# Proceedings

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# CONTENT

## Section: "Mathematics and Informatics"

<u>Mikhael Bagdasarov</u>	
Mobile technologies in education used in Israel	4
Maria Mpitsi	
Electronic governance and its course in Greece	14
Maria Mpitsi	
The use of Information Systems in e-Government as an opportunity for effective	
reorganization of Public Administration. The case of e-Justice in Greece	25
<u>Maria Mpitsi</u>	
E-government evolution in Europe and benefits that cause from its application	39
Irina Naskinova	
Convolutional Neural Networks for Chest X-ray Classification	47

## Section: "Methodology of teaching natural sciences"

#### Hristina Shekerliyska-Vachkova

Some strategic ontodidactic and methodological problems of mathematics education in secondary school 57

## Mobile technologies in education used in Israel

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**Abstract:** This work will present 4 topics regarding mobile technologies in education in Israel: UNESCO-Fazheng project case study: Mobile technologies for life-wide learning in schools in Israel - Amal Shevach Mofet High School, Israel, the ORT educational network, the AMAL educational network, and the Education technologies developed in Israel.

Keywords: ORT, AMAL, Israel education, Mobile technologies.

# 1. "Sheath Mofet" school project - School based life-wide learning using mobile technologies

The project on 'School based life-wide learning using mobile technologies' has been implemented by the Amal Shevach Mofet High School, Tel Aviv since 2013. It derives from the school's pedagogical approach, which aspires to integrate the students into society, and views individuals as independent people and as integral parts of their community (UNESCO,2019).

The life-wide learning project is based on three principles: location (moving outside the classroom to learn in real-life situations), community (giving and contributing to the community) and learning (transforming the role of teachers). Students and teachers create location-based interactive learning material to characterize some aspects of special places located in their community. The places and their characterization are selected by the teachers to cover specific subject areas of the curriculum, and the material created by the students is made available to the entire community (UNESCO, 2019).

Amal Shevach Mofet High School is located in Mount Hope in Tel Aviv. It has 900 students and 70 teachers. The school is part of the Amal Educational Network, a large school network in Israel, established in 1928, with 120 educational institutions across the country, including high schools, junior high schools and colleges, and a total enrolment of over 40,000 students. The project, which has been developed at Amal Shevach Mofet High School since 2013, derives from the school's pedagogical approach, which aspires to integrate the students into society, and views individuals as independent people and as integral parts of the community. It is endorsed by the principal, who has a clear vision of the relevance and impact of learning outside the school's walls, which leaves its mark on the physical and digital public space through signage, flyers, and code scanning on mobile devices. The project is supported by the school's flexible pedagogical and organizational principles, and the principal and management staff give encouragement to the teachers to design and implement creative and innovative projects (UNESCO, 2019).

The lifewide learning project started as a small and unique project for a group of history students. Based on its success, it was then expanded to cover material from history and literature, based on a multidisciplinary approach, and was adapted to encourage the participation of students with special needs. After these successful experiences, the project was integrated into the regular school day and afterschool programs, with the participation of middle school students. Today, the project is being used as a model for the schools in the Amal Network, and ten schools are already implementing pilot initiatives.

For each implementation of the project, teachers and students explore their community and identify places that have special meanings or significance. They then create location-based interactive learning objects (LILOs) to describe them. Places are tagged to link the LILO to its location, using GPS data and/or a QR code.

Once they have been created and linked, students and community members can activate them using a cellphone or tablet, and learn about the place or object, add comments and share them in their social network.

Although the school has a variety of technologies available for the students to use, the project does not require much specialized hardware, since most of the activities are based on the use of laptops, tablets or cellphones. In addition, for the creation of 3-D objects the students can use 360-degree cameras.

The main platform used for the project is the Wandering Ltd location-based learning environment, which is a web-based platform that was designed to facilitate outdoor, authentic and interactive learning via the creation of LILOs. In addition, students use a range of software, including Padlet, YouTube, Thing link (interactive pictures), Canva infographic, Emaze presentations, IMovie or Movie Maker, a QR code generator, Google Maps Street View 360, Google Drive and Google Classroom.

The content created by the students is constantly available to the public and has been integrated into a tourist interface. All content is public and can be accessed on a map created for Amal Network by Wandering. In relation to security and privacy, students using the Wandering platform are identified not by name but by learning avatars, and they sign privacy agreements as part of the process. The interaction with the avatars is based on e-mail

exchanges and is only visible to the system manager. Although the content created by the students is public, their individual identities remain private.

Students have full control of their accounts, which are not accessible to the teacher or network manager. They can manage the comments sent to their account, deleting or accepting them for publication on the site. In addition, there is a mechanism to report abuse, and the system administrator from the company has the right to delete any content or user.

Teachers participate in regular and structured training courses held at the school on pedagogical subjects, and new teaching and learning models are also introduced during the regular staff meetings. In addition, the Amal Network PTC offers in-service training for teachers, including 30 hours of frontal (field) training. Approximately twenty-three teachers per year participate in this course. The Amal Education Teachers' Laboratory in cooperation with Education Cities developed an online course (MOOC), which is available to all Amal schools, and has been distributed worldwide in the framework of the EDUMISSION global competition.

The course is structured in four chapters. The first one presents the concept of lifewide learning and some inspirational examples; Chapters 2 and 3 present the lifewide learning model, and Chapter 4 presents the evaluation and feedback strategy to be used with the model (UNESCO, 2019).

The project received widespread support from many bodies at different levels. It received full support from the school administration, including the allocation of hours and the funding of transportation to the Sarona area and to the Eretz Israel Museum.

It also received support from the Amal Network, which views the project as a model for emulation and learning on the Internet.

The project was recognized as an alternative assessment (worth 30 per cent) and was promoted in various forums, including:

- Entrepreneurship and Innovation award of the Department of Elementary Education of the City of Tel Aviv in 2015
- Recanati-Kop-Rashi Award for Entrepreneur Teacher 2016
- Edumission award for 'Exceptional pedagogic innovation in a school network' in 2017
- Ministry of Education formal recognition as a pedagogy model and learning unit for high school matriculation
- Certificate of Appreciation from the Ministry of Justice and Supervision of Citizenship at the Ministry of Education for social inclusion.

Introduction should contain the following parts:

- Actuality of the topic

- Object of study
- Main purpose and task of the study

#### 2. ORT EDUCATIONAL NETWORK

ORT Israel network was founded in 1949 as a network of vocational schools. Today, ORT Israel is the leading educational network of comprehensive schools in Israel, specializing in the high-tech and science fields and in instilling knowledge, skills and values in its pupils. The ORT Israel network operates throughout Israel, especially in peripheral regions, in all cutting-edge fields of scientific-technological education (Ort, 2019).

ORT Israel provides the highest quality education environments and solutions for every academic and socioeconomic level. ORT schools educate Israel's youth to become productive, caring and contributing citizens. ORT Israel does not compromise on the quality of achievements or the spirit of giving. The network firmly believes that the combination of education for giving and the promotion of science and technology is the best strategy to strengthen the social and economic fortitude of Israel (Ort, 2019).

One out of every 10 Israeli high school student's studies in an ORT managed and run institution. ORT Israel has over 100,000 students; 500,000 alumni; 7,000 employees; 201 institutions; a presence in 56 municipalities and the educational programs are implemented in 300 public schools throughout Israel. Ort school's are to be found throughout the country, from Hatzor in the Upper Galilee, Ma'alot and Shlomi near the Lebanese border, down to Yerucham and Arad in the Negev. The network reflects a microcosm of Israel's human diversity: secular and religious Jews, Druze, Arabs and Bedouin, city – dwellers and peripheral towns (Ort, 2019).

#### 2.1 ORT school's using technology in schools

Here is a list of Ort's programs which use special technology features in the teaching process (Ort, 2019):

Schulich Canada Smart Classroom Initiative

Hundreds of Israeli schools have been equipped with interactive whiteboards, wireless Internet connectivity, laptops and on-going teacher training. Each participating school has a tailored implementation plan, developed in cooperation with the Ministry of Education.

This program started in 2010 in the Galilee region, in cooperation with both the Ministry of Education and the Ministry for the Development of the Negev and the Galilee. 420 Smart Classrooms were installed during the first phase of this program. The initiative is now being

rolled out in the Negev region, to equip a total of 1000 classrooms in the north and south of the country.

#### Technology Youth Boot Camp / Technology GADNA

In cooperation with the Israeli Defence Forces, World ORT Kadima Mada runs a series of week-long, "GADNA"-style workshops for high school students, with the aim of increasing awareness and creating a more positive image of technical service in the Israeli army. Recruits with technical skills are in great demand but in short supply; the technical corps finds it hard to compete with the prestigious image of the combat units. Addressing this shortage is therefore the primary objective of these workshops. Top-performing students in the study tracks of mechanics, electronics and mechatronics are selected for the workshops, with a particular emphasis on selecting girls. Activities include introductory army activities, academic lectures in applied contexts, field trips to factories that produce hi-tech army equipment, and a graduation ceremony. Students are also introduced to career opportunities in industries which look for employees who have completed technical army service.

Alex and Betty Schoenbaum Science, Education, Cultural and Sports Campus in Kiryat Yam

Nearly 40% of Kiryat Yam's total population of 38,000 are immigrants, mostly from Ethiopia. The city faces many socio-economic challenges as it strives to assist and integrate its large immigrant population and its other inhabitants. In 2007 World ORT Kadima Mada, in conjunction with the Kiryat Yam municipality, built the Alex and Betty Schoenbaum Science, Education, Cultural and Sports Campus - with the aim of transforming the city. The campus comprises: the D. Dan Kahn Science Center, complete with high-tech laboratories; the Margot and Jozef Rethazy Planetarium Building; an oceanarium; a library; a performing arts auditorium; an athletics stadium; a sea sports centre; the renovated Rodman High School; and the Nate Lipson Ethiopian Heritage Center. The goal of the Ethiopian Heritage Center is to host cultural and educational activities for Kiryat Yam's Ethiopian community, providing them with the necessary education and vocational training to help ease their integration process into the local community. The centre also aims to teach Kiryat Yam's residents about Ethiopian culture and to increase tolerance and understanding among the city's inhabitants. Activities and classes offered at the centre include traditional Ethiopian storytelling, Ethiopian dance, arts and crafts, youth leadership training, ICT training, and matriculation assistance for students.

#### 3. AMAL EDUCATIONAL NETWORK

The Amal educational network (est. 1928) is a leading player in the Israeli education system, with 120 educational institutions across the country, including high schools, junior high schools and colleges, with a total enrollment of over 40,000 students. A driving force in entrepreneurship, innovation, and excellence, Amal is at the forefront scientific and technological innovation. Each year tens of thousands of students in all over the country – enjoy equal opportunity to acquire the knowledge and skills needed to integrate into the employment world of tomorrow. Amal provides an educational-academic framework with an emphasis on technology, the sciences and the arts for all strata of the population from high-achieving young people of Israel's elite to young people who are at risk (Amal, 2019).

The schools in the network were the first to introduce the use of iPads in Israel's educational system and specialize in integrating computers and information and communication technology (ICT technologies) into learning and education processes. The network offers study programs and primarily digital materials for technological courses of study, through a Pedagogical Technological Development Centre (PTDC), a research and development unit which focuses on the development of e-learning environments, digital courses and learning materials, as well as teacher training and mentoring. The network is motivated by a vision of innovation and entrepreneurship, and is constantly developing and experimenting with new tools, pedagogies and practices (Amal, 2019).

#### 3.1 AMAL school's using technology in schools

Here is a list of Amal's programs which use special technology features in the teaching process (Amal, 2019):

Project-Based Learning – PBL

A pedagogic program, which started at the Amal network in 2018. This involves projectbased investigative learning in a high-tech-high spirit (HTH).

Learning through Investigation was implemented in 8 schools which also led to a change in external examinations. This learning process connects the multidisciplinary principles that are relevant to real life, with issues that are meaningful for students and adults alike. The great benefit of the program is that, for the first time, the schools will operate synergistically as a single learning community, as a community carrying out a systemic experiment together, and no longer as "isolated islands" and detached episodes. The program has been approved by the Experiment Department of the Ministry of Education and is operated as a pre-experimental pilot

at eight schools in the Amal Group around the country. This is the first time that change in the Israeli learning and pedagogy culture is being implemented based on joint thinking and mutual study in communities of principles, teachers and students. Moreover, the inclusion of the practices, experiences and ways of contending with difficulties, is carried out with a view to generating meaningful and ongoing systemic change, in contrast with the current situation which is based on the personality of one principle or another, or on a teacher who has a particular interest in the particular field.

#### • Entrepreneurial Centers Initiative

Entrepreneurship Education, an innovative, unique and a groundbreaking model in Israel developed by the Amal Group, prepares youth for entrepreneurship in business and industry. The collaboration between education and industry is a growth engine for creative young entrepreneurial leadership in Israel.

As part of an innovative step which, in particular, aims to impart essential skills for the integration of youth in tomorrow's world of industry, Amal emphasizes the topic of Innovative Thinking Skills and operates Entrepreneurial Centers, in order to train business and social leaders and thereby also contribute to Israel's socioeconomic growth. The first innovation center was established at the Safed Multidisciplinary School and is operating, with great success, for 6 years. The center focuses on developing innovation, original thinking and creativity skills, and enables students to specialize in media and communications, high tech and computers, health and medicine, and recently - drowns and A.I. The aim is to help the students realize their abilities, to develop innovative thinking and to provide them with a personal example of leveraging ideas, by the country's top high-tech professionals. Following the success of the venture in Safed 7 additional innovation center began to operate which focuses on Cyber, I.O.T (internet of things) A.I. (artificial intelligence), new media, Design, Biomed App. Developing. In Hadera, the center focuses on application development and biomed. The Hadera center is the first in Israel to teach application development together with Apple and idigital, and biomed in collaboration with Hillel Yaffe Hospital and the biomedicine faculty of the Technion. Through its innovative Entrepreneurship Centers, the Amal Network is providing its students with the tools for a better future. The entrepreneurship program gives students the tools for future success and the ability to solve real questions and problems, which are taken from "the real world" - enabling them to integrate into a world of global employment.

