



**UNIVERSITY OF
TELECOMMUNICATIONS AND POST**

**Fifth International Scientific
Conference
“TELECOMMUNICATIONS,
INFORMATICS, ENERGY AND
MANAGEMENT”**



PROCEEDINGS

Sofia, 2020

UNIVERSITY OF TELECOMMUNICATIONS AND POST



TIEM 2020

Fifth International Scientific Conference
“TELECOMMUNICATIONS, INFORMATICS,
ENERGY AND MANAGEMENT”

October 3-4, 2020, Sofia, Bulgaria

PROCEEDINGS

Bulgaria, 2020



“Telecommunications, Informatics, Energy and Management” (TIEM) is a conference organized by the University of Telecommunications and Posts, Sofia Bulgaria. The goal of the TIEM 2020 conference is to provide an international forum for researchers, academics, people in industry, and students to address recent research results and to present and discuss their ideas, theories, technologies, systems, tools, applications, work in progress and experiences on all theoretical and practical issues arising in telecommunications, electronics, signal processing and applications, information technologies, energy and management.

Proceedings of Fifth International Scientific Conference “Telecommunications, Informatics, Energy and Management” contain selected papers by the topics:

- Management, Economics, Leadership and Entrepreneurship;
- Telecommunications & Information Technology;
- It & Security Technologies.

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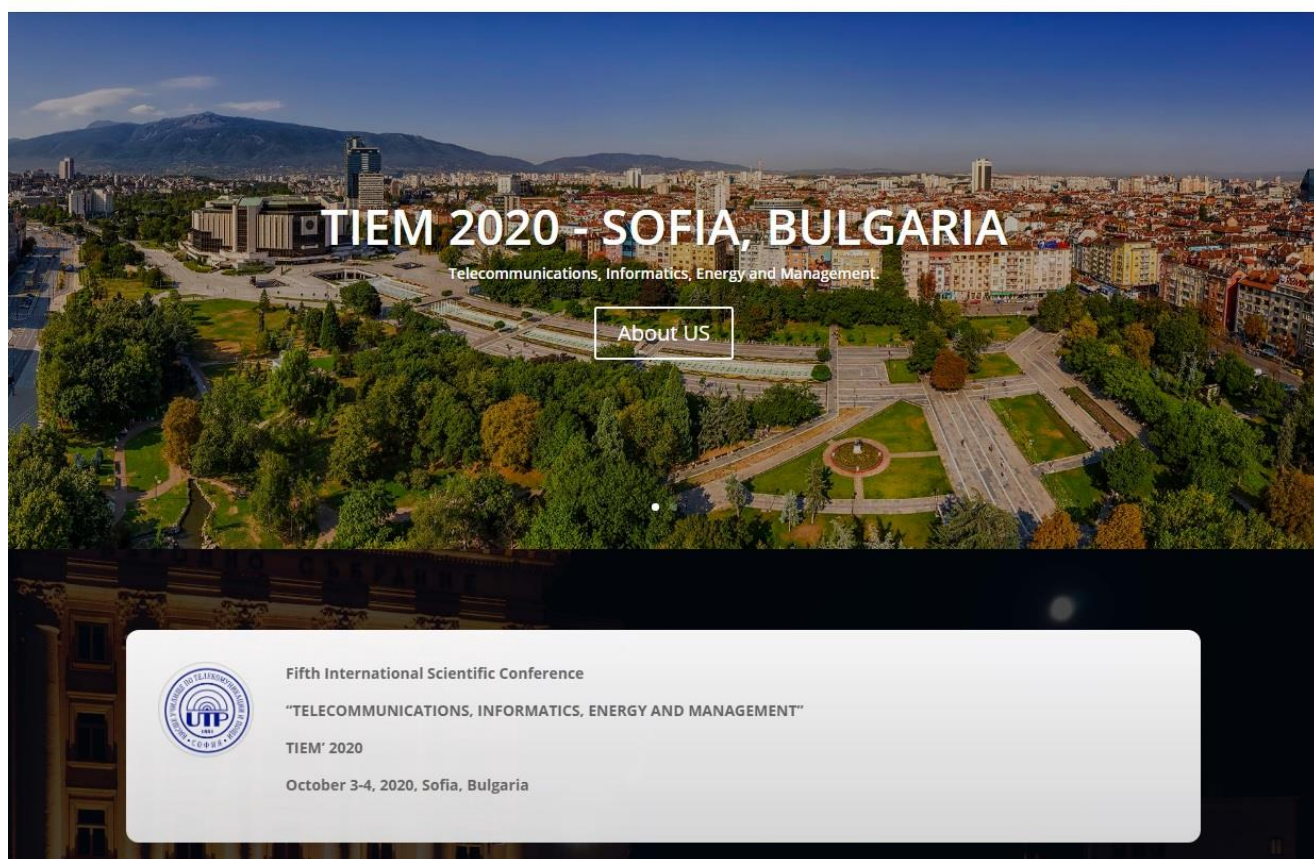
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PLENARY SESSION

Beyond the Buzzwords: AI and ML in Cyber Security

Yang Cao

Sales Director of Europe and MENA, Hillstone



AI in Cyber Security

AI: The Definition

AI involves using computers to do things that traditionally require human intelligence.

AI: An umbrella name

Machine learning, natural language processing, computer vision, deep learning are all collectively sub-branches of AI.

AI: Is not something new

- **1950s**
Turing Test measures whether a computer can think like a human being
- **1960:** Origin of machine learning
- Decades of graduate school research programs, lab simulation projects, etc.

AI: Is reaching critical mass

Faster Internet access; and more apps and use cases, data and information, mobile users, cloud computing, 5G, IoT.



Psychological Impact of Covid-19 Pandemics on Industrial and Organizational Environment

Anatoly Zankovsky¹

Abstract – The COVID-19 pandemics had dramatically affect world economy shifting many forms of traditional professional work to virtual sphere. The paper identifies main areas in which the most radical changes in professional work are expected. Though these areas do not cover the full range of problems caused by the pandemic, they can be perceived as the crucial for work and organizational psychology, both from a research and applied point of view. Remote work is viewed as a potentially main form of professional activity in the nearest future. The article outlines important reference points for activating new research and practical developments on these issues.

Keywords – Pandemics, Work and Organizational Psychology, Remote Work, Virtual Organization, Balance of Organizational and Personal (Family) Life, Virtual Leadership

The pandemic has affected all aspects of life, but it has hit the world of professional work especially sharply: unemployment has increased sharply, national economies have suffered and are suffering enormous losses, many yesterday quite prosperous areas of professional activity suddenly found themselves in dramatical situation, trying to solve the well-known Hamlet dilemma. Today, there are many predictions about possible consequences COVID-19 will have for the professionals, and what the organizational world will expect in the post-pandemic era. In this article, we tried to consider possible changes in the world of professions and professional activities in General, based on scientific research and authoritative opinions of the scientific community (Abedin, 2020; Backman, 2020; Ferrazzi, 2020; Kochhar & Passel, 2020; Zhuravlev, Zankovsky, 2017; Singer, 2020, Nazar, 2020; Shockley & Allen, 2015, 2010). These changes can create a lot of completely new and unexpected problems for the subject of labor, which labor psychologists should perceive not only as challenges, but also as new opportunities.

We have identified 7 areas in which the subject of labor expects the most radical changes in professional work both in the short and long term. These areas, of course, do not cover the full range of problems caused by the pandemic. Nevertheless, in our opinion, they are a priority for labor psychology and organizational psychology, both from a research and applied point of view. These are the following areas:

1. Remote work as a potentially main form of professional activity.
2. Virtual organization as the dominant organizational form.
3. Balance of organizational and personal (family) life.
4. Organizational stress and quality of working life in new conditions.
5. Virtual leadership.
6. Changes in the world of professions.
7. Professional career as a "puzzle".

Each of these areas requires detailed consideration, and maybe a separate article or even a monograph. Given the volume constraints, this article will briefly address only one, but perhaps one of the key problems of the post - pandemic era- remote work. The choice of this sphere is due to its Central position in the system under consideration: remote work is directly related to the virtual organization, the balance of organizational and personal life, organizational stress and the quality of working life in new conditions, and virtual leadership and new career paths.

Remote work is a work activity carried out in accordance with pre – defined plans, which the labor subject performs outside the organizational premises, using communication tools and information and communication technologies to interact with other labor subjects to achieve certain results. Elements of remote work (such as business trips) have long been used by organizations, but in the context of the pandemic, remote work has become the main form of work that allows you to avoid dangerous direct contacts. Thus, scientific research on remote work today has become not just relevant, but critical (Cho, 2020; Kramer & Kramer, 2020). Since one of the most important tasks of labor psychology is to study the psychological factors that determine individual and organizational effectiveness, the key question is the effectiveness of remote work and the factors that determine it. Existing research on this issue [e.g., Allen et al., 2015;

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Gajendran & Harrison, 2007; Shockley, 2014] are clearly insufficient, and today there is still no scientifically based understanding of the effectiveness of remote work and the factors that affect it. These factors include, first of all, individual psychological and personal characteristics of the subject of work, the level of autonomy/interdependence of professional tasks, communication characteristics, the level of team cohesion, leadership style, level of trust, etc. In addition, non-organizational variables should be taken into account: the conditions of remote work (i.e., in fact, the living conditions of the subject of work), family status, the number and age of children, the health status of family members, etc. Efforts are needed to develop psychological methods for analyzing remote activities, as well as to study the psychological aspects of such problems as managing and organizing interaction in remote work, problems of social isolation and self-management, labor motivation, values and organizational culture, organizational adaptation and socialization of employees, and many others.

Remote work has raised the issue of the boundaries between work and family, forcing the subject of work to take a fresh look at their roles at work and in the family, since they are now implemented in the same place (Kossek, Lautsch, & Eaton, 2006). The new situation creates role, organizational, and family conflicts that also need research and development of not only practical, but also practical coping approaches.

The pandemic has had, is having and will continue to have a powerful impact on the professional activities of employees and the work of organizations as a whole. The highlighted problems, of course, do not exhaust all the issues that can be solved by labor psychology and organizational psychology. The article outlines important reference points for activating new research and practical developments on these issues. Today, labor psychologists have a unique opportunity to contribute to the formation of models for future forms of professional activity and help develop organizational policies and practices that will significantly increase the resilience of the labor subject even in the face of repeated economic and pandemic crises.

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Dielectric Properties Measurement

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Scope of the Presentation

- ☐ Introduction to Dielectric → Permittivity concept and applications
- ☐ Measurements methods → Popular methods
 - Transmission lines
 - Resonant cavities
- ☐ Selection criteria
- ☐ Instrumentation for dielectric measurements
- ☐ Conclusions

Basic Terminology

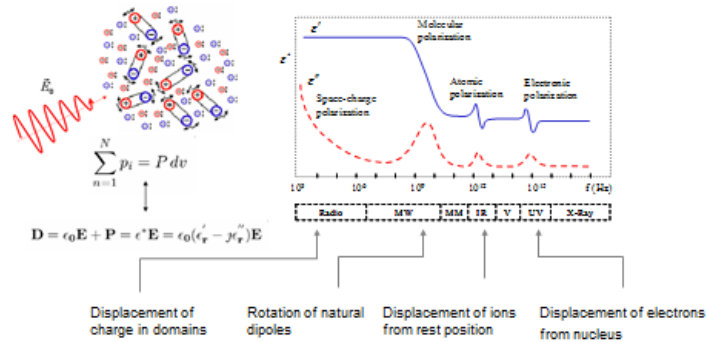
- Complex Relative Permittivity: $\epsilon_r^* = \epsilon_r' - j\epsilon_r''$
- Complex Relative Permeability: $\mu_r^* = \mu_r' - j\mu_r''$
- Absolute Permittivity $\epsilon^* = \epsilon_0(\epsilon_r' - j\epsilon_r'') \quad [F/m]$
- Permittivity of free space: $\epsilon_0 = 8.85 \times 10^{-12} \quad [F/m]$
- Loss tangent: $\tan \delta = \frac{\epsilon_r''}{\epsilon_r'}$

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EM Polarization of Dielectrics

- Complex Relative Permittivity:



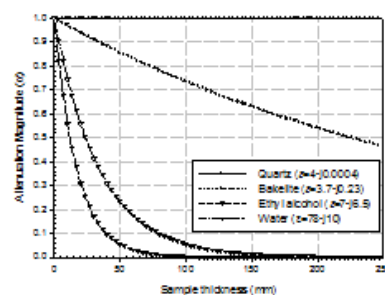
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Penetration depth

PENETRATION DEPTH OF SELECTED MATERIALS [Meredith, 1998]

Material (25°C)	ϵ_r'	ϵ_r''	$\delta_{\epsilon_r'} (915 \text{ MHz})$	$\delta_{\epsilon_r'} (2450 \text{ MHz})$
Water	78.1	10.4	0.044	0.016
Ice (-2°C)	3.0	0.003	30.11	11.34
Ethyl alcohol	7.0	6.5	0.023	0.008
Methyl alcohol	2.5	1.5	0.018	0.006
Meat (raw beef)	50.0	1.5	0.024	0.009
Bread dough	2.0	1.0	0.024	0.009
Silicon carbide	3.0	1.1	0.026	0.009
Ceramic brick (90% MC)	1.5	2	0.101	0.037
Bakelite	3.7	0.23	0.436	0.163
Nylon 66	3.02	0.041	2.210	0.825
Natural Rubber	2.2	0.0065	11.90	4.46
Polycarbonate	2.25	0.0026	30.09	11.23
Teflon	2.01	0.0001	739.4	276.1
Quartz Glass	4.0	0.0004	260.7	97.39



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Permittivity Measurement Techniques

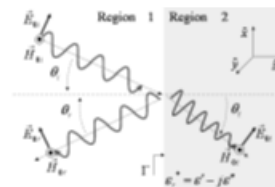
- There are significant differences in the various types of techniques for measuring the relative permittivity and loss tangent of dielectric materials.
 - ✓ Material properties
 - ✓ Accuracy
 - ✓ Frequency range
 - ✓ Temperature
 - ✓ Sample geometry/preparation (destructive or not)
 - ✓ With/without contact
 - ✓ Theoretical modeling complexity
 - ✓ Measurement equipment

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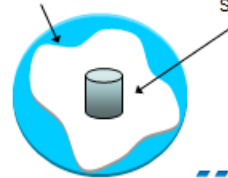
Measurement Techniques

- Transmission lines (Non Resonant)
 - ✓ Wave velocity slower
 - ✓ Wavelength shorter
 - ✓ Impedance lower
 - ✓ Magnitude attenuated
 - ✓ Wide frequency range
 - ✓ Accurate for dielectric constant
 - ✓ Not suitable for low losses (*)
- Resonant and Cavity Methods
 - ✓ Resonant frequency shifted
 - ✓ Q-factor lower
 - ✓ Measurement at one frequency only
 - ✓ Accurate for dielectric constant and loss factor



Electromagnetic structure

Dielectric Sample

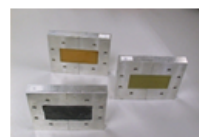
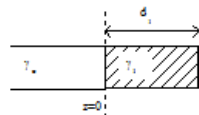


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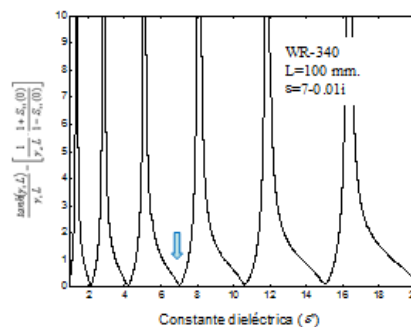


Reflection Method in Transmission Lines

- Measurement of the complex reflection coefficient (S11)
- WR-340 (86x43mm), $f = 2.45$ GHz, $\epsilon_r = 7-j0.01$, $L=100$ mm



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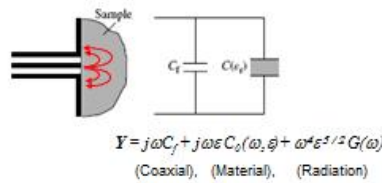


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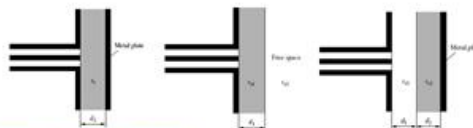
Reflection Method in Transmission Lines

- Reflection from open-ended coaxial probes (10 MHz-50GHz)



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- Alternative configurations



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Reflection Method in Transmission Lines

- Reflection from shielded open coaxial lines (10 MHz-50GHz)

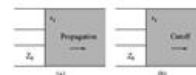
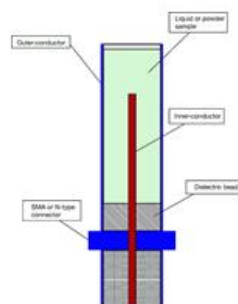


Figure 3.24 Coaxial lines opened into (a) propagation waveguide, and (b) cutoff waveguide for measurement of semiconducting samples.



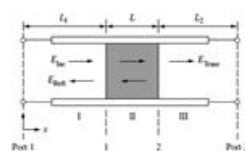
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Transmission/Reflection Methods

- Dielectric and Magnetic properties are feasible with these methods



$$K = \frac{(S_{11}^2(\omega) - S_{21}^2(\omega)) + 1}{2 \cdot S_{11}(\omega)}$$

$$\Gamma = K \pm \sqrt{K^2 - 1}$$

$$T = \frac{(S_{11}(\omega) + S_{21}(\omega)) - \Gamma}{1 - \{S_{11}(\omega) + S_{21}(\omega)\} \cdot \Gamma}$$

$$\frac{1}{\Lambda^2} = -\left[\frac{1}{2\pi \cdot d} \cdot \ln\left(\frac{1}{T}\right) \right]^2$$

$$\ln\left(\frac{1}{T}\right) = \ln\left|\frac{1}{T}\right| + j \cdot \left(\text{fas}\left(\frac{1}{T}\right) + 2 \cdot \pi \cdot n \right)$$

$$\mu_r = \frac{1 + \Gamma}{\Lambda \cdot (1 - \Gamma) \cdot \sqrt{\frac{1}{\Lambda^2} - \frac{1}{\Lambda_c^2}}}$$

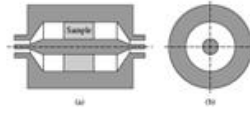
$$\epsilon_r = \frac{\Lambda_c^2 \left(\frac{1}{\Lambda^2} + \frac{1}{\Lambda_c^2} \right)}{\mu_r}$$

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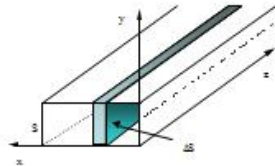


Transmission/Reflection Methods

- Measurements at lower frequencies by increasing the size of coaxial cells



- Partially-filled waveguides reduce the wall contacts uncertainties (10 MHz-50GHz)
- Requires complex numerical modeling



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Transmission/Reflection Methods

- Free-space methods.

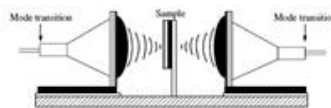


Figure 4.21 Setup for free-space measurement. Modified from Ghodgaonkar, D. K., Varadan, V. V., and Varadan, V. K. (1990). "Free-space measurement of complex permittivity and complex permeability of magnetic materials at microwave frequencies", *IEEE Trans. Instrum. Meas.*, **39** (2) 387-394. © 2003 IEEE.

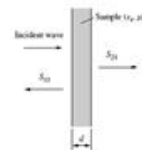


Figure 4.22 Schematic diagram of planar wave

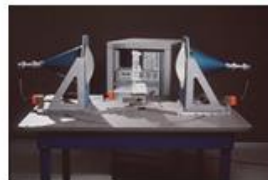


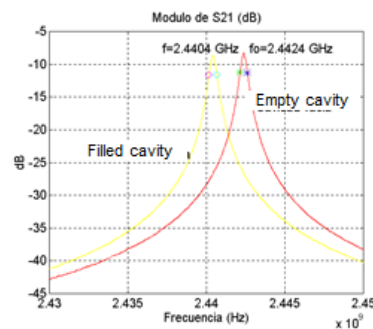
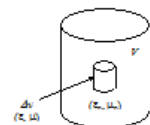
Figure 2.123 Through measurements. (a) Transmission/reflection measurement and (b) back reflection or scattering measurement

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Resonators and Cavity Methods

- Measurement of resonant frequency and Q-factor of a microwave cavity.



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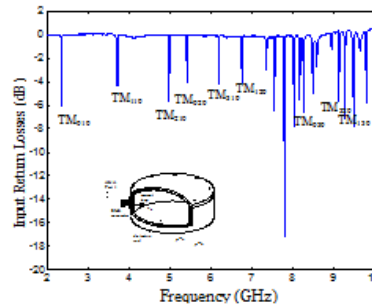
Resonator and Cavity Methods

- Increasing the frequency range of dielectric measurements in cavities by multifrequency points (several resonant modes).

- ϕ cavity = 98 mm.
- ϕ sample = 39 mm.
- height = 20 mm.
- PTFE (Teflon)



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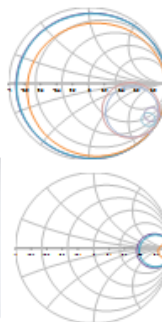
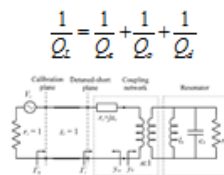


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Unloaded/Loaded Resonant Frequencies

- Measurement of resonant frequency and Q-factor in a cavity with different coupling conditions ($Q_e=110$ and $Q_e=9000$).



Material (25°C)	ϵ'	ϵ''	f_0 (GHz)	Q_e	Q_u (GHz)	Q_u^*
AIR	1.00	0	2.56110	116.28	2.57942	2849.28
Quartz (cut)	2.28	0.0026	2.69984	110.97	2.56002	2510.02
Quartz (cut)	2.66	0.0021	2.60210	102.20	2.56270	1100.02
SiC (PHE)	8.91	1.2228	2.60182	292.6	2.66882	70.95
Dielectric (water)	76.9	6.2199	1.99806	22.16	2.04899	27.66
Metallized	7.27	8.6216	2.22290	100.5	2.45245	10.7425
Dielectric	21.7	12.928	2.61112	110.0	2.29088	9.82

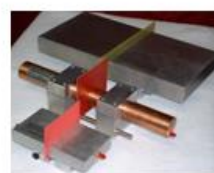
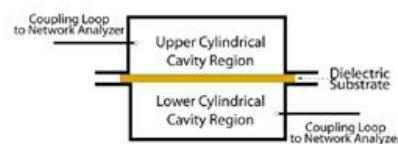
Material (25°C)	ϵ'	ϵ''	f_0 (GHz)	Q_e	Q_u (GHz)	Q_u^*
AIR	1.00	0	2.57866	2121.01	2.57942	2849.28
Quartz (cut)	2.28	0.0026	2.62947	1871.99	2.56002	2510.02
Quartz (cut)	2.66	0.0021	2.56175	797.62	2.56270	1100.02
SiC (PHE)	8.91	1.2228	2.66801	66.28	2.66882	70.95
Dielectric (water)	76.9	6.2199	-	-	2.04899	27.66
Metallized	7.27	8.6216	-	-	2.45245	10.7425
Dielectric	21.7	12.928	-	-	2.29088	9.82

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Popular Resonator Methods

- Split Cylinder Resonator (4-50 GHz).
- TE₀₁₁ resonant mode, laminate material



DAMASKOS INC, USA



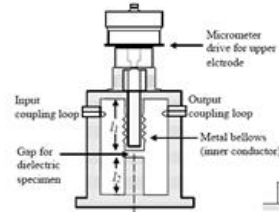
NIST, Boulder, USA

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Popular Methods

- Re-entrant Cavity, 100 MHz-2 GHz.



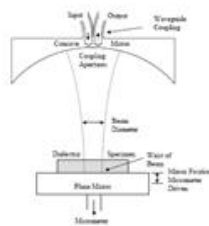
NIST, Boulder, USA

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Popular Methods

- Open Resonators, 10-200 GHz.



NPL, Teddington, UK

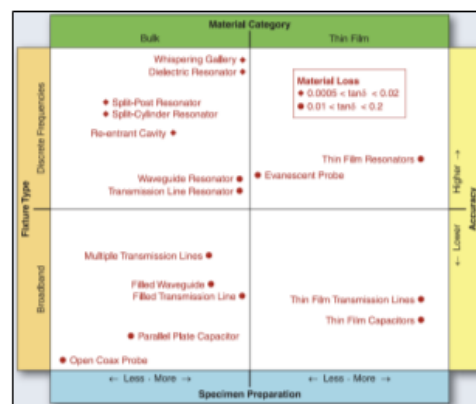


DAVIASKOS INC, USA

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What method is the best?



[1] James Baker-Jarvis, Wilmer C. Jansen, and Donald C. DeGroot, "High-Frequency Dielectric Measurements", IEEE Instrumentation & Measurement Magazine, April 2010, pp. 24-31

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Uncertainty

- ❑ Unfortunately, all measurements have some uncertainty.
- ❑ Sources of uncertainty: *calibration error, environmental error, instrument drift, theoretical model assumptions, operator error, sample contamination, etc.*
- ❑ When sources of uncertainty are expressed as standard uncertainties, one can easily combine uncertainty to calculate the combined uncertainty for the measurement

$$u_c(y) = f[u(L), u(a), u(Q)]$$

combined uncertainty standard uncertainties

- ❑ Accuracy vs precision

- Accuracy: closeness of the agreement between the result of a measurement and a true value of the measurand.



Measurement error: result of a measurement minus a true value of the measurand

- Precision: closeness of agreement between independent test results obtained under stipulated conditions.



Measurement uncertainty: characterizes the dispersion of the values

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Instrumentation

- ❑ Automatic Vectorial Network Analyzers and Calibration kits



Anritsu, Japan



Rohde & Schwarz, Germany



Agilent, USA



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Instrumentation

- ❑ Robust, Compact, Reliable and Portable Dielectric Properties Measurement System for Powder and liquid Materials at Microwave Frequencies ...



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Conclusions

- ❑ The measurement of dielectric properties is a specialized field that depends on many factors.
- ❑ The selection of the appropriate method depends on the material physical properties (geometry, shape, homogeneity, etc.). It does not exist a “universal” method.
- ❑ The frequency range is also a very important parameter for the selection of the method.
- ❑ Transmission lines provide high bandwidth dielectric measurements
- ❑ Cavity methods are more versatile than transmission lines but limited in frequency width.
- ❑ Network analyzers are the basic instrument for dielectric measurements

Novel Energy-Efficient Protocols for Wireless Sensor Networks

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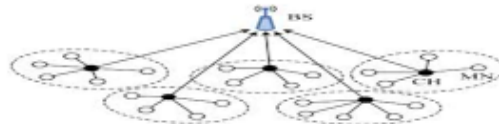
e-mail: korhancengiz@trakya.edu.tr

Novel Energy Efficient Protocols for Wireless Sensor Networks (WSNs)

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Motivation

- A WSN contains distributed sensor nodes that can sense, record and distribute physical and environmental parameters. WSNs have become an active research area since they have integrated in our daily lives with a vast number of applications, such as **disaster relief, target tracking, environmental control, smart cities, medicine and health care.**



- To distribute the sensed data, different approaches are used.
 - **direct transmission**
 - Direct communication between sensor nodes and receivers
 - **multi-hop routing**
 - Relays between sensor nodes and receivers
 - **clustering**
 - Clusters of sensor nodes collect and transmit data for each cluster
 - Efficiently maintain the energy consumption of sensor

Related works

- **LEACH** (low-energy adaptive clustering hierarchy) [6, 7, 8] is one of the most popular distributed cluster based routing protocols for WSNs.
- **set-up phase,**
 - CH election
 - CH advertisement
 - Cluster formation
- **steady-state phase,**
 - Data transmission to the base station
- The above process repeats until the end of network lifetime in LEACH.

ONE ROUND

5

Related works

- Other protocols are working approximately similar to LEACH, with some extensions to LEACH. The types of these extensions can be grouped into 3 categories.

Type of Extensions to LEACH
Changing CH Selection Mechanism
Determining CHs According to Residual Energy
Using Fixed Clustering

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Low Energy Fixed Clustering Algorithm (LEFCA)

- The algorithms mentioned above use fixed clustering approach or CH determination approach performed by BS. On the other hand;
 1. LEFCA aims to use fixed clustering and CH determination via BS approaches together.
 2. LEFCA uses intelligent CH determination mechanism which tries to elect the nodes that are almost at the center of their associated clusters at the beginning of the algorithm instead of determining them randomly.
 3. LEFCA introduces a threshold based CH change mechanism.
 - It aims to abuse the energies of the CHs before electing a new CH. **Note that, this idea is not proposed in any of the existing algorithms.**

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Low Energy Fixed Clustering Algorithm (LEFCA)

- LEFCA uses the clustering approach by dividing the nodes into fixed clusters. The operation of LEFCA is divided into two different phases.
 - **Set-Up Phase:** The clusters are formed by electing the CHs. After the determination of the member nodes for each cluster, the initial CHs set the TDMA schedule for their clusters.
 - **Steady State phase:** The collected data is transferred to the base station through the CHs and each CH determines whether to continue as a CH or elect a new one. The operation of the steady-state phase is repeated in time frames referred to as rounds.

