents the level of the activation of the mechanism i, is defined as:

$$P_i = Ld_i \cdot C_I \tag{3}$$

in which C_I is the coefficient of importance of the mechanism (Table 2).

Table 2: Coefficient of importance C_I concerning the collapse mechanisms for masonry buildings.

M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16
0.50	0.50	1.0	1.0	1.0	1.0	0.50	0.50	0.50	0.50	0.25	0.25	0.25	0.25	0.25	0.25

The main mechanism of the building is recognized in that which has the greater value of P_i. The safety index I_S is, at the end, defined as the normalization on the maximum possible level of damage of $P_{i\,max}$:

$$I_S = \frac{P_{i\,max}}{3} \quad (4)$$

3. 2009 L'AQUILA EARTHQUAKE CASE STUDY

An application of the procedure is following described. The analyses are based on the survey activities developed by Plinivs Study Centre (University of Naples, Italy) after 2009 L'Aquila earthquake (Italy), on about 250 buildings, located in the historical centre of L'Aquila city.
With the aim to evaluate the reliability of the procedure, the survey activities in situ have been performed collecting two forms:

- MEDEA ([1], [2]);
- and AEDES [3], which is the form adopted by Italian Civil Protection, in the post-earthquakes structures safety check.

Knowing the mechanisms of collapse and the level of damage of each structure from the MEDEA forms, the *safety index* I_S is evaluated (Section 2.4) and a comparison with the outcome of safety of AEDES [3] form is done.
The results coming from the procedure are expressed as an *on/off* information, in which the possibilities for each building are 'safe' or 'unsafe' depending on the value of the index I_S. The graduated information of the AEDES form from A to E is synthesized assigning 'safe' to judgements 'A' (building safe) and 'B' (building temporarily not safe but safe with emergency measures) and 'unsafe' to judgments 'C' (building partially not safe), 'D' (building temporarily not safe – to deepen) and 'E' (building not safe).
The limit value of I_s used to define the safety and unsafety of a building was calibrated from the comparison of the results coming from the AEDES, and in particular it is assumed equal to 0,40. To support this decision, the Gaussian distribution of the buildings for each level of damage (Figure 6) shows that assuming this value to separate the outcomes all buildings with a not structural level of damage (D1) are considered 'safe', and on the contrary all collapsed buildings (D4-D5) are considered 'unsafe'. The outcomes of structures with level of damage equal to D2 and D3 are variable, but in more than the 50% of the cases are 'unsafe'.

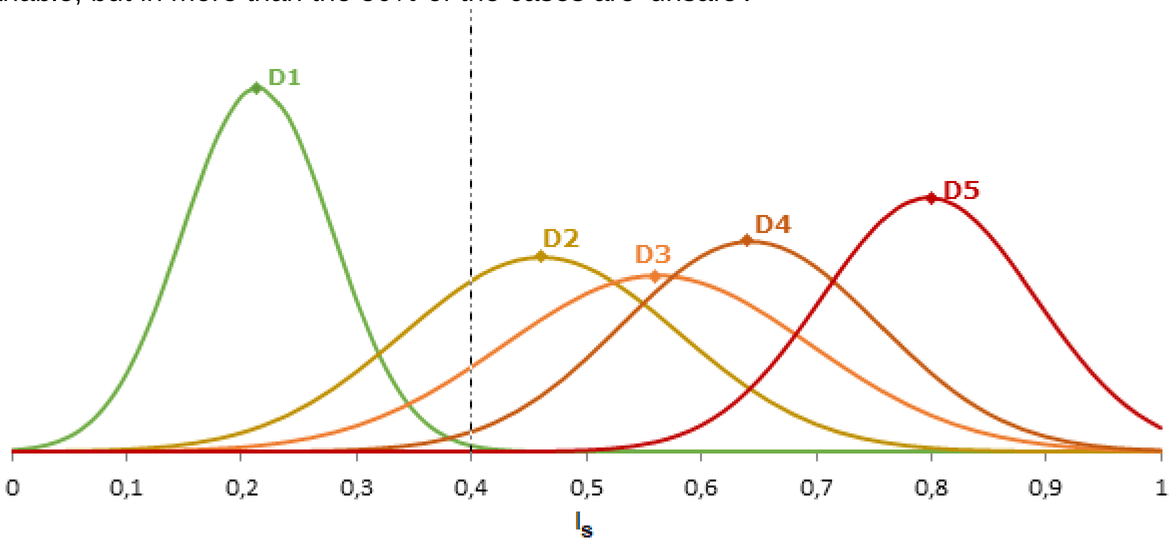


Figure 6: Gaussian distribution of the buildings for each level of damage

The maps with the results are represented in the Figure 7 and a summary is reported in Table 3.