International Innovation Lab

The Amal Group began to run an International Innovation Lab in collaboration with Education Cities. This lab enables participating teachers, principals and staff members to learn, to plan and to implement innovative solutions to the challenges they face. In this way, a

cohesive group of colleagues who enjoy searching and creating change, who are passionate about network learning, experimenting and international sharing, is created in the laboratory. The innovation lab also generates fascinating collaborations and mutual learning with similar groups from around the world: schools from Denmark, Italy, Mexico, Brazil, England, New Zealand, USA, Poland, Romania and other countries. In a rapidly changing world, the Amal Group is leading and breaking new ground. It has become a symbol of the wonderful integration between the individual and the group, between personal development and work in the network group. The pioneering teachers from the schools participating in the lab are developing international initiatives and collaborations. They travel to colleagues' school to learn from them and host the teachers from those schools at Amal. A group of Amal's leading teachers met for an entire year at the Amal Entrepreneurship Center at the "Shevach Mofet" School in Tel Aviv, and under the guidance of an Education Cities team, raised ideas, did research, shared experiences, got inspiration, and finally launched two original self-study courses (MOOC = massive open online course) that exemplify Amal's uniqueness in two key areas: Educating for Entrepreneurship and Learning in Life Spaces. Each course, which includes four videoed classes, brings a wealth of examples and means of illustration drawn from Amal's recent experiences.

• Learning and teaching via iPads

The Amal Pedagogic Administration and Pedagogical Technological Development Center (PTC), is having a significant corporation with APPLE company (via Idigital Israel) on learning and teaching via Ipads – they are running a unique innovative project for studying projects, by means of iPad appliances, in the technology streams of 10 schools. Some of them on a 1 on 1 model whereby all the students and teachers receive iPads. The project examines two types of models – an individual learning environment and a school learning environment, with close collaboration with Ministry of Education inspectors in the areas of communications technology (new media), mechatronics, aviation systems and machine control, as well as with worldwide Apple and idigital, through their Israeli representatives. The design of the active mobile learning experience highlights collaboration, investigation and creativity, making the databases of the world's educational applications accessible and utilizing the strength of the iPad as a means of multidisciplinary visual demonstration.

#### 4. NEW EDUCATION TECHNOLOGIES DEVELOPED IN ISRAEL

Here are seven Israeli educational technological start-ups which are used in schools in Israel this year (Klein, 2018):

Jolt is creating actual "microcampuses" (Jolt Rooms) for small-group interactive skills learning led remotely in real time by experts in anything from storytelling to contract negotiation. You simply download the Jolt app, find classes in your area that interest you and reserve a seat around the table in a meeting room or co-working space near you. The company is based in Tel Aviv and London.

TinyTap offers more than 150,000 educational mobile games developed mainly by teachers worldwide and vetted by in-house educational experts. Founded in Tel Aviv in 2012, TinyTap recently hit 1 million registered users. Used by parents and classroom teachers, the app offers a parents' guide, The Learning Plan, to age-appropriate games in a variety of subjects. This guide is available in Hebrew and English, and soon in Arabic, French and Mandarin. TinyTap recently partnered with Oxford University Press to develop premium games.

Copyleaks is a cloud platform using AI to detect plagiarism and copyright infringement — even highly paraphrased and rearranged similar content — in any language. Founded in 2015 by former programmers in the Israel Defense Forces' 8200 intelligence unit, Copyleaks aims to help educational institutions maintain academic integrity and identify students struggling with writing assignments. Working with universities and companies including Microsoft Education, Copyleaks has its R&D in Kiryat Shmona and a new office in Connecticut.

CirQlive makes an integration platform to simplify the coordination of live online courses over universities' existing web-conferencing services (such as Zoom or WebEx). Current clients include universities in the US, Australia, Europe and South America, but K-12 teachers can use the technology to reach pupils unable to come to school. Started in 2014, with offices in Jerusalem and New Jersey, CirQlive is adaptable to a variety of languages to enable collaborative learning across campuses and continents.

Storyball, developed a screen-free smart toy that uses games, stories and challenges to get children playing, learning and moving in a personalized way due to AI and machine learning. Different elastic "skins" wrap around Storyball to change the game – including characters from *PAW Patrol, GUNK Aliens* and *Magic Ballerina*, thanks to partnerships with Nickelodeon and HarperCollins. A companion app lets parents track their child's progress. Following a successful crowdfunding campaign, Storyball is expected to ship in November.

Agree Online, teaches members of Gen Z how to achieve peaceful digital conflict resolution using age-appropriate learning technologies in a secure digital environment led by their teacher and guided by their classmates as mentors. Children also learn to distinguish between digital conflicts and cyberbullying. The Ramat Gan-based startup is working with schools in Israel and is in discussions with potential distributors in the US, UK, Argentina and other countries.

Edusoft of Rosh HaAyin is a subsidiary of Educational Testing Services (ETS), the world's largest private educational assessment and research organization. Edusoft develops technology-based English language learning and assessment software solutions serving a range of educational, governmental and corporate clients in more than 30 countries.

#### 5. REFERENCES

Amal educational network (2019) General information.

[http://www.amalnet.k12.il/english/]. Accessed November 4, 2020.

- Klein, L.A. (2018) *Get an edge this school year with these 7 great Israeli technologies.* Israel 21c. [https://unitedwithisrael.org/get-an-edge-this-schoolyear-with-these-7-great-israeli-technologies/]. Accessed November 4, 2020.
- Ort educational network (2019) *General information*. [https://www.ort.org.il/aboutort/]. Accessed November 4, 2020.

Ort educational network (2019) *Technology in schools*. [http://prospectus.ort.org/countries/israel/enriching-science-and-technology-inisraeli-schools/]. Accessed November 4, 2020.

UNESCO (2019) *Mobile technologies for life-wide learning in schools in Israel*. Paris, UNESCO. [https://en.unesco.org/themes/ict-education/mobilelearning/fazheng/case-studies]. Accessed November 4, 2020.

## **ELECTRONIC GOVERNANCE AND ITS COURSE IN GREECE**

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Abstract: E-government is in the daily life of the citizen. Influences his habit, influences his social behavior. Public administration is called upon to keep up with the rapid developments of technology, moving at a faster pace in a digital age. Success lies in collective cooperation at local, regional and national level, as well as between Member States. The digital public administration contributes to the transition from an inelastic and inefficient public administration focused on the state to an administration with a central point of reference for the citizen and the provision of services to meet his needs and desires. Respect and guarantee of freedom of expression and protection of the privacy of the citizen is a necessary obligation. The public sector in Greece is belatedly, with several problems, intensified by the economic crisis, trying to promote the necessary changes for the digital age. Technology has contributed significantly to the computerization of administration services and is viewed positively by the younger executives of the public administration. Digital technology in public administration contributes to the redesign of processes, to the efficiency and effectiveness of services and to good governance. Political will at all levels is a prerequisite for promoting innovation and action for an integrated digital administration, inspiring all those involved in the processes with appropriate education and training, aiming to change the mentality of using e-government services and eliminating resistance to change, aiming at the digital integration of all inclusive citizens. Greece should intensify its efforts for the development of e-Government, especially now that it is in a very difficult economic situation and due to the covid-19 pandemic it is affected, as well as the entire world economy. Reducing public spending costs is now an urgent need for the Greek economy and this can be achieved through the implementation of e-Government.

*Keywords: E*-government, citizen, Greece, information and communication technology (ICT), information systems.

#### INTRODUCTION

E-government is a globally recognized need. Starring at all levels of collaboration, organization and administration whether we are referring to the private or public sector. It includes the use of Information and Communication Technology in order to improve services to

citizens, businesses and other public services. E-government is developing and can help on the one hand to improve the services provided and on the other hand to improve communication with citizens. It can also help with immediacy and service.

The need to reduce government spending, especially in a time of severe economic crisis, to improve the quality of services provided, to increase transparency, and to increase citizen participation in government, have been instrumental in its implementation. E-government provides transparency, while enabling the Greek state to modernize and lead in the future successfully.

E-government is a point of development of the administration that allows the two-way relationship with other bodies, the utilization of information technology, digital tools and telecommunications. It marks the progress towards the provision of government services by the internet but also the strengthening of the transparency and the efficiency of the work of the public administration with the aim of the recognition and acceptance by the citizens. E-government defines a new concept in the service of the citizen and businesses by the public services, since it eliminates the need for natural transition and presence of the citizen in the local centers of power.

The evolution of telecommunications and the development of the internet is creating a new civil society with high expectations and demands. On the other hand, the state realizes that the adoption of digital technology solves significant administrative problems and helps to redefine relationships with citizens or organizations. At the same time, the development of the information society, the expansion of networks and the IT revolution are improving productivity and simplifying bureaucratic procedures.

E-Government is defined as the use of ICT in public services (central and regional, central or local government), in conjunction with organizational change and new staff skills. The aim is to improve the provision of public services, as well as to strengthen democratic processes and support for public sector policies for the benefit of citizens. «E-government is one of the European Union's top priorities».

The first step towards the completion of e-government is the creation of an «e-government portal» (e-government portal). The «e-portal» is emerging as a key tool and access point for citizens and businesses to e-government services and the organization of «digital relations» with the administration.

The next goal is the completion of the technological infrastructure. E-government business models require strong enough standards to achieve the proper operation of servers, telecommunications networks and databases. For the most complete support and successful operation of e-government programs, the development of intranets and external networks

(intranets and extranets) and the evolution of internet technology promise to provide: 1) speed, 2) continuous connection, 3) access, 4) usability , 5) intelligence and 6) security.

The last level of e-government is defined by the ability to interconnect the «gateway» with information systems of third parties, organizations or companies and especially with Enterprise Resource Planning-ERP systems or other standard information systems. Also, towards the integration, the use of Customer Relationship Management-CRM4 systems, Knowledge Management, Database Management and Data Warehouse, as well as Intelligent Systems (Natural Networks) and mining systems has started to be implemented Data (Data Mining).

Finally, «e-gov.gr» is a hub created by the e-government laboratory of the Department of Informatics and Telecommunications of the University of Athens, providing information on resources related to e-government. The purpose of «e-gov.gr» is to inform citizens and businesses, public administration and local government about the projects and results of e-government services as well as researchers for practical results and best practices (best practices). The above are examined from the point of view of the final recipient of the services (user-citizen) including the technological components in the context of achieving the goal with the slogan: «the citizens online, the bureaucracy off-line».

The present work is a bibliographic study and research. Its main purpose is through the presentation of the course of e-Government in Greece, to demonstrate the factors that are considered necessary for its implementation, the benefits and problems that arise from the effort to implement it.

#### METHODOLOGY

The scientific article is based on a bibliographic review, European Commission texts, scientific articles that have been published, research on the course of e-government in Greece, the benefits and problems that may arise from the development of e-Government.

#### **RESULTS AND DISCUSSION**

#### **GENERAL PRINCIPLES OF ELECTRONIC GOVERNANCE** [1]

- ➡ Public bodies apply ICT in compliance with the principles of legality, good administration and transparency.
- ⇒ Searching for information from the citizen once and for all about a life event and maintaining it in an authorized body for that event.

- ➡ Public administration funding for e-government actions will be demonstrated by saving resources through cost-benefit analyzes.
- ⇒ Integrate software into single database centers with shared and single access rules.
- Ability to transfer, process, use information in a unified and efficient way between different information systems of different public bodies.
- ⇒ Data security and authenticity, in accordance with the European Union General Data Protection Regulation (GPRD) as entered into force on 25 May 2018. Guarantee the protection of the privacy of the citizen in the collection, processing and distribution of private information from the use of non institutionalized or delegated mechanisms.
- Information and ensuring accessibility to the websites of the public administration by configuring the systems in order to serve equally people with disabilities and vulnerable groups of the population.



#### FORMS OF ELECTRONIC GOVERNANCE [5]

- Government to Citizen (G2C): G2C initiatives are designed to facilitate citizens' interaction with the State, which is considered by many to be the primary goal of e-Government. They seek to enhance access to public information through the use of media such as websites and newsstands.
- Government to Business (G2B): G2B transactions include various services provided by the State in the business world, such as the disclosure of laws, policies and memoranda.
- Government to Government (G2G): According to many researchers, the G2G sector represents the backbone of e-Government. G2G services can be used for intergovernmental transactions and as a tool for international relations and diplomacy.
- Government to Employee (G2E): It is the latest field of application of e-government. It refers to the relationship between the government and its officials. It enables more direct

communication between a civil servant and the central government and speeds up the internal administrative procedures for devising the best solutions.

#### BENEFITS OF DEVELOPING ELECTRONIC GOVERNANCE

- Improving Efficiency: New technologies enhance efficiency improvements in complex public processes.
- Improving Services: Successful services are built on understanding user requirements, as is the case with online services [3].
- Achieving Specific Results: The Internet can help the entities involved share information and ideas to achieve concrete results [6].
- It is an Important Motivation for Transformation of Governance: Developments such as globalization, changing demand, changing societies and the growing demands of citizens mean that the reorganization process must be continuous [3].
- Citizens' trust in their government: Building trust between governments and citizens is very important for good governance. New technologies can help in this direction.
- Strengthening Democracy: Includes creating a more accessible government and encouraging citizen participation in democratic processes [7].
- Better Business Environment: Technology is a proven catalyst for increased productivity and economic growth.
- Improving the Quality of Life of Degraded Communities: Technology enables the state to access isolated groups and improve their lives [7].