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LEFCA

Set-Up Phase of LEFCA

- The set-up phase of LEFCA is shown below:



1- CH Selection

- Instead of selecting the CHs randomly the intelligent CH determination mechanism is developed for LEFCA.
 - Random selection provides each node to have equal chance to become a CH. **On the other hand**, CHs may be distributed unevenly and remote nodes can be selected as CHs resulting in significant energy dissipation and a shorter lifetime.
- In intelligent CH selection mechanism of LEFCA;
 - The BS broadcasts a position information request message to the WSN. When sensor nodes receive this message, each sensor node sends its position information to the BS.
 - The transmission of the position information causes energy consumption by the nodes, **however it is realized only once as the clusters are fixed.**
 - After the transmission of the position information, the BS selects the CHs located at the center of each cluster. The number of clusters is determined according to the optimum cluster number for a WSN.

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LEFCA

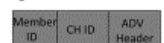
2- Cluster Formation

- Once the nodes in LEFCA are elected to be CHs by BS, the CH nodes broadcast an advertisement message (ADV) shown in **figure below**.



This advertisement message contains the ID of the CH and a header that recognizes this message as an announcement message.

- Each non-CH node decides to which cluster it belongs by selecting the CH that needs the minimum communication energy, based on the received signal strength of the advertisement message from each CH.
- After the members choose their clusters, these members must inform their associated CHs about their selection.
- Each node in a cluster sends a join-request message (Join-REQ) which is shown in figure to the selected CH using again a non-persistent CSMA MAC protocol.



This message contains the ID of the member node, the ID of the associated CH and a header.

- Note that, the length of these messages are fixed, and contrary to LEACH and LEACH based protocols, the transmission of these messages are realized only once in LEFCA because it uses fixed predefined clustering approach.

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LEFCA

2- Cluster Formation

- Once the clusters are formed, the CHs broadcast a TDMA schedule within its own cluster which includes allocated time slots (TSs) for each cluster member to transmit data.
 - Also in each cluster, one extra TS is assigned for existing CH as shown in figure below to transmit collected data from members to the BS. The length of the frame is determined according to the number of nodes (k) in the cluster ($k+1$ slots for each cluster, $+1$ for CH for each cluster).

TS for Node 1	TS for Node 2	...	TS for Node k	TS for CH
---------------	---------------	-----	---------------	-----------

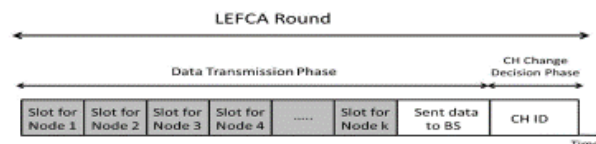
- After the reception of the TDMA schedule by the cluster member nodes, **the set-up phase is completed** and data transmission with **steady - state phase is ready to start**.

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LEFCA

Steady-State Phase of LEFCA

- The main objective of the Steady-state phase is to **transmit the collected data** to the base station through the CHs and to determine whether **a CH change** needs to be made.
- Figure below shows a LEFCA round.



- Steady-State Phase consists of Data Transmission Phase and CH Change Decision Phase.

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LEFCA

2- CH Change Decision

- The LEFCA algorithm uses fixed clusters, however the CHs may change at the beginning of a new LEFCA round.
- When data transmission is completed, the CH needs to decide whether it will **continue to act as a CH** for the next round or **choose a new CH**.
- This decision is made based on the CH's remaining energy.
 - If the CH's remaining energy is above a predefined threshold value (ThV), it continues to act as the CH for the next round.
 - If on the other hand, the CH's remaining energy is below the ThV , the current CH selects a new cluster head.
 - The current CH chooses the new one randomly among the alive members of its cluster.

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LEFCA

2- CH Change Decision

- Determination of (*ThV*) is an important step for LEFCA because the *ThV* has a significant impact on the network lifetime.
 - If the *ThV* value is very small, the CH might die during a round resulting in network disconnectivity.
 - If the *ThV* is large, the algorithm might select a new CH for every round resulting in larger network and set-up costs.
 - Also, if *ThV* value is selected to be equal to initial energy of a node, the CHs will change, at every round and LEFCA will behave like the LEACH protocol.
- To reduce the networking and clustering costs seen with traditional LEACH, the *ThV* should be determined in such a way that the CH should be alive at the end of the round to keep network connectivity.

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LEFCA

2- CH Change Decision

- For example, assume that, the farthest node to the BS has the coordinates of (0,0) and the BS is located at outside of the sensor field at (150,50). So d_{toBS} can be calculated according to (3):
- $d_{toBS} = \sqrt{(150-0)^2 + (50-0)^2} = 158.1139$
- In here, to determine the *ThV*, it is assumed that only one cluster is formed and the (*x,y*) coordinates of the CH are (0,0) (The worst scenario). Thus, $k = 1$ (only one cluster is formed) hence, $\frac{N}{k} = 100$.
- For experiments in LEFCA, $l = 6400 \text{ bits}$, $E_{elec} = 50 \text{ nJ/bit}$, $\frac{N}{k} = 100$, $E_{DA} = 5 \text{ nJ/bit}$, $\epsilon_{mp} = 0.0013 \text{ pJ}$ and finally $d_{toBS}^4 = 6.25 \times 10^8 \text{ m}^4$.
- When these values are placed into (1):
 $E_{CH} \sim 0.0052$

According to this result, if remaining energy of any CH node in the system is **greater than 0.0052 it can survive certainly for a round**. Thus, to provide connectivity between any CH with BS, the *ThV* is determined as **0.05 J in LEFCA**.

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Multi-Hop Low Energy Fixed Clustering Algorithm (M-LEFCA)

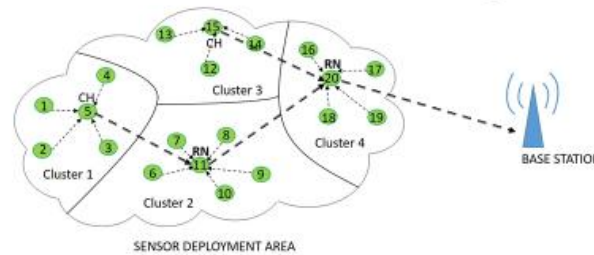
- The proposed M-LEFCA uses **multi-hop intra cluster communication** approach.
- It selects **optimum forward neighbor CHs** as relay nodes (RNs) and CHs transmit the collected cluster data to the BS by using these forward RNs.
- M-LEFCA aims to decrease energy consumption and prolong network lifetime by **combining clustering and multi-hop approaches**.

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M-LEFCA

Steady-State Phase of M-LEFCA

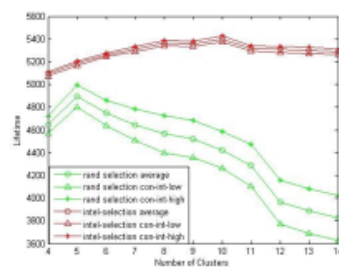
- The RNs collect and aggregate the incoming data and forward the data to the next RN.
- This process continues until all data reach to the neighbour CHs of the BS.
- At this point, last CHs (RN) transmit data directly to the BS. Data transmission of M-LEFCA is illustrated in figure below.



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Simulation Results for LEFCA

1- Impact of Number of Clusters



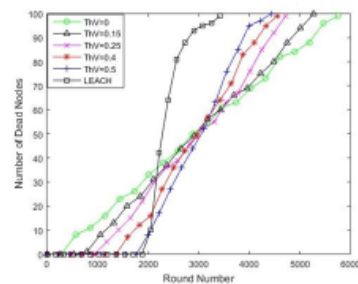
In this part, LEFCA is analyzed for its lifetime when CHs are selected based on the intelligent CH selection mechanism or randomly. For each value of the number of clusters, the average and 95% confidence interval values of are obtained for 100 iterations of a sensor network with 100 nodes.

As can be seen from this figure, the average lifetime of the WSN **increases significantly with intelligent CH selection**. The difference increases as the number of cluster increases. For example, for a network with 10 clusters, the lifetime gain is approximately 800 rounds. Thus, **intelligent CH selection** outperforms traditional **random CH selection** method for lifetime and energy-efficiency.

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LEFCA

2- Impact of the ThV in Network Lifetime

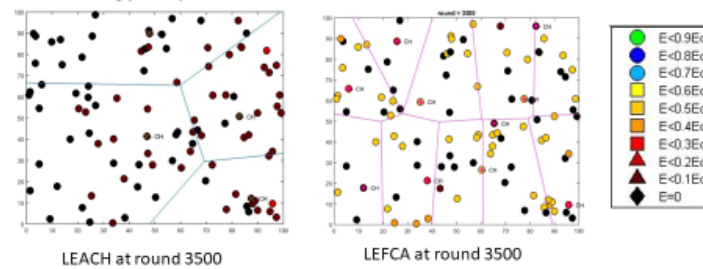


This figure compares the performance of LEACH and LEFCA for different ThVs by illustrating the number of dead nodes vs. round number. From this figure, it can be observed that, as the ThV **increases** the network lifetime **decreases**.

A lower ThV also results an earlier first node death as LEFCA **abuses the CHs** before selecting a new CH. However, the lifetime gain for any ThV is very significant. Note that, the lifetime of LEACH for the same network is approximately 3200 rounds and a **significant improvement** for network lifetime is achieved with LEFCA.

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3- Energy Map of the Network



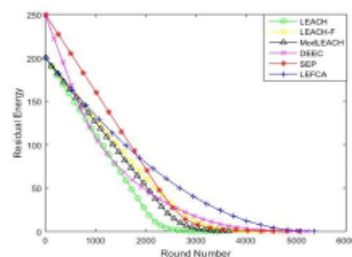
At this round, approximately half of the nodes are dead and very few nodes closer to the BS have a very small amount of remaining energy in the order of $0.1E_0$ for LEACH. In LEACH, the alive nodes will quickly drain their remaining energy and the **network will lose its complete functionality**.

On the other hand, in LEFCA, two thirds of the nodes are still alive with significantly higher energy levels. The alive nodes still have $0.5E_0$ of their total initial energy, thus, the LEFCA protocol will be able to **collect data from each of the clusters at the upcoming rounds**.

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LEFCA

4- Residual Energy

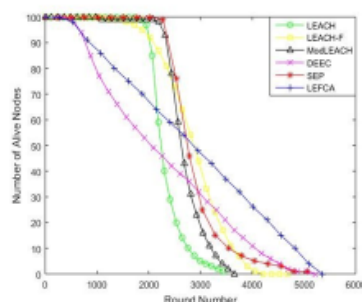


This figure compares the total residual energy of LEFCA with LEACH, LEACH-F, ModLEACH, DEEC and SEP. While LEFCA, LEACH, LEACH-F and ModLEACH use **homogeneous networks** where all the nodes are identical with the same initial energy, SEP and DEEC use **heterogeneous networks** where some of the nodes have more initial energy compared to the rest of the nodes. Thus, the total initial energy of the WSN with SEP and DEEC are 250 J while for the other algorithms it is 200 J.

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LEFCA

5- Number of Alive Nodes



In this figure, various cluster based routing algorithms are compared based on the number of alive nodes. The lifetimes are measured when all the algorithms start with an initial number of 100 alive nodes. When compared with LEACH, a **57% improvement** in the network lifetime can be observed under LEFCA. While LEACH lasts for **3237 rounds**, LEFCA lasts for **5659 rounds**. LEFCA not only has a longer lifetime than LEACH and its variants (LEACH-F and ModLEACH) but also a comparison with SEP and DEEC (both have 25% more initial network energy) yields a longer lifetime for LEFCA.

Node deaths start **earlier** under LEFCA, but the **rate of node deaths is much lower** than all the algorithms compared. While trying to transmit the collected information through abused CHs, infrequent CH changes keep remaining nodes' energy levels as high as possible under LEFCA and node deaths are distributed almost evenly for the network lifetime. For LEACH based protocols and SEP, following the first node death, the remaining node deaths occur quickly. As a consequence, a longer lifetime is achieved under LEFCA.

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LEFCA

6- Network Lifetime

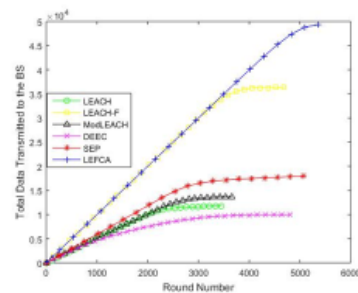
Algorithm	Average Lifetime	Maximum Lifetime	Initial Network Energy
LEFCA	5371	5756	200 J
DEEC	5221	5941	250 J
SEP	5059	6177	250 J
LEACH-F	4112	4471	200 J
ModLEACH	3742	4123	200 J
LEACH	3478	4216	200 J

- For each algorithm, the simulations are repeated 100 times for different topologies and the maximum and average observed lifetimes are presented in this table as well as the initial network energies.
- LEFCA's conservative energy consumption ratio increases the lifetime of a WSN significantly. **LEFCA outperforms LEACH and its variants.**
- When LEFCA is compared with novel routing algorithms such as SEP and DEEC, extended lifetimes are also observed although LEFCA starts with lower initial energy.

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LEFCA

7- Total Data Transmitted to the BS



The number of packets delivered to the BS per round is plotted cumulatively in this figure. **Due to the fixed clustering**, data can be **continuously collected for every round** and transmitted to the BS under LEFCA.

On the other hand, the **probabilistic CH selection mechanism** for LEACH based algorithms may sometimes result in rounds **without any cluster formations** and thus **no data is collected** for some rounds especially when the alive number of nodes is decreased. As a result, the total amount of data transmitted to the BS for LEFCA is **significantly larger** than other protocols.

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Comparison of LEFCA with M-LEFCA

3 – Network Lifetime

Algorithm	ThV	First Node Death	Average Lifetime	Maximum Lifetime
LEFCA	0.05	288	5319	5782
LEFCA	0.15	567	5104	5589
LEFCA	0.25	831	4865	5416
LEFCA	0.35	1105	4508	5059
LEFCA	0.45	1378	4278	4961
M-LEFCA	0.05	508	5774	6015
M-LEFCA	0.15	649	5532	5800
M-LEFCA	0.25	846	5142	5677
M-LEFCA	0.35	1151	4865	5574
M-LEFCA	0.45	1427	4487	5270

Table shows the average results of 100 iterations for LEFCA and M-LEFCA for different ThVs. For 100 iterations, the average round value of first node death, average lifetime of the network and maximum lifetime of the network are presented here.

The **RN selection** based mechanism of M-LEFCA provides to **delay draining of the batteries of the remote CHs** by **decreasing the transmission distance of them significantly**. Thus, M-LEFCA provides to **delay the first node death in the network** when compared to LEFCA. M-LEFCA also aims to prolong the lifetime of WSNs by utilizing RNs. The usage of RNs in M-LEFCA causes **additional network costs** because of the usage of some **additional notification messages**. However, M-LEFCA provides extra energy savings and approximately 10% lifetime improvement when compared to LEFCA.

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Conclusions

- Due to the **distance factor**, the clusters that are farthest from the BS tend to consume **more energy** under LEFCA. The first nodes that die in the network are usually the members of **far clusters**.
- To solve the distance factor problem of LEFCA, **M-LEFCA** is also proposed. By using a fixed number of clusters, reducing the number of CH changes and **utilizing multi-hop routing between CHs**, M-LEFCA minimizes the cluster formation overhead.
- When compared with other protocols **significant improvements** are obtained in terms of energy consumption, network lifetime and number of packets delivered to the BS in M-LEFCA.
- M-LEFCA **extends the lifetime** of the WSNs, while reducing the energy consumption **by using relay nodes** between clusters.

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Information Technologies for Medical Innovations

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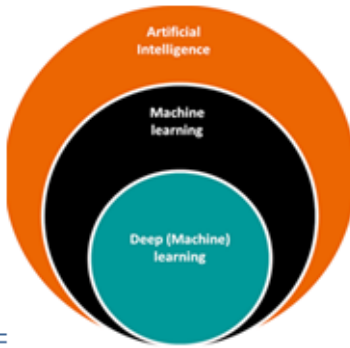
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Motivation

- In today's digital world, the innovations in medicine will become increasingly important for improving the quality of life.
- Currently more than 500 patents for medical solutions related to machine learning;
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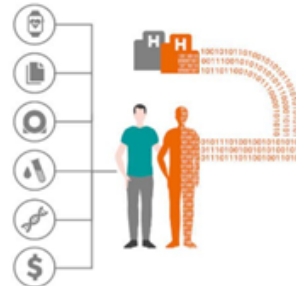
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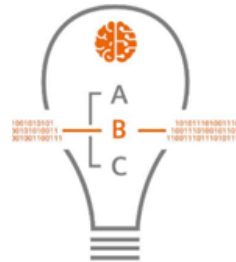
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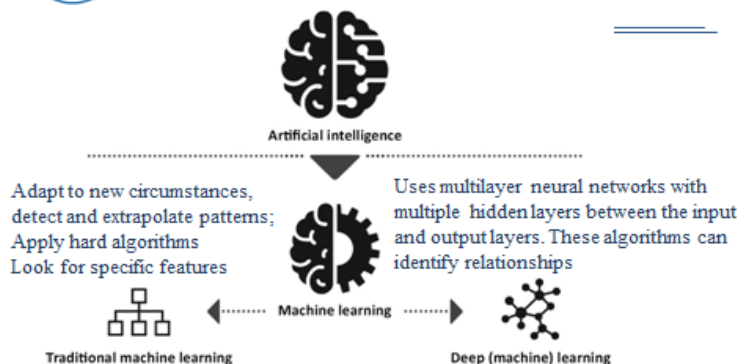
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Section 1

MANAGEMENT,

ECONOMICS,

LEADERSHIP AND

ENTREPRENEURSHIP

The effects of the cyber-physical systems on the production systems in the digital business organizations

Miglena Temelkova¹

Abstract – The article studies the major effects of the cyber-physical systems on the production systems in the digital business organizations by investigating the definition of the concepts in research literature and analyzing the relationship between them. In the course of the research, there have been synthesized four effects of the cyber-physical systems on the production systems in the economic entities, namely: integration between real-life physical and virtual objects and processes, coordination, flexibility and adaptability and optimization of the production process. As a result, there are identified the main consequences from the presented effects of the cyber-physical systems on the production systems in the digital business organizations. Finally, the conclusion is reached that there is a need for efficient transformation of the existing production systems into cyber-physical production systems.

Keywords – Cyber-Physical Systems, Production Systems, Digital Business Organizations

I. INTRODUCTION

The production system is part of the business organization, determined by the material and cash flows and based on the rational formation and organization of production through supplying elemental factors, transforming them and realizing a complete final product. At the same time, it is also an organizational unity, which brings the development of the production process in line with the relevant organizational principles, targeted at achieving an economic effect and profitability.

The development of the production systems over time is an undisputable prerequisite for the emergence and spreading in contemporary production management of the cyber-physical systems, which integrate a large range of physical objects, services and processes, and gather data from the physical world via sensors, whereby creating an essential precondition for solving real-life production and economic problems. Actually, spreading not only of the cyber-physical systems in the real-life production process, but also of digitalization of a number of organizational processes in contemporary business organizations, as well as shifting real-life organizational processes from the real-life physical environment to the digital one, is increasingly leading to the definition of the economic entities as digital ones.

The cyber-physical systems facilitate taking prompt, timely and profitable management decisions. This is achieved on the basis of analysis, evaluation and storage of large amounts of data [1].

The substantial added value of the cyber-physical systems

results from the fact that they are based on a network of digital communication technologies, whereby facilitating not only the operation of the digital business organizations in a digital environment, but also the digitalization of the management process itself, and its elements. At the same time, the impact of the cyber-physical systems on the physical and virtual world contributes to the efficient determination of the added value from the activities of the digital business organizations along the value chain.

II. RESEARCH MODEL

The systematic approach, oriented towards the integration in one single unity of all the elements and characteristics of the production and management processes in the business organizations is applied for the complete, systematic and comprehensive research of the effects of the cyber-physical systems on the production systems.

The research model is based on the real-life physical elements of the production systems, which are modelled also as elements of the cyber-physical systems, where the infrastructure of the information technologies forms interrelated and interdependent controlling and information systems.

In the course of the study, the real-life and the virtual elements are presented through simulation in respect to their functional plane and organizational-and-technical or organizational-and-management relations.

Machines and facilities, details and templates, production assignments and the “bottlenecks” are set as virtual elements in the simulation operational system [2].

Thus, the model of the production system and its factual working environment is administered through modeling, while the model of the cyber-physical system is generated through stimulation, where it implements the assigned tasks, being able to reflect very fast also a possible change between

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various operational and strategic scenarios and production processes. The high degree of autonomy, issuing from the simulation as a research approach, enables making a relevant comparison between a production system and a cyber-physical system by comparing various versions in respect to key parameters and indicators, reaction speed or the time for omitting a reaction.

A restrictive condition in the current article is the fact that production system models manufacturing only one product are outside the scope of the study. That type of production systems is unsuitable for analysis and evaluation of the existing relations between the technical, organizational and human elements in the production systems, where cyber-physical systems are implemented and function.

III. STUDYING THE MAJOR EFFECTS OF THE CYBER-PHYSICAL SYSTEMS ON THE PRODUCTION SYSTEMS IN THE DIGITAL BUSINESS ORGANIZATIONS

The cyber-physical systems enable connecting into a network resources, information, objects and people. There are based on and integrate in themselves the elements of the ecosystem “machine – human”, as well as of the blockchain technologies by interacting with the physical reality through the stored by them large amounts of data and their evaluation.

On the basis of the global Internet network, the cyber-physical systems enable not only identifying objects, production processes and capacities, and organizational-and-production problems, but also localizing them in real time. Moreover – they allow for ongoing monitoring and management of the entire production and management process in the digital business organizations, while fostering the encompassing and closing of the full cycle of the transformational process from the order to the delivery of the finished product.

A. Integration between real-life physical and virtual objects and processes in the production systems

On the basis of analysis and synthesis of various definitions of the concepts “production systems” and “cyber-physical systems”, there can be brought forward the effects resulting for the production systems from the integration in the production process of the cyber-physical systems.

First – through the cyber-physical systems in the production ones there is specific integration of imbedded computers and networks, which monitor and control the physical processes, using feedback chains [3].

Second – the effect on the production systems results from the fact that the cyber-physical systems are smart systems, which encompass hardware and software, as well as efficiently integrated physical components, which interact in view of reflecting the alterations in the real-life environment.

Third – the production systems on the basis of the cyber-physical systems operating in them, are upgraded to specific combinations between real-life physical and virtual objects

and processes for processing information through open, partially global and permanently interrelated informational networks [4].

B. Coordination of the production systems

The global Internet network mediates the performance by the cyber-physical systems of specific coordination of the entire production and management process in the digital business organizations and contributes to redefining the concept for the overall planning therein. One of the most substantial effects of the cyber-physical systems on the production ones, resulting from their coordinating role, is the operational option for planning materials, raw-materials, deliveries and production following the principle “just in time” in real time, and even during the implementation of the processes.

The reduced time for planning, as well as the possibility to react right on time in the real-life production process, leads to optimization of production in respect to the consumption of time and financial resources.

The two-way communication between products and production system leads to establishing a specific feedback, on the basis of which optimization can be pursued of the whole digital business organization. In view of achieving optimality, this feedback should be direct, while ignoring the concrete hierarchical planes of the informational subsystem of the production system.

The coordinating function of the cyber-physical systems is also related to regulation, on the basis of analysis of large amounts of data of various production and management models, of their capacity and production capabilities. By coordinating the orders – on the one hand, the resources – on the other, and the duration of the operations – on the third side, there is optimization achieved of the production systems’ capacity, which leads to optimization also of the resource consumption in the production of one product unit.

C. Flexibility and adaptability of the production systems

Rendering greater flexibility to the production systems is another effect issuing from the application of the cyber-physical systems in the digital business organizations.

The elements of the production systems, where the cyber-physical systems operate, are capable of full or partial self-organization. These capabilities facilitate, mediate and adapt the reaction of the production structure in respect to the changes in the environment [5].

The flexibility and adaptability of the production systems, which have cyber-physical systems imbedded in them, is a result of their self-configuration, self-maintenance and self-organization. The cyber-physical systems allow the production ones to store the data and experience accumulated in the course of the real-life production, thus leading to higher flexibility and adaptability of the production process itself.

Under the conditions of the Fourth Industrial Revolution, the flexibility and adaptability of the production systems in

the digital business organizations should be pursued in the introduction of a discrete type of production, based on individual, specific client's orders and requirements. Moreover – with cyber-physical systems functioning in the production systems, the client-specific features do not lead to complicating the processes of designing and planning, and that, in turn, does not increase the costs for the production of one specific product unit (under an individual order).

At the same time, accepting client's requirements and needs as guiding, with the individualization of the products, on this basis, determine the indisputable individualization of the production processes as well. This requires pursuing optimality in the production system on the basis of a specific production process. Moreover – the flexibility and adaptability of the production systems, which have cyber-physical systems functioning in them, are expressed in the process of the actual, physical performance. On this basis, the properties of the product, the costs, logistics, safety, reliability, the time requirements and product sustainability already can be adapted to the specific requirements of the client during the performance, irrespective of the restrictions during the designing [5].

The information bulks of data from the clients lead to control over the production power and capacity, where the changes in the clients' preferences and requirements should cause a prompt reaction for applying alternative operational and strategic production and management approaches.

At the same time, the cyber-physical systems create genuine opportunities for adapting the production systems to the actual operational parameters of the human resource system, where the flexibility of the production process will be expressed in taking into consideration the number of the employed people, the time for the production of a product unit, the length of the communication processes, the spatial layout of the workplaces.

D. Optimization of the production process

The elements of the production systems, where cyber-physical systems are imbedded, communicate through the global network quickly, efficiently and with high quality, while observing the main principles for optimality of the production process.

The optimality of the production should be pursued not only along the entire real-life production cycle, but also along the entire management process, in all functional planes related to the production process, as well as in all the elements of the entire organizational system. Indisputably, under the conditions of Industry 4.0, the optimization of the production systems, on the basis of the cyber-physical system application, results from combining virtual and real-life components of the production process in real-life and digital space and time. That means subjecting the production system to the principles of the circular economy and closing the production cycle from planning the resources, through controlling and following the orders, planning, managing and monitoring of the work schedule and production process, to the generation of a

finished product with certain qualitative and quantitative parameters, while putting waste into additional or auxiliary production lines, and to the delivery the manufactured production to the actual user with an option for recycling the already obsolete or used product.

The activities on optimization should concern not only the entire value chain in a digital business organization, but also all the elements and parameters of the production systems, which can be managed, upgraded and further improved on the basis of the cyber-physical systems.

IV. RESULTS

The effects of the cyber-physical systems on the production process have their expression in the impact on the major elements of the production systems – their input, output and clients.

The implementation in the organizational production system of cyber-physical systems increases substantially the complexity and the requirements to the structure, the hierarchical levels and the relational dependences in the production systems. Designing the production systems on the basis of the application of the cyber-physical systems in them in the aspect of space and time leads to taking into account the complexity of the transformational processes in the digital business organizations, as well as to prioritizing monitoring, auditing and controlling in them.

In Industry 4.0, production should be more efficient, more flexible and more powerful. On this basis, the controlling functions are transformed and switch from central control in the production systems to control from the cyber-physical system itself. Thus, the strictly hierarchical production systems turn into decentralized systems, subjected and bound to the main principles of work of the cyber-physical systems. That means a radical change in the concept for the structure of the production process and its organization and management. On the background of this, the production systems are built in modules, the controlling functions and tasks are transferred to the cyber-physical systems, and the global network is a key component in the production process system.

The higher degree of self-organization, self-upgrading and self-regulation of the production systems on the basis of the work of the cyber-physical systems in them, means that the classical conceptual approaches for planning, organizing, managing and controlling the production systems are currently irrelevant.

The implementation of the cyber-physical systems in the production ones leads to independent coordination of part of the elements of the production systems, even in the process of the actual performance. This, in turn, means that planning as a major operational function has ever more decreasing importance in the course of the contemporary production process. Thus, designing various alternative conditions of the production system is not an essential element of its existence in the digital business organizations either.

“The bottlenecks” in the production systems are registered by the cyber-physical ones in them on an electronic or

software level, and they are scenarios for their elimination generated subsequently in a digital environment.

V. CONCLUSION

The research and analysis in the present article suggest that the production systems and the cyber-physical systems can be mutually integrated and work effectively and efficiently. In view of the full-scale development of the industrial production under the conditions not only of Industry 4.0, but also of Industry 5.0, there is a need for upgrading the classical production systems to cyber-physical production systems. Therefore, however, studied should be:

- the cyber-physical components, which make the real-life technological chains adaptable;
- the designed socio-mechatronic subsystems, whereby the pressure on the human resources in the digital business organizations is determined;
- the autonomy of certain elements of the production systems;
- the components of the cyber-physical systems facilitating the emergency operations or the restart after registering a critical situation;
- the coordination and optimization of the production systems on the basis of the data generated during the real-life production.

The tasks assigned in this way formulate also the major principles of the efficient transformation of the existing production systems into cyber-physical production systems, which are:

- an innovative type of ecosystems, created in view of performing certain tasks under certain conditions, where physical components, blockchain networks and robotized systems, based on artificial intelligence and sensor technologies, most commonly interact [1];
- robotized models, which, through accurately described and machine-simulated algorithm, are capable of analyzing and evaluating the surrounding environment, as well as undertaking actions, which increase the possibility to achieve particular goals [1];
- sensor based technologies, which through abstract symbols try to reproduce human reasoning on a hierarchical, logical level, or which imitate human brain through neurons and neural networks, organized in layers, connected with each other through simulated lines, where those neural networks

are able to upgrade the acquired knowledge by gathering experience and growing [1].