Figure 7: 2009 L'Aquila seism. Post-earthquakes structures safety check: comparison between MEDEA and AEDES procedures

Table 3: 2009 L'Aquila seism. Post-earthquakes structures safety check: comparison between MEDEA and AEDES procedures.

	AEDES		MEDEA		CORRESPONDANCE	
TOTAL BUILDINGS	safe (A - B)	unsafe (C - D - E)	safe	unsafe	**Y**	**N**
250	11	239	28	222	211	39

In the Table 3, the correspondence between the two analyses is shown. The procedures MEDEA and AEDES furnish the same judgment ('safe') for 211 buildings on 250 (equivalent to the 85% of the total).

Further results about the analyses on MEDEA’s data are reported in the Figure 8, in which is represented the buildings distribution and the trend of the average of the I_S on the global level of damage. It’s shown that the greater number of building has a level of damage equal to D3, and that a smaller number of damages are on D1 and D5. It is also evident that I_S grows up with the level of damage, and that the limit value for the safety is a bit smaller of the average of Is of the first level representative of the structural damage D2.

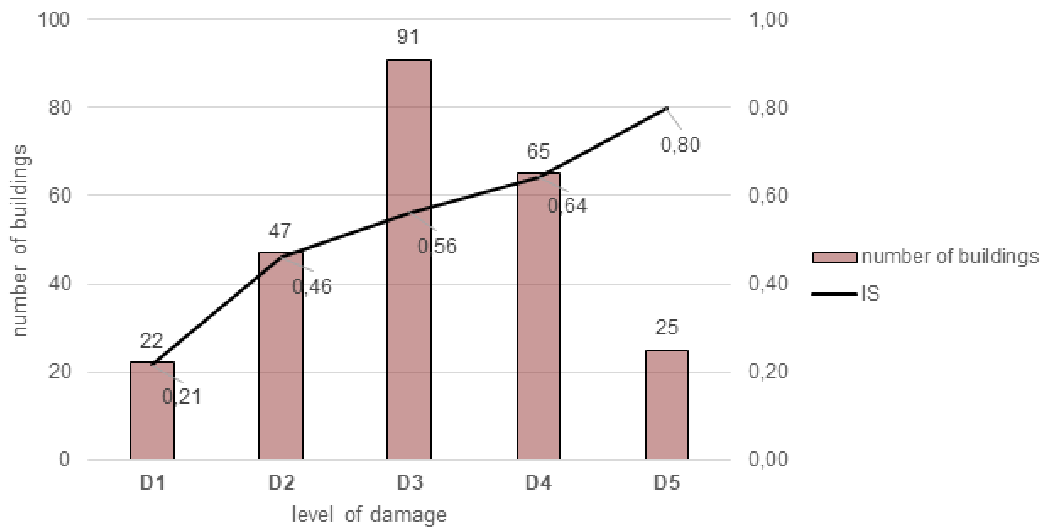


Figure 8: Buildings distribution and the trend of the average of the I_S on the global level of damage

The proposed procedure represents a good tool to evaluate the safety of a building. It evaluates the outcome starting from the cracking patterns of the structures and so goes beyond a simple quantitative analyses done in AEDES. The differences in the results surely have to been deepen. They could be depend on the necessity of a better calibration of the limit value of I_S for the proposed procedure, or on the necessity of attributing more weight to the mechanisms in the AEDES evaluation. It’s also opportune to point out that a technician appointed, through a simple quantitative procedure of the AEDES form, to declare the safety of a building in doubt tends, for precautionary purposes and in the absence of exhaustive information, to choose a declaration of unsafety.

4. CONCLUSIONS

The procedure here illustrated, founded on the logic of MEDEA, constitutes an useful tool either in the post-event phase, to perform, on the basis of the cracking path and of the potential collapse mechanisms about to be activated, the safety check of the buildings or in “peace time” the vulnerability assessments, to identify vulnerability factors responsible of potential activation of collapse mechanisms and to evaluate possible interventions of improvement and upgrading of the structure response as mitigation measure to reduce the effects of the vulnerability factors, in order to parameterise the expected service life.
The procedure can be also adopted to evaluate the opportunity of maintenance or strengthening interventions according to the damage and vulnerability parameters identified.
Possible correlation between the safety condition of the building and its expectation of life are derivable either considering standard functions of resistance decay due to lack of maintenance or by seismic intensity return period and expectation of damages for specific building classes.
Nevertheless, the structure of the procedure allows making also different kind of analyses, such as the possibility of defining the expected service life of building structures, in order to integrate LCA (Life Cycle Assessment) and LCC (Life Cycle Costs) studies.
According to this specific point of view, the analysis of observed damages due to past destructive events or potential damages due to vulnerability factors identified are both linked to the need of reliable information about the expectation of life of structural components in case of retrofit or refurbishment intervention.
The results can be easily adapted to all countries, with reference to the most recurrent buildings typologies and materials of the area.

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