# THE MAIN FACTORS THAT CONTRIBUTED TO THE DEVELOPMENT OF ELECTRONIC GOVERNANCE [4]

- ⇒ The rapid growth of ICT, where they contribute daily to the direct communication of citizens with each other, with businesses and public bodies through the use of the Internet at low cost, has been an innovation in society and the economy.
- ⇒ The need to provide increased services with less human and financial resources due to the social and economic crisis.
- ⇒ Need for reorganization of public sector structures and processes as states are called upon to address in the international environment more and more social problems and issues of globalization of economies.

- ⇒ Need for convergence in the effectiveness of the services provided in relation to the private sector.
- The need for more citizen participation in the public (e-democracy). Through processes of stimulating the interest of the citizen, which systematically devalues the political system, on issues that concern him and it would be possible to influence with his opinion the final result of their institutionalization [9].

#### FACTORS SUSPENDING THE IMPLEMENTATION OF ELECTRONIC GOVERNANCE [2]

- The lack or weakness of ICT infrastructure. Lack of coordination between actors is an obstacle. Decentralized services often operate without direct cooperation with the central administration.
- A second equally important factor, especially in times of severe economic crisis, is the resources required for the installation, operation and maintenance of infrastructure that exceeds the planned design several times.
- Lack of security resulting in lack of confidence in the confidentiality of personal data, fear
  of cyber fraud and other acts may delay its implementation. In fact, security is one of the
  most important challenges and one of the biggest obstacles to the implementation of egovernment.
- Another important parameter that acts as a deterrent to the implementation of egovernment is the lack of digital education, ignorance of the use of ICT, the so-called «digital divide» which is a consequence of the economic and social gap.

#### THE FUTURE OF ELECTRONIC GOVERNANCE

Once a government decides to adopt strategies to transform its processes, significant challenges arise, which it faces in the future.

- Infrastructure Development: The countries that adopt e-Government are striving to create a basic infrastructure to take advantage of new technologies and communication tools.
- Security: Each government will address issues related to the protection of its information and systems from breaches that threaten the integrity and availability of services, as well as citizens' trust in the system.
- ⇒ Privacy: In order to maintain citizens' trust in e-Government and to prevent illegal use of personal data, a government must determine how to restrict the distribution of personal

data to individuals and organizations that the user did not enter the data, inside and outside the state machine.

- ⇒ Trust: e-Government programs must build trust between government agencies, citizens and businesses.
- ⇒ Digital Divide: The differences in access to e-Government services, commonly referred to as the "digital divide". Every democratic society has a moral and legal obligation to fight for the elimination of all forms of exclusion. Therefore, the state should maintain the traditional methods of providing services, for those who are unable to use such electronic.
- ➡ Economic Differences: Income is a major concern in rich and poor countries. The economically weaker have "the lowest levels of access, but often the highest levels of interaction with the state."
- ➡ Training: In general, as the level of education rises, so does the use of the Internet. Training in the use of technology seems to be the key element in this gap.
- Accessibility: Ensuring that people with disabilities can use government websites. Failure to access online services poses the threat of virtual isolation of these individuals.
- ➡ Transparency Informing citizens: Citizens rarely understand how government decisions are made. Lack of transparency can obscure corruption or favoritism by the state.
- ➡ Human Resources: A trained and willing human resource is very important for the success of e-Government. Civil servants will need training and incentives to "integrate" with the new infrastructure.
- ⇒ Benchmarking: Governments should regularly evaluate the progress and effectiveness of investments in order to determine if the goals and objectives meet the schedules [8].
- ➡ Priorities: There is of course the risk of promoting e-Government at the expense of key responsibilities of the government.
- ⇒ Legislation: The adoption of e-government is more of an organizational than a technical issue. The implementation of the principles and functions of e-government requires the creation of new rules, and government changes to address e-activities such as earchiving, digital signatures, information transmission, data protection, cybercrime and intellectual property rights.

#### **TECHNOLOGICAL ISSUES**

#### DATA PROTECTION

Directly intertwined with the security of Public Websites is their reliability and acceptance by users. It must therefore be ensured:

- Integrity of the information that is circulated, published, stored and processed so that it remains unchanged.
- Identification that refers to the identification of the user.
- Confidentiality refers to access to information only by those who have the appropriate authorization.
- Authentication which ensures that the identity declared by the user corresponds to him.
- Authorization to ensure that each entity has access to those system resources that have been granted access.
- Availability of information whenever an authorized user attempts to access it.
- Non-repudiation concerning the non-denial of a user that he / she has performed any action related to the access, registration and processing of information.

#### ACCESS – AUTHENTIZATION

In order to access information concerning the user, whether is an organization, citizen or institution, his identity must be verified in advance. The level of security depends on the criticality or sensitivity of the services and data.

#### **AVAILABILITY - SYSTEMS PERFORMANCE**

Since the backbone of the internet infrastructure is once the structured cabling, which has a significant cost and can not be replaced often, so the operator should take care of its short-term and long-term changes.

#### AVAILABILITY - SERVICE PERFORMANCE

The operation of a Public Website also involves the servers which are: a) the web server that supports the user interface with the Public Website and the presentation of the Public Website on the internet, b) the application server that hosts the applications that support the operation of the Public Website but also the services it provides, and c) the database server in

which the data for the various applications are stored. Therefore, public bodies should first assess the needs and then procure the systems that will support the operation of the Public Website.

#### RESISTANCE TO PHYSICAL SECURITY RISKS

Public bodies should also take into account the possible occurrence of risks such as natural disasters, interruptions or fluctuations in electricity supply, etc. and take appropriate action.

#### ACCESSIBILITY

Every website should be accessible to as large an audience as possible. This access should not be related to the infrastructure of the users and should take into account the possible special needs of the people to whom it is addressed.

#### CONCLUSIONS

The constant rearrangements in the global IT environment and especially the change in the terms and conditions of the internet maturity make it more imperative to monitor and examine the evolution of e-government from the modern literature and articles. The above finding is attributed to the breadth and size that the evolutionary course of the internet has progressively given to the issue of e-government, a fact that has prompted a number of approaches from scientific areas (IT, technology, economics and administration, politics, sociology, medicine) to engage in creating knowledge.

The aim of the implementation of e-government programs is to improve the quality of public services provided by governments, which will be measured by specific indicators such as, reducing the processing time and improving the service of citizens.

E-government is the «tool» for the realization of the new relationship between the modernization of the citizen and the state, the improvement of the processes, the communication between the public services, institutions and organizations. This is achieved through the focus on issues of interconnectedness and interoperability of public sector information systems resulting in faster, more economical, transparent, more secure and qualitatively upgraded service to citizens. The digitization of the huge amount of information held by the central, regional and local authorities provide the possibility for a more efficient and rational administration.

In recent years, Greece has made progress in terms of e-Government. However, the progress made by Greece is not enough to reach the level of the countries of the European Union, despite its needs to reduce operating costs, increase productivity and efficiency of the public sector, as well as increase transparency [10].

Greece presents the lowest percentage (10%) of electronic transactions (transaction) to which contribute only the two well-known services provided by TAXISnet related to the submission of electronic income tax and value added tax returns. While it is worth emphasizing the satisfactory position and perspective of Greece that seems to provide advanced and reliable e-government applications.

Greece, therefore, must intensify its efforts for the development of e-Government in order to reduce costs and bureaucracy, to increase transparency, but also to strengthen the Republic, through increasing the participation of citizens in the Government.

#### REFERENCES

- [1] Apostolakis, I., Loukis, E., Halaris, I., (2007), Electronic Public Administration, Chapter 7, p.247.
- [2] Apostolakis, I., Loukis, E., Halaris, I., (2008), e-Government, National School of Public Administration, Informatics Program.
- [3] Alenezi, H., Tarhini, A., & Sharma, S. K. (2015). Development of quantitative model to investigate the strategic relationship between information quality and e-government benefits. Transforming Government: People, Process and Policy, 9 (3), 324-351.
- [4] Boufeas, G., Halaris, I. and Kokkinou A. (2004) Business Plans for the development of egovernment in Greece. An appraisal. Athens, UNTC Occasional Papers Series, NO 5, 2004.
- [5] Hashim, H., Lin, A., & Foster, J. (2016). Barriers surrounding e-government implementation: A case study of Government to Business (G2B) system. In Communication, Management and Information Technology: International Conference on Commonwealth, Management and Information Technology (ICCMIT 2016, Cosenza, Italy, 26-29 April 2016) (p. 295). CRC Press.
- [6] Lambin, E. F., Meyfroidt, P., Rueda, X., Blackman, A., Börner, J., Cerutti, P. O., & Walker, N. F. (2014). Effectiveness and synergies of policy instruments for land use governance in tropical regions. Global Environmental Change, 28, 129-140.

- [7] Roman, A. V., & Miller, H. T. (2015). New questions for e-government: Efficiency but not (yet?) Democracy. In Public Affairs and Administration: Concepts, Methodologies, Tools and Applications (pp. 2209-2227). IGI Global.
- [8] Fan, J., Zhang, P., & Yen, D. C. (2014). G2G information sharing among government agencies. Information & Management, 51 (1), 120-128.
- [9] Jaeger, P. T. (in press), «The social impact of an accessible e-democracy: Disability law in the development of e-government», Journal of Disability Policy Studies.
- [10] European Parliament, «eGovernment: Using technology to improve public services and democratic participation», European Parliamentary Research Service (E.P.R.S.), 2015.

# The use of Information Systems in e-Government as an opportunity for effective reorganization of Public Administration. The case of e-Justice in Greece.

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**Abstract:** In our country, the Republic, despite its enviable stability, is characterized by its strong administrative inadequacy. Aspects of this inadequacy, which is constantly and in many ways seen at every step of the Greek citizen, is the continuing murky landscape in terms of the responsibilities and responsibilities of each administrative body, the general organizational liquidity, the lack of coordination of both structures and the law they are developing, legal-regulatory inflation and widespread mismanagement, do not allow the Judiciary to play its own corrective and decisive corrective role.

Above all, however, it seems that both administrative problems and judicial weakness arose as a result of deliberate choices of the dominant political system all these years, which in this way, while maintaining a weak Administration, an ineffective Justice and at the same time a grid of customer relationships, confirms and reproduces its dominant position. The many reform efforts undertaken over the years have failed miserably due to the suffocating dominance of the conservative, which stubbornly refuses to modernize. On the other hand, a portion of the population has so far not been so demanding and pushing for this modernization, and the economy seems to have just begun to demand rules of transparency and impartiality.

The major economic-political crisis, which broke out in 2009 and continues to this day, was nothing but the logical conclusion of the inadequacy of the Greek Administration in combination with the inefficiency of the Administration above all Justice.

Having replaced rational organization with chaotic one, the way it operates on the basis of clear and uniform rules with unrestrained lawmaking and formalism, it finally pursues the public interest by satisfying many, big and small, but selfish interests in the Hellenic Republic collapsed when the waste of resources to which it relied for years exceeded all tolerable limits.

Greek society needs a modern state, with an effective Public Administration, capable of consistently implementing public policies and dealing with public problems with responsibility and know-how, as well as an Open Horizon Justice that will intervene in a timely and corrective manner when necessary, in order to restore lawful functioning of state authorities, to ultimately strengthen the Republic itself.

*Keywords:* e-government, e-justice, information systems, democracy, public administration reorganization, governance systems, digital readiness.

#### INTRODUCTION

In an external environment characterized by an aging population, lack of infrastructure, high external debt, unstable international relations and interactions between states, individuals, groups and regions, the need to modernize the public administration and redefine its role in the new economic is considered imperative. Increasingly, the role of the State is moving away from the production of goods and services through public organizations towards the creation of an appropriate economic environment that will enhance economic growth. In this context, the need to redesign the public administration, which is already being implemented in many developed and developing countries, is urgent.

Redesign of public administration refers to the change of a public organization through the reasoning of "what it does" instead of "what it is" and includes a complete redesign of the administrative processes of organizational structure and information systems in direct or indirect response to external forces in order to achieving specific goals such as drastically reducing time and cost efficiency (Saxena, 1996). It focuses on the development of an organizational architecture that links the strategic goals of the organization with the necessary organizational processes to ensure that these strategic goals are actually achieved [1].

Redesigning public administration requires a willingness to innovate and is difficult to achieve as public bodies are quite bureaucratic in the sense of legislating procedures and adhering to standard rules, and do not have mechanisms to promote change as is the case in the private sector. This is mainly due to the fact that public bodies are funded under a predetermined budget, which is not linked to their efficiency and effectiveness, so they have no incentive to improve their efficiency. The same, of course, applies to managers of public services, whose hierarchical development and earnings do not depend on the performance of the organization they run but on their formal qualifications and seniority. In addition, the administrations of public bodies are not as free to exercise administration as those in the private sector as they largely implement the planning of the political leadership of each ministry and are subject to its hierarchical control.

In this article an attempt is made to answer the following research questions:

- The IT projects in the Greek Public Administration are progressing and the first results are appearing in the field of Justice. But is there organizational adequacy? Can e-justice work effectively in Greece?
- How can the quality of IT projects in the public sector be improved? What are the main pathogens? What are the key changes proposed?
- What changes do Digital Technologies bring to Governance Systems?
- What are the reasons for the delay in the administration of Greek Justice and how can the efficiency and quality of the Greek judicial system be improved through e-justice for the benefit of citizens, the legal community and organizations?
- How is the «Digital Readiness» of our country judged in the fields of Economy and Justice, taking into account the financing of the Community Frameworks (previous and new)?

#### METHODOLOGY

The scientific article is based on a bibliographic review, on European Commission texts, on published scientific articles, on research on the use of Information Systems in e-Government and finally on scientific journals dealing with the reorganization of Public Administration and Electronics.