On the basis of the presented in the article, it can be summarized that Industry 4.0 has the potential to radically change the industrial production by implementing cyber-physical systems in the production processes of the digital business organizations, thus integrating the virtual and physical worlds. For this mission and this vision, however, the current infrastructure concepts should be simultaneously tested.

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Innovative Employees Retention Tools in IT Industry

Teodora Lazarova¹

Abstract – The current paper evaluates the importance of retention strategies in the IT companies. The author highlights the business meaning of having long-term strategies and to build motivated and dedicated teams and leaders. The paper defines the challenges for growth in the IT companies and suggests retention strategies in order to retain the best talents. Retention process begins from the first step – the recruitment process and the ability to recognize the right candidate that will fit organizational culture and environment. The labour market in the IT industry is highly competitive but each company tries to provide great benefits and place for the employees where they can grow and develop. Employee retention means also solid employer brand that inspire and elevates others.

Keywords – Employee Retentions, Satisfaction, Motivation, Innovation

I. INTRODUCTION

Employee retention is not just part of the human resources management process but is an integral part from the business planning of each organization. The cost of employee turnover rises dramatically each year. Well-known fact is that it is more expensive to replace the employee with external resources – not only in terms of price, but in terms of necessary time for onboarding and education. Employee retention is often described by statistics – the percentage of people that stay in the company for a certain period of time [1]. Employee retention practices in the organization are based on the satisfaction of people and their long-term commitment to stay in the organization. The companies ‘main goal is to minimize employee’s turnover.

Some research suggests that the costs directly related to hiring a new employee in place of an already departed one can be almost as high as 50-60% of an employee's annual salary. The total cost can reach up to 90-200% of the employee's annual salary [2]. These include pre-selection funds, training of the new employee, salaries of employees or consultants in the selection process, the impact on other employees, reduced sales and other miscellaneous costs for the organization. Fluency can also affect organizational performance. Industries with a high staff turnover rate, such as the service sector, the food industry, tourism, service delivery and sales centers, occupy a large part of the country's business. Replacing employees in some of these industries has a lower value than in others (e.g., high-tech areas and the IT industry [3].

On the other hand, having a small turnover rate could be also healthy for the company in some business. Replacing and finding the right employee is taking between 6 to 9 months in salaries. Losing great performing team member can affect the

team motivation and dedication which can also affect the moral of the team. One of the biggest benefits of having employee retention strategy is to have a sustainable productivity flow. The employees who are part from the organization from a long time bring a lot of value and professionalism. They understand very well the company, mission and goals and the meaning of their company ‘role. They also have all the skillset and knowledge the complete the tasks and even mentor the junior employees. Rating good experts and reliable employees is financially beneficial for the business. With maintaining lower turnover costs companies could invest in career development programs and other business. Last but not least, long-term professionals are well trained and feel confident to grow and lead others.

II. RETENTION STRATEGIES

Employee retention is critical problem for the IT problem as ensuring the educated and talented resources is long-term project and they need to survive in the competitive environment of other companies that struggle to find the best people as well. Organizations that focus on the employee retention can have better performance, increased productivity and higher quality of work. Employee retention and engagement and satisfaction start from the leadership team. Most of the leaders do not truly understand that they need to be considered as a role model. Many of them underestimate the power which have and their influence on the engagement and retention levels of their teams. One of the most important steps in the organizations is to have engaged leaders which understand the impact that they can have on the organization and the employees. Engaged leaders mean also good listeners who are able to build trust and open communication within the teams [4]. Listening to employees’ feedback is a leadership key characteristic and part of the company operations and success [5]. Setting the right expectations will help to gather valuable feedback and have a long-term company strategy.

Currently, many organizations noticed that creating an inclusive and supportive culture is mandatory of they want to have diversity and engagement. If the companies do not

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provide the conditions which allows different employees with a different background and status to adapt the recruitment process could be endless, once people find out the reality about the company culture. The companies should observe and monitor the internal organizational factors that affect employees and bring them to the decision to leave the organization. There are plenty of researches which show that money is not often the main motivator for people to change their job. Some of the reasons are dissatisfaction of the organizational climate and the role people owned in the organization. Most of the employees highlight that want to see the meaning of their role and to have career path in the company. The companies should be flexible and adaptive and to create career growth opportunities.

In order to determine adequate measures to increase engagement and reduce turnover in the organization, the roots of the turnover problem should be identified. Once the measures have been defined, a specific program can be developed to respond and address the problem. There are many programs aimed at retaining staff:

- **Opportunity for career development** - it is important for employees to understand their career path within the organization in order to stay motivated in their work and achieve their personal career goals. Through surveys, questionnaires and focus groups within the organizations themselves, employees can better understand and organize their personal and professional development goals. Managers can and should link the career development of the employee with the overall organizational goals;

- **Training of leaders in the organization** - this can be used to create competencies in the organization. Training can be very useful in times of organizational change to increase the effectiveness of leaders and encourage the application and adaptation of successful techniques in the company. This process should start with an assessment of both strengths and weaknesses that need to be improved. Improving problem areas contributes not only to individual but also to organizational development;

- **Intergenerational motivation** - today's workforce includes diverse generations working together in the organizational environment. Each generation has different expectations from the work environment and it is important for the employer to understand the differences between them in terms of employee motivation and engagement. It is especially important that team managers have the appropriate understanding of generational differences;

- **Orientation and introductory training** - the employer's understanding of the organization is reflected in the introductory training of the company. About 90% of employees decide whether to stay in the organization for the first 6 months [6]. It is in the interest of both parties for the employee to be introduced quickly and efficiently, as well as to be integrated into the work environment. In addition, the employer should offer continuous training through a systematic process of induction training in the first year, which can increase employee engagement by about 25%. By implementing an effective introductory training process, the

new employee will increase their engagement and the overall effectiveness of the organization;

- **Programs for keeping women in the organization** - these are programs such as mentoring and development programs for leaders in the organization. Creating special programs aimed at the ladies in the organization would help create conditions for them to balance between their many social roles. By striking a work-life balance, employees can be more engaged, better integrated into the organization, and more productive in the work environment.

Due to Florentine [7] there are several important employees' retention strategies. The first step **in the process is the recruiting**. Retention begins from the first step from checking the applicant's CVs, through overall process to the decision which candidate should be invited for job interview. Most of the companies, especially in IT world understand the importance of the “right” recruitment process for finding the best talents at the market. The model is increasing return model in which the longer some employee is part of the company, the more productive they become over time. The recruitment should be long-term plan in which ideally the company is only interested filling the vacancies but interested in finding the right talents that understand and fit corporate culture and environment.

The next step during the recruitment process is to try to evaluate which **candidates will stay long-term in the company**. The labour market in the IT industry is highly competitive but each company tries to provide great benefits and place for the employees where they can grow and develop. It will be great if the recruitment and leadership team have the ability to look beyond the data written in the CV. They should have the ability to make the difference between job-hoppers and the employees who still looking for their dream place and job.

The IT career is demanding and challenging. That is why most of the employees are looking for companies which can provide them **ongoing training and development** and show them the way to grow. Growing within the companies increase the value of the business and also possess positive employer branding reputation. The possibility to grow to management level will enhance employee motivation, development and retention but also helps the company success. The dynamic IT world requires adopting of new skills and process almost constantly and that is why high-skills trainings and professional development plans are perceived as among the top benefits for retaining best employees. The companies which are learning-focused understand the importance of learning and development programs and integrate small task in every new project and in each employee's requirement. The focus on education and development is also a retention strategy and there are companies which are known as a place that are ready to mentor and invest in young professionals.

Investing in social benefits and perks is another successful retention strategy. We should say that there are businesses that provide very unpopular benefits trying to be unique and attract more people. Additional benefits play

important role for keeping employees engaged, valued and happy. Usually in the IT companies benefits go beyond the popular additional health coverage, paid sick leaves and additional vacation days. In the recent years most of the start-ups offer stock options to show the employees that their efforts bring value and they will part of the growth and development of the company. Currently, based on the uncertainty of the environment flexible working schedule or the possibility to work remotely is highly valued. Generous paid leave is also very attractive and emphasize the company belief that they respect the balance between work and personal life. Flexible work arrangements and the possibility to learn, grow and develop in the company are rated among the most attractive additional benefits [8].

Open communication between employees and management can foster a sense of community and shared goals and purposes. Open and friendly environment and regular meeting in which employees can share their feedback and generate ideas set open-door culture in the company. This environment show appreciation to employees and convey a sense of trust and dedication to the company. The meeting that allow each employee to be heard encourage them speaking frankly and learn and grow inside current organization. For this purpose, especially for teams which are not located in same office and country, the technology offers many online tools for communication and sharing ideas. Business changes during the year so the do the people, younger generations love technology and prefer to save time and be more productive by using such tools. The main goal is to have more people committed and ready to share their ideas and perspectives so the technology offers right the right tools for that.

Most organization have **incredible amount of employee data available** that can be analyzed in order to define trends. AI can be used to automated and make the process more efficient and productive. The modern business the authors believe that human resources management should be data-driven in order to take the right and correct decisions. By using AI analytics, the organizations can find the factors that contribute for attrition. These data will show if there are any internal factors which negatively affect the employee's motivation and engagement. Looking more closely to the data and the result can provide uncover patterns and identify and address issues before they become responsible for people happiness and satisfaction. Last but not least **being prepared for turnover is retention strategy as well**. This allows the company to better plan its resources and train more people who are able to replace the key positions.

III. IMPLEMENTING RETENTION STRATEGIES

Effective employee retention programs also require the search for and implementation of effective measures and programs. There are a variety of recommendations and approaches to turnover management. Some of them are:

- **Conducting surveys among employees** - by surveying employees we could gain an idea of their motivation, commitment and satisfaction with the employer. It

is important for the organization to understand the point of view of employees to create programs tailored to their specific needs and desires;

- **Interviews with outgoing employees (outgoing interviews)** - by conducting interviews with employees leaving the organization, we can gain valuable information about the processes within it. This type of interviews helps the management of the organization to understand what are the strengths of the company, as well as what are the negative environmental factors leading to the departure of employees. The organization can use this information to create the necessary programs and measures to retain the best talent in the organization. Interviews conducted at the "exit" in the company require asking the right questions, as well as frank and honest answers from employees who leave in order to be effective and provide the necessary information;

- **Employee Retention Consultants** - Employee care counsellors could be assistants to the organization in the employee retention process. Consultants can provide expert knowledge on how to identify key talents and increase the level of engagement in the organization. Then they can offer programs for organizational change.

Why do employees leave? By understanding the reasons for leaving employees, organizations can more easily shape and change their work environment and adapt it better in the future. Often, low satisfaction and dedication leads to thoughts of more attractive opportunities outside the current company. If managed properly, outgoing interviews are a very good source of feedback on the reasons for leaving. The main reasons for leaving are the search for better pay, better working hours and better opportunities. The responses of leaving employees are a signal of deeper problems that need to be explored. By asking appropriate questions, the employer can gather accurate information.

Contrary to common organizational beliefs, employees often leave because of the relationship they have with the team manager [9]. Metrics related to employee retention in the organization identify costs and help analyses what affects employee loyalty, performance, and engagement.

What do good practices in the field indicate? Organizations go a long way in building an environment of high employee engagement and commitment. Organizations identify their culture and personality type that may be appropriate for this environment. Introductory training usually reflects the organizational culture. Attracting the best employees in the market requires time, resources and finances. However, some employees fail to identify their career path with the organizational one. Research shows that the first 10 days of the employee in the organization are critical for his socialization and inclusion in the organization. Companies become desirable employers when they are the best choice for the employee.

There are several areas that need to be analyzed when building an appropriate retention strategy. When selecting staff, it is important for employees to be aware of the realistic requirements for the position - this would have a positive effect later during the introductory training. Employers, who

are open about the positive and negative aspects of their company, as well as the challenges, problems and expectations, position themselves in the market as sincere and well-meaning entities and hire and retain the best candidates [10].

Pre-selection of employees - there are many innovative tools that help to analyze the performance and retention of employees. These include subjective and objective criteria, and while organizations use subjective methods (such as interviews, CV evaluations, etc.), objective methods are gaining in popularity. For example, the use of biographical data in analysis can be a very effective technique. Past experience also shows certain trends in employee behaviour.

Introductory training - socialization and introductory training practices help the employee to fit into the company and stay for a longer period of time. The inclusion of individual experience and work in the overall activities of the group promotes rapprochement between people and learning about each other's roles. These practices can provide employees with a specific role model, a specific mentor or colleague to train them and provide regular feedback.

Training and development - providing training and development opportunities within the organization can reduce turnover rates by meeting future development opportunities. In fact, dissatisfaction with opportunities for potential career development is one of the three most important reasons why employees do not feel good in the organization. Those who receive more training are less likely to leave than those who receive little or no training. Employers who do not provide training to their employees run the risk of losing some of their core talent. In addition, employers can increase employee engagement through development opportunities by encouraging them to continue their education, as well as funding the relevant fees if the employee stays with the company for a certain period of time.

Incentives, rewards, level of pay - dissatisfaction with the level of pay and lack of satisfaction are some of the most common indicators of the decision of employees to leave the organization. Many organizations offer incentive packages of social benefits, which attract employees from organizations that do not have such bonuses. Organizations can link incentives and financial incentives to retention - for example, additional days off for senior positions in the company, various plans and options for additional benefits. Research shows that financial incentives are associated with a longer stay in the company. Organizations also encourage intrinsic motivation by giving employee autonomy in the process.

IV. CONCLUSION

The modern IT organizations do business in very challenging and dynamic environment. A successful employee retention strategy requires leaders to think about the employee 'perspective. They want to feel valued and appreciated in their companies. They want to be challenged, well paid and to have opportunities for growth and development. In the online world is easy to find any information and that is why extremely

important for companies to understand the meaning of having strong and solid brand and reputation. The retention program starts with the first step of the employee in the company the recruitment and onboarding. The mentorship programs within the company and the possibility to have well-established and onboarding process will increase the employee motivation and satisfaction from the company. The different social benefits, compensation and wellness programs will possess the companies as responsible employers who value the balance between work and personal life. The ability for career growth and development, along with regular annual reviews and feedback are highly valued from the employees. Last but not least building successful teams and motivated employees requires building strong innovative company culture that fosters teamwork, diversity and acknowledge milestones.

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Leadership and Crisis Management in IT Industry

Teodora Lazarova¹

Abstract – The current paper evaluates the fundamentals characteristics of the modern leaders in IT filed. A crisis management mindset requires the ability to think ahead and predict the worse-case scenario and several solutions. Organizations and employees should be prepared with rapid responses and execute them. The paper highlights some of the basics leadership theories by evaluating their implication in the business organizations. Coaching in crisis management before the organization occurs in crisis is one of the steps ensuring readiness and sustainability of the business operations. Leading through a crisis requires taking the long-term perspective, as opposed to focusing the present.

Keywords – Leadership, Crisis Management, Motivation, Innovation

I. INTRODUCTION

Most of the modern organizations faces unprecedented challenges nowadays. The leaders and managers could learn many lessons in time of crisis. We have to say that we evaluate all crisis in terms of unexpected event where there is no protocol to follow. In the same time managing each organization requires long-term plan and goals and readiness for unexpected events. The successful leaders should think outside the box and try to be always one step ahead in time of uncertainty. Crisis management and business continuity plans becomes extremely important in times of pandemic. Coaching in crisis management before the organization occurs in crisis is one of the steps ensuring readiness and sustainability of the business operations.

We truly believe that leading in crisis is a source of learning and development for each leader. If the leader manages to fins the proper way to resolve the complex problems the organization grows, develop and even become resilient. The expectation for the modern leaders is to be highly adaptive, flexible and open-minded. Being prepared ahead in time will help the leaders to avoid the unexpected situations as much as possible and develop decisiveness as one of the main leadership skills.

II. LEADERSHIP APPROACHES

In his book on innovative solutions in the organization, Brands develops 10 key characteristics that every organization must have in order to achieve successful business growth and to rely on satisfied and motivated employees of the company. According to him, the modern reality offers extremely diverse challenges and conflicts that are common to many organizations. In addition, most companies face the so-called.

generational crisis and have to be mediators and meet the diverse needs of employees in the organization. It is believed that in 2025 the generation of the so-called "millennials" will be about 75% of the global workforce, leading to major changes in which the generation of so-called "baby boomers" and "generation X" will be displaced [1].

While much of the generation of the so-called. "baby boomers" are preparing to leave large corporations, organizations are not yet ready for it. According to a report by the McKinsey Quarterly Survey, this generation is the best educated and has the most knowledge and skills in the history of the US labour market. Although it represents about 40% of the current workforce in the market, its positions are almost entirely in the role of managers, doctors and lawyers in the labour market [2].

Regardless of the existing generational differences that currently exist in the workplace, the exit from the market of any generation will lead to serious changes in the organization of work and organizational culture. The losses associated with people who have so much knowledge and skills, especially in the R&D field, where it is difficult to have deep knowledge, would definitely have consequences for many companies. In this sense, organizations should respond quickly and build a package of preventive measures that will lead to the creation of programs for the transfer of knowledge to younger employees and generations in the organization. To counteract this negative trend, Brands [1] proposes a package of concrete steps that will lead to higher employee engagement in the organization:

- **Creating uniform rules for work and communication with customers** - information about the customer base should be collected in a certain way. This helps the information to be processed through the same approaches and the customers to always receive feedback and service at a very good level;

- **Analysis of the professional picture** - creating a unified database or internal software that analyses and organizes information in a specific way. The program must have enough functionality so that employees can make the most of the information from it. This helps to transfer

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knowledge and prevent the possibility of work tasks being performed in different ways;

- **Creating a database for collecting information** - large organizations often have difficulty managing knowledge within organizations. Although such databases vary in level of complexity and difficulty, they serve as a library or place that stores and analyses information, data, and processes in the organization;

- **Creating processes and rules for already created products** - proper documentation, as well as a detailed description of the processes is a huge plus in the transfer and transfer of knowledge. Every next employee has a base from which to start in the invention of new products, rules or work procedures. Proper documentation of what has been achieved so far allows employees to have more time for innovation and innovation in existing processes;

- **Creating "bridges" between the generations** - creating a connection between employees in the organization, as well as encouraging teamwork, fosters a positive organizational climate and improves communication and knowledge transfer between generations;

- **Creating events that bring people together** - organizing various events and meetings of an informal nature unites people and supports communication between them;

- **Use of various social channels and tools** - use of all functionalities of social networks, as well as the creation of various social groups related to the company, creates a virtual place for communication and sharing;

- The process of knowledge sharing and transfer should become a permanent mission of the organization, not a one-time act - knowledge sharing between different teams and generations in the company should be part of the organizational culture and be encouraged.

Social working conditions such as planning, clarity of work obligations, good interpersonal relationships and a positive intra-group climate also determine the higher involvement, commitment and motivation of employees. The appraisal is necessary to determine those employees whom the manager must retain at all costs, as well as those who could be laid off in a given market situation. Of course, other things being equal, the organization will strive to retain those employees who perform the tasks best assigned to them, and in the event of the need to close jobs to lay off those who do not fully cope with the work. To meet this need, instead of the judgment of the immediate supervisor, which may not always be objective, each organization must have an effective for its conditions and requirements system for assessing human resources and a database of the results of its operation.

Evaluation is extremely important for the material encouragement of employees who have high professional qualifications and fully realize their potential to achieve the goals of the organization and the group. The results of the evaluation of the activity of the people in the labour process are an important tool for a change in the basic salary, for differentiation of the premiums and other labour remunerations. In order to support the self-esteem of employees, to activate the process of self-development and

good self-realization in work, it is important that they feel properly and adequately evaluated in the workplace. This is of great importance for the integration of employees with the goals of the organization.

Modern management practices for motivation related to employee recognition programs, flexible working hours and bonus schemes. These practices emphasize the importance of various external motivational incentives - bonuses or rewards. A connecting link in the motivation of employees, which takes into account both individual needs and differences, and external incentives, is the so-called psychological ownership. Psychological ownership enhances organizational behaviour and efforts beyond what is required by job description [3].

It is the intrinsic motivation of the individual that has been the subject of research since the early 1970s. Internal motivation is formed as an internal need of the individual to seek new challenges, as well as to observe and gather knowledge [4]. The nature of intrinsic motivation was first observed in experimental animal studies. In these studies, the authors found that organisms tend to participate and be more involved in fun and enjoyable activities that arouse their curiosity, even if there are no incentives and rewards. Intrinsic motivation is a natural motivational tendency and is a key element in cognitive, social, and physical development. The two main elements in this process are self-determination and increasing the level of acquired competence. The roots of behaviour are related to internal causes, known as the internal locus of control, and individuals who engage in a behaviour must feel that the task increases their knowledge, skills, and competence.

Usually a person starts his career in need of meeting physiological needs, as well as adequate pay in the organization. Employees who do not have their basic needs met may be able to make their decisions based on pay levels and stability in the company [5]. In this case, it is difficult to talk about long-term intrinsic motivation if these needs are not met. Once these basic needs are met, employees go to the level of meeting the need for belonging or the range of social needs of the individual to the organization. Often, the level of relationships with other colleagues in the organization is determined by the personal characteristics of the employee - according to the degree of introversion or extroversion. More employees would like to work in a supportive environment that accepts them and meets their communication and interaction needs. Interpersonal relationships are very important, so leaders in the organization should focus on building a supportive environment.

How to satisfy the highest hierarchical needs in modern dynamic organizations? The need for self-improvement and self-expression is related to the image that the employee has for himself. Even if the employee does not want to develop hierarchically in a management position, he would probably get bored of performing the same work tasks within 20 years. The transfer to another team, the acquisition of new technologies, as well as the expansion of his expert competencies in his professional field are only part of the measures for continuing his career development. Enriching

job descriptions and developing a specific project are other methods that make the workflow more inspiring. Employee participation in the decision-making process in the organization is also an important approach to employee development. Last but not least, the achievements related to the job position, the external symbols of status - business cards, a separate office space, are another important part for the development of self-affirmation of the employee.

The incentives that the employer offers must be balanced in order to have the maximum effect. In order for the work process to be motivating and inspiring, a symbiosis between organizational effort and intrinsic motivation should be created. On the path of cultivation, the employee is interested in personal growth and individual development. Its goals in this area can be varied - from interesting and inspiring work tasks, the opportunity to cover a certain educational degree, to gain autonomy and freedom in decision-making.

III. LEADERSHIP THEORIES

Theory Y is based on the idea that people are proactive, with their own potential for development and skills to make independent decisions. The management in the organization is called to take care of creating an appropriate corporate culture that will stimulate and encourage the development of employees. This view of human needs subsequently serves as a starting point for the creation and development of various motivational models in the organization. In order to incorporate these theories into practice, it is necessary to adopt a holistic approach in constructing a work environment. Individuals are motivated to work in organizations that meet both their professional and personal needs in the workplace. Personnel selection should focus on linking individual and organizational goals much more than on the individual performance of the candidate. Companies should apply the ideas of these theories by delegating responsibilities, expanding job roles and regular feedback [6].

A study of students shows that those who have intrinsic motivation to perform tasks also increase the level of their competencies [7]. They would have intrinsic motivation if:

- relate their successes in the environment to the factors subject to their control, or have autonomy or a locus of control;
- believe that they have the knowledge and skills to successfully achieve their goals or believe in their own effectiveness and efficiency;
- are extremely motivated in the development of their knowledge and skills, not just in the acquisition of high results.

Also interesting is the thesis of Professor Reiss, who in a study of more than 6,000 people, proposed a motivational theory based on 16 motivational needs related to the formation of overall human behavior [8]. He defines intrinsic motivation as the tendency to discover new challenges, to learn and to be curious about the world. This is reaching the maximum potential that the person has. The 16 factors that it brings out and shape our personality are:

- Acceptance - the need to be accepted by others;
- Curiosity - the need to learn;
- Nutrition - the need for food;
- Family - the need to raise children;
- Honour - the need to be loyal to the traditional values of your own ethnic group;
- Idealism - the need for social justice;
- Independence - the need for individuality;
- Order - the need for an organized, stable and predictable environment;
- Physical activity - the need for movement;
- Power - the need to influence or win;
- Romance - the need for contact and beauty;
- Collection - the need for collection and collecting;
- Social contacts - the need for friendship;
- Social status - the need for social significance;
- Calmness - the need for security;
- Revenge - the need for battle and competition.

The attributive theory of motivation is another approach to understand the employees in order to help the achieving the best results. The author describes the process in which a person evaluates his behaviour based on various causes or events [9]. A theory developed by Weiner describes individual beliefs about the causes of success or failure and their impact on emotions and motivation. The theory can be considered in two perspectives - internal and external to the individual. The inner perspective of the personality includes self-regulated thoughts and emotions that relate to the personality itself. The external perspective is associated with beliefs about the responsibility of others and their direct effect on behaviour, as well as the responsibility that a person transfers for events to others [10]. The person forms attributions in order to understand the events that happen to him and looks for reasons for failure. When a person expects positive feedback from failures, he uses what he has learned to develop and improve his performance. When a person attributes failure to external events - a manager who does not like him, difficult work tasks, rather than their own abilities, this leads to an external locus of control and inability to grow and develop.

In recent years, more and more innovative and complex theories of leadership and motivation have emerged. In today's dynamic environment, every business tries to keep the level of motivation in people high enough. One of the latest theories of motivation is the theory focused on stress, strength and hope. On this basis, research on positive organizational behaviour has even appeared [11]. Another interesting theory is centered on positive energy and full engagement. It borrows from the sports environment and transfers the concept to the modern business world, as both theories are related to motivation, behaviour and performance in the workplace.

Eustress is defined as healthy and positive stress [12]. The emphasis on positive organizational behaviour is on the strengths of the organization, as well as on discovering the positive aspects of work and positive emotions in the workplace. This theory focuses on the positive emphases of the workplace and a healthy organizational climate. It is based on the way events are interpreted by man. People are

motivated by eustress when they see opportunities, not problems and obstacles. In this sense, eustress is a healthy and positive motivating force for people who use its energy creatively.

The second theory, borrowed from professional sports, develops in a corporate environment and is aimed at creating the so-called "corporate athletes" [13]. The basic principles according to Loehr are energy management to find the balance in full engagement. In this sense, people are not activated by unmet needs, but are motivated by physical, emotional, mental, and spiritual energy. The role of the manager is to teach others how to manage their psychic energy and how to feel restored and renewed and to build positive motivation for work. Energy recovery is equally important, and even more important than energy consumption. This approach to the work environment is based on a balanced approach to the potential of the human body and energy and helps a person maintain a high level of efficiency and performance in an environment of increasing labour requirements. This helps organizations with high levels of employee engagement and loyalty to remain stable even in uncertain economic times.

Another basic theory in leadership is the theory of justice. It is a procedural theory of the social exchange of motivation, which emphasizes the interaction between man and the environment. Unlike theories focused on internal needs, this theory is determined by social processes that influence motivation and behaviour. According to Blau, exchange and power are key to understanding human behaviour [14]. Later, Etzioni created and defined three types of exchange relationships - bound, calculated, and alienated engagement in the organization. Bonded relationships are moral relationships with strong positive intensity, calculated relationships are characterized by weak positive or weak negative intensity, and alienated relationships are characterized by strong negative intensity. The theory of social exchange is perhaps the best way to understand the effort-reward relationship, as well as the meaning of equity in the workplace.

The calculated engagement is based on the idea of social exchange, as each side of the relationship requires certain things from the other and accordingly contributes to the exchange. Business partnerships and employment relationships are an example of calculated engagement. Both sides work well and benefit from what has been done. When certain conflicts in orientation appear, a negative orientation also appears. Single events can upset participants in the system they are in and move them toward competition [15]. This model often explores the nature of the relationship between the individual and the organization that hired him. Each party in this exchange has expectations and demands on the other. These requirements can take the form of a specific goal, mission, job expectations, performance goal and feedback. Satisfaction of individual needs forms the basis of expectations or requirements addressed by the organization to the person. Meeting the needs of each employee as well as a sense of belonging are important for healthy social exchange and membership in the organization.

In order for the exchange between the parties to be successful, each party in the process must contribute with certain knowledge, skills and benefits to the satisfaction of the other. Employees can meet the requirements of the organization through various contributions through their skills, abilities, knowledge, dedication and commitment. By increasing their competencies, employees contribute more and more to the expectations of their organization. The organizations are also an active participant in the exchange and offer various initiatives and incentives to meet the requirements of their employees. These are the various material incentives provided, as well as status and social responsibility. It is in the common interest of the employee and the organization that the relationship is fair to both parties. Perceptions of social exchange are also based on the leadership style and organizational culture of the organization [16].

The ideas of authors such as Blau and Etzioni provide a basis for understanding the social processes of exchange in the context of the concepts of justice, honesty (respectively - injustice and dishonesty) in labour relations. Adams developed the concept that injustice in the process of social exchange is an important factor reflecting on motivation. Stacey Adams's theory of injustice assumes that injustice motivates people more than justice or honesty [17]. Injustice occurs when a person receives less than he or she thinks he or she deserves, according to the effort he or she makes. Injustice is associated with experiencing tension and tension impulses a person to act in a way that changes the situation.

According to Adams, people analyze both their contributions to relationships and results, and the contribution of the organization. After this analysis, they calculate the contribution-result ratio, which is compared to a circumstance that embodies an idealized idea of justice. Difficult to measure characteristics such as emotional investment or job satisfaction are also measures of a sense of fairness. For example, gender inequality in certain positions or differences in norms between countries is a common theme. The main criticisms of Adams' theory have to do with the lack of a way to measure whether contributions such as effort and experience or certain outcomes are more important than an employee's degree or certification in a particular field.