#### **RESULTS AND DISCUSSION**

#### **BASIC ELEMENTS OF PUBLIC ADMINISTRATION REDESIGN**

In any case, it is generally accepted that redesigning public administration is not an easy task, it requires a fundamental change in the way public administration thinks and works. It must therefore be treated as a holistic concept. It consists according to Saxena (1996) of four basic elements which are analyzed as follows:

- Strategy defines the goals of an Organization and its direction and is the basis of redesign as it determines its way and functions. The redesign of procedures must lead to the transformation of the vision in a direction of modernization and upgrading of the quality of the provided services based on the needs of the citizen.
- Information Technology contributes substantially to improving the efficiency of public administration by introducing Information Systems, modernizing management systems, connecting public organizations through modern communications networks and reducing

the cost of public-private communication, enabling public-private sector public administration to meet the needs of citizens with new methods of providing public services.

- The organizational structure of a public organization is traditionally hierarchical, while the goal of the redesign is to bring employees to the base of the hierarchical pyramid, closer to the Citizen, to understand their problems and needs.
- Organizational culture is the set of beliefs, values and expectations that are common to members of an organization and contribute to the creation of rules and patterns of behavior that regulate the attitude of employees in the organization. The redesign aims to change the organizational culture, to create a new one more receptive to change. Continuous training of employees and information on the benefits that can bring in the performance of their duties is required. It refers to establishing communication between all levels of administration, taking initiatives and making decisions as close as possible to the base of the hierarchy.

Improving just one of the above can have a lower than optimal impact on the whole process if it does not contribute to the improvement of the rest.

#### **OBSTACLES IN THE REDESIGN OF PUBLIC ADMINISTRATION**

The redesign of public administration is not easy to implement due to the special characteristics of public bodies which differentiate them from the private sector and make its implementation very difficult. These characteristics are indicatively reported by Saxena (1996) as follows:

- Most public bodies focus on adherence to procedures and lack a clear wording of their strategy. Therefore, a precondition for implementing a reorganization in such an organization is the formulation of its strategy in terms of vision and goals.
- The concept of customer was difficult to define in the public sector. Of course with the advent of new public management the concept of the customer is restored and takes its rightful place in the organization of public organizations.
- The benefits of reorganization come from the fact that the organization thinks, organizes and acts horizontally in terms while public bodies are organized according to the vertical hierarchy, so it is difficult to understand the meaning of horizontal organizational change.
- The concept of improving a process presupposes the definition of execution and its measurement, however this definition is difficult in the public sector in terms of indicators that are measurable.

#### **CATEGORIES OF REDESIGN OF PUBLIC ADMINISTRATION** [1]

Public bodies do not implement public administration redesign to the same degree due to multiple difficulties. Depending on the amount of financial resources available, the commitment of the leadership to the goal it has been called to achieve and the risk it is willing to take, the degree and extent of the changes that are attempted are determined each time. As a result, we distinguish three categories of redesign (Saxena, 1996):

- Process Improvement. Refers to a limited redesign of a single component, process, or function. The goal is to improve individual subprojects without causing a significant change in the performance of the organization. The advantage of this type of redesign is that it involves a small number of employees, who as a rule do not resist its implementation as long as they understand the purpose of the desired change.
- 2. Process Redesign. This is a more holistic approach that consists in the overall redesign of the process by coordinating the substations - subprojects and reorganizing the way in which they are connected. The assistance of information technology in the design of new processes is usually required. It can prove to be a dangerous undertaking insofar as it requires the cooperation of more functions and departments.
- 3. **Organizational Transformation.** It refers to the case of a radical change in the structure and culture of the organization in order to improve its processes. The potential benefits of such a sweeping redesign can be a radical improvement in the overall performance of the organization and the achievement of its strategic goals, without, of course, ignoring the risks and costs of such a large-scale change.

#### **REDESIGN OF PUBLIC ADMINISTRATION USING INFORMATION SYSTEMS**

As mentioned above, a key element and precondition for the redesign of public administration is the use of information technology. However, the introduction of information systems in an organization presupposes the restructuring of its processes. Therefore, the redesign of procedures and the introduction of Information Systems must be a single program of restructuring of the organization (Kalyva, Gotzamani, 2011).

Combining the findings of the literature, Kalyva and Gotzamani come to the definition of the redesign of public administration using online Information Systems as «the redesign of the organizational structures, the institutional framework and the business procedures of the public administration, ie to society as a whole, the formulation of public policy as well as supportive processes» [2].

Regarding the conditions in order to succeed in the redesign of the public administration with the use of Information Systems, the following are mentioned:

- 1. Support and commitment of political and administrative leadership to secure the necessary resources, lead the effort and monitor the progress of the process.
- Development of a redesign strategy by defining the objectives and the program to be followed.
- 3. Align the objectives of the redesign program with the broader state strategy for the modernization of public administration in the context of e-government.
- 4. Align the objectives of the program with the requirements of society as a whole.
- 5. Effective change management by creating the right culture, managing resistance and creating user support plans.
- 6. Selection of a project team from executives of all organizational units with possible participation of external experts.
- 7. Identify the limitations of the redesign resulting from legislation and obligations of the public body.
- 8. Training of employees in new technologies to be able to use the full range of capabilities and functions of the new Information Systems.
- 9. Promoting cooperation and interoperability between public bodies so that the direct exchange of information and knowledge is possible.
- 10. Informing the citizens about the new ways of providing Public services and promoting their use to the largest possible percentage of citizens, especially in vulnerable groups.
- 11. Continuous review of redesign programs based on technological developments and measurements of citizens' satisfaction with the new processes.

# NECESSITY OF REDESIGNING PUBLIC ADMINISTRATION WITH THE USE OF INFORMATION SYSTEMS

The reasons for which it is necessary to redesign the procedures using information systems can be considered the following:

- The expanded responsibilities of the public administration as a consequence of the increasing complexity of social problems, the emergence of new fields of state action and the internationalization of the economy.
- 2. The need to limit public spending as a result of fiscal consolidation programs implemented worldwide due to the economic crisis.

- 3. The expanded implementation of the new public management and the need to increase the productivity and efficiency of the public sector which suffers from fragmentation and duplication of responsibilities between organizations and ministries creating useless burdens and delays in business activities.
- 4. The general dissatisfaction and discrediting of the state institution in combination with the demand of the civil society for greater participation in the formulation of the policy through the electronic consultation.
- 5. The increase of the educational level of the citizens, their familiarity and the possibility of their access to the electronic information and the electronic transactions with consequence the expansion of their demands and their criticism.
- 6. The low level of citizens' satisfaction with the public services provided so far and the requirement to provide them electronically to save time and costs.
- 7. The demand of the citizens for transparency, accountability and modernization of the public administration in order to deal with the phenomena of corruption and bureaucracy that directly affect the attraction of investments for economic development.

#### THE CHANGES THAT DIGITAL TECHNOLOGIES BRING TO GOVERNANCE SYSTEMS

- 1. Modernization of the State and Public Administration with a vehicle of Information and Communication Technologies (ICT).
- 2. Information and Communication Technologies (ICT) are at the core of the country's new development model.
- Targeting and best practices. However, local specificities due to the economic crisis should also be taken into account (eg lack of money, acceleration of projects, new forms of financing, etc.).
- Proper implementation of projects. Greek best practices (KEP, TAXIS, Transparency, etc.) should be utilized and the critical success factors of large IT projects should be taken into account.

#### THE EFFECTIVENESS OF IT PROJECTS IN GREEK E-JUSTICE

In Greek Justice, important IT projects are now a reality. The implementation of the Action Plan 2014-2018 of the Ministry of Justice, Transparency and Human Rights creates new data in the management of legal information and the use of new technologies, which definitely contribute to the economic development of the country and in any case operate for the benefit of the citizen - party and legal professions.

The question that arises at this stage is how ready are the administrative mechanisms to manage these projects in the four basic stages of their implementation: their design, construction, production operation and maintenance - development. It is a fact that IT services presuppose the existence of central management systems, in order to enable the recording of needs and risks, the design and implementation of action plans, the support of productive operation and the optimization of applications. This means that dedicated staff (and to some extent specialized skills), organizational structure and management procedures are required. The current reality in the field of Justice highlights serious deficits in this area.

The implementation of the project of the Ministry of Justice, Transparency and Human Rights «Integrated Judicial Case Management System of Civil and Criminal Justice - IACSD-PP» revealed the following: In the planning phase of a project, a horizontal inter-ministerial level, an action that for the Greek data has an objectively high degree of difficulty. Characteristically, I will mention that the IACSD-PP project had as a precondition for its construction the project «Optimization of the Flow of Criminal, Political and Administrative Procedure» of the same Ministry, which for various reasons started several months later.

Also, a key element for the construction and operation of IACSD-PP was the construction and operation of the networks of SYZEFXIS 2, a project which presents an exceptional time lag. A more effective timing of actions would save resources. In the construction phase of a project, the organization is required to utilize the human resources at its disposal, selecting the business and IT experts who will frame and guide the contractor, giving the necessary directions and the appropriate information. At the same time, the body serving the need for interoperability, in accordance with the spirit and principles of the institutional framework for e-Government, must develop similar coordination actions with other bodies of Public Administration. In the productive operation phase of large IT projects the entity is required to have organized the appropriate structures that will allow it to manage the project.

There are no such structures in Greek Justice. The organization of the courts to date serves (with several difficulties) the operation of only local systems. In order to meet the new needs, the constitutional requirement of the independence of the Judiciary must be taken into account. Consequently, it is necessary to establish administrative bodies (for example: board of directors, steering committee, board of central system administrators, organization of local administrators), regulations and management procedures under the supervision of the supreme courts and with the participation of judicial and prosecutorial officials, court officials employees with specialized technical knowledge.

In the maintenance and planning phase, the organizational structure of the project management is required, as previously described, to evaluate the performance and needs of

the systems, to make decisions on the required maintenance and upgrade actions, to propose to the Central Administration legislative interventions, where necessary, and business plans to meet future needs. It is extremely important to diagnose the needs caused by the operation of the systems. It is also crucial that this diagnosis is timely and reliable. If this does not happen, all the works that are currently in various stages of construction or operation, will be devalued. In such an undesirable development, the financial cost for the country will be many times the spent resources.

# KEY CHANGES PROPOSED TO IMPROVE THE QUALITY OF IT PROJECTS IN THE PUBLIC SECTOR?

The quality of information systems designed, received and operated in the public sector is decisively influenced by the system of unworthiness that has existed for decades in the majority of public services.

In IT, but also in other sectors, due to multiple malfunctions of the public procurement system, most projects are implemented in 36-72 months. The constant rotation of political staffs and the inability of the superiors to serve the public interest, have led to the creation of networks «intermediary» with skills and knowledge to deal with the respective political power. In this context, project resources are wasted in non-productive activities and healthy competition is significantly undermined. Unfortunately, at the political as well as the academic level, there is no will to cure the causes that have led to this situation. As a result, instead of forming a consensus for the strengthening of public administration and independent authorities, by adopting institutionalized procedures that ensure the meritocracy of supervisors and transparency in their operation, «progressive» views are formed to further limit the relative autonomy of public sector structures [5].

In the public sector over the last 30 years a large number of IT projects have been implemented which have been financed mainly from Community funds. Unfortunately, only 1 in 4 worked productively. A great opportunity was lost for these projects to be pillars for both the administration and the Greek IT organizations that implemented them so as to leave know-how in both the market and in the public administration. If we take as an example the list of projects formed in the autumn of 2009 according to the then political priorities, we will notice that the majority of these projects were never completed, although they were prioritized at the highest political level.

Most of these projects would have to be self-financed if there were cost centers in the public sector that would manage the cost reductions resulting from the productive operation of the

projects. Three projects that are considered successful and with international recognition are: DIAVGEIA, Electronic Prescribing and the project Management of Contracts and Electronic Procurement. From the study of the implementation and productive operation of these projects but also the description of projects that were implemented in the period 2009-2012, useful conclusions emerge that can be used in the design of respective projects. A basic condition is that the body that will be selected to manage the project must have at least implemented a similar project successfully. At the technical level, the projects should be designed collaboratively with open standards, open software and from the first day to be implemented through platforms.

It is important to have an introductory guide for the management and storage of a) software, b) data, c) content, as well as d) studies for public bodies and organizations in Greece. This approach allows the immediate and flexible development of operational prototypes in an extremely short period of time. At the same time, it provides the opportunity to make a realistic assessment of the costs and risks that exist in a project in an equally short time and without the risk of designing huge projects with a high degree of uncertainty and questionable utility for the end user.

There is an urgent need for IT projects to be designed with the aim of providing the service, with small development cycles, based on open standards and providing open data. And all this can really only happen when the human resources that will design and operate them have been selected and operate with equally open procedures and practices.

#### Improving the delay in the delivery of Greek Justice through e-justice [3]

The delay in the administration of Greek justice is a major issue with multiple consequences for the economy and society as a whole. It depends on the data of our judicial system, but also on a wider circle of pathogens, with the consequence that the judicial function, with significant deficiencies in support structures, is faced with a huge volume of pending cases. But the problem that has been discovered in recent years is not new. It had been highlighted since the mid-1990s, has taken on particularly alarming proportions since the early 2000s and has become uncontrollable in recent years. There is no Minister who has not legislated for the acceleration of the administration of justice. However, this effort with firefighting interventions, without serious planning, to date has no results. Especially for administrative courts, the reasons for the congestion of courts by cases are many.

The creation of administrative disputes is directly related to the socio-economic situation in our country, the legal framework that regulates it, the way it is legislated, but also to the effectiveness of the executive bodies of the Administration that are called to implement it. Due to poor legislation and the constant change of laws, the executive bodies of the Administration do not manage to be informed, and this, in combination with anachronistic mentalities and perceptions of the Administration, such as indifference and arbitrariness, result in the incorrect application of the law with problematic interpretations of citizens' rights and the production of a multitude of new disputes that especially in recent years have caused and continue to cause the memorandum legislation. Experience shows that despite the difficulties faced by citizens, recourse to the courts is intensifying. Therefore, any insurance, tax or other reform necessarily prescribes new differences that are added to the existing ones.

Thus, the solution of the problem depends mainly on changes - which, however, do not take place - in the legislative function and in the structure and functionality of the Public Administration. The whole situation, however, is aggravated by the anachronism, which exists in the daily operation of the courts, which is also a factor of delays. The functions of information technology in the judicial systems of most European countries have helped to reduce bureaucracy, improve the functioning of the courts and save time and money. If the aim is therefore for justice to be qualified, fast and efficient, the modernization of the system with the application of information technologies is also required.

#### **CONCLUSIONS - SUGGESTIONS**

First of all, the issue of «Digital Readiness» of our country - especially in comparison with other EU countries - needs a more comprehensive assessment, in order to identify the factors of weakness, their causes and of course how to «cure» them. The Digital Readiness Index, called the Digital Economy & Society Index (DESI), is moving in the direction of this valuation and is based on the evaluation of 5 key parameters per country, namely: Connectivity, Human Resources, Internet Use, Integrity, Digital Technology, Digital Public Services. Unfortunately, the report for our country is indulgently mediocre as ... unfortunate, as only in the aspect of Integrity of Digital Technology we present a decent performance, while in the other parameters our performance is below the low average. Especially in the parameter of Digital Public Services, unfortunately we are still low, especially in individual criteria, such as the percentage of users who use electronic services and / or the interoperability of services. So starting with a negative sign in the big picture, and focusing our analysis on the Economy, we are probably taking some «encouraging breaths», as the current situation highlights a number of electronic services in the Public Sector (TAXISnet, ICISnet, Electronic Procurement, etc.) at the Banks

and in Public Enterprises and Organizations as well, but with a small degree of interoperability [4].

And while the messages in the field of Economy are encouraging, unfortunately in the field of Justice both the analysis of Digital Readiness in comparison with the wider geographical area of the EU, as well as the reality (eg island systems, lack of homogenization, completeness, lack of interoperability with third parties, quantitatively limited staff, etc.) is ... sad. However, the realization of the need for homogenization of the procedures, for a central integrated approach that interacts inside and outside the area of Justice and to produce extremely useful statistics and finally for the development of human resources that will perform its work in the right conditions, seems to have matured to a significant extent.

It is worth noting the great importance of the concept of interoperability both within an organization and between organizations because it involves the exchange of information and knowledge between organizations through the business processes they support through the exchange of data between their ICT systems. Achieving interoperability can significantly increase the benefits of using ICT in public administration.



Figure 1: Conceptual Model for Interoperability in e-Government

Proposed Solution: Less infrastructure in government agencies - Better services for citizens...The ICT sector in Greece, as in many other European countries, has developed into a

model of state-owned technological infrastructure. These infrastructures now create a significant burden on the state mechanism, both in terms of maintenance needs and in terms of «necessarily» upgrading them to serve new technological data. Also, a significant part of these investments has been wasted due to aging, without being able to make a real valuation of the benefit and its depreciation.

At the same time, the services provided by these systems to citizens and organizations can, with few exceptions, be valued neither for their use, but certainly not for their productivity and the benefits they offer to our digital economy.

By introducing a new logic linking ICT investment to real digital services and productivity through private-public partnerships - the country will be able to create a new modern digital map, significantly enhancing its services and dramatically increasing extroversion of its digital actions. This new approach focuses on the final service to the citizens, as a unique element of evaluation and costing of each investment: Every public project can produce a business benefit, coming from direct or indirect return of the services provided.

Main problems that need to be addressed: Public-Private Partnerships in the ICT sector present significant difficulties in identifying technical specifications, replacing suppliers and finding third-party funding. At the same time, the useful life of IT projects is limited (10-12 years), which requires high rates of repayment of the initial investment. International experience in Public-Private Partnerships in the field of ICT has shown that these partnerships are particularly successful when the projects are properly designed and at the same time there is experience from all stakeholders.

Specific Proposals for the utilization of Private Management and Leasing Contracts:

- Creation of a single flexible institutional framework for each form of partnership Private
   Public sector, including concession contracts (according to Law 3389/2005).
- Creation of a horizontal framework mapping of actions that can be implemented through Public-Private Partnerships.
- Development of a transparent environment for the creation / maturation of new actions with a market participant in open consultation procedures.
- Opening a process and activating the market with the aim of creating investment formations to finance development investments in the ICT sector.

In the difficult economic situation that the country is going through, Public-Private Partnerships can and will be the alternative proposal for the development and promotion of our digital economy. At the same time, they can signal a new perception of the real issue, which is none other than the essence and usefulness of each of our digital actions.

By implementing Private-Public Partnerships in ICT projects: Private funds will be used for the implementation and provision of public infrastructure and services, which operate in addition to the limited public resources due to the economic situation.

The State will not disburse resources to repay projects and, where required, repayment will be made gradually and over time, freeing up public resources to pursue more development priorities.

Keeping the time and cost of implementation will now be a strong incentive for the private contractor, as the start of repayment of the project will not be subject to adjustments, cost overruns and failures.

The contractor will be repaid on the basis of a detailed payment mechanism, which evaluates the quality of the project and the services offered throughout its life. Low quality of service means reduced payment. Strong incentives are needed for the long-term maintenance of a technically sound project and the provision of high quality services. With the implementation of Public-Private Partnerships, synergies will be achieved by integrating the design, implementation and operation into a (single) long-term contract.

#### REFERENCES

- Saxena K.B.C., (1996). *Re-engineering Public Administration in Developing Countries*. Long Range Planning, Vol. 29, No. 5, pp. 703 to 711.
- [2] Kalyva, E. & Gotzamani, A. (2011). Redesigning Public Administration Processes Using Information Systems: A Theoretical Framework. ESDO 2011 Poster sel.32-345.
- [3] Koumakis, P. (2017). Electronic Justice. Measurement of Acceptance of the Integrated System of Practical Courts (OPSD) by the Judicial Officers of the Civil Courts of the Peloponnese. Postgraduate Thesis. University of Pelopponisos. Tripoli.
- [4] Georgakopoulos, G. (2016). *The E-Government in Greece: A Theoretical Framework.* Greek Business Management Company. Athens.
- [5] Vouzas, F. (2018). *Public Management.* Scientific Journal of the Public Administration. Thessaloniki.

## E-GOVERNMENT EVOLUTION IN EUROPE AND BENEFITS THAT CAUSE FROM ITS APPLICATION

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**Abstract:** With key incentives, cost reductions and improved public service delivery, countries have developed e-government applications.

The development of e-government in Europe has made significant progress. The digital transformation of governments is the cornerstone of a single digital market and the achievement of the EUROPE 2020 targets. Europe has managed to be a world leader. «A Europe with a dynamic and more competitive economy in the world based on knowledge», remains from the Lisbon strategy to this day the point of reference for the action plans that have been drawn up and relate to e-government.

*E*-government is a worldwide need. Starring at all levels of cooperation, organization and management whether we are talking about the private or public sector. It includes the use of Information and Communication Technology with the aim of improving services to citizens, businesses and other public services.

The need to reduce government spending, especially in a time of severe economic crisis, improving the quality of services provided, increasing transparency, and increasing citizen participation in government governance have contributed significantly to its implementation.

This paper is a bibliographic study and research. Its main purpose is to demonstrate the benefits of implementing e-Government in Europe.

*Keywords:* e-government, citizen, Europe, information and communication technologies (ict), information systems.

#### INTRODUCTION

Governments realized that the Internet, which had already prevailed in the private sector, could be used in a similar way by states to serve citizens and organizations. In this context, a new model of public administration, called e-Government, has begun to develop.

E-government is essentially the technological intermediary between citizens and governments, under the guise of an electronic release in communication, in the development of regulations, and in the democratic expression of the will of the people.

Combined with technological developments, it is certain that the Internet has redefined the expectations of the public, governments and the services they offer. E-Administration and e-Democracy are also characterized as modern approaches to e-government.

The provision of public services with e-government methods is a goal of today's governments, in the direction of improving communication and the quality of citizen service. Until now, the infrastructure of the State, in IT technologies concerned the internal use of systems, within the individual departments and services.

Now, governments can expand their infrastructure to the wider society so that the primary values of the digital age - faster, better, cheaper and more easily accessible - can be applied to public services as well.

Through the implementation of e-Government, countries will succeed in increasing transparency, strengthening democracy, by increasing citizen participation in public administration, improving the quality of life of citizens, increasing productivity, efficiency and efficiency of the Public Sector.

The vast majority of authorities acknowledge that in order for e-Government to succeed, change in organizational structures, the public sector, education of civil servants, the creation of digital and technological culture in the citizen, and above all, information on all sides are required.

However, it is characteristic that the term e-Government is not known to the largest percentage of the Greek population, who, in any case, do not see any significant difference in their contact with public services. In a more general context, we could say that the main obstacles to the implementation of e-government programs are not technical. They are social and cultural.

E-Government has been at the forefront of the international arena for several years. Since the early 1990s, governments at all levels have adopted e-Government programs to provide electronic, information and services to citizens and businesses. Today, e-Government is at the forefront of both research and application, and this new space attracts the attention of governments, technology providers and researchers.

For the realization of e-Government, it is worth mentioning the important role that information systems play in public organizations. Their benefits concern both employees, making them more efficient and better at work, and citizens, who are served directly and quickly by public organizations. Information systems also tend to eliminate the huge bureaucratic problems of the public sector. However, other steps are needed to achieve high efficiency. Continuous evaluation of information systems is also required in order for it to work effectively. In addition to the evaluation, it is necessary to continuously upgrade it with regular staff training.

E-government is now in the daily routine of the citizen. It affects his habits and affects his social behavior. The public administration is called upon to keep pace with the rapid developments in technology, moving at a faster pace in a digital age. Success lies in collective cooperation at local, regional and national levels, as well as between Member States. Digital public administration contributes to the transition from an inelastic and ineffective public administration focused on the state to an administration with the citizen as its central point of reference and the provision of services to meet its needs and desires. Necessary obligation to respect and ensure the freedom of expression and protection of the privacy of the citizen.

The public sector in Greece is late, with several problems, intensified by the economic crisis, trying to promote the necessary changes for the digital age. Technology has made a significant contribution to the computerization of the administration's services and is being treated positively by the latest executives of the public administration. Digital technology in public administration contributes to the redesign of processes, to the efficiency and effectiveness of services and to good governance.

Political will at all levels is a prerequisite for promoting innovation and action for a comprehensive digital administration, inspiring all those involved in the processes of appropriate education and training, aiming to change the mindset of using e-government services and eliminating resistance to change, aiming at the digital integration of all citizens without exclusions.

We come to the following conclusions:

- States aim to save available resources and a more efficient and effective public sector
- Society hopes that e-government will help reduce public waste, increase transparency, and make more efficient public administration in line with private sector standard.

#### METHODOLOGY

The scientific article is based on a literature review, European Commission texts, published articles, research on the course of e-government in the European Union, the benefits and difficulties that may arise from the development of e-Government.

#### **RESULTS AND DISCUSSION**

Difficulties may arise in the development, integration and upgrading of e-Government applications. Once a government decides to adopt strategies to transform its processes, significant challenges will arise (general and specific) that it will have to face in the future.

The main general challenges are:

- Infrastructure Countries adopting e-Government applications are trying to create a basic infrastructure to take advantage of new technologies and communication tools. These countries must include in their strategies efforts to develop infrastructure, innovative approaches, and the need for state-of-the-art connectivity.
- Digital Divine Differences in access to e-Government services commonly referred to as the «digital divide», after a set of issues. The issues of the digital divide that seem to be common to every culture and country are related to both the ability to serve and the ability to access content. Every democratic society has a moral and legal obligation to fight for the elimination of all kinds of exclusions, and to ensure that every citizen enjoys easy and equal access to the services of the state.
- Training [2] In general, as the level of education increases, so does the use of the Internet (Department of Commerce, 2002). Training in the use of technology seems to be the key element in this digital divide [1]. Internet user experience groups are the most frequent users of online services (Booz Allen Hamilton, 2002).
- Accessibility [4] Ensuring that people with disabilities can use government websites is another important issue in the development of e-Government. For people with disabilities, a website is accessible «if it can be used in a variety of ways, not dependent on a sense or ability» [3] (Nadler, D. M. & Furman, V. M., 2001). Failure to access eservices poses a threat to the virtual isolation of people with disabilities {Jaeger, P. T. (in press)}.
- Transparency Government transparency should be an important factor in infrastructure design. Lack of transparency prevents most citizens from actively participating, asking questions, or protesting misguided decisions. Government websites and online services must comply with the principles of law in relation to government functions.
- Human Recourses Human resources must be structured, keeping in mind the goals of e-government. A trained and willing human resources are one of the most important factors in the success of e-Government. Political will is able to play an important role in creating a positive climate for the implementation of e-Government, ensuring sufficient training and rewarding those who support this transformation.

In particular, the challenges [5] that arise are (European Parliament, 2015):

• Electronic identification, Security and Trust - One of the biggest issues that undermines the use of e-services is that users do not trust e-government services, especially the

most advanced, transactional services that require self-identify and disclose private or personal data. There are doubts about the security of their access and the extent to which their data is protected. For example, a study by the Boston Consulting Group found that 47% of users of government digital services want more certainty that their data is private. Internet trust depends on electronic identity information, which may vary in completeness depending on the environment. Likewise, citizens have the right to be informed when collecting personal data and the purpose for which it is done.