If an injustice is found, according to Adams, one has the opportunity to apply several strategies:

- Change of own results;
- Change of own contributions;
- Change the results of the other party for comparison;
- Change the other side for comparison;
- Rationalization of inequality;
- Leaving the organizational situation.

Choosing the right coping strategy and tactics is a matter of possible long-term consequences. Research related to the theory of justice shows that it can explain important organizational implications. According to a study, employees who perceive their pay as fair demonstrate greater satisfaction and commitment and commitment to the organization.

A number of discussions of the theory of justice and social exchange have been formulated in contemporary literature. Huseman [18] creates an interesting theoretical framework based on people's preferences for justice. He defines people's sensitivity to justice as preferences for justice based on an originally formulated theory. Research on organizational justice also has a long history, and according to research, a person's position in the organization influences self-imposed expectations for performance [19]. For example, climbing two levels in an organization without additional pay creates a higher self-imposed expectation of performance than climbing one level with moderate additional payment. At the same time, a two-level downgrade in the organization without a pay cut creates lower self-imposed performance expectations than a one-rate downgrade with a more modest pay cut.

IV. CONCLUSION

As a conclusion we would like to highlight the huge impact of the leadership approach on the organizational development and growth. There are plenty of leadership theories which try to explain the nature of the leadership and to give suggestions for appropriate and successful leadership behaviour. Crisis management is usually associated with disruptive and unexpected event that threatens the organizations. The element of surprise and the shortage of decision time requires bunch of psychological characteristics of the modern leader. Crisis management is situation-based leadership and requires adaptability and flexibility. It is different from the concept of risk management where the leaders still have time to plan, evaluate and execute possible scenarios.

A crisis management mindset requires the ability to think ahead and predict the worse-case scenario and several solutions. We believe that IT world is highly-competitive and demanding. Organizations and employees should be prepared with rapid responses and execute them. The brand reputation of each company is influenced by their responses during crisis situations. Last but not least we believe that leadership approach is setting the tone of communication, defining the organizational culture and setting mission and vision. The ability of the leaders to change, grow and be resilient build trust and enhance employees to follow the best scenario in time of uncertainty

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Project Planning Meetings in Telecommunications Companies

Gergana Dimcheva¹ and Ivaylo Stoyanov²

Abstract -The planning phase is vital for the subsequent implementation of the project, as it covers strategic aspects of its organization and management in terms of information and resource security, as well as making key decisions in the relevant functional areas of the activity. The purpose of this publication is to propose a process for the formation of workshops for project planning in the field of telecommunications.

Keywords – Workshops, Planning, Projects, Telecommunications

I. INTRODUCTION

The high rates of technological development, the growing competition and the constantly increasing expectations and requirements of the customers make the organizations constantly adapt to the changing external environment in order to maintain their competitive position on the market.

Regardless of the changes that occur, most modern organizations achieve this by using a project approach.

Undoubtedly one of the most dynamically developing industries is telecommunications. This dynamic requires a change not only in the organization and management of telecommunications companies in general, but also a change in approaches to project management in this area.

The purpose of this publication is to propose a process for conducting workshops on project planning in the field of telecommunications business.

II. PROJECT. PROJECT PLANNING

A project is a temporary undertaking undertaken to create a unique product, service or result [1], with limited resources, time and budget.

The result of the project can be tangible or intangible [1, 3].

Project management differs significantly from the routine management process of an organization [2].

Project management is the application of knowledge, skills, tools and techniques for project activities to meet project requirements. The stages of the project management are: initiation, planning, implementation, monitoring and control, and completion [1, 2, 3]. In all projects, the stages are

consistent and usually their beginning and end are "materialized" in measurable parameters, characteristics, indicators, etc.

The planning phase is extremely important for the subsequent successful implementation of the project. It includes the processes needed to establish the scope of the project, refine the objectives and identify the main activities to achieve them [3].

The project management plan is the document that describes how the project will be implemented, monitored and controlled. It includes: identification and description of scope, tasks, schedule, required resources, costs, people, roles and responsibilities, communications, risks. Describe all the necessary tools and techniques that will be used in each of the phases of the project.

The content of the plan may vary depending on the area of application and the complexity of the project [3].

The processes in the planning phase play a very important role for the successful management of the project in the next stages. One of the main tools for this is to conduct effective working meetings of the project team.

A. Workshops in project management

Different types of workshops are held throughout the project life cycle. It is essential when organizing the meetings on the one hand to clearly define the objectives for their implementation, and on the other hand the correct definition of roles and responsibilities between the individual participants in the project team.

What is a project team workshop? This is an event in which all those who are interested / have a commitment to the project participate, including the project stakeholders and / or other participants, in order to build relationships, share information, solve problems. Proposals are made in order to make decisions that will contribute to the effective and timely implementation of project activities, in accordance with the planned objectives and expected results. Adapted after [4].

The process of conducting workshops includes three main stages (Table 1).

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TABLE I
PROCESS OF PLANNING AND CONDUCTING EFFECTIVE WORKSHOPS IN
PROJECT MANAGEMENT
ADAPTED AFTER [5, 6, 7]

Stages	Key activities
Planning project workshops	• Defining the purpose / objectives of the meeting. • Identification / identification of participants. • Clarification of roles and responsibilities. • Defining the decision-making process. • Determining the type of meeting (eg. virtual). • Determining the date, place and time. • Preparation and sending of the necessary materials for the meeting. • Sending an invitation and agenda.
Conducting workshops on the project	• Reminding the participants of the purpose of the meeting; what will be discussed; what is expected of them and what information they will have to provide; coordination of roles. • Meetings must begin and end on time. • The chairman of the meeting (usually the project manager) should be aware that some items on the pre-announced agenda are combined, others are more controversial and their place is decided during the meeting. • No deviation from the agenda should be allowed, which would lead to delays and loss of time.
Post-meeting activities	• Sending the participants information from the meeting about the decisions taken, deadlines, and tasks for implementation. • Receiving feedback from the participants in the meeting, in order to improve the conduct of such in the future.

B. Types of workshops in project management

The working meetings of the project team follow the logical sequence of the stages of implementation of the project itself. As is well known, projects can vary in scope, location, etc. From this point of view, it is not possible to state with complete certainty that the indicated types of workshop meetings on projects should be the same, especially in terms of number and subtypes.

In the scientific and specialized literature, the working meetings are generally classified as: introductory meetings; meetings related to the progress of the project; closing meetings. Some authors [4] consider them as regular project meetings, change control meetings, project status review meetings. Other authors [8, 9] define them as introductory meetings, project status meeting, project review meetings, stakeholder meetings and regular / follow-up meetings [9]. Authors offer an interesting classification, such as [10] (1) meeting "start", (2) meeting "review of basic rules", (3) meeting "introduction and review of resources" and (4) summarized meetings and presentations. Similar to this

classification, meetings such as [11] are considered: information sharing meetings, decision making meetings, problem solving meetings, project status update meetings, team building meetings.

Some authors [6] consider the working meetings of ch. item of their frequency of holding, namely: daily meetings, weekly / monthly meetings, occasional (irregular) meetings.

Based on the considered types of workshops, the authors of the present study propose the following classification (Fig. 1):

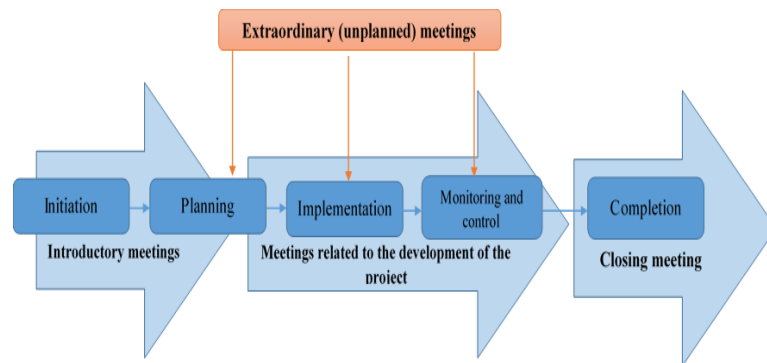


Fig. 1. Types of workshops during the project life cycle¹

➤ **Introductory meeting(s)** - this type of meetings are initiated when there is a need to develop a project. The purpose of such meetings is to clearly set the goal of the project, to define the scope, to identify project participants, to form and present a project team. As shown in Fig. 1 the introductory meetings (according to the authors) cover the stages of initiating and planning the project. There are usually more than one introductory meeting, as the project often needs to be refined. One of the prerequisites for introductory workshops is for the project manager to present as much information as possible about the project - such as implementation time, budget (if possible at this stage), and some of the challenges that the project team can face. In this way, the project team will have the opportunity to respond in a timely manner, if necessary.

A description is made of all basic rules, restrictions and assumptions of the project; technical specifications, drawings, schedule and descriptions of working elements and resource assessment forms [9].

In addition to the introductory meetings, the authors include meetings with clients and stakeholders, with whom it is often necessary to clarify and / or obtain additional information related to the project.

➤ **Meetings related to the development of the project** - these meetings of the project teams are related to the stages of implementation, and monitoring and control of the project management. The purpose of these meetings is to report on interim results related to the progress of the project. The project manager presents detailed information (reports,

¹ Author's development based on [4, 6, 8, 9, 10, 11]

reports) to the stakeholders about the current state of the project. These meetings provide answers to the following questions: Is the project implementation schedule followed? Are resources being used efficiently? Are there potential risks in the subsequent implementation of the project? Is the project being implemented within the budget? A useful tool for this is the project plan, which provides answers to these questions.

➤ **Extraordinary (unplanned) meetings** - the dynamic environment in which modern organizations operate, based on a project approach, and not only, require very often the so-called extraordinary meetings. Most often the reason for their implementation is vaguely set / supplementing new requirements by the client to the organization during the planning of the project. This in turn can lead to a change not only in the scope of the project, but also in the time for its implementation, the budget, and often to a change in the number of members of the project team. Every project manager should avoid / minimize such meetings in order to minimize deviations from project progress. That is why effective workshops during the planning phase are one of the most important factors for the successful completion of the project.

Good advance planning may not eliminate the need for change, but it can reduce the number to a minimum. Therefore, project participants must adhere to several basic rules, namely: Adapted after [10]:

- Clearly defined goal(s);
- Detailed descriptions of the tasks for implementation, goals, requirements and main stages;
- Preparation of detailed schedules and proper distribution of the workforce, in accordance with the budget and the project schedule;
- Defining and complying with time, cost and productivity constraints;
- Observance of operational procedures and basic rules;
- Setting clear reporting requirements;
- Identifying the main areas of risk, uncertainty and conflict;
- Minimization of disagreements / conflicts / problems between the members of the project team and / or the stakeholders.

➤ **Closing meeting** - it coincides with the last stage of project management - project completion. At this meeting, a

comprehensive report is made on the activities carried out under the project. An analysis is made of the main indicators for the success of the project, indicated in the planning stage. At the final meeting, each member of the project team provides information on project implementation in order to identify problem areas to be improved in future projects. Proper communication between project team members and / or stakeholders is essential for the successful completion of a project [11, 12, 13]. A good indicator of this is the satisfaction of all project participants. Based on the received assessment, measures are taken to improve the management process of future projects.

III. WORKING MEETINGS FOR PROJECT PLANNING IN TELECOMMUNICATION COMPANIES

Telecommunications operators maintain relationships with different users, which differ significantly in terms of desires and needs. Diverse user profiles lead to a variety of projects.

The telecommunications industry has always been a dynamic environment that requires flexibility, skills and excellent project management knowledge. Therefore, project managers need to combine traditional and expert techniques, such as: change management, stakeholder satisfaction, virtual team management, planning and cost reduction [14].

All this is related to many different types of projects, which set different requirements for project managers and their teams. However, there are also general requirements related to project management in the field of telecommunications [15], compliance with which leads to the effective organization and holding of workshops of project teams.

Figure 2 shows the main stages of the process of conducting workshops for project planning, tailored to the specifics of telecommunications services (Fig. 2).

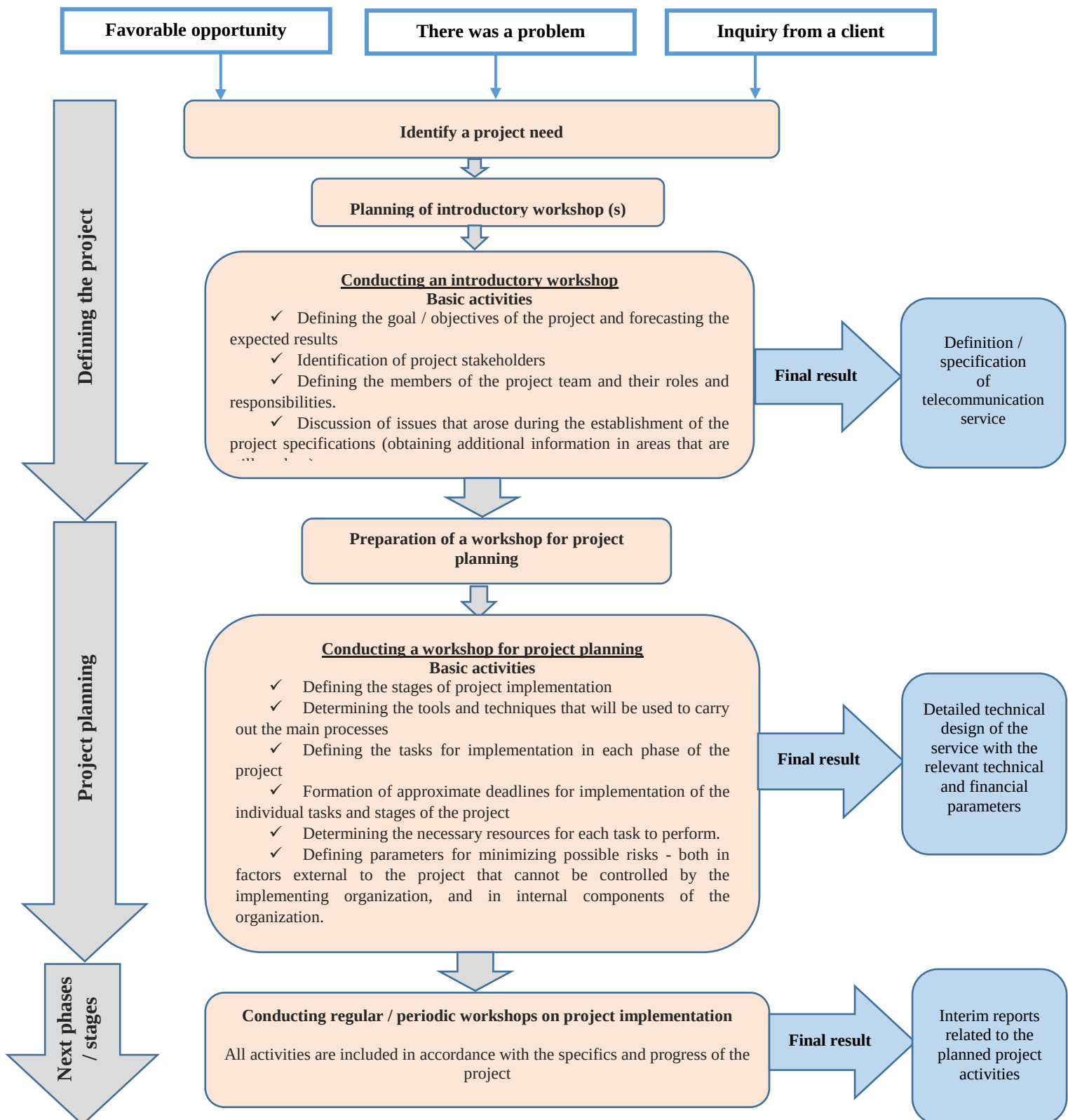


Fig. 2. Process of conducting workshops for project planning in telecommunication services²

² Author's development based on [5, 6, 7, 15, 16, 17]

➤ **Identify a project need.** Like other telecommunications industries, projects are initiated for one of the following reasons:

1) **There is a favorable opportunity for the telecommunications operator**, which can be expressed in: opportunity to enter a new market; to offer better customer service, to introduce new opportunities (improve existing services or implement new ones).

2) **Initiating a project to solve a problem.** This can occur in cases such as: available equipment that does not meet certain requirements for a particular service; an existing process is no longer as efficient or does not satisfy a customer; danger of existence of a new competitor, etc.

3) **Customer inquiry for a telecommunication service.** Many customers (especially corporate ones) often require innovations related to high performance costs. This is related to the design and implementation of non-standard technical solutions for the provision of telecommunications services that meet customer requirements. Such services may be: voice services, data services, network access services and infrastructure.

In this area, the client's participation is a prerequisite for the successful implementation of a project. The involvement of the client in the process of development and implementation of the project ensures that the work performed is consistent with its needs and requirements.

➤ **Planning introductory workshops** - at this stage it is necessary to comply the requirements for holding effective workshops discussed in the previous section of this publication.

➤ **Conducting introductory workshops** - as shown in Fig. 2, the purpose of the project shall be determined at these workshops. When the project is initiated by a client, it is necessary to clearly define / specify the requirements for the service and coordination with the telecommunications provider.

Very often, in such cases, it is necessary to form two teams (by the customer and the supplier). Both teams can be considered as a unique team (led by two project managers on both sides). It is important to build a good team, fast and distributed communication.

➤ **Conducting a workshop for project planning** - at this stage of the process of particular importance is the collection, processing, analysis of detailed information about the project.

An assessment is made and the required type (people, materials, tools, equipment, etc.) and amount of resources for each of the tasks are determined, as well as the periods of time during which each resource will be included in the respective work (activity) [18].

At this workshop, the benefits for the customer should be indicated, and not only the technical parameters of the respective telecommunication service. Such benefits are: reliability, speed, response time, troubleshooting time, risk minimization parameters, SLA (Service Level Agreement) parameters, communications security, number of faults, number of recurring faults, service.

When specifying the project, it is necessary to make: a description of the conditions for its implementation, forecasting the expected results, to reflect the specifics of the project, and in particular its complexity and degree of novelty. As a final result of this stage, a plan with specific parameters for the specific telecommunication service / infrastructure has been prepared.

➤ **Conducting regular / periodic meetings on project implementation**

In the next stages, the project manager monitors whether and to what extent the activities and processes formulated during the planning are implemented, how the project is implemented in terms of time, price, quality, risk. Interim reports are prepared and then a final report on the implementation of the project.

IV. CONCLUSION

Conducting effective workshops is a key factor for successful project management, which saves time, increases motivation, productivity, solves problems [18]. This in turn leads to good results, satisfied stakeholders, effective decision making.

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Dimensions Determining the Differences of Human Resources of the Workplace and Influencing Factors of the Organizational Environment

Ivaylo Stoyanov¹

Abstract – The publication examines the dimensions that determine the differences in human resources in the workplace and the influencing factors of the organizational environment. Dimensions are categorized into two groups, with primary and secondary context. The primary dimensions of the personality are those, externally and intrinsically characteristic for each person features, which are a natural given, some of which are difficult to change or do not change at all. In contrast, the secondary dimensions allow a person to change, to adopt different views or behaviors, which will allow him to better adapt to the social environment and in particular to the work process. For the people, the primary and secondary dimensions are not unambiguously determining the workplace, as they are also influenced by factors of the organizational environment. These factors depend on the way each organization functions, its management policy and the attitude of managers to the differences, work and behavior of people in the work environment.

Keywords – Human Resources, Dimensions, Differences, Workplace, Organizational Environment

I. INTRODUCTION

The globalization of the business, the migration of human capital to developed countries, as well as the digitalization of many of the business processes of companies, have imposed a new approach to work and work efficiency. Today, organizations require human resources to achieve target goals, to be motivated, to be proactive, to offer solutions and to be creative. The problem for most managers is not only to deal with the socio-psychological element in managing people and reconciling their value systems, it is more global and requires a leadership approach to strategic human resource development. A vision of companies at all levels is needed to manage human relationships in the workplace and achieve results that are the result of the efforts and work of different people.

Of course, this is a difficult task when it comes to a palette of individual traits of people, their competencies and behavior manifested in the work environment. The challenge arises from the fact that people are different, not only in terms of personal characteristics of the individual and their own perception, but also the perception of others to themselves. Hence the question of the differences in human resources in the workplace, the positives and negatives of this inevitable for our time aspect of human behavior in the work environment. This requires knowledge of the personal

dimensions of the individual (primary and secondary) and the factors of the organizational environment that affect the behavior and decisions of people in the work process.

II. PRIMARY DIMENSIONS OF THE PERSONALITY

The primary dimensions of the personality are innate and cannot be ignored, as they are genetically set and determine a person's personal traits in the social environment. In these dimensions, people differ from each other without realizing it or hiding it, because in one way or another they are visible to others. The main ones are the following [1, 3, 5, 9, 14, 18, 23, 27]:

Age - has to do with the composition and structure of the workforce, and the problem worldwide, and in corporations in particular, is the balance between young people (entering the workplace) and adults (experienced) staff who need to retire. *Two trends are reported here: First*, the aging population, which affects not only the labor structure of individual countries, but also the migration of human resources. *Second*, how the continuity between young and professionally trained specialists will be determined, and more specifically by whom, people will acquire the necessary (practical) competencies in the work. We should not underestimate the views on the age limit of human resources in the organization - in motivation, pay, attitude to work, moral views and norms of behavior, career development, etc.

Nationality (race) - the differences arise from the color of people's skin and prejudices in the workplace. Many workers who are a minority in the organization feel oppressed and neglected by others. This is seen in multinational companies or people working in different cultural communities [9, 10, 25]. Much of the negative attitude towards people with different skin color or their ethnicity is due to events and facts

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that are relevant to the history. But the history is a part of the past, and the only thing it can teach people is not to repeat mistakes they have already made. No one can choose where to be born, what color his skin should be and what religion he should have. All people are born with equal rights and are free to do what they want, as long as they do not break the law and prevent others from their full development.

Gender - the differences affect the work performed by men and women in the workplace from which the phrases arise. "Male" and "Female" Work [8, 16]. In today's business, more and more women are establishing themselves as leaders and executives, which can be a problem for some men who are used to dominating or unable to accept directives (power influence) of the opposite sex. In some organizations, conservative rules from the past still apply and there is a division between men and women who cannot hold certain positions or are discriminated against. There are other prerequisites that affect gender differences in the organization - they do not think alike, do not approach work, people, etc. It is not uncommon for people to have a negative attitude towards young girls and boys who advance in the hierarchy or succeed in their careers, calling them insulting words, because their successes are the work of others but not of professional qualities. Of course, this is also possible, but people at work should not be judged by their gender, what they look like or what protections they have, and according to the results they achieve (if they have any), for which the maxim applies - "When the facts speak and the gods are silent"!

Physiology - people are physiologically different, which applies not only to weight and height, for example, but also to the viability of the human body (mental or physical trauma). Problems can arise at work with people who are disabled or have disabilities. Often these people are perceived as "second grade", Their right to work is restricted (if they can do so), they are ignored by others or they avoid people due to inconvenience and anxiety [2, 15, 27]. Some organizations avoid taking people with disabilities, even though they can perform job functions. The reasons are different, but the main ones are related to problems with labor legislation or doubts about the quality and effectiveness of the work of these individuals and their adaptation (socialization) in the team and the organization as a whole.

Sexual orientation - the differences arise from the fact that people choose what their sexual orientation should be, which may not coincide with that of other individuals. This is often a negative for people and the organization, which causes a problem of a sexual nature. If sexual views are not imposed and generally accepted norms of behavior are not violated, everyone has the right to do what he or she prefers. *We have an equal start and the privilege to choose with whom to be in family relations and whatever our sexual orientation, BUT IN GOOD WILL AND WITHOUT FORCED ATTACK ON OTHER PEOPLE!* People of different sexual orientations are reprimanded or stigmatized as sick or perverted. This oppresses them, they shun of the group, suffer the humiliation and mocking comments of the others.

III. SECONDARY DIMENSIONS OF THE PERSONALITY

The secondary dimensions of the personality are subject to constant change, because the person adapts depending on environmental factors or joins a certain social group. These dimensions are subject to correction (or concealment) to varying degrees, and people use them to develop and improve in life and work. The main ones are the following [3, 6, 9, 10, 13, 18, 21, 22, 25, 26, 27]:

Religion, values and norms of behavior - The differences are related to the way people perceive the world around them and their behavior in the social environment. In some organizations there are problems with religious motives, but also religion determines the reaction of people in one situation or another, ie. the principles of the moral and the immoral in life and the business environment. Everyone has his own understanding of "The divine forces", the equivalent of faith or atheism and the imposition of another's opinion is meaningless and useless. The companies have written and unwritten rules, formed by the normative base or the company culture, with which the people comply. In case of deviations from these norms, they have different than expected behavior and are subject to reprimand or sanctioning mechanisms.

Political and life views - each person determines his behavior and actions from personal motives and perceptions that bring conviction to his work and personal life. People have political biases, their own understandings of life and the social environment, which are subject to constant rethinking. However, it is difficult to change established stereotypes of thinking and behavior, especially in people with a rigid value system, which is not a big problem for young people. This does not mean that people should not adapt to changes in the social environment. On the contrary, they need to seek development in all areas of the socio-political system.

Educational qualifications - The differences arise from the fact that each person has an educational qualification, which may not correspond to that of the other members of the team (group). In the company people have professions and specialties and specialize in performing certain functions. If they do not correspond to their professional qualification, conflicts and contradictions arise, and the efficiency of the work decreases. Education today varies widely and can be acquired not only nationally and internationally, but also in public and private universities.

Professional experience - people have different professional experience that shapes them as experts with a certain level of specialized skills. It depends on the length of service in the field of the respective profession or specialty and the practical intelligence of the individual. Some people have much more solid professional experience than others, but this does not make them better experts or, if they are, they may be discriminated against at work.

Manner of communication and work habits - People differ in how they communicate with others and whether they understand them. Work style and communication are important for fulfilling professional tasks, priorities and strategic goals. Expression, non-verbal communication,

culture and behavior are prerequisites for determining the effectiveness of human relationships [6, 13, 15]. Each person approaches the professional activity differently, which depends on the work habits and the work assigned to him. People achieve results that are the result of their abilities, efforts and desire for professional development.

Lifestyle - Differences in work may arise from people's lifestyle, which affects their work commitments. If people lead a loose style of behavior and communication, it can create problems for them in the team (group) or reduce the effectiveness of work (stress, fatigue, apathy, etc.). Conservative understandings can also prevent people from expressing themselves fully at work or influencing their relationships with others. Social status determines a person's place in the social environment and leads to differences in people's perception and understanding. For example, people who have financial opportunities demonstrated in the workplace (to dress well, to spend money, to indulge, etc.) will be perceived well by some (respect and esteem) and badly by others (malice, envy, etc.). The place of birth can also give rise to different attitudes towards the individual, formed on the basis of prejudices about the geographical location, the populated area and the mentality.

Marital status - People differ in whether they have a marital or intimate partner next to them, which affects the effectiveness of work and relationships with others in different ways. People who have regular sex with their partner are usually enterprising at work, smiling, calm and well-meaning, and vice versa for those who do not. On the other hand, people who are married or have a person next to them are torn between work and personal relationships. People who *"are not emotionally engaged with another person"* usually spend more time to the work, concentrate and achieve better results. In both cases, however, it depends on the person himself, his attitude to work and his perceptions.

Free time and entertainment - People have different views on what and how to spend their free time (hobbies, outings, etc.). In the process of work, these inclinations help to build informal relationships in the organization and influence human relationships. Even with expert differences or dissimilarities in behavior, common passions for a particular cause bring people together and make them accountable to each other. These relationships make it much easier to fulfill work commitments and achieve optimal results for the organization.

IV. INFLUENCING FACTORS OF THE ORGANIZATIONAL ENVIRONMENT

Independently from *the primary and secondary dimensions of the personality, people work in an organizational environment where there are influence factors, which to varying degrees determine the social climate and the performance of work.* It is important for any management to understand the importance of this component of the company's business because *optimal results are achieved with good management and clear rules for*

carrying out domestic business. Otherwise, deviations from the development of the system (organization) are possible, and where there is chaos (lack of order), there is a decline and destruction. This is an important rule in the field of management, because the appropriate company culture, clear regulation of rights and responsibilities, precise prescriptions and instructions in the work and career of the individual are a guarantee of motivation and stable professional achievements.

Some of the influencing factors of the organizational environment are the following [2, 4, 7, 11, 12, 15, 16, 17, 19, 20, 24]:

Company culture and social climate - people's attitude to work and their motivation / demotivation for work are formed by the company culture, which is a barometer of the processes that take place in the organizational environment. In order to have normal human relations and efficiency of the labor process, a balance between personal and organizational interests is required. A climate is created in the organization where the individual or group feels empathetic or repulsed by norms and principles of behavior. For people, it is not so much the material incentives and benefits that are important as the attitude. The role of the company's culture is to create an environment (atmosphere) that unites people around the goals of the company and their implementation, but not to oppose them. A problem arises when there is no fair treatment to all and some are tolerated in front of others [2, 11, 16]. It requires a social environment, loyalty, ethics and respect for the people who work in the organization. Management has an important role to play in managing differences and designing an appropriate company culture to ignore problems and their causes. If management does not intervene in difficulties in the corporate processes, this leads to alienation of the people, arbitrariness, a sense of private inviolability and organizational collapse.