- Cross-border services and interoperability Citizens and businesses wishing to take advantage of the Single European Market to travel, work, live or provide services in other Member States of the European Union., they must also use electronic public services in these Member States. Businesses want to register, get licenses, pay value added tax (Value Added Tax V.A.T.), and cross borders without any problems. Interoperability, (not only the compatibility of the technical infrastructure, but the compatibility of the legal framework and organizational structure), is critical to eliminating barriers for citizens / businesses wishing to use these services from anywhere in the European Union. On the other hand, the additional cost for cross-border use of an online service is not high, representing, on average, less than 5% of the total cost of implementing a new service.
- Electronic Participation (e-Participation) E-participation is the use of ICT to facilitate political participation, allowing citizens to communicate with each other, with civil society, and with their elected representatives and their government. E-Participation actively engages citizens in the policy-making process so that they can raise issues, change agenda, and change government initiatives. Stronger participation in the Internet, through technology, has the potential to improve the quality of political decisions, and increase the perceived legitimacy of the decisions taken. Some see this aspect of e-Government as a new era of democratic participation (e-Democracy), with greater transparency and accountability. A variety of different technologies can contribute to online participation, including: 1) web-streaming, 2) social media (especially Facebook and Twitter), 3) blogs, 4) online forums, 5) decision support systems and 6) electronic voting systems.
- Public sector information and open data Open data is data that is freely distributed to all, in a convenient and modifiable form, under conditions that allow their use, reuse and redistribution. Government open data is a particularly important resource for two main reasons: 1) The very large amount of data available to governments, which can be

processed and analyzed to provide information and support the receipt of decisions) and 2) The fact that public funds have been paid for their collection.

The creation of «open» government data is considered by many to be that it provides greater returns on public investment and policy support to tackle complex problems. It also improves public policies and the efficiency of public services, leads to the creation of economic growth and wealth, through new subsequent applications, policy development and service delivery, while increasing transparency and democratic control. Much of the interest in the discussions on the subject is focused on the supply side, and not on how or for what purpose this data can be used. Furthermore, there has not been enough study of some factors - obstacles such as: 1) Change in government policy, 2) Filtering of data to eliminate sensitive or personal data, 3) The complexity of using large amounts of data, 4) Lack of information about the quality or importance of data and 5) The absence of standardized forms and metadata.

Simply posting open data will not necessarily lead to a more open and transparent government.

E-Government provides the public sector with the opportunity to maintain and strengthen good and sound governance in the knowledge society. This means that:

- A public sector that is open and transparent. Governments that are understandable and accountable to citizens, open to democratic participation and thorough scrutiny.
- A public sector in the service of all. A public sector with a focus on the citizen who will be included, that is, will not exclude any of its services, and will respect everyone as personalities, providing personalized services.
- A productive public sector that provides the highest possible value to its taxpayers. This
  means that less time is spent on «queues». Mistakes are minimized, more time is
  available for «face to face» professional service, and therefore the work done by civil
  servants is more recognizable.

In summary, e-Government contributes to achieving a more open, inclusive and productive public sector, always in line with good governance. This is a prerequisite for a public sector that wants to be prepared for the future.

Europe must be based on its advantages. It has a leading role in mobile communications and digital television. These industries are on the verge of convergence, offering Europe the opportunity to capitalize on its technological advantages, as well as unleash its business potential. At the same time, the European production of content, based on its cultural heritage and linguistic diversity, must be promoted. This will help Europe achieve internal social cohesion, but also achieve the target of the «Lisbon Strategy», which is «creating an environment that favors private investment and job creation, increasing productivity, modernization public services, and the opportunity for everyone to participate in the global information society».

#### **CONCLUSIONS - PROPOSALS**

E-Government is defined as the use of information and communication technologies in public administration, in conjunction with organizational change, and with new features, in order to improve public services, democratic processes, but also to strengthen public support regulations.

E-Government is, therefore, a tool that enables better and more efficient management. It improves the development and implementation of public rules and helps the public sector to meet its conflicting requirements, and to provide better and better services, with fewer resources.

For example, one of the most important areas that can be improved, both in terms of efficiency and competition, is the area of public procurement / contracts. Through e-procurement, hundreds of millions of euros are being saved that can be invested in public services and goods, thus contributing to the economic development of each country. At the same time, transparency and accountability for public procurement are improving.

The public sector is often the target of criticism, in terms of its ability to meet the needs of citizens and businesses. Bureaucracy and the low level of services offered are the most common causes of dissatisfaction for those dealing with public organizations. Undoubtedly, the low quality of public sector services contributes to the deterioration of the quality of life of citizens. Also, the bad image of the public sector inevitably forms a similar picture for the country.

The implementation of e-government programs is related both to issues related to change management and to issues of selection and implementation of technological solutions. The main challenges that need to be addressed are inextricably linked to human resources, organizational culture and the management of the requirements of all participants. This means that communication, training and development strategies need to be created and integrated into the project budget and investment decisions. However, the success of e-government initiatives also depends on the support of all stakeholders.

E-Government in the European Union has now reached a level where member states have the opportunity to make people's lives easier, while reducing their costs.

In recent years, Greece has made progress in terms of e-Government. However, the progress made by Greece is not enough to reach the level of the countries of the European

Union, despite its needs to reduce operating costs, increase productivity and efficiency of the public sector, as well as increase transparency.

Greece, therefore, must step up efforts to develop e-government in order to reduce costs and bureaucracy, to increase transparency, but also to strengthen democracy, by increasing citizen participation in government.

#### REFERENCES

- [1] Department of Commerce, «A nation online: How Americans are expanding their use of the internet», European Union 2002.
- [2] Booz Allen Hamilton «International e-economy benchmarking: The world's most effective policies for the e-economy», 2002.
- [3] Nadler, D. M. & Furman, V. M., «Access Board issues final standards for disabled access under section 508 of Rehabilitation Act», Government Contract Litigation Reporter, 2001.
- [4] Jaeger, P. T. (in press), «The social impact of an accessible e-democracy: Disability law in the development of the e-government», Journal of Disability Policy Studies.
- [5] European Parliament, «e-Government: Using technology to improve public services and democratic participation», European Parliamentary Research Service (E.P.R.S.), 2015.

## Convolutional Neural Networks for X-Ray Image Classification

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**Abstract**: Pneumonia accounts for the death of every fifth child in the world. It is also the most common cause for adult hospital admission and for people over 75 often has a fatal outcome. Yet, pneumonia is curable and can be successfully treated if it is diagnosed early. X-Ray images is a preferred method of diagnosing pneumonia. However there is lack of qualifies diagnosticians in the most adversely affected regions of the world. We are proposing a method for X-Ray image recognition and classification based on convolutional neural networks which can be a supplement to the decision making process in diagnosing pneumonia.

*Keywords:* CNN, convolutional neural networks, image detection, medical image recognition, X-Ray image classification.

#### INTRODUCTION

Pneumonia remains one of the main causes of child mortality and accounts for fatal outcomes of infected with it adults with pre-existing health problems or aged over 65<sup>[1,2]</sup>. There two types of pneumonia. Bacterial pneumonia requires antibiotic treatment, while viral can be healed on its own<sup>[3]</sup>. The symptoms are confusing as they overlap with other diseases, such as difficulties in breathing, inflamed air sacs, cough with phlegm or pus, fever. The mortality caused by pneumonia can be prevented, as the treatment is low-tech and low-cost, yet it often goes unrecognized<sup>[4]</sup>. X-rays are the most common and accepted worldwide diagnostic imaging technique <sup>[4,5]</sup>. The chest x-ray is the most commonly performed diagnostic x-ray examination. An x-ray (radiograph) is a non-invasive medical test that helps physicians diagnose and treat medical conditions.

Computer-aided diagnosis (CAD) can reduce the cases of untreated patients by enhancing the existing expertise of X-Ray clinicians. Convolutional neural networks(CNN) and deep learning has achieved extraordinary results in image detection, classification and segmentation and many research studies show that the results are accurate even in the field of radiology<sup>[6–8]</sup>. The purpose of the current study is to propose a convolutional neural network classification model which can be implemented in a decision-making support system for pneumonia X-Ray diagnostics.

#### METHODS AND APROACHES

Transfer learning is the preferred medical image classification method<sup>[8,9]</sup>. It is based on adopting already trained convolutional neural networks over hundreds of thousands of images, which have proven to work well. Transfer learning is a machine learning(ML) technique where knowledge gained during training of one set of ML problems is used to train another <sup>[10]</sup>. Recurrent neural networks are used to describe the context of a disease, extracting deep convolutional neural network features [11]. Artificial neural networks are used for chest disease diagnosis<sup>[12]</sup>, 3D medical image registration<sup>[13]</sup>, X-Ray weld image classification<sup>[14]</sup>, medical image analysis<sup>[15]</sup> and different application areas: neuro, retinal, pulmonary, digital pathology, breast, cardiac, abdominal, musculoskeletal<sup>[15,16]</sup>. The best performing technique for image classification is Convolutional neural networks, It showed very high accuracy in feature extraction, image classification, object detection and segmentation. Most approaches are leveraging very complex CNN topologies. Dunnmon et al demonstrated a system trained and tested on the radiographs from their institution. They achieved an AUC of 0.96 on the normal versus abnormal classification task. They compared training from scratch and transfer learning models and the different model architectures <sup>[17]</sup>. Tang et al. additionally evaluated more CNN architectures and analyzed the impact of different image resolutions<sup>[18]</sup>. Mohamed Loey at al. <sup>[19]</sup> used Alexnet, Googlenet, and Restnet18 in a transfer learning experiment to detect COVID-19 through chest X-ray classification.

The main contribution of the current paper is the study of shallower CNN topologies with fewer training epochs and to compare their results. The model proposed shows a custom CNN which is faster to train and achieves relatively good results of nearly 90% accuracy on the validation set. An important factor for achieving good performance metrics is the fine-tuning of the model and the selection of optimization and activation function. The following sections introduce the experimental data, the proposed custom CNN topologies, the results and model evaluation.

#### – Data

The dataset is provided by Dr Paul Mooney for Kaggle in 2017 <sup>[20]</sup>. It consists of 5836 X-Ray images, which are divided into a training and testing set and each of them contain two subset categories – normal and pneumonia. The images cover both bacterial and viral pneumonia and no labeling on this criteria is made. The X-rays are taken during routine clinical care and are diagnosed by a clinician. Figure 1 shows examples of normal (healthy) and pneumonia categories from the training, testing and validating data sets.



The data is separated in training, test and validation set. seventy-one-point-five percent of the complete dataset was used as the training dataset. Ten-point-seven percent of the complete dataset was used as the testing dataset. Ten-point-eight percent of the complete dataset was used as the validation dataset.

	Traini	Test Set	Validation
	ng Set		Set
Normal	1082	234	267
Pneumonia	3110	390	773
Total	4192	624	1040
Percentage	71.5%	10.7%	10.8%

Tab 1: Experimental dataset distribution.

#### – Data Augmentation

Data augmentation is applied to the training images. In this way we increase the number of the images and also prevent overfitting by adding diversity to the image set. The images are rescaled, zoomed, vertically flipped. Apart from the data augmentation, the images are also resized to fit in a standardized training set for the CNN and normalized.

#### Model Architecture

In the experimental part two models are proposed. The models are based on Keras API. Built on top of TensorFlow 2.0, Keras is an open-source software library that provides a Python interface for artificial neural networks that can scale to large clusters of GPUs or an entire TPU pod. Both are trained on 10 epochs and are fine-tuned and compared according to predefined metrics. The topologies of the two models are as described in figure 2 and table 2. They consist of 3 blocks of 2D convolutional layers, followed by MaxPooling. These initial layers are responsible for feature extraction and image exploration. The images are resized 150px to 150px on the input and initial parameters are 896. As the images enter the second convolutional block they are twice reduced in size and feature extraction processing is done on 75px by 75 px images. In the third block they undergo yet another reduction in size to 37px by 37px. Then the result is flatten with an input of 147584 parameters which are processed by two fully convoluted dense layers. In this last block of fully convoluted layers the classification is done and the result is a single parameter which is either 0 (normal), or 1 (pneumonia).





Output Shape	Param #
(150, 150, 32)	896
(150, 150, 32)	9248
(75, 75, 32)	0
(75, 75, 64)	18496
(75, 75, 64)	36928
(37, 37, 64)	0
(37, 37, 128)	73856
(37, 37, 128)	147584
(18, 18, 128)	0
(41472)	0
(128)	5308544
(1)	129
	Output Shape (150, 150, 32) (150, 150, 32) (75, 75, 32) (75, 75, 64) (37, 37, 64) (37, 37, 128) (37, 37, 128) (18, 18, 128) (41472) (128) (1)

Tab 2: CNN Model Shape.

As we see the binary classification is done in the last 2 dense layers. At this point we introduce the difference between the models by leveraging two different optimizers. The first model is using stochastic gradient descent, while the second model is using Adam optimizer.

Even the learning rate and the momentum are kept the same – learning rate equals 0,001, momentum is 0,9.

rub o. Model inte taring parameters					
Architecture	Optimizer	Learning Rate	Momentum		
Model1	SGD	0.001	0.9		
Model1a	Adam	0.001	0.9		

Tab 3: Model fine-tuning parameters

#### **RESULTS AND DISCUSSION**

#### Model Evaluation Metrics

The model performance is evaluated through the metrics – accuracy, precision, recall, loss function and AUC score.

The confusion matrix is in the core of all the model metrics. It estimates true positive, true negative, false positive and false negative for each model.

True Positives (TP) is a prediction result where the model correctly classifies the image as the positive class. These are the correctly predicted positive values which means that the value of actual class is yes and the value of predicted class is also yes. E.g. if actual class value indicates that the patient has pneumonia and the predicted class tells you the same thing.

True Negatives (TN) is a prediction result where the model correctly classifies the image as the negative class. These are the correctly predicted negative values which means that the value of actual class is no and value of predicted class is also no. E.g. if actual class says this patient is healthy (normal) and predicted class tells you the same thing.