Composition and structure of human resources - The people in the organization are different not only in age, race, gender, etc. (i.e. the individual features of the personality), but they also form a different composition and structure, a matter of the division of labor by functions or activities (directions). Each organization has not only a quantitative set of staff (number of employees), but also qualitative characteristics (professions, specialties and qualifications). They are not a constant value and are constantly changing, and management must maintain an optimal composition and structure of human resources. People have professional interests that are related to different areas and should be used in the best way for the organization and the individual.

Management style - is part of the company culture and determines the approach of management to people and corporate issues. Here, too, issues related to values and principles concentrated in individual or team management, stimulation and development are addressed. People's leadership differs in the way the organization and managers perceive the situation (environment) in which the business is carried out. Different styles are applied, which must be in line with the strategic priorities and the managed management policy. The problem arises when this policy does not

correspond to the goals of the company and / or has a negative attitude towards people's behavior.

Hierarchical status - The people in the organization occupy a different rank, which empowers them and makes them responsible not only for the processes in it, but also for the decisions they make. The higher is the level of the personality in the company, the more authority hi/she should have. The problem arises when this authority cannot (or the person does not want to) use it for its intended purpose. Some managers do not use power according to the legal framework or take advantage of it, i.e. exceed the powers conferred on them. Then the authority serves not only for personal purposes, but is a destructive mechanism for the development of the organization. This is noticed when there is no principled attitude towards people (there are no equal criteria), there are prerequisites for conflicts, wrong decisions are made or there is a passive attitude of management to corporate problems.

Group norms and values - People are social by nature and need to share their views and problems at work. They seek support from colleagues and like-minded people, which associates them with the group and its dynamics. Each group is distinguished by norms and values that determine the social climate in it. Differences may arise from the fact that some groups impose stereotypes of behavior or conformism, where not every person is able (or willing) to adapt. This alienates the person from the group and she does not accept him due to differences between his personal characteristics and the imposed norms and values. Social education is an important indicator of the company's climate and the way it works.

V. CONCLUSION

The primary and secondary dimensions of the personality discussed in the publication, as well as the influencing factors of the organizational environment are marked by their complexity and diversity. Each person is a unique alloy of characterological and physical features that distinguish him from others, but does this mean that he is below or above them? Of course not, it's just that people have different behaviors, physiologies and perceptions of a situation. In parallel, they work in an environment that requires the combination of different value systems, i.e. it is necessary to take into account the factors that affect their performance. They are determined by a person's personal choice to lead a certain lifestyle or are normative in the organizational environment - where he works.

ACKNOWLEDGEMENT

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Analysis of the Consumption of Cloud Services in Bulgaria

Gergana Dimcheva¹ and Svetlozar Iovchev²

Abstract – The dynamic development of technology provides more and more opportunities for both individual users and business organizations. In recent years, interest in cloud services has grown. The reason is that these technologies offer their customers reliable and affordable services at flexible prices.

The purpose of the publication is, through a theoretical justification of the nature and features of cloud services to analyze and assess the state and development of the cloud services market in Bulgaria.

Keywords – Cloud Services, Consumption, Bulgaria

I. INTRODUCTION

Rapid technological development has drastically changed both the ability of organizations to carry out their activities and the preferences of consumers for services.

In the conditions of intensified competition, Cloud technology has become a popular idea for servicing both employees and various customers. In order for an organization to be competitive, it must take advantage of the opportunities provided by Internet access by using various Internet services. They help organizations to focus on developing good business applications that will bring real business value [1].

Through cloud services, you can easily and quickly hire the right amount of resources for the needs of the organization and, if necessary, again quickly and easily to increase or decrease them, with just a few mouse clicks. In this case, the only thing the organization needs is Internet access. This is one of the advantages of the cloud. It is accessible from anywhere the user has access to the Internet.

Despite the advantages they bring, cloud services also have their disadvantages, one of which is the constant access to the Internet.

Therefore, in order for cloud technology to be successfully applied, it must only be used by companies that meet certain criteria, with specific needs and resources.

The aim of the publication is to trace and analyze the consumption of the cloud services in Bulgaria through a theoretical substantiation of the nature and peculiarities of the cloud services.

II. CLOUD SERVICES - NATURE AND CHARACTERISTICS

A. Nature of the concept of cloud services

The term "cloud computing" means a set of information services for storing, processing and using data via remote computers available on a network [2]. These computers combine their computing resources into a single system (Cloud). Cloud Computing has two main components - "Processing Nodes" and "Storage Area Network" [3].

A service is said to be located in the cloud, but in practice there are thousands of different clouds, as any group of servers that are grouped together to perform an activity can be thought of as a cloud. Some businesses prefer to have their own, private cloud. Others rely on public opportunities, while third-party businesses need a combination of both.

This leads to the three most common types of clouds (Microsoft Learn, 2019) [4]: Private (*Private*), Public (*Public*) and Hybrid (*Hybrid*) cloud.

B. Key features of cloud services

Cloud services have their specific characteristics, which can be summarized as follows [5, 6, 7, 8]:

1) **self-service in case of need** - the user can unilaterally request the provision of computing capabilities as required, without requiring intervention by the service provider.

2) **wide access to the network** - Cloud services are available from anywhere in the world, from different client platforms, through all possible standard devices providing Internet access (eg mobile phones, tablets, laptops)

3) **pooling resources** - data processing and storage resources are distributed in a balanced way within a common infrastructure, with specific resources and capacities not allocated to individual users (tenants) [6]. In other words, so-called multi-hire allows multiple customers to share the same applications or the same physical infrastructure, while

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maintaining confidentiality and security for their information [7].

4) **elasticity with increasing or decreasing consumption** - consumers can arbitrarily increase or decrease the capacity of the requested service.

5) **the price varies according to consumption (measured service)** - Unlike other services, in the cloud the payment is determined by consumption. There is no need for an annual contract, nor for the establishment of minimum levels of resource consumption. The cost model is based on "pay for what you use" - the payment is variable depending on the actual consumption of the production organization.

III. ANALYSIS OF THE CONSUMPTION OF CLOUD SERVICES IN BULGARIA

The growing use of cloud services, as well as the fact that all studies point to their even greater use in the future, there is, quite naturally, the need for more disk (virtual) space. Each company, as well as individual users, needs more space to store the growing volume of information [9]. Especially in a crisis situation, and if it is global - for example, the health situation caused by the global epidemic of COVID-19 (COVID-19 pandemic, 2020) [10] and the imposed measures and restrictions, the need for more computing power, redirection of calculations, location on servers and the need for more virtual space is felt more and more clearly. Therefore, the European Union meets the requirements and needs of corporations - the largest providers of cloud services, the necessary conditions and predispositions to offer and implement the best quality of services offered.

A. Consumption of cloud services in Europe

The development of cloud services is fast and continues to increase its speed. The European Union takes into account the importance of cloud services for businesses and promotes their use and development. The goal is also for Europe to remain neutral to nature and climate until 2050. (European Commission, Europe for the Digital Age, 2020) [11].

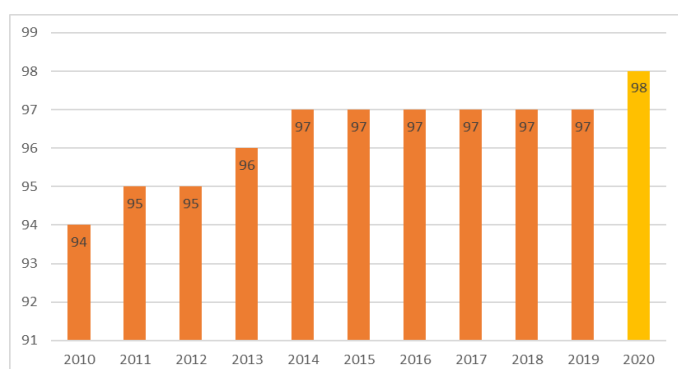


Fig. 1. Enterprises with Internet access³ (% of total)
(According to Eurostat)

³ In all figures, the data for 2020 are forecast

As can be seen from the data, the percentage of companies in Europe using the Internet is high and Bulgaria is not inferior to them, as will be seen in the following figures, which visualize the results for Bulgaria. In the period 2014 so far, the percentage does not exceed the lower limit of 97 percent. The forecast for 2020 shows an increase of one point and / or maintaining the current percentage.

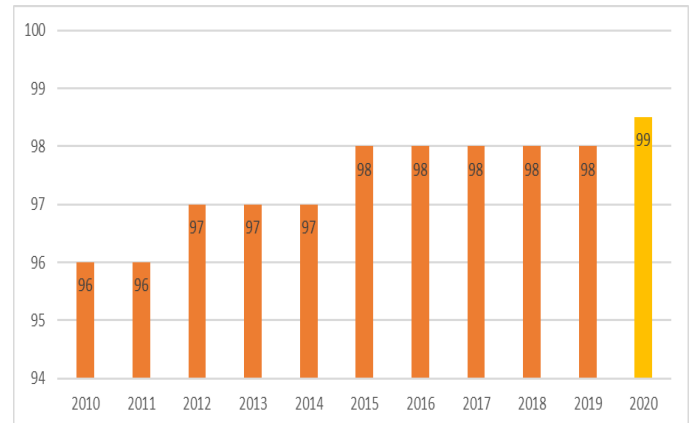


Fig. 2. Percentage of enterprises that use a computer
(According to Eurostat)

The percentage of enterprises that use a computer is 100 percent (Fig. 2). Nowadays, this is normal and it is extremely surprising if a profitable company still manages to operate without computers. In practice, such cases do not exist, and forecasts for 2020 show a further increase of one percent.

Every profitable business in the EU has an online presence of some kind - for example, a website or a social media page.

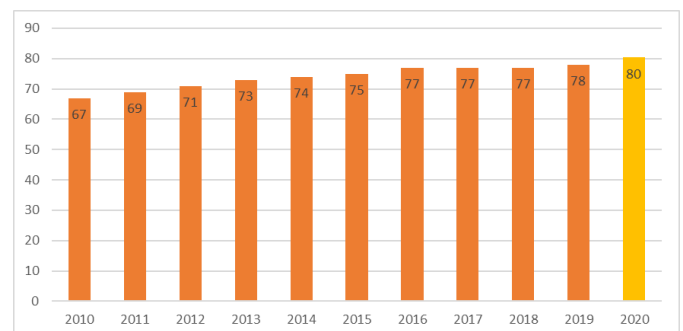


Fig. 3. Businesses that have a website
(According to Eurostat)

Statistics show that companies in the Member States of the European Union still prefer to have their own website (Fig. 3).

Since 2010, their number has increased by 12 points, and since 2012, the lower limit of 70 percent has not been exceeded. This shows that online sites are increasing their usability among companies to advertise their services and to contact their customers. Forecasts for 2020 show an increase of one to two percent.

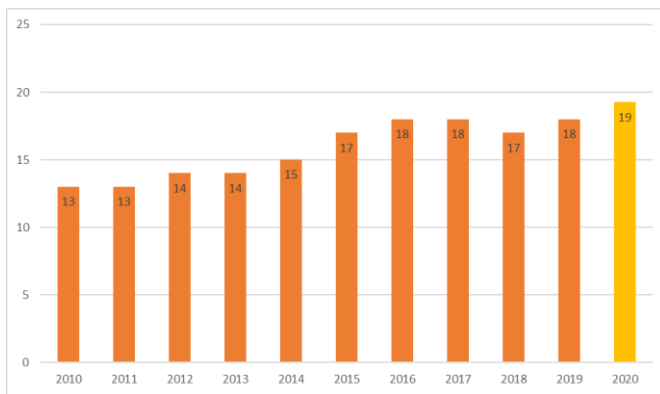


Fig. 4. Companies that made online sales
(According to Eurostat)

According to the data, the number of companies that make online sales is not large - in the years from 2017 to 2019, it remained at 17-18% (Fig. 4). This is still a good share of sales, taking into account the variety of other sales methods. In a situation of crisis in which the world entered in early 2020, of course, online sales are increasing. More and more people are taking advantage of these services, and businesses continue to profit from online sales, as shown by the 2020 forecast.

Businesses that buy goods and / or services online hold an average of 24 percent. The percentage contrasts with that for online sales, which is normal and given that the supply of goods is easier online, discounts are greater and this allows the purchase of larger quantities, it is not surprising that more and more companies are taking advantage from the new technologies for this activity. The projected results for 2020 show a further increase of more than five percent (Fig. 5).

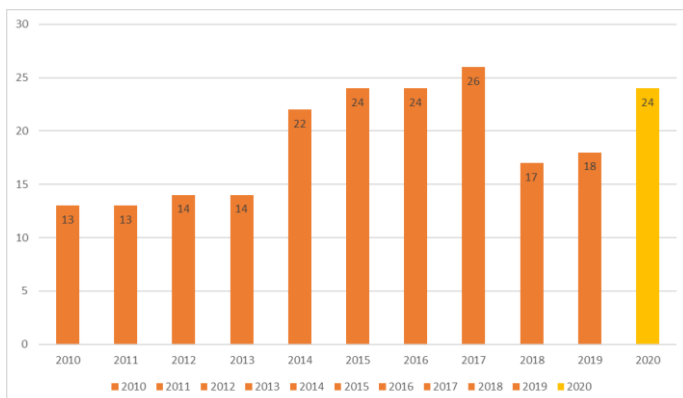


Fig. 5. Businesses that made online purchases
(According to Eurostat)

The following two figures (Figures 6 and 7) show the percentage of companies that benefit from cloud services in their varieties.

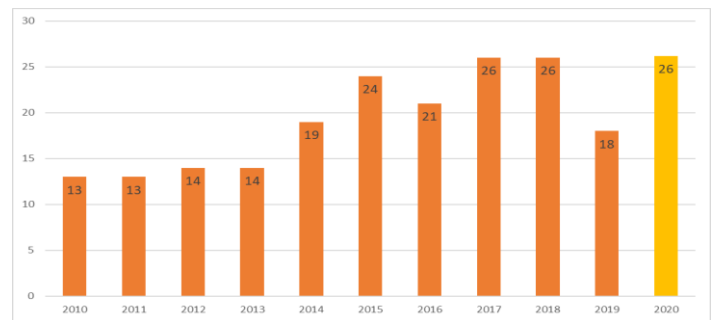


Fig. 6. Companies that have purchased cloud computing services
(According to Eurostat)

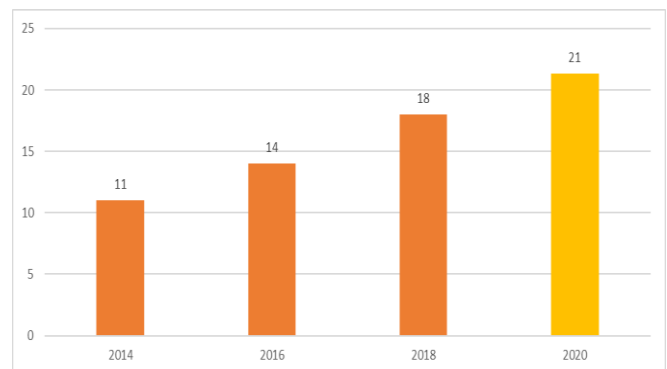


Fig. 7. Businesses that have purchased at least one of the following cloud services: Database hosting, Online accounting applications, CRM software, Computing power
(According to Eurostat)

According to available data, companies using cloud computing services do not reach the 30% limit. This should come as no surprise, given that these services are used by large companies specializing in the processing of large data sets (Big Data). With the crisis in early 2020, there has been an increase in this number, as there was a need to process huge arrays of statistics on various aspects of the health situation. In this case, the benefits of how cloud services can help and offer great ease of use stood out.

B. Consumption of cloud services in Bulgaria

The consumption of cloud services in Bulgaria still lags behind that in Europe by more than twice at many points. According to a study presented by Ludmil Stoychev, Managing Analyst, CBN Pannoff, Stoytcheff & Co, at the forum "The Future of your Business in the Cloud - Security and Efficiency"(Economic.bg, 2019) [13], companies using cloud services in Bulgaria are 8% compared to 26% in Europe, and 5% buy office software compared to 14% in the EU. In Bulgaria, 64% of citizens use a computer compared to 81% in the European Union. Of the households with Internet access, in Bulgaria they are 67% compared to 87% in the EU, and online purchases are only 18%.

The companies with Internet access are 95%, in the European Union - 97% (Fig. 8). Half of these companies have

a website, compared to 77% in the EU. Employees who use computers are 30%, while in the EU they are 56%. A quarter of Bulgarian companies use business software such as ERP, while in the EU they are 34%, and 7% analyze big data compared to 12% in the EU. Only 7% of companies have managed to sell online, and at least 1% of their income comes from such activities.

The following figures examine the available statistics, which reveal the picture of the consumption of cloud services in Bulgaria for the period up to 2019, as well as forecast results for 2020.⁴

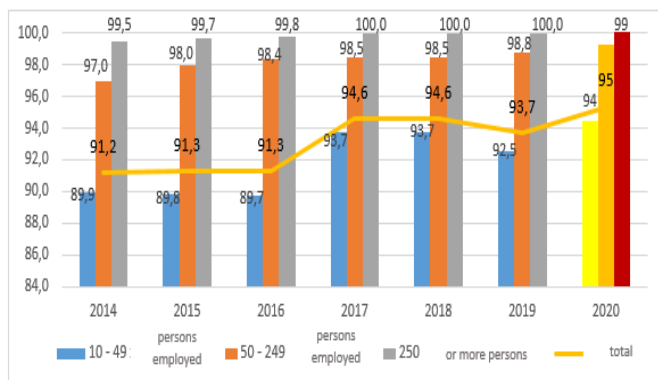


Fig. 8. Businesses with Internet access (%)
(According to NSI data)

For the past five years, the number of companies with Internet access is high (Fig. 8). There is a slight increase, followed by a slight decrease in 2019. The highest percentage of companies with Internet access is those with more than 250 employees. The value has always been high - close to 100%, and in 2019 and the previous two years these companies fully use the Internet.

The companies with a smaller number of employees - from 50 to 250, are also close to full usability, with a steady increase over the five years under review and retention of 98.8%. The percentage of development is highest in small enterprises - employees from 10 to 50. Among them, it rose from 89.9% to 93.7%, with a slight decrease to 92.5% in 2019. Forecasts for 2020 show a decrease of one percent for companies with 250 or more employees and an increase in the other two categories of companies.

It is not logical the employees in the companies using Internet nowadays to be below 30 percent, but this is exactly what we see in Bulgaria in the five years from 2014 to 2017 (Fig. 9). This is due to the situation in our country. A few companies in comparison with the total number are engaged in online services or trade. However, the trend for 2020 is to increase this percentage by one to two percent.



Fig. 9. Employees in companies that use Internet
(According to NSI data)

For companies that have a website, the percentage tends to increase for those with an average number of employees - for the years from 2014 to 2019 it has increased by seven points (Fig. 10). For small companies the percentage has increased by one point, and for those with more than 250 employees there is fluctuation, which reaches and remains at 84.5% in 2019. The forecast results for 2020 show an additional increase of up to more than five points.

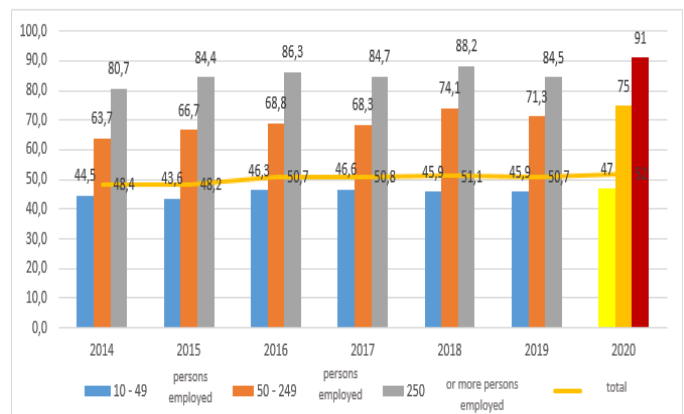


Fig. 10. Businesses that have a website (%)
(According to NSI data)

The enterprises whose trade passes online are extremely small in comparison with other countries (Fig. 11). Here there is a logical tendency for the smallest companies to have the lowest percentage of online sales, as the percentage increase in them varies between one and two, and for large companies (employing over 250 people) - up to 20%.

⁴ In 2020, the data are forecast

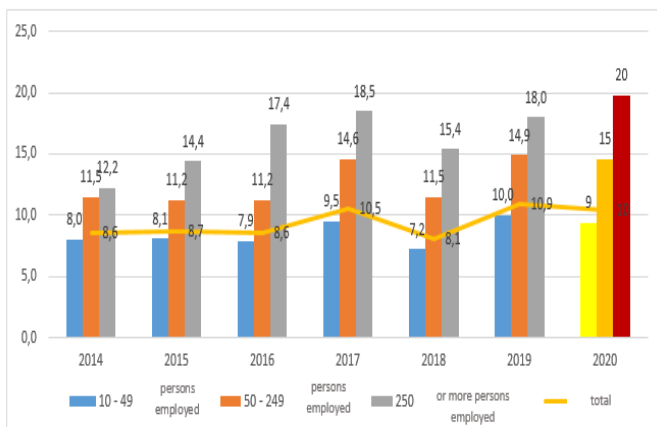


Fig. 11. Businesses that have sold online (%)
(According to NSI data)

The purchase of goods and services online has increased significantly in the period from 2014 to 2018 (Fig. 12). In all three categories of companies there is a high increase. The small ones - 10%, the medium ones - 16.2%, and the big ones - 16.2%. The results for 2019 show a significant increase for all three categories of companies - from 3% for small and more than 5% for medium and large enterprises. The forecast trends for 2020 show a further increase, albeit by up to one percent.

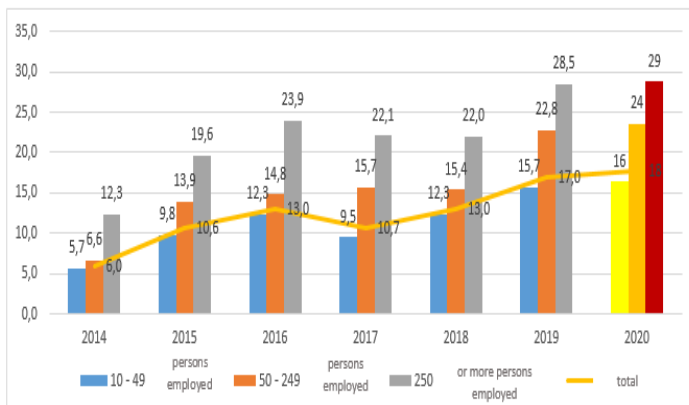


Fig. 12. Companies that have purchased goods and services online (%), (According to NSI data)

The use of electronic resource management systems (ERP) also observed a significant increase, being the highest for medium and large companies - by ten and twenty percent, respectively, for the period 2012 - 2019 (Fig. 13). For the same period, small companies reported an increase of 2.1 percentage points. The expected results for 2020 show an additional increase, as for large companies it is close to 10%.

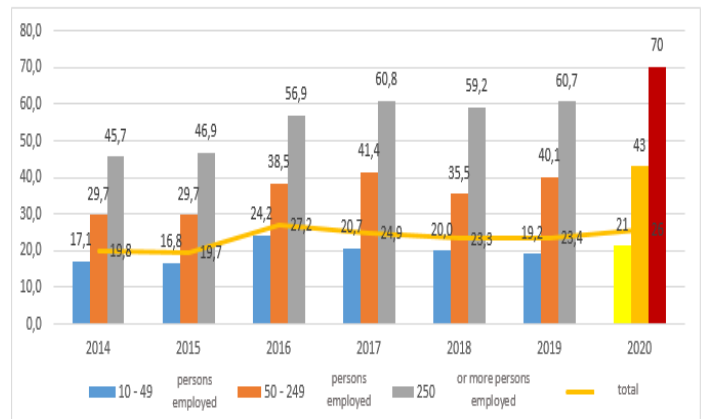


Fig. 13. Companies using a resource management system (ERP) (%) (According to NSI data)

Enterprises using customer information management software (CRM) applications are significantly smaller than the previous ones (for ERP) (Fig. 14). They reach a maximum of 34.1%, and for large companies. For small companies there was a decrease of 1.5 points for the six years, and for medium and large companies an increase of 3.2% and 5.9%, respectively. The forecast for 2020 is for a further increase.

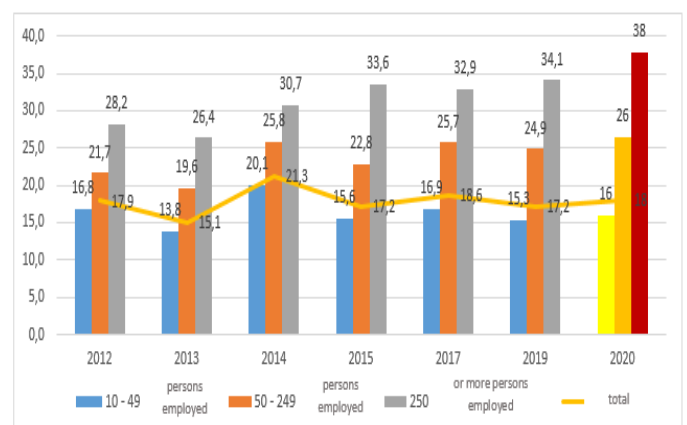


Fig. 14. Businesses that use software applications to manage customer information (%)
(According to NSI data)

Regarding the automation of business processes of enterprises for communication with suppliers and customers (Fig. 15) there has been a large decline since 2012 - this year was clearly the peak for these companies, seeing an increase and decrease of more than fifteen percent, respectively before and after her. With the exception of 2012, as a percentage, all three categories of enterprises maintain similar values in the remaining years - about 16% for small, 23% for medium and 31% for large. The forecast results point to a further decline in 2020.

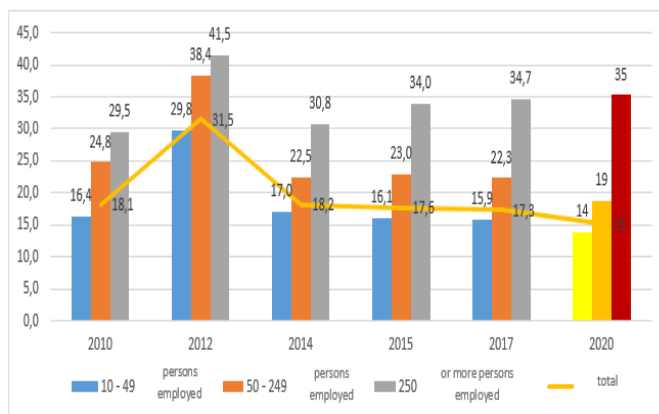


Fig. 15. Companies whose business processes are automatically connected to those of their suppliers and / or customers (%)
(According to NSI data)

For companies that use cloud services, there was an initial decline of 2.3 percentage points from 2014 to 2015 (Fig. 16). Then there is an increase every year until 2018. Large companies, employing more than 250 people, significantly increased their access to cloud services between 2016 and 2017, but failed to reach 30 percent in 2018. Medium-sized companies (employed from 50 to 249) will reach 15 percent in 2018, and small (10-49 employed) will not pass the ten percent. Despite these results, the trend is for companies to significantly increase the use of cloud services in 2020 - companies with 250 or more employees by more than 10%.

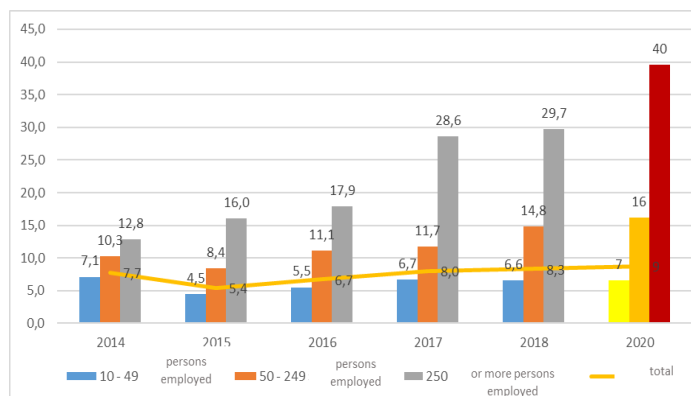


Fig. 16. Businesses that use cloud services
(According to NSI data)

According to the available data, the number of companies that use cloud services to process large data sets - the so-called "Big Data" ("Big Data") is increasing (Fig. 17). Despite the small overall percentage, the increase from 2016 to 2018 is significant, by 2 to 3 points, and for companies with 250 or more employees, it has increased by 4 percent. Forecasts for 2020 further show a significant increase for them by 13 percent.

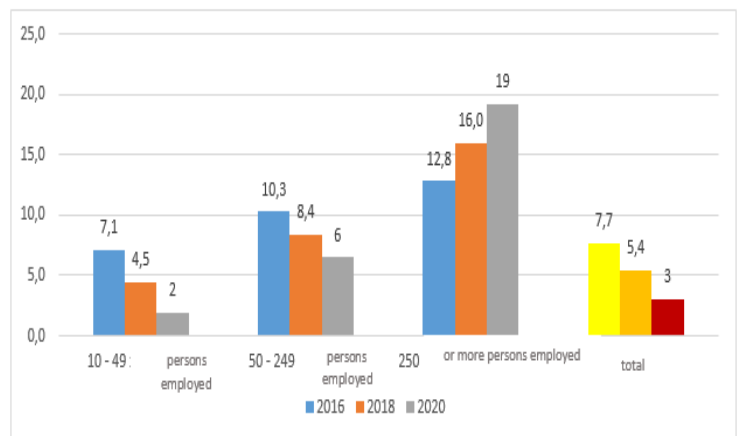


Fig. 17. Businesses that use Big Data
(According to NSI data)

IV. CONCLUSION

The world is increasing the use of technology and it is entering in our lives more and more. Now, as mentioned, it is impossible to imagine the operation of many services without a computer or the Internet.

All forecasts and statistics show that Bulgaria's development in information technology will continue to be rapid, with more and more young people working in this field. They prefer to stay in Bulgaria due to the high standard of living offered to them. This, of course, is in stark contrast to other fields, but that does not stop us from being proud of our technical skills and proven results, expressed in partnerships with international companies that have long proven themselves as world leaders in their field. The continuing opening of offices of such companies in all major cities in Bulgaria proves that Bulgaria continues to be preferred for international investments in the field of information technology.

ACKNOWLEDGEMENT

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Едва 8% от предприятията у нас купуват облачни услуги.
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The Future of the Television Service and its Role for Telecom Operators in Bulgaria (part 1)

Dimitar Kolev¹ and Elizar Stanev²

Abstract – The television (TV) service is among the most popular and profitable services provided by the Telecommunication operators. In the past decade it has shifted from national wide antenna or cable TV to high definition (HD), 4K and via Internet provided television or IPTV which allows customers to watch data stored broadcasts and shows. Some video-on-demand broadcasters have also emerged (such as Netflix, HBO GO, Amazon) and they’ve been taking over larger and larger market shares, making TV service provision an even more competitive market environment. On the other hand, the exponential growth of Internet use has changed the way consumers find and watch videos, threatening to potentially make classic television an obsolete service in the future.

This article delves into the challenges faced by the telecommunication operators in Bulgaria in supplying the aforementioned services, the fast changing environment, the strife for retaining market shares and customers. Within this study we measure customer satisfaction with the current services provided. On that basis, some key conclusions about the TV service and its role for the telecommunication sector in Bulgaria are drawn.

Keywords – Telecommunications sector, Television Service Technologies, TV service suppliers

I. INTRODUCTION

The turbulent development of internet services and widespread internet access of information is forcing traditional television (TV) services to the side. Meanwhile, companies providing these types of services are looking for various ways of secure their falling market shares and attract new customers through expanding their service portfolio – higher video quality (HD, 4K, 8K), subscription-based online video libraries, television interactivity, exclusive events, etc.

The TV service market in Bulgaria is fragmented. There are several big telecom companies that provide said services nationally. On the other hand, according to a 2019 report from the Bulgarian Communications Regulation Commission there are “215 cable TV suppliers and 43 IPTV suppliers” [1], which constitutes a highly competitive local market. In order to preserve their market share, participants are strongly incentivized to innovate and improve service quality.

The goal of this paper is to formulate a theoretical framework for the classification of TV services and use that as a basis for a questionnaire survey, in order to determine the Bulgarian customers’ needs and preferences. For the fulfillment of the goal the following tasks are expanded upon:

- formulate a theoretical framework for TV services;
- research customers’ needs and preferences in the context of the Bulgarian TV market;
- draw conclusions and guidelines for the companies

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operating in the field concerning the prospect of offering said services on the market in the future.

II. THEORETICAL FRAMEWORK AND SURVEY METHODOLOGY

Modern trends of digitalization have fundamentally affected the nature of the TV service and the methods by which it is supplied to the customer. From that perspective TV services can be split into two basic categories: live broadcast (linear) and video on demand. Linear TV services constitute a passive audience, one that does not interact in any way with the service itself besides watching. Generally, the service provider owns the infrastructure used for the transmission of the signal. The provider determines the list of channels with audio-visual content and makes it available to the customer, usually 24/7 [2, 3]. Examples of existing transmission infrastructure that specializes in linear services is the national terrestrial broadcasting (both analogue and digital), cable TV (through coaxial or hybrid-coaxial cable) and satellite TV. Traditional TV networks international standards are ATSC, DVB, ISDB and DMB. Practically, these networks are linear and offer little to no interactivity (besides Teletext) [2].

In Bulgaria, the transition from analogue to digital signal of terrestrial broadcasting began in 2004, but most of the network was built from 2011 to 2013. Local cable TV providers have also been upgrading the functionalities of their services by moving from a coaxial cable infrastructure to using broadband internet instead. This constitutes additional capital investment for transitioning to IPTV and hybrid alternatives. Satellite TV mostly still falls under the “linear” category.

As far as the other main category – video on demand - is concerned, the differentiating factor is that the user decides

what to watch and when to access the offered content within the constraints of the options offered. These forms require a two-way signal (to include the consumer input) and thus broadband internet infrastructure is used. The possibilities for the spread of video on demand can include wireless alternatives (3G/4G) using the UMTS and IMT/LTE standards. Such an approach allows mobile devices (such as tablets, smartphones, laptops) to be used as receivers too, without compromising their mobile features. One of the main features of video on demand is the possibility of segmenting the services offered for a more custom-tailored end-user experience. This division is made possible through flexible payment plans. Some of the additional functionalities that these advanced type of services offer are: pausing and viewing older content; video libraries; subtitles; electronic guides; picture-in-picture; higher video quality and others. In the Methodology part of the article these additions to the basic service are included in the survey to determine which specific ones are important enough to influence the choice of supplier.

The transition from traditional linear services towards more interactive alternatives seems like a natural evolution of the service, but it certainly requires additional investment from both the suppliers and the users in terms of the infrastructure used (network, receiver devices, newer television devices, etc.). In that line of thought, it stands to be expected that a segment of the target population cannot or would not make the transition due to budgetary constraints. This is especially valid for the older demographic, who are also facing difficulties due to the generational technologic gap with the advent of complex service navigation.

As it stands, the Bulgarian market for radio and TV services is valued at 424 mln. BGN. The total number of retail subscribers in 2019 is 2 029 464, of which 552 044 use cable TV, 514 257 – IPTV and the largest segment are the satellite TV users at 963 163 [1]. It is important to note that the numbers of satellite TV users, due to the mobile nature of the service, cannot be solely attributed to the national market. The same goes for IPTV, as access to the internet from any location is enough for the service to be used.

From the standpoint of supply, most of the retail TV service market is split between 3 major telecom companies – Bulsatcom (holding a 36.30% market share), A1 (25% market share) and Vivacom (24.10% market share). While this is the main service offered by the largest market share company, for the other two telecoms this is a secondary service (voice call services being their main one).

Concerning the tendencies of user preference in regards to the division between traditional TV and video on demand, Bulgarians are slowly moving away from linear services towards more interactive forms. IPTV subscriptions relative to classic TV are reported to have risen by 5% from 2017 to 2019, reaching 25.3% [1]. This trend corresponds with global preference for more interactive forms, but the rate of transition is slower in Bulgaria.

In order to determine the specific preferences of Bulgarian consumers concerning their TV service experience a survey was conducted. For the evaluation of the results descriptive

statistics has been used – both one-dimensional and two-dimensional distributions are employed. Appraisals in relative value and ranks are applied to assess the significance of each individual factor through “Likert scales”.

The structure of the survey is comprised of 5 segments. The first group of questions addresses the so-called passport characteristics - gender, age, education, net income. The second part of the survey concerns overall TV service consumption in Bulgaria. The third one is about evaluation of the services used measured through Likert scales. The next consists of questions for the future of TV services and desired additional features. The final section debates the need and sustainability of the terrestrial national wide public TV and the possibility of an additional tax for its upkeep.

The main channel used for the distribution of the survey is via Internet, through e-mail and social networks, which may skew results by omitting certain population segments who do not use the channels mentioned.

III. RESULTS AND DISCUSSION

The respondents of the survey are 42% male and 58% female, who are distributed in 5 age ranges (under 18, 19-30, 31-40, 41-50 and above 51). The survey reports that around 86% of them have a university degree. As far as age is concerned most respondents are between 31 and 40 (72% of the males and 50% of the females). Such a main focus group is suitable in the context of the generational transition and global push towards Internet-based TV services, as they fall in-between traditional forms and interactive TV. Also, they can be considered as the main future users of TV services, as younger generations tend to prefer Internet content alternatives (e.g. YouTube videos and other user-made content).

In terms of the division between traditional live broadcast and interactive TV, respondents are split among several types of service, with traditional methods still holding the largest percentage of users (52.69%) compared to video-on-demand (11.83%), but a large segment of the population studied have noted to use both forms parallel to each other (20.43%). 12.9 percent of respondents report that they're currently not using TV services of any kind (Fig.1).

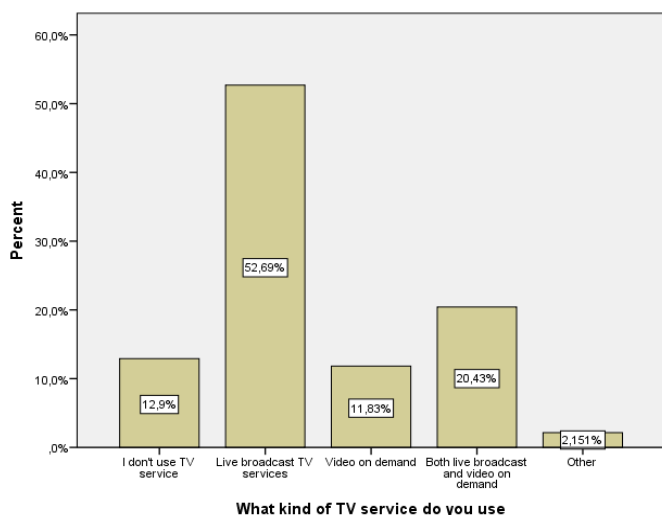


Fig. 1. Different types of TV services used

The study also indicates that the surveyed population mainly procures TV services through local suppliers and national telecom operators.

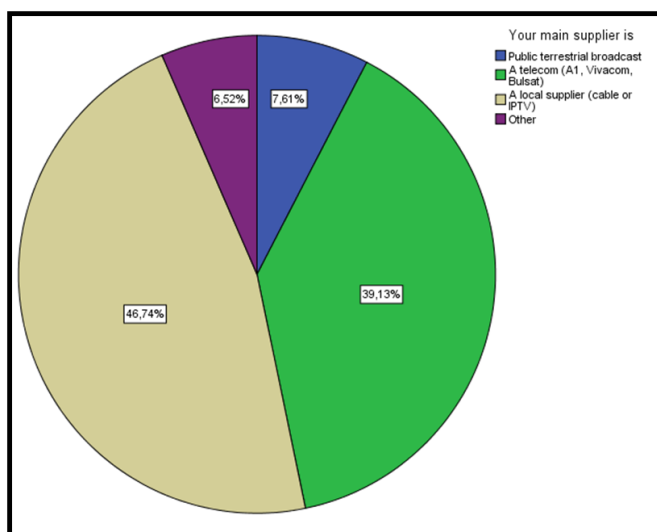


Fig. 2. Main TV service supplier

As evident from Figure 2, 46.74% depend on local cable and IPTV suppliers, while 39.13% are customers of telecoms. Public terrestrial broadcast is used only by a relatively small percentage (7.61%), while 6.52% of respondents report other means of procuring television. These findings partially contradict the reports of the BCRC in terms of user proportions by suppliers, which might be attributed to specifics of the particular fraction of the population studied (age range, education, etc.).

According to a global study of TV and streaming video [4] the average weekly usage gravitates around 16 hours. In contradiction, our study finds that the largest segment of Bulgarian responders watch television less than 5 hours a week (Fig.3) – around 30%.

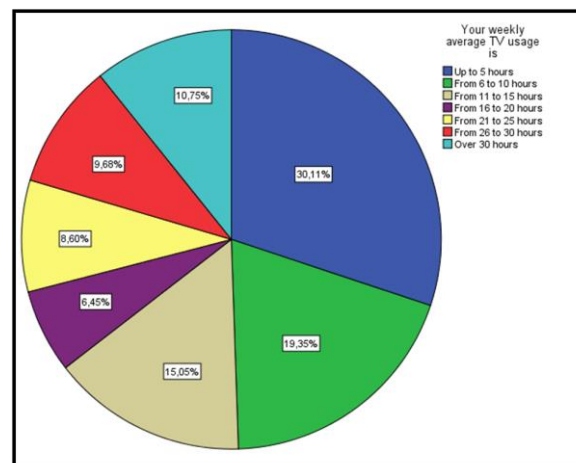


Fig. 3. Average weekly TV service usage

19.35% report watching TV from 6 to 10 hours weekly, while 15.05% consume between 11 and 15 hours weekly. Surprisingly, around 20% claim to watch television for more than 26 hours, with half of them doing it for more than 30 hours each week on average. The results show that a larger percentage of Bulgarian consumers, on average, watch significantly less television overall weekly compared to global data. It could be stated that the service itself is not as important and popular among the Bulgarian population as it is on the global scene, although the data does vary significantly from country to country.

Concerning the quality of services offered in Bulgaria, respondents were asked to fill in a Likert scale for each type. The types are as follows: terrestrial live broadcast TV, satellite TV, cable TV, IPTV, video libraries. The evaluation is divided into 6 segments (see Table 1).

TABLE 1
PERCEIVED QUALITY OF TV SERVICES IN BULGARIA (%)

Evaluation >	Undetermined	Very low	Low	Average	Good	Very good
Type v						
Ter. TV	48.1	4.9	7.4	16	16	7.4
Satellite TV	44.4	3.7	4.9	18.5	19.8	8.6
Cable TV	21	2.5	3.7	25.9	39	16
IPTV	24.7	2.5	3.7	21	24.7	23.5
Video libraries	23.5	2.5	2.5	8.6	27.2	35.8

The data collected shows a large percentage of respondents who are unsure about the quality of a certain service. This might be due to the fact that households generally use only one type of service and thus respondents are hesitant to evaluate the other types. Regardless, those who did evaluate terrestrial live broadcast are mainly considering it as “average” or “good” quality, both scoring 16 percent. Satellite TV also falls into the same category, with most respondents pointing at “good” quality (19.8%). More people have evaluated the quality of cable TV, with only 21% falling

into the “undetermined” category. Most consumers have rated it at “good” quality (39%). IPTV, on the other hand, is considered “good” (24.7%), but almost the same number of people consider its quality as “very good” – 23.5%. In contrast to all other types, video libraries score the highest evaluation of all 5, with 35.8% of respondents pointing at the rating of “very good” in terms of quality.

Overall, it can be stated that Bulgarian consumers are satisfied with the services they receive, as most of them report above average quality.

An integral part of quality evaluation are the different characteristics and features included in the service. This is why respondents were asked to rate the importance of various features. The results are shown in Table 2.

TABLE 2
IMPORTANCE OF DIFFERENT FEATURES INCLUDED IN THE TV SERVICE WHEN CHOOSING A SUPPLIER (%)

Importance > Factor	Undetermined	Unimportant	Slightly important	Important	Very important
Channel quality and variety	4.9	7.4	8.6	53.1	25.9
Premium channel subscriptions included	9.9	9.9	14.8	37	28.4
Service price	7.4	2.5	4.9	35.8	49.4
Customer support	6.2	0	6.2	25.9	61.7
Linguistic support	12.3	11.1	21	28.4	27.2
Electronic guide	12.3	16	22.2	34.6	14.8
Video library or archive	13.6	8.6	16	39.5	22.2
Interactive functionalities	12.3	7.4	23.5	27.2	29.6
Pay-per-view	22.2	19.8	32.1	18.5	7.4
Picture quality	8.6	1.2	11.1	30.9	48.1

It is important to note that customers were asked to evaluate each feature individually and some people have abstained from rating the proposed factors mainly due to them not using TV services at all (between 12-13%). Surprisingly, “service price” was evaluated by the respondents as second-

of-importance after “customer support”. 61.7% of people surveyed point at adequate customer support as the most important feature of the service offered. Picture quality was also noted as very important by 48.1% of the population studied. The least important feature according to the survey is “pay-per-view”, with close to 20% classifying it as “unimportant” and 32.1% considering it only “slightly important”.

These findings can be used as guidelines for telecom operators and local suppliers for which features to stress on when offering their current services.

IV. CONCLUSION

In conclusion, Bulgarian consumers tend to use less television than the global average, but they are relatively satisfied with the quality of the services they are receiving. Among the important factors for choosing a supplier key service features are mainly customer support, the price of the service package and picture quality. These findings can be used by telecoms or local providers, which are the most common suppliers of TV services in Bulgaria, in order to become more competitive in their economic environment.

ACKNOWLEDGEMENT

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The Future of the Television Service and its Role for Telecom Operators in Bulgaria (part 2)

Dimitar Kolev¹ and Elizar Stanev²

Abstract – This article is a logical addition to a previous study about the challenges faced by the telecommunication operators and local suppliers of TV services in Bulgaria. It deals with customer retention and government involvement in the sector - particularly through new taxation legislature for public TV use. Within this study we measure customer intention towards TV services and potential tax obligations. On that basis, some key conclusions about the TV service and its role for the telecommunication sector in Bulgaria are drawn.

Keywords – Telecommunications Sector, Television, Public TV Tax, TV Service Suppliers

I. INTRODUCTION

The TV service market in Bulgaria is fragmented. There are several big telecom companies that provide said services nationally. On the other hand, according to a 2019 report from the Bulgarian Communications Regulation Commission there are “215 cable TV suppliers and 43 IPTV suppliers” [1], which constitutes a highly competitive local market. In order to preserve their market share, participants are strongly incentivized to innovate and improve service quality.

Our previous study [2] showed that Bulgarian consumers are relatively satisfied with the current services offered by the industry in terms of quality. We measured 3 key factors that determine the choice of a TV service supplier – customer support, price and picture quality. The current article is a logical continuation of the previous study, but the focus is on determining the overall public opinion towards future use of TV services and people’s perception on the need for national wide public broadcast television and related taxation.

In order to accomplish said goals several tasks are formulated to approach the subject of the financial aspect of TV services:

- evaluate customers’ intentions towards future use of TV services in Bulgaria;
- research attitudes towards the need for public national TV and the related tax legislation;
- draw conclusions about the future of the sector.

II. RESULTS AND DISCUSSION

As pointed out in the introduction, the data used to

accomplish the tasks at hand is drawn from the same survey as the previous article. Thus, the methodology and specifics of the survey performed are detailed there [2].

The questions that were asked concerned the intentions of current customers concerning their future use of the service. Also, respondents were asked to point out additional features that they desire and would be willing to pay more for in the future. The questions are formulated in a way to allow an individual to point out one or more answers, which provides additional freedom to the respondents, thus the sum of percentages can exceed 100%. The results should be indicative of the future of the demand for TV services in Bulgaria and can be used to draw valuable conclusions and directions for telecom operators and local suppliers.

Another set of questions the respondents were asked to elaborate on concerns the future of public national television as a widespread service and its maintenance through additional taxation. As it stands, public national television is funded through the state budget, which constitutes a dependency on current government decisions. A contrary legislative idea is to make public television funding independent through the application of a separate TV tax imposed per household that owns a TV set. Respondents were asked to evaluate the need for public television overall, would they be in favor of such tax legislature, the optimal amount of an eventual public TV tax and whether they would cease using TV services altogether if the tax is higher than the amount selected. In addition, we survey whether there is a correlation between net personal income reported and willingness to pay a higher public TV tax. Conclusions drawn from this set of questions can be applied as guidelines for government involvement in the sector.

The results of respondents being asked about the type of service they intend to use or keep using in the future are shown in the figure below (Fig.1).

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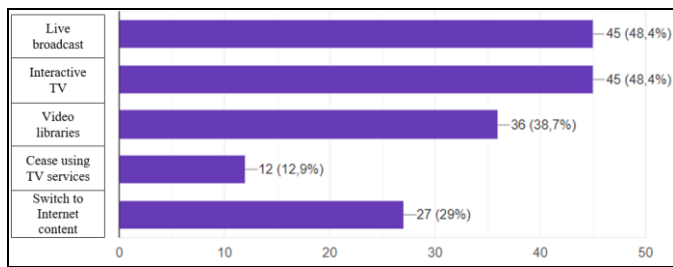


Fig. 1. Future intentions towards different types of TV service usage

As evident by the results, most consumers consider using (or keep using) live broadcast services and interactive TV (48.4%). The second largest group intends to use video libraries (at 38.7%) and 29% have indicated to plan on swapping television services for Internet content alternatives (YouTube videos, etc.). The data points out that Bulgarian consumers follow the global trend of combining traditional methods of using TV services with video-on-demand and slowly transitioning towards Internet alternatives. A small fraction of the population studied has indicated that they plan on not using TV services at all (12.9%). This number coincides with the number of people who already answered a previous question in which they pointed out that they use no television services currently. Thus we conclude that they also don't plan on using said services in the future.

These results can be helpful for suppliers as they might want to focus on more interactive services, creating their own online video archives and online TV platforms, since the trend for moving towards Internet-based TV consumption is evident.

In order to enrich these conclusions in terms of which features consumers might be willing to pay more for we posed a specific question. Users were asked to specify which out of a set of features might influence them to upgrade their current service package, but keeping in mind that this would cause a price increase. The answers are shown in Table 1 – they can be employed by telecom operators and other suppliers of TV services in order to prompt additional investment towards certain types of infrastructure to allow key features that their current service packs might be lacking.

TABLE 1
WILLINGNESS TO PAY MORE FOR ADDITIONAL FEATURES

Features	Responses (%)
Interactivity	25.8
Premium channels	35.5
Picture quality	32.3
Video archives	29
Channel variety	14
Service mobility	35.5
Extras – TV guide, subs	8.6
Pay per view	8.6

Around a quarter of respondents report that they would be willing to pay more for interactive features, such as: pausing, rewinding and skipping content. Concerning premium channel

subscriptions, 35.5% of respondents have pointed out that they would be willing to pay more for access, which is one of two highest-rated features according to the survey. The example channels provided as a reference in the question were HBO, Diema Sport package and the Max Sport package. Picture quality was, again, rated as one of the most important features, with 32.3% of respondents willing to increase their TV service budget for higher visual quality (HD, 4K, 8K). Video archives are also considered as a good deal, with 29% selecting it. Channel variety was something that a smaller fraction of people consider as valuable enough to increase their spending on, totaling a 14% of responses. Service mobility, as in the service being available to be used on mobile devices and offering movable infrastructure (e.g. – using receivers in different locations, including abroad) was also pointed as extremely valuable, gathering a 35.5% support. Extras like TV guides and subtitles and pay per view were rated relatively low, with only 8.6% of people willing to pay additional fees for their inclusion in the service.

As a whole, the three main features that respondents declared worth paying additionally for are premium channel subscriptions and service mobility, followed closely by picture quality. These can be considered the main features that suppliers should focus on if they want to increase their income.

Parallel to private TV services in Bulgaria, there exists a state-funded national television. As we pointed out earlier it is subsidized by the government. Recently, there has been a legislative push towards making its budget independent of government decisions through the introduction of a separate so-called “public TV tax”. In order to study the public perception for sustaining said television we asked respondents to answer a series of questions regarding the need for such a tax, its tolerable amount and whether a higher tax would influence their consumption of TV services as a whole. It is important to note that the current proposal is to impose the tax per household which owns a TV set. In general, we can differentiate two affected groups – the first being users who would not be able to afford the tax, thus forcing them out of the market. The second group – the suppliers – could also lose segments of their customers, since even if they abstain from offering public TV in their packages, households would still be eligible for taxation (they still own a TV set). Thus, we study public attitudes towards the proposed taxation to determine the expected outcomes.

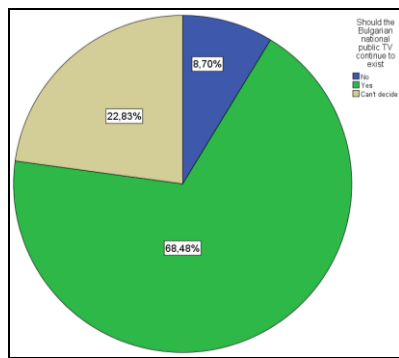


Fig. 2. Opinions towards the need for sustaining national public TV

The main problem with public terrestrial broadcast television is that it falls into the category known as “public goods”, with all problems in consumption restriction accompanying it. When asked whether public TV is a needed service in Bulgaria, most respondents react positively (68.48%). 22.83% are unsure, while only 8.7% think it is unnecessary. In stark contrast, most people are skeptical towards the implementation of a separate public TV tax, as evident by the answers represented in Figure 3.

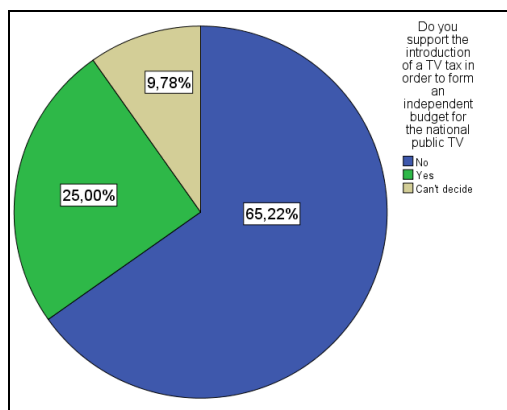


Fig. 3. Public support for TV tax

Most of the respondents don't support such a tax – 65.22% and only a quarter of them are in favor. The discrepancy in opinions could be explained by the fact that no other tax breaks are proposed to mitigate the implementation of the new fee, practically increasing the overall tax burden on consumers. Also, there is no clear distinction between people who use TV services but do not watch public TV at all, thus making such taxation seem like an additional fee for consumption of television overall.

Although most people do not agree with the implementation of a separate public TV tax, we did ask respondents to follow on what would the suitable monthly tax amount be. The results clearly reinstate the overall consensus that such a tax should not exist, with most survey responses pointing at zero BGN.

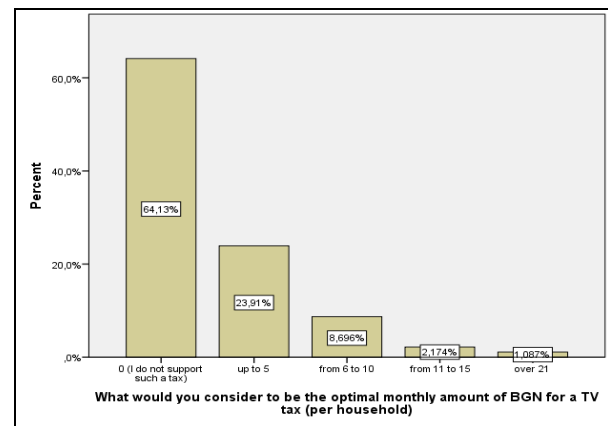


Fig. 4. Public TV tax optimal amount (per household)

23.91% of respondents considering the tax a good legislative move declare the optimal monthly amount per household to be up to 5 BGN. Only 8.7% are willing to provide between 6 and 10 BGN monthly for public television. The higher categories provided were only selected by outliers, with 2.17% and 1.09% willing to pay 11 – 15 BGN and more than 21 BGN respectively. Provided that the government moves forward on imposing the aforementioned tax regardless of public opinion, the data shows that the amount should not exceed 5 BGN monthly.

In the context of determining whether higher income groups are willing to pay a higher public TV tax we made an attempt to measure the correlation between net monthly income and the tax amount specified. Unfortunately, results were inconclusive due to the low amount of respondents placed in higher income groups. The majority of survey responses, regardless of income disparity, show that the general public is not in favor of tax implementation.

Moreover, when faced with hypothetically higher payments than expected within the boundaries of the previous question, responses indicate a large segment of the studied population who would forego owning a TV set altogether (Fig. 5).

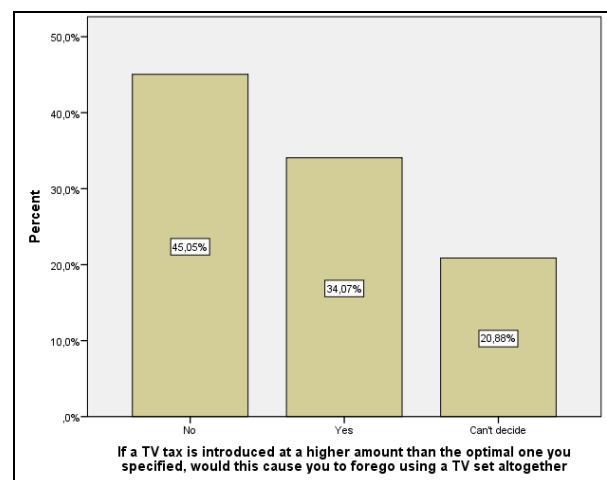


Fig. 5. User reaction to a higher than expected public TV tax

The 34.07% who are willing to cease TV service consumption are the potential client losses that could be suffered by the industry if the government moves forward with a higher than personally anticipated tax rate. Considering that most respondents who were pro-tax pointed at a flat rate of up to 5 BGN per month it follows logically that should the tax exceed 5 BGN monthly a significant loss of customers for TV service suppliers is to be expected (our calculations predict losses of up to 28% of customers).

III. CONCLUSION

In conclusion, the findings of the study show that suppliers, both telecoms and local ones, will be forced to transition to more interactive forms of television, mainly Internet-based (online platforms for content, video archives, etc.). This push towards innovation is in accord with global tendencies.

Bulgarian consumers are oriented equally towards traditional live broadcast TV and video on demand, with a clear tendency of using more and more subscription-based video libraries (like Netflix, Amazon, HBO Go and others).

In order to respond to consumer demand, suppliers should focus on including key features – service mobility, premium channel subscriptions and picture quality.