False positives and false negatives, these values occur when your actual class is not the predicted class, so the prediction is wrong.

False Positives (FP) is a prediction result where the model incorrectly classifies the image as the positive class. When actual class is no and predicted class is yes. E.g. if actual class says this patient is having pneumonia but predicted class tells you that the patient is healthy.

False Negatives (FN) is a prediction result where the model incorrectly classifies the image as the negative class. When actual class is yes but predicted class in no. E.g. if actual class value indicates that this patient survived and predicted class tells you that patient will die. The orange color in the graphics below indicate the training set performance metrics. The blue color indicates the test set metrics.



Tab 4: Model Comparison and Evaluation

Accuracy (1) is an intuitive performance measure and it is the ratio of correctly predicted observation to the total observations. However, it is not always true that a high accuracy means a well performing model. This is the case only when the datasets are symmetric where values of false positive and false negatives are almost same. That is why a model is evaluated on more parameters.

(1) ACC = 
$$\frac{TP + FN}{TP + TF + FP + FN}$$

(2) 
$$R = \frac{TP}{TP + FN}$$

Precision (3) is the ratio of correctly predicted positive observations to the total predicted positive observations. The question that it answers is of all the images that are labelled as pneumonia, how many actually were of pneumonia? High precision relates to the low false positive rate.

$$Pr = \frac{TP}{TP + FP}$$

A loss function (4) or cost function is a function that maps values of one or more variables onto a real number intuitively representing some "cost" associated with the value. An optimization problem seeks to minimize a loss function. So the lower the loss function, the more reliable is the confident is the prediction. The cross entropy loss increases as the predicted probability diverges from the actual class.

(4) 
$$\operatorname{En} = -\frac{1}{N} \sum_{i=1}^{N} y_{i\log}(p(y_i)) + (1-y_i) \log(1-p(y_i))$$

AUC values are in a range from 0 to 1. An AUC of 0.0 means that the predictions are all wrong. An AUC of 1.0 means that all the predictions of the model are correct. AUC is invariant in terms of scale and classification threshold. It measures the quality of the model's predictions irrespective of scale or classification threshold choice. AUC can be considered the probability that the model ranks a random positive sample more highly than a random negative sample.

The comparison of the two models shows that the model 1a with Adam optimizer with the same parameters for momentum and weight decay provides consistently better performance when the training is span across 10 epochs. Model 1a has validation accuracy of 87,50%, while model 1 is 86,35%. Model 1 has validation precision 84.22%, model 1a – 84,49%. Model 1 validation recall is 96,03%, model 1a is 98,17%. Validation loss is 33,10% for model 1, and 37,62% for model 1a. Validation AUC is 94,61% for model 1, and 94,94% for model 1a.

For the testing set, the results differences are more visible. Model 1a has testing accuracy of 92.08%, while model 1 is 90.74%. Model 1 has testing precision 93.29%, model 1a - 94.98%. For both models testing recall is 94.31%. Testing loss is 22.61% for model 1, and 19.85% for model 1a. Testing AUC is 95.97% for model 1, and 96.93% for model 1a.

The fine-tuning of the models with split-testing the choice of optimizer shows that the Adam optimizer with the same parameters as Stochastic Gradient Descent accounts for improved performance. There is a gained performance of at least 2% across all the evaluation metrics for the testing set and at least 1% for the validation test. Overall the results of the proposed model topology is promising. Keeping in mind that this is a very shallow and relatively fast-trained convolutional neural network mode, we can conclude that such a tool can be used as a computer aided supplement to the decision-making of radiologists during pneumonia X-Ray diagnosis.

#### CONCLUSIONS

Pneumonia-related mortality is unduly high, especially among children and at-risk groups of people with chronic diseases or aged over 65, because of the lack of radiology equipment and trained clinicians worldwide. The study shows that a custom convolutional neural network architecture, further fine-tuned with the Adam optimizer can achieve automatic detection of pneumonia in chest X-ray images accuracy approaching 90% for validation data. Keeping in mind that this is a very shallow, consisting of 3 blocks of two 2D convolutional layer for the feature selection layers and 2 dense fully convolutional layers, as well as being relatively fast-trained over ten epochs, we can conclude that such a tool can be used as a computer aided supplement to the decision-making of radiologists during pneumonia X-Ray diagnosis. The wider availability of CNN-backed tools has the potential to help in the reduction of the mortality caused by pneumonia.

#### REFERENCES

- [1] Stupka, J. E., Mortensen, E. M., Anzueto, A., & Restrepo, M. I. (2009). Communityacquired pneumonia in elderly patients. *Aging Health*, 5(6), 763–774. https://doi.org/10.2217/ahe.09.74
- [2] World Health Organization, Department of Maternal, N., Child and Adolescent Health, & World Health Organization. (2014). *Revised WHO classification and treatment of pneumonia in children at health facilities: Evidence summaries.* http://apps.who.int/iris/bitstream/10665/137319/1/9789241507813\_eng.pdf?ua=1
- [3] Clinic, M., & Recorded Books, I. (2019). Mayo clinic family health book the ultimate home medical reference. RosettaBooks. https://rbdigital.rbdigital.com

- [4] Fancourt, N., Deloria Knoll, M., Barger-Kamate, B., de Campo, J., de Campo, M., Diallo, M., Ebruke, B. E., Feikin, D. R., Gleeson, F., Gong, W., Hammitt, L. L., Izadnegahdar, R., Kruatrachue, A., Madhi, S. A., Manduku, V., Matin, F. B., Mahomed, N., Moore, D. P., Mwenechanya, M., ... O'Brien, K. L. (2017). Standardized Interpretation of Chest Radiographs in Cases of Pediatric Pneumonia From the PERCH Study. *Clinical Infectious Diseases*, *64*(suppl\_3), S253–S261. https://doi.org/10.1093/cid/cix082
- [5] Cherian, T., Mulholland, E. K., Carlin, J. B., Ostensen, H., Amin, R., de Campo, M., Greenberg, D., Lagos, R., Lucero, M., Madhi, S. A., O'Brien, K. L., Obaro, S., & Steinhoff, M. C. (2005). Standardized interpretation of paediatric chest radiographs for the diagnosis of pneumonia in epidemiological studies. *Bulletin of the World Health Organization*, 83(5), 353–359. https://doi.org//S0042-96862005000500011
- [6] Yasaka, K., & Abe, O. (2018). Deep learning and artificial intelligence in radiology: Current applications and future directions. *PLOS Medicine*, 15(11), e1002707. https://doi.org/10.1371/journal.pmed.1002707
- [7] Thrall, J. H., Li, X., Li, Q., Cruz, C., Do, S., Dreyer, K., & Brink, J. (2018). Artificial Intelligence and Machine Learning in Radiology: Opportunities, Challenges, Pitfalls, and Criteria for Success. *Journal of the American College of Radiology*, 15(3), 504–508. https://doi.org/10.1016/j.jacr.2017.12.026
- [8] Hashmi, M. F., Katiyar, S., Keskar, A. G., Bokde, N. D., & Geem, Z. W. (2020). Efficient Pneumonia Detection in Chest Xray Images Using Deep Transfer Learning. *Diagnostics*, 10(6), 417. https://doi.org/10.3390/diagnostics10060417
- [9] Pasa, F., Golkov, V., Pfeiffer, F., Cremers, D., & Pfeiffer, D. (2019). Efficient Deep Network Architectures for Fast Chest X-Ray Tuberculosis Screening and Visualization. *Scientific Reports*, 9(1), 6268. https://doi.org/10.1038/s41598-019-42557-4
- [10] Sarkar, D., Bali, R., & Ghosh, T. (2018). Hands-on transfer learning with Python: Implement advanced deep learning and neural network models using TensorFlow and Keras. http://proquest.safaribooksonline.com/?fpi=9781788831307
- [11] Shin, H.-C., Roberts, K., Lu, L., Demner-Fushman, D., Yao, J., & Summers, R. M. (2016). Learning to Read Chest X-Rays: Recurrent Neural Cascade Model for Automated Image Annotation. *ArXiv:1603.08486 [Cs]*. http://arxiv.org/abs/1603.08486
- [12] Er, O., Yumusak, N., & Temurtas, F. (2010). Chest diseases diagnosis using artificial neural networks. *Expert Systems with Applications*, 37(12), 7648–7655. https://doi.org/10.1016/j.eswa.2010.04.078

- [13] Hermann, S. (2014). Evaluation of Scan-Line Optimization for 3D Medical Image Registration. 2014 IEEE Conference on Computer Vision and Pattern Recognition, 3073–3080. https://doi.org/10.1109/CVPR.2014.393
- [14] Yang, N., Niu, H., Chen, L., & Mi, G. (2018). X-ray weld image classification using improved convolutional neural network. 020035. https://doi.org/10.1063/1.5048766
- [15] Litjens, G., Kooi, T., Bejnordi, B. E., Setio, A. A. A., Ciompi, F., Ghafoorian, M., van der Laak, J. A. W. M., van Ginneken, B., & Sánchez, C. I. (2017). A survey on deep learning in medical image analysis. *Medical Image Analysis*, 42, 60–88. https://doi.org/10.1016/j.media.2017.07.005
- [16] Kermany, D. S., Goldbaum, M., Cai, W., Valentim, C. C. S., Liang, H., Baxter, S. L., McKeown, A., Yang, G., Wu, X., Yan, F., Dong, J., Prasadha, M. K., Pei, J., Ting, M. Y. L., Zhu, J., Li, C., Hewett, S., Dong, J., Ziyar, I., ... Zhang, K. (2018). Identifying Medical Diagnoses and Treatable Diseases by Image-Based Deep Learning. *Cell*, *172*(5), 1122-1131.e9. https://doi.org/10.1016/j.cell.2018.02.010
- [17] Dunnmon, J. A., Yi, D., Langlotz, C. P., Ré, C., Rubin, D. L., & Lungren, M. P. (2019). Assessment of Convolutional Neural Networks for Automated Classification of Chest Radiographs. *Radiology*, 290(2), 537–544. https://doi.org/10.1148/radiol.2018181422
- [18] Tang, Y.-X., Tang, Y.-B., Peng, Y., Yan, K., Bagheri, M., Redd, B. A., Brandon, C. J., Lu, Z., Han, M., Xiao, J., & Summers, R. M. (2020). Automated abnormality classification of chest radiographs using deep convolutional neural networks. *Npj Digital Medicine*, 3(1), 70. https://doi.org/10.1038/s41746-020-0273-z
- [19] Loey, M., Smarandache, F., & M. Khalifa, N. E. (2020). Within the Lack of Chest COVID-19 X-ray Dataset: A Novel Detection Model Based on GAN and Deep Transfer Learning. *Symmetry*, *12*(4), 651. https://doi.org/10.3390/sym12040651
- [20] Mooney, Paul. (n.d.). Chest X-Ray Images (Pneumonia). Retrieved November 8, 2020, from https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia/version/2

## SOME STRATEGIC ONTODIDACTIC AND METHODOLOGICAL PROBLEMS OF MATHEMATICS EDUCATION IN SECONDARY SCHOOL

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Abstract. The article discusses the objectives and tasks of secondary school mathematics in the context of dynamically changing environment and existing social mobility. The author formulate the following statement: The existing learning content, the lack of new training technologies, coordinated with the opportunity of the contemporary informational environment and the lack of applicable mathematical knowledge, are the main factors for the weak internal motivation for learning. This turns a large part of students in vocational high schools into passive observers, uninterested in the grading of the reproductive theoretical knowledge required by them.

*Keywords*: learning objectives, learning content, mathematics teaching methodic, applicable knowledge, learning motivation

The importance and influence of mathematics and informatics in economics, planning, managerial decision-making, sociology, political studies and many other public areas is so great that it makes it impossible to function without their use. That is why they are exceptionally important and issues related to mathematical training in secondary and tertiary schools will always be relevant. Processes in society are so dynamic that they place before the theoretical pedagogy and practical pedagogy hard-to-solve and changing-in-time problems. Evidence for this is the low level of training of secondary and tertiary education graduates and more alarmingly - the sustainability of this trend in recent years. Missing is high-quality vocational secondary education. The labor market has long given indications of this, and there is already talk of "importing" foreign specialists. The forecast is even long-term. Common are the changes in standards, curricula, teaching materials; the hours set for mathematics are continuously reduced.

I will limit our findings and analyzes to secondary education, although the situation in higher education is similar. The situation in the Bulgarian secondary schools is such that everybody is dissatisfied: students - because they think they are learning unnecessary things; teachers - because they think the students are not motivated to study and the salaries are small; principals - because priorities and requirements quickly shift and the results of the matriculation exams are

bad; the Minister of Education - because there are insufficient funds for education and science; business – because of lack of good vocational education.

It is difficult to determine which of the above subjects is "the guiltiest one" for this situation, but the problem is extremely serious and alarming. The strategic issues - what are the goals and tasks of education in modern society, what, when and how to learn and teach - go beyond the scope and beyond the responses to ontodidactic theory. Today, education requires, more than ever, adequate funding, material and technical facilities, actual communication with the business environment and some sort of attention by the state administration.

Imperative is applying training technologies enabling and stimulating individual activity, building research and innovative qualities in an individual who is capable of self-education. Contemporary vocational success is related to the ability to apply knowledge and skills in new and changing conditions. Can the purpose of education be the acquisition of a particular profession? The static nature of the profession, which is characteristic of the past, is now replaced by a frequent change of place of residence (country), workplace, job, functions and responsibilities. In the context of the above it follows that the subject knowledge cannot be an objective of contemporary education. Any information is already available on the Internet, and the dynamics of technology requires so-called "lifelong learning", i.e. the knowledge and skills acquired are quickly depreciated and become morally obsolete.

Then the question "What to learn?" comes naturally. Despite the changes in the last 50-60 years, the training in so-called "elementary mathematics" has not been substantially altered. The school mathematical course includes elements of arithmetic, algebra, analysis and geometry. In addition to heavily reduced hours in secondary school mathematics, the other visible and significant change in the curriculum is the inclusion of topics from "Probability Theory and Mathematical Statistics".

Some innovative ideas having emerged after 1970s were rejected. Such is the textbook "Numerical Methods for X grade" (Ivanov & Kaltinska, 1978). It examines the task of linear optimization, the simplex method and the solving of the transport task. This curriculum provides applied knowledge and skills to solve a number of practical problems in tens of public life areas - economics, trade, construction, transport and others. It does not matter whether the student will continue his studies at university, it does not matter what vocational school he is studying in, and last but not least, it does not matter what the future will be, these knowledge, skills and competencies have been and will be useful to the student and society. Similar is the textbook "Applied Mathematics for 11<sup>th</sup> Grade" (Gerov & Dimitrov, 1989), which includes approximate calculus, probability theory, statistics, game theory, linear optimization and transport task.

By taking into consideration the possibilities of the current information environment (SPSS, Mathlab, Geogebra, and many others), the lack of such topics in the mathematics course of study in secondary schools is perplexing, particularly in vocational schools. Graduates of such high schools not only lack the knowledge and skills but lack notion (idea) of problems such as - problems of resource distribution, transport task, objects deployment, compiling schedules, optimal routes search, network planning and management (critical path method), assignment problem, travelling salesman problem, mass service problem, repair and replacement of equipment problem. Yes! The topics are many. The content of the curriculum cannot include the "infinite human knowledge" but it can at least inform the student about the idea of these problems, giving him an opportunity and an initial awareness where, how, and what to look for in the Internet space in relation to solving them.

An argument when rejecting the aforementioned textbooks is the fact that these are scientific topics, i.e. they will be studied in the higher education. Now is the time to point out another alerting fact - the lack of smooth transition and serious connection between the secondary and tertiary education. This issue has been point of interest of many people. The famous German mathematician Felix Klein is all for the tighter connection between the mathematics content in high school and at the university. This idea Klein develops in the end of XIX and the beginning of the XX century. He gives it a brief verbal expression by calling it "double discontinuity". "The mathematics content in secondary school is so far away from the higher mathematics that for a pupil who is to become a student to understand the higher mathematics it is important to forget what he has learnt in school. Later, however, when he acquires higher education and graduates, to be useful in the secondary school, he shall forget everything he has learnt in the university." Felix Klein read a course "Elementary mathematics from an advanced standpoint" (Klein, F., 1993, 1973). Probably due to his impact in the beginning and the mid of the last century a new, more flexible approach for solving the problem is sought. Discussed is the following idea: every university teacher shall careful search in the subject he teaches those elements that could be used in school and clearly state those elements in the respective lectures. This way, the connection between school and university mathematics will be eased and complete. As an example I can state "school interpretation" of basic notions from the algebra structures and related operations and relations. University subjects such as "Algebra", "Optimization", "Graph Theory", "Number Theory", "Probability and Statistics" give really good opportunities in this direction.

An extremely interesting, innovative and useful experience in updating the curriculum in mathematics and the way the training methodology was experimentally introduced in some Bulgarian schools in the 80s is the so-called "Sendov System". This is an attempt to change the

teaching methodology with a fundamentally new for Bulgaria methodology, requiring not only reproductive theoretical knowledge but research and solving real problems by working in a team. This is, actually, the imposition of a "research approach" in the training. Subsequently, in the 90s, a research shows that students trained in this system have better performance and results than those conventionally trained in the so-called "class-lesson" learning form. This is, in essence, training based on constructivism applied in the USA, Great Britain, Canada and others. This theory is associated with the names of many authors continuing the research of J. Dewey (2002), G. Piaget (1969) and L. Vigotski (2005). International studies (PISA, TIMSS, etc.) unequivocally show that the classical "teaching" (being knowledge transfer) has serious shortcomings - lack of motivation, good residual knowledge and abilities of graduates to practically apply this knowledge.

Obviously, the "class-lesson" form cannot and should not be removed or replaced altogether, but the role and function of the teacher as a consultant managing the individual work of the students (individually or in a team) shall be updated. Analyzing a large number of literary sources, Desislava Georgieva successfully summarized in (Georgieva, 2014) some basic conclusions about the principles of constructivism in mathematics education: "the textbook is not a main source of information; taken into consideration are the individual characteristics and interests and providing an opportunity for an individual educational path; assured is research work, time for applying and integrating the knowledge; after solving each problem a "look back" is done; using problem-based training and in-process method; learners work individually, in teams or groups with the purpose of working at different levels; the lecturer promotes active and critical thinking; the teacher is the organizer of the learning and research activity, providing diagnostics and monitoring the educational process" and others.

A significant number of lessons and hours are spent so the student can carry out many unnecessary formal calculating operations. Here I do not mean the primary school where "calculating" is a natural and useful activity. I mean the advanced grades and the lessons there - equivocal transformations, trigonometric and logarithmic equations and inequalities, irrational equations, finding derivatives, computational geometric problems with trigonometry, and others. Missing is correlation between the type of secondary school and the lessons learned during compulsory education. The lessons foreseen for supplementary training are negligibly little and even then they are used to upgrade the knowledge and skills from the compulsory training. Possible is reduction of some topics or parts thereof which to release a time resource for reviewing topics of applied nature and solving them using contemporary equipment - calculator, computer, websites. This naturally would lead to greater motivation among students. I know that it is a general educational subject, the abstract beauty of mathematics - its systematic nature

and precision. However, as found in (Popkochev, 1995): "The educational content is reflected in curricula transferring the logic of science to learning subjects. The logic of transformation, however, is the logic of adults, of people who have developed ability to abstract and classify. Bearing these scars, the subjects contradict the emotional and overall nature of the child's experience. It happens that in the school subjects the child meets with partial knowledge ... This is why the subjects are difficult to absorb and do not motivate the activity."

Seeking the goals and values of contemporary education, A. V. Borovskih and N. H. Rozov form the following thesis in (Borovskih & Rozov, 2012): "The purpose of education is to prepare the person for future activity in society, but the content of education - assimilation of common methods and forms of human activity. The subject matter serves education only as a means of conducting the learning process. And that is why the goal of education is to acquire habits for performing activities. Habits shall mandatorily be in a summarized form, due to the fact that change of types of activity becomes a norm, the habits shall be universal in nature and the summary becomes one of the most important methods of universalization. Algebra is studied not to remember the formula for solving square root equation, but to learn to use symbol objects, geometry is not studied to remember the proof of the Pythagorean Theorem, but to develop our geometric imagination. So, we immediately move from object content to the overarching one, to the content of the work, to the question of what do we teach children?"

In my opinion this thesis is justified. Here comes notion "major" (class or school profile). A person graduates "mathematical" major and as an occupation is a sociologist; another has a "law" major and works as a police investigator, and third one graduates economics and works as an investigative reporter. Present are three different experts, three different occupations but the main activity the three of them do is actually one and the same. These people gather information, process the data, announce the result and seek causations having caused the results. In this sense seeking something "overarching" is really an integral part of education's purpose. Even more, nowadays a person not only often changes his occupation but the country (environment) where he works. This environment has its different traditions, organization, rules, specifics and requirements. And this suggests mobility and variations of activities in order to guarantee the successful professional realization.

So naturally the hardest and most difficult question arises: "How to learn, how to teach?". The question of what to learn is the easier one because there are mandatory standards and regulations which the teacher shall observe (as oppose to Finland and other countries where things are otherwise). In the last 50-60 years imposed is a classical model of teaching mathematics in the Bulgarian schools which in its essence hasn't been changed. This model could be seen in any mathematical textbook:



#### Figure 1.

Then the teacher's "invocation" comes that what you have learned has a wide application in practice and real life. Using such mantra does not inspire, convince or motivate and does not lead to much enthusiasm in students. Mathematics, in the best case scenario, is determined to be "uninteresting", "difficult" and "unnecessary".

Impressive is the cognitive constructivism idea by G. Piaget, according to which "learners learn by building their own mental structures while completing practical assignments, appropriate for their development. In the process of accumulating experience, adolescents move from concrete to more abstract ideas." The following pragmatic idea in learning is not to be neglected. It starts with a problematic situation, formulated are specific problems, given are ideas and ways to analyze and solve them, and naturally reached are mathematical concepts, theory and justification of the methods used. The theory, on the other hand, generates new ideas for its practical application.

The proposed training technology is applicable and useful for every grade, both at secondary and tertiary education, i.e. it does not imply age restrictions. The "practice-theory" correlation is a continuous spiraling and cyclic process of dialectical unity. In many polls, students say they do not like mathematics. These students actually "do not like the school mathematical course". That is the good news. The bad news is that for the rest of their lives, many of them have the impression and conviction that mathematics is what they have learned at school. The sad news is that many of them will say for the rest of their lives that mathematics is a terribly complicated, difficult and uninteresting thing, and they are not smart enough to deal with it. The creation of such a complex and internal bias is perhaps even worse than their scanty residual knowledge after graduation.

This only confirms the thesis that something in the Bulgarian mathematics training needs to be changed or modified. Obviously, it is not a matter of giving up the mathematical rigor and precision, i.e. the principles of scientific and systemic, but to the emphasis on the principles of accessibility, visibility, integrity. Such an approach has constructivist elements - mathematical knowledge is constructed by learners when involved in real situations. It has a somewhat research character and corresponds to the game approach and the placement of the student in problematic situations. In learning mathematics too much time is devoted to comprehensive, accurate proving of all theorems. Often, there is an unnecessary formalism in formulating problems and describing proof. Why does the comprehensive subject of mathematics have no lessons on history of mathematics, on classical and contemporary mathematical theories and their applications (Games, Management, Chaos Theory)? Why are the entertaining mathematics, mathematical conundrum, mathematical folklore, mathematical paradoxes, mathematical logic so neglected? They, I think, would motivate students to participate actively in the learning process. This increased interest and motivation would make it easier to bear other so-called "uninteresting topics". Research shows that students with unsatisfactory grades in mathematics show no worse results than others on IQ tests.

The motivation of pupils is definitely increasing when solving problems with an applied and / or entertaining nature. In other words, mathematics can be interesting, entertaining, it can be mathematics with a "human face".

This type of learning content and training method modifies the subject-object oriented relationships and turns them into a true pedagogical interaction where both parties are active, i.e. into a subjective relationship, in which students are an active subject. They actively participate, exploring and solving specific problems behind which basic mathematical information is encoded. Such updating of the mathematics content curriculum at the average course would lead to a better balance between the theoretical and applied knowledge and skills acquired by students, as well as a smoother transition from secondary to higher education. Problem-solving in the school course is an indisputable advantage related to student motivation.

What and how to learn are questions whose answer is unambiguous in time and it is not within the remit of one or more people (researchers). Scientific research in the field of neurobiology, bioinformatics and other scientific areas reveals new facts that cast doubt on the importance and timeliness of many current principles and concepts of learning. It turns out that there is some hidden learning mechanism that we still do not know. And this mechanism is different from the "instructor" approach in the "class-lesson" form that is most commonly applied in practice. Evidence of its existence and rationality is the lack of answers to many "why and how" questions: little children thrown into the water do not drown; children deal with computers and phones better than adult learners; 10-year-olds, "self-taught" in PlayStation, have faster reflexes and take more reliable decisions than test pilots trained under extreme conditions; people who do not know the alphabet and the grammar of one language can compile sentences in the correct syntax; in the IT sector, approximately 20% of programmers who do not have a secondary and tertiary education in the specialty work successfully?

Even though only debatable, constructivism as an approach to mathematics training undoubtedly brings positives and the reluctance and inability to use it is perplexing. What we are sure of is that the dynamics of time and the environment we live in (social mobility, new scientific discoveries and technologies) require some adequate and greater flexibility, mobility and variation of education in many of its aspects. Let's avoid the situation in Hans Christian Andersen's tale "The Emperor's New Clothes" that the King is ... inappropriately dressed for the occasion.

#### REFERENCES

- Borovskih, A.V., Rozov, N.H. (2012). Evolyutsiya tseley i tsennostey obrazovaniya.Vestnik Moskovskogo universiteta. Moskva: izdatelstvo Moskovskogo universiteta, 20 (2), 3-17.
- Dewey, J. (2002). Kak mislim. Sofia: izdatelstvo Minerva.
- Georgieva, D. (2014). Rolyata na konstruktivizma v obuchenieto po matematika. Nauchni trudove na Rusenski universitet, 53 (6.2), 173 179.
- Gerov, G., Dimitrov, B. (1989). Prilozhna matematika za 11. klas (II stepen) na ESPU. Sofia: darzhavno izdatelstvo Narodna prosveta.
- Ivanov, G., Kaltinska, R. (1978). Chisleni metodi (Lineyno optimirane), uchebnik za X klas na obshtoobrazovatelnite trudovo-politehnicheski uchilishta. Sofia: izdatelstvo Narodna prosveta.
- Klein, F. (1973). Razvitie na matematikata prez XIX vek, parva chast, Sofia: izdatelstvo Nauka i izkustvo.
- Klein, F. (1933). Elementarnaya matematika s tochki zreniya vyisshey (ruski prevod, GTTI).
- Piaget, J. (1969). Izbrannyie psihologicheskie trudyi, Psihologiya intelekta, Genezis chisla u rebenka, Logika I psihologiya, M: izdatelstvo Prosveshtenie.
- Popkochev, Tr. (1995). Pedagogicheskata paradigma na John Dewey. Nachalno obrazovanie, 3, 47-54, 4, 50-55.
- Vigotski, L. S. (2005). Izbrani psihologicheski proizvedeniya. Sofia: izdatelstvo PSIDO EOOD.