Regarding the possible implementation of a public TV service tax the government is advised to avoid it, due to the fact that a flat tax rate higher than 5 BGN monthly would risk the loss of up to 28% of TV consumers, who would quit using the service altogether.

ACKNOWLEDGEMENT

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The Future of Bulgarian Postal Sector and the Role of Information and Communication Technologies

Anna Otsetova¹

Abstract – The postal services as services providing the necessary territorial, social and economic connectivity play an increasingly important role in today's global and dynamic business environment. The evolution of Information and Communication technologies (ICTs) had has and are still having impact on postal services. In the past years the postal sector in Bulgaria has faced a profound transformation. This transformation has led to structural changes. All activities like mail sorting and delivery, the retail network, the work organization has been deeply impacted by ICTs. This article dealt with the opportunity and challenges faced by the Bulgarian Postal Sector in the conditions of digital economy and the impact of ICTs on postal sector development.

Keywords – Information and Communication Technologies, Postal services, Postal Sector Development

I. INTRODUCTION

Postal service is a public utility like telecom, railways, supplying the community with electricity, gas, water, sewerage, etc. The postal sector has been subject to the identical market reforms as those seen within other public utility sectors. These include the introduction of more competition and privatization. Within the European Union (EU), the rules for such reforms in the postal area were formulated in the Green Paper on the development of the single market for postal services [1].

The Postal Services Directive was adopted in December 1997 as the culmination of a process that was initiated with the Green Paper. Amendments to the Postal Services Directive in 2002 and 2008 did not alter its basic concept, which reflects a situation of 25 years ago. Since then, however, several developments in social, economic, and technological circumstances can be recognized that have had and will continue to have, a significant impact on the postal sector [2].

The evolution of ICTs had has and are still having an impact on postal services.

In last ten years predominant in postal market development is the continuing decline of letter mail volumes in the postal market. By contrast, the delivery of physical goods like small packages and parcels is likely to be of increasingly importance. These trends can be seen in the growing parcel volumes in most countries all over the world. This volume decline of letter mail is, to a large extent, caused by the possibilities provided by progressive development of ICTs in terms of more efficient, instant, and direct

communication. Of particular relevance is the impact of this development on the provision of Universal Postal Service (UPS) [2]. UPS is defined as continuous provision of a set of basic postal services with a defined quality, on the whole territory of the country, at affordable prices for all users [3].

At the same time, digitization also provides possibilities for efficient processing and delivery of postal items (for example, by using intelligent sorting machines and sophisticated track and trace options), while the evolution of the digital economy has given an impressive boost to the emergence of e-commerce and subsequent growth in the volume of parcels.

Electronic substitution of traditional postal services is caused both by customers and businesses adopt of electronic processes across multiple domains. Nowadays, customers are attracted to greater convenience, faster service, and lower costs. The digital economy requires postal operators to apply modern and innovative approaches to service delivery. Postal operators should offer new products and services which reflect the new trend of binding nation together in a new world where people are increasingly communicating digitally [4].

The ICTs revolution has had a considerable impact on the postal sector in Bulgaria too. The national postal operator which is managed in the traditional government mould has generally been late adopters of ICTs, partly because is it subject to fewer competitive pressures, compared with private postal operators. However, today almost every postal operator, whether private or state-owned, either uses or is keen to use ICTs in order to become more efficient, profitable and competitive.

The postal services as services providing the necessary territorial, social and economic connectivity play an increasingly important role in today's global and dynamic business environment [4].

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In the past years, the postal sector in Bulgaria has faced a profound transformation. This transformation has led to structural changes. All activities like mail sorting and delivery, the retail network, the work organization has been deeply impacted by ICTs.

This article dealt with the opportunity and challenges faced by the Bulgarian Postal Sector in the conditions of digital economy and the impact of ICTs on postal sector development.

II. POSTAL SECTOR DEVELOPMENT IN BULGARIA

The general definition of postal services includes any kind of service provided by postal operators. It is characterized by the varied presence of both public and private operators offering a broad range of services and products. Postal services include the traditional services of collecting, sorting, and delivering letters, documents, and parcels on national territory and abroad, as well as express, courier and home delivery services, city messenger, postal money orders, etc. The services provided by postal operators may also include communication, logistics, retail, money transmission, and other financial services, and many others [5].

According to the EU Postal Directives, there are three categories of postal services: universal postal service, postal services within the scope of universal postal service and non-universal postal services (NPS).

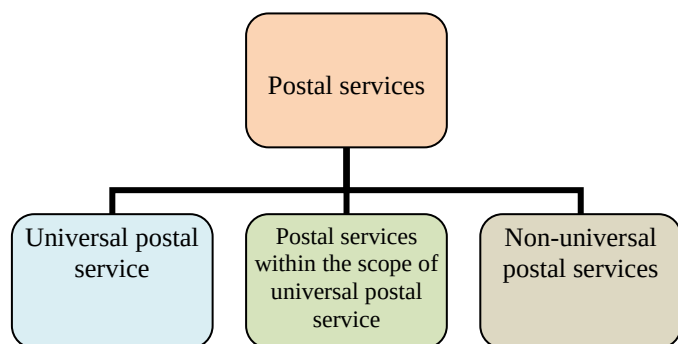


Fig. 1. Categories of Postal Services [3]

Universal postal service is defined as a set of postal services provided in a country, within the prescribed quality, at affordable prices and under equal conditions for all users [6]. The main value of UPS is that it arguably helps to reduce social exclusion by overcoming the “separation”, as well as encouraging social and economic development, particularly in rural areas where the costs of providing postal services are higher than in urban areas [4].

The Postal Directives defines minimum requirements regarding the UPS scope, accessibility, frequency of collection and delivery, quality, and price [3, 7].

TABLE I
MINIMUM REQUIREMENTS FOR UPS [3]

Scope of services	• Letter-post items up to 2kg; • Parcels up to 20 kg; • Delivery of international inbound parcels up to 20 kg; • Registered and insured items.
Accessibility	Density of access points in accordance with users' needs.
Frequency	One collection and one delivery every working day, not less than 5 times a week.
Quality	D+3 85% D+5 97%
Prices	Accessible, cost-oriented, affordable for all users.

Postal services within the scope of the UPS are services which from a user's perspective, can be regarded as interchangeable to a sufficient degree with the UPS, taking into account the characteristics of the services, including added-value features, as well as the intended use and the pricing. These services are offered in a fully competitive environment, without any restrictions on postal operators regarding the types of services provided and territorial coverage requirements, prices, and others [4].

Non-universal postal services are domestic and international postal services that are not covered by the universal service obligation, e.g. postal services from the UPS domain, exceeding the set limits for weight. These services include all types of postal services with added value to UPS, which are developed and will develop as a consequence of the ICTs development.

The scope of the NPS is open to expansion and will occupy an increasing share of the postal market. These postal services will continue to be available in a fully competitive environment. NPS bring high added value and their prices are not subject of regulation. The provision of such postal services is based on a market principle.

Non-universal postal services include large parcel services, express delivery services, courier services, direct mail services, hybrid services and postal money order services.

Bulgarian Postal Market was fully liberalized at the beginning of 2011. As a state-owned enterprise structured as a corporate entity, the national postal operator *Bulgarian Posts* is responsible for the provision of UPS in Bulgaria, in a fully liberalized postal market. The company provides UPS on the territory of the whole country, including in rural areas, with a certain quality level and at affordable prices. Universal service is partially funded by the Bulgarian government when the universal service obligation results in net costs and represents an unfair financial burden for it.

At the end of 2019, there are thirteen postal operators in the UPS market, including the national postal operator *Bulgarian Posts*. From the beginning of 2011, the competition

in services within the scope of UPS has been gradually growing.

For the period 2011 - 2019, the number of registered operators in Bulgaria providing NPS continues to grow, from 96 registered operators in 2011 to 172 in 2019 (which is more than 170% growth) (Table II).

TABLE II
NUMBER OF POSTAL OPERATORS IN BULGARIA (2011-2019)

Year	Number of postal operators providing postal services within the scope of the UPS	Number of postal operators providing NPS
2011	4	96
2012	4	112
2013	5	128
2014	6	138
2015	6	145
2016	6	151
2017	9	157
2018	11	160
2019	13	172

Source: Communicationas Regulation Commission, Annual Reports (<https://crc.bg/>)

In 2019 the volume of the postal market was about BGN 564 million and was formed by the revenues provided in UPS and NPS market segments. The volume of the postal services market represented an increase of 20% as compared to 2018. A driving force for the development of the postal market in the last years has been the services of the NPS segment. From 2011 there is a trend of a significant predominance of the share of NPS in the total market volume.

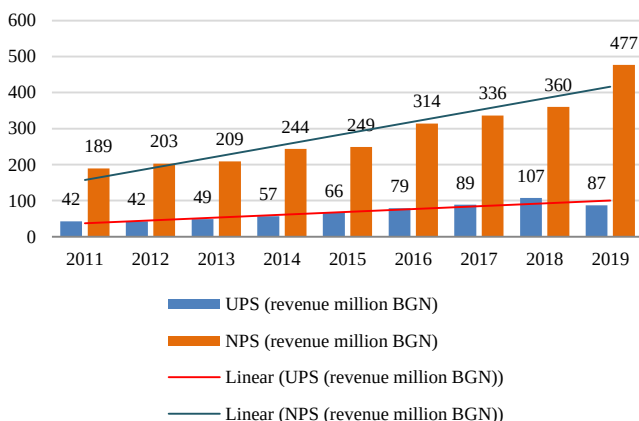


Fig. 2. Revenues from UPS and NPS in Bulgaria (2011-2019)

Source: Communicationas Regulation Commission, Annual Reports (<https://crc.bg/>)

The total revenues realized from the services in the UPS segment in 2019 decreased by 17% compared to 2018. In the NPS segment, there was a significant increase in revenues of 32%. According to data from licensed operators providing services within the scope of UPS, the reason for the decline in UPS revenues is due to an observed change in the attitudes of consumers who in the past year have consumed more courier services instead of traditional postal services. Also in 2019, most of the shipments generated by e-commerce were delivered as courier services.

In 2019, the total volume of the postal market is formed mainly by revenues from courier services, whose relative share reaches nearly 80% of total revenues.

Over the last ten years, in the Bulgarian postal market, two steady trends were formed – a decline in the demand for traditional postal services and an increase in the consumption of parcels and courier services. This led to more intense competition in this segment and shrinking of the market share of the incumbent operator Bulgarian Posts (Fig. 3).

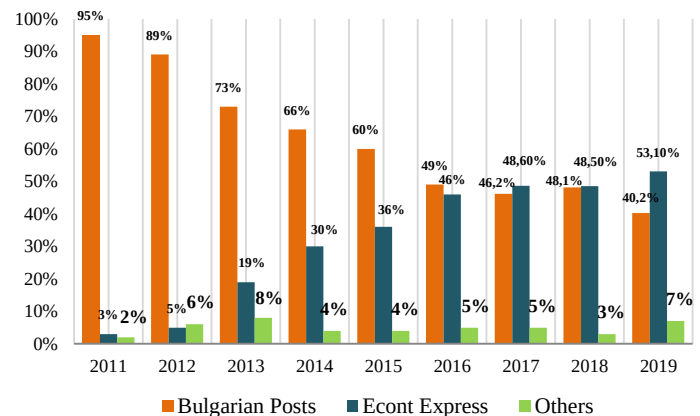


Fig. 3. Market shares of UPS postal operators

Source: Communicationas Regulation Commission, Annual Reports (<https://crc.bg/>)

The year 2017 will remain historic for the postal business in Bulgaria. For the first time since the liberalization of the postal market in the country, private operator Econt Express outpaced Bulgarian Posts in market share in the category of UPS (namely letters and small postal parcels up to 20 kilograms). Data from the Communications Regulation Commission (CRC) annual report show that Econt Express has a market share of 48.6% and Bulgarian Posts 46.2% respectively.

In the NPS segment, the national postal operator also lost a significant market share of 4.8% in early 2011 to 1.6% in 2019. The undisputed leader in this market segment is Econt Express with a market share of about 30%.

III. THE ROLE OF INFORMATION AND COMMUNICATIONS TECHNOLOGIES ON POSTAL SECTOR DEVELOPMENT

New technologies are re-shaping and modeling the postal sector. They are not threats, but should be seen as catalysts which will help the postal operators reinvent themselves. ICTs are an opportunity for the contemporary postal operators to improve their existing services or to evolve a whole new range of services. New technologies change the management and the work culture of the organizations and promote innovation.

ICTs are revolutionizing the way individuals, businesses and other parts of society communicate, work, shop and function. The Internet has opened up the world. Users can send and receive e-mails or go online to an internet site from anywhere on the world, enjoying instant communication at negligible cost.

Bulgaria has for many years been one of the lagging countries with regard to the use of electronic communication services. Bulgaria ranks as number 27-th on the EU Digital Economy and Society Index (DESI) (Fig. 4) and is also on the end the list concerning to the use of the Internet and Integration of Digital Technology (a parameter for business use of ICTs).

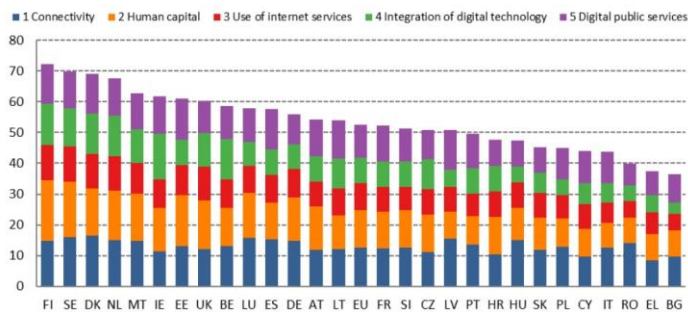


Fig. 4. Digital Economy and Society Index 2020 Ranking

Source: DESI, 2020, European Commission, <https://ec.europa.eu/digital-single-market/en/desi>

From a postal sector perspective, digital public service can be expected to be the most important parameter for future development⁵. According to DESI, Bulgaria is in this area lagging far behind the leaders.

The potential for electronic substitution of postal services is huge, but substitution is promoted both by the provision of electronic services and by poor quality of postal services, which is especially true for the UPS in Bulgaria.

The Postal Directive provides requirements and rules for quality of services (QoS). QoS indicator for transit time is calculated as a percentage of first class (or equivalent) postal items that UPS provider delivers on-time. The indicator is related to transit times in $(D + n)\%$ when D represents the date

of deposit, and n represents the number of working days which elapse between the date of deposit (D) and date of delivery to the addressee. The indicator gives the percentage of postal items delivered on-time [7].

In particular, quality standards for cross-border mail within the EU have been set as follows:

- 85% D+3 delivery;
- 97% D+5 delivery.

The results of measuring the quality of the UPS provided by Bulgarian Posts are far from the set targets and indicate a rather low quality of the services (Table III).

TABLE III
PERCENTAGE OF POSTAL ITEMS DELIVERED ON-TIME

End-to-end Transit Time	Service Quality Target	Results of the Republic of Bulgaria
D+3	Not less than 85% of the postal items	44%
D+5	Not less than 97% of the postal items	81%

Source: Communication Regulation Commission, Annual Reports (<https://crc.bg/>)

Despite the poor indicators of Bulgaria in terms of DESI index, ICTs continue to spread throughout the country and more and more people have access to the Internet and its information and applications, and Bulgarian users are becoming increasingly skilled.

New technology development changes customers' preferences as well. Today they are much more informed and their requirements for the quality of services are growing. This has stimulated the need for Bulgarian postal operators to innovate and develop postal electronic services.

Postal electronic services (e-services) are defined as services delivered by postal operators to their end customers through ICTs channels [8]. Universal Post Union (UPU) divided postal electronic services into four groups: e-post, e-commerce, e-finance and e-government. The study of UPU covers only the designated operators of UPU member countries.

E-posts services include – public internet access point in post offices, web information on services and tariffs, postal address validation, track and trace, electronic notification to Post of postal item needing to be collected, electronic notification to addressee that parcel is to be delivered, etc. [8].

According to the last report of Universal Postal Union, the incumbent postal operator in Bulgaria offers only 4 services from this group (Table IV).

⁵ https://www.econstor.eu/bitstream/10419/190416/1/G1_3_Falch-and-Henten.pdf

TABLE IV
E-POST SERVICES IN EUROPE AND CIS (COMMONWEALTH OF INDEPENDENT STATES)

	Public internet access in post offices	Web information on services and tariffs	Postal electronic mailbox	Online direct mail	Electronic stamp	Customized electronic stamps	Postcode lookup	Postal address validation	Post office location lookup	Track and trace
Belarus	O	O	O	O	O	O	O	O	O	O
Bosnia Herzegovina		O					O	O	O	O
Bulgaria		O					O		O	O
Cyprus		O	O				O	O	O	O
Hungary	O	O		O		O	O		O	O
Kyrgyzstan	O	O					O		O	O
Lithuania		O				O		O		O
Malta		O					O	O	O	O
Poland		O					O		O	O
Russian Federation	O	O	O				O		O	O
Slovakia		O					O		O	O
Turkey		O					O		O	O
Ukraine	O	O	O			O	O		O	O
Uzbekistan	O	O	O				O			O

Source: Universal Postal Union, 2019, Measuring Postal E-services Development. A Global Perspective, <https://uniglobalunion.org>

E-finance services are financial services provided by postal operators to end customers using ICTs, like: electronic invoicing, e-payment of water bills, e-payment of electricity bills, e-payment of phone bills, electronic money transfer, etc. [8]. No services of this group are offered by national postal operator Bulgarian Posts (Table V).

TABLE V
E-FINANCE SERVICES IN EUROPE AND CIS

	Electronic invoicing	Electronic account management	Electronic remittance	Online bill payments	Bills management	E-payment of water bills	E-payment of electricity bills	E-payment of phone bills	Electronic money transfer
Belarus	O	O	O	O	O	O	O	O	O
Bosnia Herzegovina									O
Bulgaria									
Cyprus									O
Hungary									
Kyrgyzstan			O	O	O	O	O	O	
Lithuania									
Malta									
Poland									O
Russian Federation			O			O	O	O	O
Slovakia			O			O	O	O	O
Turkey		O		O		O		O	O
Ukraine			O						O
Uzbekistan			O						O

Source: Universal Postal Union, 2019, Measuring Postal E-services Development. A Global Perspective, <https://uniglobalunion.org>

E-commerce services consist of buying and selling products and services using ICTs [8]. This group include: online shop for philatelic products, online shop for postal goods, online shop for non-postal goods, etc. The incumbent postal operator of Bulgaria offers only two services from the group of e-commerce, namely subscription for periodicals and e-commerce web-based customer service and contact (Table VI).

TABLE VI
E-COMMERCE SERVICES IN EUROPE AND CIS

	Online shop for philatelic products	Online shop for postal goods	Online shop for non-postal goods	Subscription for periodicals	E-commerce web-based customer service and contact	SSL web certificates
Belarus	O	O	O	O	O	O
Bosnia Herzegovina					O	
Bulgaria				O	O	
Cyprus	O				O	
Hungary	O		O		O	
Kyrgyzstan					O	
Lithuania	O			O	O	O
Malta					O	
Poland	O					
Russian Federation			O			
Slovakia		O	O	O		O
Turkey	O					
Ukraine	O	O		O		
Uzbekistan	O				O	

Source: Universal Postal Union, 2019, Measuring Postal E-services Development. A Global Perspective, <https://uniglobalunion.org>

E-government services are driven by government and provided through ICTs means, using Posts as a trusted third party [8], like: digital identity, online shopping for tickets to cultural and/or sports events, online passport application, electronic medical certificates, etc. Bulgarian national postal operator does not yet offer services from the group of e-government services (Table VII).

TABLE VII
E-GOVERNMENT SERVICES IN EUROPE AND CIS

	Digital identity	Driving licence renewal	Online shopping for tickets to cultural and/or sports events	Electronic university registration	Electronic payment of retirement pensions	Online passport application	Management of patients' electronic medical files	Electronic medical certificates	Electronic collection of public medical fees
Belarus								O	O
Bosnia Herzegovina									
Bulgaria									
Cyprus									
Hungary									
Kyrgyzstan									
Lithuania									
Malta									
Poland									
Russian Federation						O			
Slovakia									
Turkey									
Ukraine									
Uzbekistan									

Source: Universal Postal Union, 2019, Measuring Postal E-services Development. A Global Perspective, <https://uniglobalunion.org>

The e-finance and e-government services widely seen as important components of modern core postal offerings have not yet been developed by the national postal operator. The e-post and e-commerce services are still underdeveloped.

It can be concluded that in terms of offering e-postal services the Bulgarian incumbent postal operator lags significantly behind the incumbent operators in other EU countries.

In contrast to the national postal operator, private postal operators in Bulgaria are much more active in offering electronic postal services.

Based on the own web survey it was found that more than a half of the registered private postal operators in Bulgaria provide e-services. Each operator, however, provides a different combination of services [9].

The most widely offered by private postal operators are the services of the group of e-commerce services, followed by the e-post services.

The results indicate that the services of category of e-finance and e-government services are not widely distributed in our country.

UPU calculated Digital postal services capacity index (DPSCI), which illustrates postal operators' potential to provide digital inclusion [8]. According to last report of UPU DPSCI of Europe is 0.33 of maximum 1. The leaders in Europe are France and Germany with average score 0.81. The DPSCI of Bulgaria is 0.19. Only Romania ranks behind Bulgaria among EU countries with value of the index of 0.14.

IV. CONCLUSION

Nowadays, ICTs open up new opportunities for value creation in postal sector.

A driving force for the development of the postal sector in Bulgaria in the last years has been the services of the NPS segment and in particular - the courier services.

Bulgaria ranks last among all EU countries in terms of Digital Economy and Society Index. Nevertheless, the ICTs continue to spread throughout the country and more and more people have access to the Internet and are becoming increasingly skilled.

Increasing competition in the Bulgarian postal sector is forcing postal operators to strive for greater competitiveness by providing postal electronic services. Postal electronic services are services delivered by postal operators to their end customers through ICTs channels.

Based on the analyzed results it can be summarized that national postal operator Bulgarian Posts lags significantly behind the national postal operators of other EU countries in offering e-postal services. Private postal operators are significantly more active and innovative in offering e-postal services, but they still offer a relatively limited range of e-postal services.

Many of the private postal operators are trying to adapt their business models, shifting their focus from traditional postal services to new e-postal services. Their efforts are focused on creation of new and innovative services with high quality at a reasonable price.

Bulgarian postal operators need to adapt to the new digital reality. To be able to compete effectively, postal operators need to speed up the digitalization of their products and services in the near future. This means that postal operators that have not fully digitalized, and have not used the full potential of ICTs need to do it urgently, or they risk to be excluded as digital service providers.

Digital transformation of postal sector in Bulgaria will not only depend on ICTs, but also require a comprehensive approach from government and CRC, and in particular with regard to e-government services.

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Industry 4.0 and Courier Services Operators Development – the Case Study of Bulgaria

Anna Otsetova¹

Abstract – In the conditions of Industry 4.0, companies are increasingly investing in tools and solutions that allow their progress, devices, employees, product and services, to be integrated into a single network of data collection, data analysis, the evaluation of company development and performance improvement. In such a context, courier services companies (courier operators) need to respond to the challenges of the digital economy and the growing demands of consumers. This requires strong investment in new technologies and connectivity. Therefore, every company that wants to remain in the market and to be competitive must move towards to the IoT. The objective of this study is to discover how courier operators in Bulgaria function in the conditions of Industry 4.0, and what kind of IoT tools they use to support their processes, and what critical issues they face during the process of digital transformation. Online survey was used to collect the necessary data. Registered courier operators in Bulgaria are the main units of the study. The results show that RFIDs and cloud storage are the most widely used tools and that the application of IoT tools has the strongest impact on the efficiency of the process with supplier and ordering partner, followed by efficiency of internal logistics. The main factors hindering the application of IoT tools are the unknown level of costs and qualification of the employees.

Keywords – Industry 4.0, Internet of Things, Courier Services, Courier Services Market

I. INTRODUCTION

Industry 4.0 is defined as the technological change for automatic systems based on the significant increase in the speed of information processing, data storage capacity, and massive development of Information and Communication Technologies (ICTs) [1].

New Industry 4.0 is perceived as a new scenario in which the convergence of different emerging technologies strengthen by the Internet of things results in cyber-physical and intelligent systems that can create value for all types of business activities [2].

The main feature of Industry 4.0 is that it is based on data. The way, in which the information can be extracted, systematized, processed, analyzed, and used to make the right decisions, has become a competitive advantage. A source of competitive advantage in a digital economy is also the way companies filter the relevant information from the generated data in order to support decision-making [3]. This allows the company to make products and/or services more suited for the customers.

In such a context, courier services companies (courier operators) need to respond to the challenges of the digital economy and the growing demands of consumers. This requires strong investment in new technologies and connectivity.

In order to remain competitive in a globalized

environment, courier services companies need to constantly evolve their systems and accommodate the changing demands of markets.

With the rapid progress of today's technology, the need for the Internet is increasing day by day [4]. The IoT plays an important role for courier operators due to today's technology. Therefore, every company that wants to remain in the market and to be competitive must move towards to the IoT. In this process of transition, the problems encountered by the courier operators are costly and time-consuming.

Hence, the objective of this paper is to discover how courier operators in Bulgaria function in the conditions of Industry 4.0, and what kind of Internet of Things tools they use to support their processes, and what critical issues they face during the process of digital transformation.

II. INDUSTRY 4.0 AND COURIER SERVICES

The main purpose of Industry 4.0 is to achieve improvements in terms of automation, operational efficiency, and effectiveness [5]. The Industry 4.0 concept is defined from many authors as an umbrella term for a new business paradigm which embraces a set of future industrial developments including IoT, Internet of Services (IoS), Cyber-Physical Systems (CPS), Robotics, Big Data, Cloud Computing and Augmented Reality [6].

Computers, automation, and robotics existed in previous decades, but the opportunities provided by the development of Internet revolutionize their use and the opportunities they provide.

The main characteristics of Industry 4.0 can be summarized as follows:

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- *Interoperability*: the ability of devices, sensors, and people to connect and communicate with each other via the IoT⁶.
- *Information transparency*: enabling the gathering and analysis of data and providing the derived insights immediately.
- *Decentralized decision-making*: the ability of cyber-physical systems to make simple decisions on their own and become as autonomous as possible⁷.
- *Technical assistance*.
- *Convergence*.
- *Cost reduction and efficiency*.
- *Mass customization*.

The scope of Industry 4.0 can grow at the company's border, covering the supply chain or, more broadly the supply network. Industry 4.0 by using technologies maximizes the transparency of all processes in the company by exploiting the possibilities of digitalization and integrates the corporate value chain and the supply chain into a new level of customer value creation [3].

In the last three decades, courier services worldwide have undergone radical changes from an operational, social, and technological perspective.

Technological changes are confronting courier operators with new forms of competition from other communication services (e.g emails), while providing many new opportunities [7, 8].

The courier services sector has started to play an increasingly important role in the global economy and it has turned into a mediatory unit supporting economic activities in other sectors and as well as contributing to the greater efficiency and integrity of the economy [9].

As market competition for courier operators increases, a growing number of firms try to pursue the operational excellence so that the company can provide the excellent operations to gain a reasonable market share and distinctive competitive advantage.

Courier services in Bulgaria continue to play a leading role in the overall postal market revenue. According to the Annual Reports of Communications Regulation Commission (CRC) in Bulgaria courier services determine the postal services market structure. Courier services in Bulgarian formed about 80% of the total amount of revenue from postal services [10].

The growing demand for courier services, process automation, the everyday introduction of new technologies, and the increasing use of electronic means, are considered as the most significant change drivers in the courier services sector. Taking into consideration the above-mentioned changes, new courier services are constantly being developed both internationally and nationally [11].

The Bulgarian courier services industry consists of about 172 companies both large and small, which have combined

annual revenue of about 446.5 million BGN in 2019. The sector registered a steady growth in the last fifteen years (Fig. 1).

A dynamically growing market attracts new players every year, so that competition is generally increasing.

According to the Annual Report of CRC courier services market in Bulgaria is characterized as a competitive market with medium to moderate level of concentration. There is also a continuing reallocation of operators' market shares.

E-commerce trade is one of the major drivers of the Bulgarian courier services sector. According to the latest data from Theoremus for Audience Profiling, 80% of urban Bulgarians aged 16-65 shop online; 36% at least once a month and 29% at least once every three months⁸.

The growth of e-commerce stimulates the implementation of various business solutions by courier operators in order to meet customer requirements.

The use of digital technologies in the delivery of courier shipments is dictated by the mobility of consumers who want lower prices, greater convenience when buying goods, trouble-free receipt, and return of shipments. These requirements encourage operators to apply combinations of technologies and strategies. Most operators use data analysis to help them respond quickly and predictably to the future needs of their customers. The key solutions in this direction are mobile technologies and IT solutions.

The next section of the paper presents results of a questionnaire survey conducted among courier operators in Bulgaria.

⁶ <https://www.bryairprokon.com/industry-4-0/>

⁷ Abdullah Bahari, Abdullah Bahari,
<https://www.scribd.com/document/389451859/INDIVIDU-552>

⁸ <http://dialogical.team/2019/>

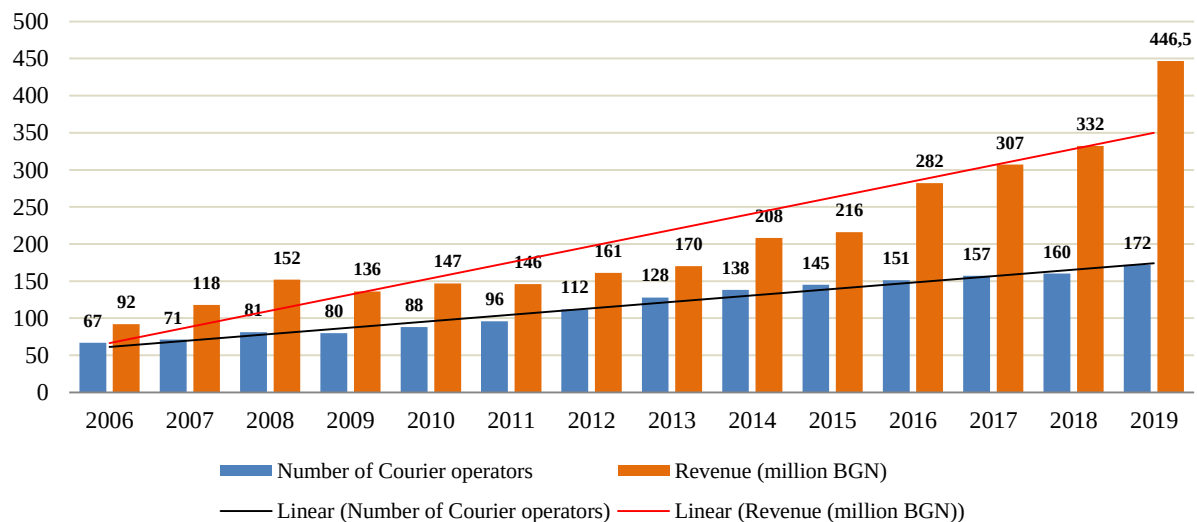


Fig. 1. Revenue and number of the courier operators in Bulgaria (2006-2019)

Source: Annual Reports of Communications Regulation Commission

III. ANALYSIS AND FINDINGS

Registered courier operators in Bulgaria are the main units of the study. A structured online questionnaire, administered by *Google Docs* software was conducted. Due to the inability to create a sample that meets the requirements for a completely random selection the author used two types of non-random sample - volunteers who agree to participate and snowball sample. According to the Communication Regulation Commission at the end of 2019, the number of registered courier operators in Bulgaria is 172. 57 of them declared that they did not perform activities. The number of courier operators in Bulgaria that carrying out the activity is 115. Using the apparatus of mathematical statistics at significance level $\alpha=0,05$ and margin of error $\varepsilon=0,05$ minimum sample size determined to be 80 [12]. The number of returned and valid questionnaires is 91.

The study was conducted between May and September 2020.

Most of the courier operators (68.7% of the sample) fit in the category of small firms, meaning 10 to 49 employees. Fewer firms (27.7% of the sample) are medium-sized firms, employing 50 to 250 people and 3.6% of the operators are large with more than 250 employees (Fig. 2).

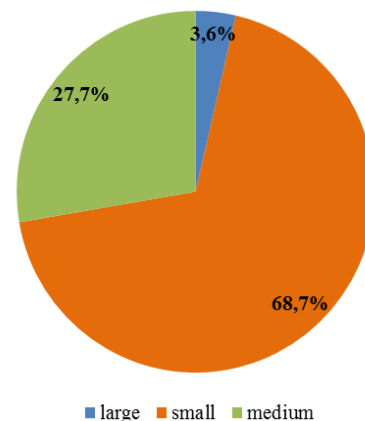


Fig. 2. The composition of the sample based on the size of the courier operators

The next section of the survey examines the prevalence of IoT tools and solutions used by Bulgarian courier operators. The IoT tools and solutions surveyed in the research are: sensors, RFIDs, cloud storage, big data analytics, CPSs, Automatic Guided Vehicle (AGV), and other smart devices. A multiple-choice question was used about whether the courier operator uses a given IoT technology or not.

The results show that RFIDs is the most widely used tool (91%). Cloud storage is also widely used (59%). At the same time integration of sensors and AGV are relatively unusual (Table 1).

Large courier operators in Bulgaria used all mentioned IoT tools. Cloud storage and RFID are most widely used by small operators.

TABLE I
THE PREVALENCE OF IOT TOOLS AND SOLUTIONS

Tool	% of courier operators	Number of courier operators
RFID	91%	83
Sensors	26%	24
Cloud	59%	54
Big Data Analysis	35%	32
Smart devices	34%	31
AGV	3%	3

The next question identified the benefit of IoT tools. The utility was evaluated on a scale of 1 to 5. The goal of the question was to identify the benefit of above mentioned IoT tools on different aspects of the business performance of courier operators. The question evaluates the usefulness of the IoT tools and how they support internal and external process improvements and company performance.

TABLE II
THE BENEFIT OF IOT TOOLS ON DIFFERENT ASPECTS OF BUSINESS PERFORMANCE OF COURIER OPERATORS

Utility	Mean
The efficiency of internal logistics	4,09
The efficiency of the process with ordering partner	4,18
The efficiency of the process with supplier partner	4,20
Cooperation between certain functions of the courier operator	4,01
Market performance of the courier operator	3,43
Financial performance of the courier operator	3,71
Competitiveness of the courier operator	3,19

The results show that the application of IoT tools leads to the higher efficiency of internal logistics, more efficient processes with their partners and better cooperation between certain functions of the courier operators.

According to courier operators, the application of IoT tools has the strongest impact on the efficiency of the process with supplier and ordering partner, followed by the efficiency of internal logistics.

In addition, courier operators were asked to indicate what hold them back from using IoT solutions.

According to the courier operators included in the study, the main factor hindering the application of IoT tools is the unknown level of costs. The majority of courier operators indicate that new technology has uncertain costs, which do not, at present, have guaranteed returns.

35% of the register courier operators in Bulgaria identified data security as a risk factor. All most half of the respondents considered the labor force with inadequate qualifications as a barrier.

The results indicated that the introduction of basic technologies for IoT in the courier business in Bulgaria has already begun. At the same time, many of the courier operators are afraid of the unknown level of economic benefit of digital investment and high cost of these investments.

It can be concluded that courier operators in Bulgaria are aware that the data use was the key for digitalization and a new source of competitive advantage.

IV. CONCLUSION

The results show that digitalization so far mainly influences the operations processes of courier operators. The research found also that the uncertain level of costs and the qualification of the employees are the main obstacles to the digitalization of courier operators in Bulgaria. So it can be concluded that the management of the courier operators have to make employees understand the inevitability of change caused by the widespread penetration of IT. The research shows that lack of digital culture and training is one of the biggest challenges for Bulgarian courier operators.

ACKNOWLEDGEMENT

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Herd Behavior in Financial Markets

Milena Penkova¹

Abstract – In this paper delth with on the process of selection of information, the different biases it is influenced by and how it translates in monetary terms.

Keywords – Heding, Herd Behaviour, Financial Market

The paradigm of share price reflecting all the available and relevant information is one of the basic pre requirements of the efficient market hypothesis (EMH). In this paper we will concentrate on the process of selection of information, the different biases it is influenced by and how it translates in monetary terms. The capability of the markets to accumulate, dissect and evaluate information is central to their efficiency and herding as phenomenon of human behavior constitutes a serious challenge to it.

Herdng is a form of convergent social behavior that can be broadly defined as the alignment of the thoughts or behaviors of individuals in a group (herd) through local interaction and without centralized coordination

The people as a social animals are involved in complicated system of community networks and these networks influence our behavior. We are constantly put under pressure by our peers, family members and the society to be conform within public boundaries. Two main concepts of herd behavior are “mechanisms of transmission” of information and “patterns of connections” among participants in the interaction.

Short trading horizons can influence asset pricing and in turn their function as reliable market indicators, which bring markets in imbalance. Furthermore, they provide incentives for managers to ignore projects with positive NPV and concentrate on short-term stock-price maximization. Particularly affected are unpopular measures that can send wrong signals to the stock market - price cuts, restructuring or closing inefficient market niches are seen as negative news that affect prices. This in turn leads to liquidity traders herding on speculative information, which “might help create the informational problems that are a necessary precondition for short-sighted investment behavior by corporations.”

Furthermore, investors, speculators and managers are put under enormous peer pressure when making a decision. Individuals will try to reassess their position if it confronts directly the expectations of their peers. Thus, even if an investor shares the vision of a company’s management for

price cutting that will negatively affect share prices in the short-term, but will have a positive effect in the long-term, he may reconsider his position and conform with other’s expectations, which contradicts the classical view that economic agents are acting independently for utility maximization.”

Similar approach adopts Banerjee, who investigates the decision making process of independent agents, all of whom undertake a particular action after they have observed the actions of previous agents. He argues that this is a rational choice as the former agents can possess valuable information that is unavailable for the latter. Essentially, people have to choose between their internal information and the external one they receive prior to the decision making. The results of his study explicitly demonstrate that even optimizing individuals fail in the pattern of herd behavior and value the external information more than their own judgment, and this leads to market inefficiency.

By contrast, Scharfstein and Stein consider herd behavior based on informational asymmetries and the agency problem in the labor marlcet. They elaborate on Keynes assumption about managers being put under pressure and the need to “follow the herd” — their performance relative to other managers’ performance - playing critical role in reward and punishment based incentives. They develop model with two main kinds of managers - “smart” and “dumb” and as in the model we discussed the market cannot differentiate between them at the beginning. It only adjusts its perceptions after the two sets of information are unveiled:

If the manager has exploited a money-making opportunity.

How executive behavior relates to his peers’ behavior Scharfstein and Stein conclude that managers try to mirror and follow actions of rivals, disregarding valuable information made available to them, because board of directors is either more likely to assess executive performances relative to the industry average, or because unconventional decisions that lead to losses can be damaging for their reputations.

This “sharing-the-blame” effect may lead to managers ignoring projects with positive NPV and investing in ones with negative NPV only to be conform with the behavior of their peers. 240 These findings are consistent with the results of Morck, Shleifer, and Vishny (1989), i.e. board of directors face uncertainty in accrediting fault to top managers if their rivals were pursuing similar strategies leading to industry wide downfalls.” The above is also valid for institutional

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investors in the financial markets as their decision making mimic other institutional investors' actions more thoroughly than the process of asset.

"Ninety percent of what we do is based on perception. It doesn't matter if that perception is right or wrong or real. It only matters that other people in the market believe it. I may know it's crazy, I may think it's wrong. But I lose my shirt by ignoring it. This business turns on decisions made in seconds. If you wait a minute to reflect on things, you're lost. I can't afford to be five steps ahead of everybody else in the market. That's suicide.

The above quote gives us a real time insight in the financial markets, how they work and react. The emphasis here is not on the value or the relevance of the information, but on its perception and the anticipated reaction - "herding" of the other market participants, investors and speculators. This interaction, anticipation and differentiation, and their implication on the asset prices are presented in the FSS model. The model is a branch of the so called Investigative Herding Models, which consider situations where informed speculator focus on analyzing a valuable information that will be investigated later by second-movers, and that information will have implication on the price in a future period.

The model is based on speculators forming short term (consisting of 4 periods) trading strategy and exploiting weaknesses of uninformed investors using market makers as mediators. Both types of investors compete for a single asset offering a dividend D . The expected return of the dividend is the sum of two independent attributes a and b , which are normally distributed:

The informed speculators are risk averse and obtain important information about only one of the variables before they place their orders, so they make an informed decision and try to speculate on it, while as already mentioned the market makers set the price only on the order flow of both type of investors, so there is market inefficiency and is mispriced. The uninformed investors with inelastic demands also place their orders in period 1 or 2, expressed as and respectively.

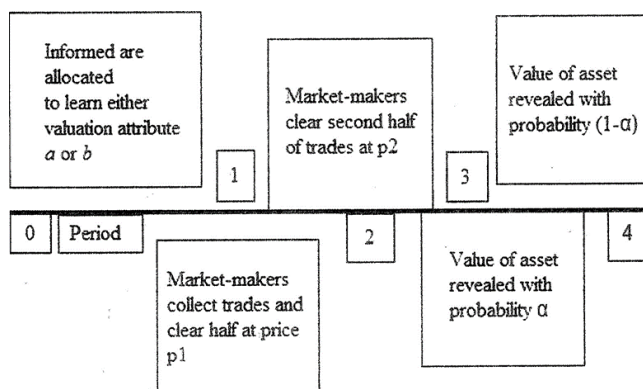


Fig. 1. Figure example

Figure 1 illustrates the whole process — based on the information they have available about a or b the speculators

place their orders in in the market makers execute randomly 50% of the orders at price P_1 , while in the second period are cleared the rest of the orders at price P_2 . In t_3 the informed investors close out their trades and in this moment with a probability α is unveiled the value of the dividend. If the value of the asset is unveiled in t_3 then the probability will be $(1 - \alpha)$.

$$F_{TA} = \frac{n_a}{2} q_a + \frac{n_b}{2} q_b + \varepsilon_t \quad (1)$$

"where q_a and q_b are the equilibrium demands of speculators informed about a and b , respectively and ε_t expresses the orders of the liquidity (noise) traders with inelastic demands and no regard to real value.

Short trading horizons can influence asset pricing and in turn their function as reliable market indicators, which bring markets in imbalance. Furthermore, they provide incentives for managers to ignore projects with positive NPV and concentrate on short-term stock-price maximization. Particularly affected are unpopular measures that can send wrong signals to the stock market - price cuts, restructuring or closing inefficient market niches are seen as negative news that affect prices. This in turn leads to liquidity traders herding on speculative information, which "might help create the informational problems that are a necessary precondition for short-sighted investment behavior by corporations.

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model we discussed the market cannot differentiate between them at the beginning. It only adjusts its perceptions after the two sets of information are unveiled:

- If the manager has exploited a money-making opportunity.
- How executive behavior relates to his peers' behavior

Scharfstein and Stein conclude that managers try to mirror and follow actions of rivals, disregarding valuable information made available to them, because board of directors is either more likely to assess executive performances relative to the industry average, or because unconventional decisions that lead to losses can be damaging for their reputations.

This "sharing-the-blame" effect may lead to managers ignoring projects with positive NPV and investing in ones with negative NPV only to be conform with the behavior of their peers. These findings are consistent with the results of Morck, Shleifer, and Vishny (1989), i.e. board of directors face uncertainty in accrediting fault to top managers if their rivals were pursuing similar strategies leading to industry wide downfalls. The above is also valid for institutional investors in the financial markets as their decision making mimic other institutional investors' actions more thoroughly than the process of asset allocation of private traders or noise traders. The "share-the-blame" effect is of a particular concern in stock exchanges as "herding" on "noise" information often leads to rash movements and can cause the creation of market bubbles and stock crashes.

The sentiment to confer responsibility on the actions of other agents is also consistent with the model proposed by Graham, based on Scharfstein and Stein's "dumb" and "smart" investors. The "smart" speculators have an access to information about the expected market yield, act accordingly and thus their actions are related, whereas the signals "dumb" investors rely upon have no value. The temptation of the "dumb" investor to herd on the actions of the market leaders:

1. increases with her initial reputation
2. decreases with her ability
3. increases in the strength of prior public information that is consistent with the leader's action
4. increases with the level of correlation across informative signals.

All these characteristics are cross-related and he argues that they should be considered together and should not be distinguished in order to help to explain herding as phenomenon. Graham observes the implications the market-leading newsletter "Value Line Investment Survey" has on market newsletters and the results are consistent with his hypothesis, though he also admits that the model has to be used carefully and the term "herding" should be distinctly specified. Furthermore, he elaborates on reputation and how to measure it correctly, whether or not the period for which a newsletter has existed is in any capacity correlated with the newsletter's reputation, or whether age is a neutral factor, how the informative signals influence each other and their correlation, etc.

There are four distinctly techniques that try to explain the reason behind herding and conscious conformity:

- sanctions on deviants
- positive payoff externalities
- conformity preference
- communication

The three former mechanisms are able to demonstrate why people can accept unpopular choices, while communication, if reputable, leads to taking correct actions. However, all of them are unable to clarify why modest changes can cause enormous shocks and alteration of the behavior of large masses.

Plausible explanation by Bikhchandani, Hirshleifer and Welch is that such kind of conform behavior is due to "informational cascades", which "occurs when it is optimal for an individual, having observed the actions of those ahead of him, to follow the behavior of the preceding individual without regard to his own information. They further argue that these cascades may be the reason behind takeover waves of 1960s, which cannot be accounted for rational factors only and that similar price fluctuations on the stock exchanges are induced by "waves of investor sentiment".

Whether there are "informational cascades" "share-the-blame", peers' pressure, conformity, principal-agent problems or reputational issues, it is clear that herding does exist in financial markets. Additionally, we should also mention that sometimes it can have positive effect, for example when institutional investors herd on relevant information, that private ones do not possess, or receive signals pointing towards mispricing of an asset and act accordingly by either selling overvalued stock or buying undervalued one and thus restoring "true" market equilibrium.

What happens if all those factors interact together and influence the market at the same time? In the most extreme case they can cause a market bubble and serious damage to the economy.

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Section 2

TELECOMMUNICATIONS & INFORMATION TECHNOLOGY

Information Model for Blockchain Management in Smart Grid

Mila Ilieva-Obretenova¹

Abstract – Power Supply and Smart Grid represent specific business, which must be managed by permissioned (private) blockchain. Despite its disadvantages – time consuming, expensive, and losing from network effect – the permissioned blockchain offers balance, guarantees stability, and provides physical limitations for usage of validating nodes only in the network. The paper represents the third stage of project Blockchain in Smart Grid: describing of Managed Objects classes for functional areas of blockchain life cycle: Provision, Configuration, Maintenance, Security, Accounting, Performance, and Subscriber control. As a reference is used the life cycle of telecommunications networks. The models are designed for user interface developers, professors, and students.

Keywords – Power Supply, Smart Grid, Permissioned (private) Blockchain, Network Effect, Validating Nodes

I. INTRODUCTION

Power Supply and Smart Grid represent specific business, which must be managed with permissioned (private) blockchain. Despite its disadvantages – time consuming, expensive, and losing from network effect – the permissioned blockchain offers balance, guarantees stability, and provides physical limits for usage of validating nodes only in the network. Management of permissioned blockchain is necessary for process tracing in it. [1] shows private data security and high transparency in permissioned blockchain. [2] considers practical deployment of (permissioned) blockchain and particularly its provision. [3] shows that blockchain increases the communicational requirements due its decentralized nature. [4], [5] and [6] show blockchain applications. Details about network management are missing. The paper represents the third stage of project Blockchain in Smart Grid: describing of Managed Objects (MO) classes for functional areas of blockchain life cycle: Provision, Configuration, Maintenance, Security, Accounting, Performance, and Subscriber control. Life cycle of telecommunications networks [7] is used as a reference. Models are intended for user interface developers, professors, and students.

II. METHODOLOGY

Managed Objects classes are defined on the base of management functions applying Unified Modeling Language (UML) [8]. From the structure diagrams are used class diagrams. A class diagram describes the different types of

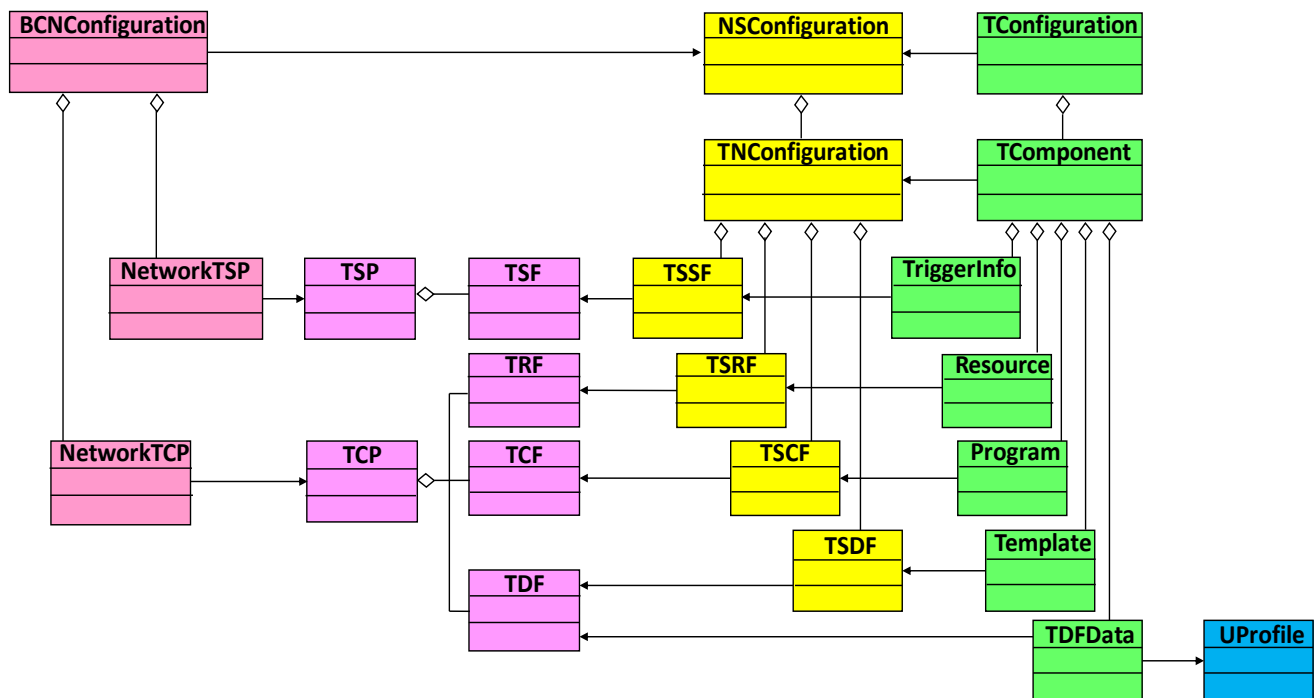
objects in the system and the different types of static relationships between them. Diagrams show also features and operations of classes and limitations for the way connecting objects. Features are one term, but they are represented with two quite different notations: attributes and associations. The notation for an attribute describes a distinct feature as text line (second row) in the rectangle, symbolizing the class. The association is a directed line between two classes and its direction is from class-source to class-aim. The name of the feature is set on the aimed end of the association with its majority. The aimed end of the association is connected to the class which is the feature type. The majority of the feature is a note for how many objects could complete the feature. Operations are actions which a class could realize. The “Part of”-relationship between objects is shown with a rhombus and a line. In the paper are represented specific attributes of selected Managed Objects classes. The operations are not represented.

III. RESULTS

A. Managed Objects classes for Network Provision

MO Operator represents information for the organisation, which provides the network. MO BCNetwork represents a set of interconnected managed objects (logical and physical), able to transfer information. These objects have one or more common characteristics, e.g. they could be assigned to single user, producer, or provider or to be connected to specific transactions network. A blockchain network could be embedded in another one. MO NetworkProfile contains the whole management information for a blockchain network. MO BCNConfiguration represents the common blockchain network configuration. It contains all available network elements. MO BCNMaintenance represents management information for network maintenance. MO BCNSecurity represents the rights on network security and the appropriate data. This object also must contain root key, which allows all transactions in the platform to be observed.

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MO TSF (Transaction Switching Function) representing the management information of node functionality. MO TCP (Transaction Control Point) represents management information for a full node. Full nodes consist of blockchain copy and their basic functions include confirmation of transactions and consensus support with other full nodes. Full nodes are added to existing distribution points as step-down transformers at distribution lines to users. This node consists of three functions: MO TCF (Transaction Control Function) represents management information for transaction control. MO TDF (Transaction Data Function) represents management information for transactions users. MO TRF (Transaction Resource Function) represents management information for producers in the transactions. MO NSConfiguration was introduced in subsection A. Managed Objects classes for Network Provision. MO TConfiguration represents the configuration for Transaction, needed for Provider or tailored on special order of Subscriber. MO TComponent contains all elements of different transactions, which must be validated in infrastructure of blockchain network. MO TriggerInfo represents routing information connected with possible directions for network access for specific user. This object is also needed for transactions allowing user several sources for power supply, e.g. routing depending on time and weather. E.g. if the wind stops blowing, the system instantly compensates by discharging the batteries to the grid, as power from the main grid gradually increases to match demand. When the wind starts blowing again, the batteries immediately

MO Resource represents description of specialized resource used in a specific transaction. It contains the following objects (are not available on fig. 2): MO PowerPlant describes the data for the used powerplants, e.g. thermal and nuclear. MO Renewables describes the data of used renewables, e.g. hydroelectric power plants, solar parks, wind generators, generators with biomass etc. MO GridStorage describes the data of used electricity storages, e.g. pumped and battery storages. MO Program represents the description of a program with transaction logic (consensus), e.g. PoW (Proof of Work), PoSt (Proof of Stake), PoSe (Proof of Service), PoI (Proof of Importance). MO TDFData represents an entry in functional element TDF for specific Transactions User, e.g. Received/Consumed/Rest/Sold

Energy. MO Template represents the description of entry format for each transaction in blockchain. The last seven objects belong to level Transaction Management, too. MO TNConfiguration (Transaction Network Configuration) contains information for all functional elements included in key digging and validation of specific transaction. MO TSSF (Transaction Specific Switching Function) contains information which elements TSF are included in key digging and validation of request or offer of user/producer. MO TSDF (Transaction Specific Data Function) contains information which elements TDF are included in key digging and validation of transaction subscriber as producer or user. MO TSRF (Transaction Specific Resource Function) contains information which elements TRF are included in key digging and validation of producer's offer. MO TSCF (Transaction Specific Control Function) contains information which elements TCF are included in key digging and validation of transaction between user and producer. MO UProfile was introduced in subsection A. Managed Objects classes for Network Provision. Fig. 2 shows UML diagram of Managed Objects classes for Network Configuration.

C. Managed Objects classes for Network Maintenance

MO BCN Maintenance and MO NSMaintenance were represented in subsection A. Managed Objects classes for Network Provision. MO PreventiveFunction represents programs for network testing in normal working conditions. MO Result represents the result after preventive function execution. MO TestingFunction represents testing programs for programs and network resources by fault detection. MO NetworkLocalizaton contains information for functional element, in which is detected a fault. MO AlarmLog contains the collected maintenance events. MO AlarmRecord represents alarm-reaction by fault detection. MO SFaultInfo represents fault information provided to Network Subscriber. MO SComplaintLog represents the events log Subscriber complaint. MO SComplaint contains information for complaints submitted from Network Subscriber. Fig. 3 shows UML diagram of Managed Objects classes for Network Maintenance.

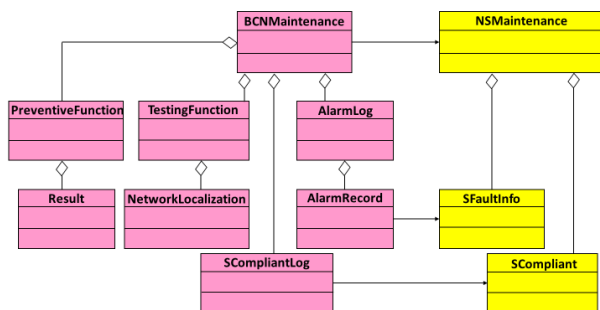


Fig. 3. UML diagram of Managed Objects classes for Network Maintenance

D. Managed Objects classes for Network Security

MO BCNSecurity and MO NSSecurity were represented in subsection A. Managed Objects classes for Network Provision. MO NetworkSecurityLog represents collected events on network security. MO SecurityAlarm represents alarm-reaction by security breaking. MO NetworkDataSecurity represents security rights on Network Operator data. MO AutorisationTrail represents security rights for specific Network Subscriber and allows him to control access to his profile. Fig. 4 shows UML diagram of Managed Objects classes for Network Security.

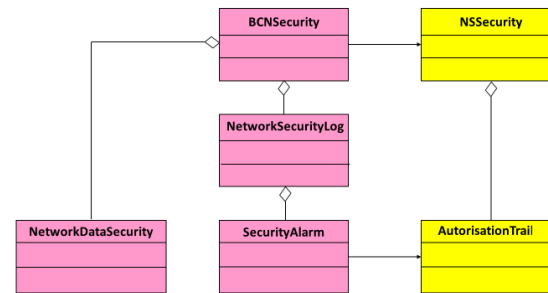


Fig. 4. UML diagram of Managed Objects classes for Network Security

E. Managed Objects classes for Network Accounting

MO BCNAccounting and MO NSAccounting were represented in subsection A. Managed Objects classes for Network Provision. MO UAccounting contains all detail on accounting of a user(-producer). MO PlanningLog represents results of planning stage for Network Accounting. MO NetworkTariff represents complex specification of accounting, containing different objects from Network Operator's point of view. MO AccountingLog represents collected entries on Network Accounting. MO TSFAccountingLog represents collected entries on TSF Accounting for transaction execution. MO SAccount contains usage information for network resources from a Network Subscriber. Fig. 5 shows UML diagram of Managed Objects classes for Network Accounting.

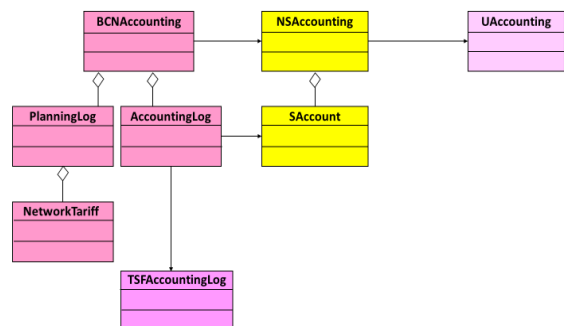


Fig. 5. UML diagram of Managed Objects classes for Network Accounting

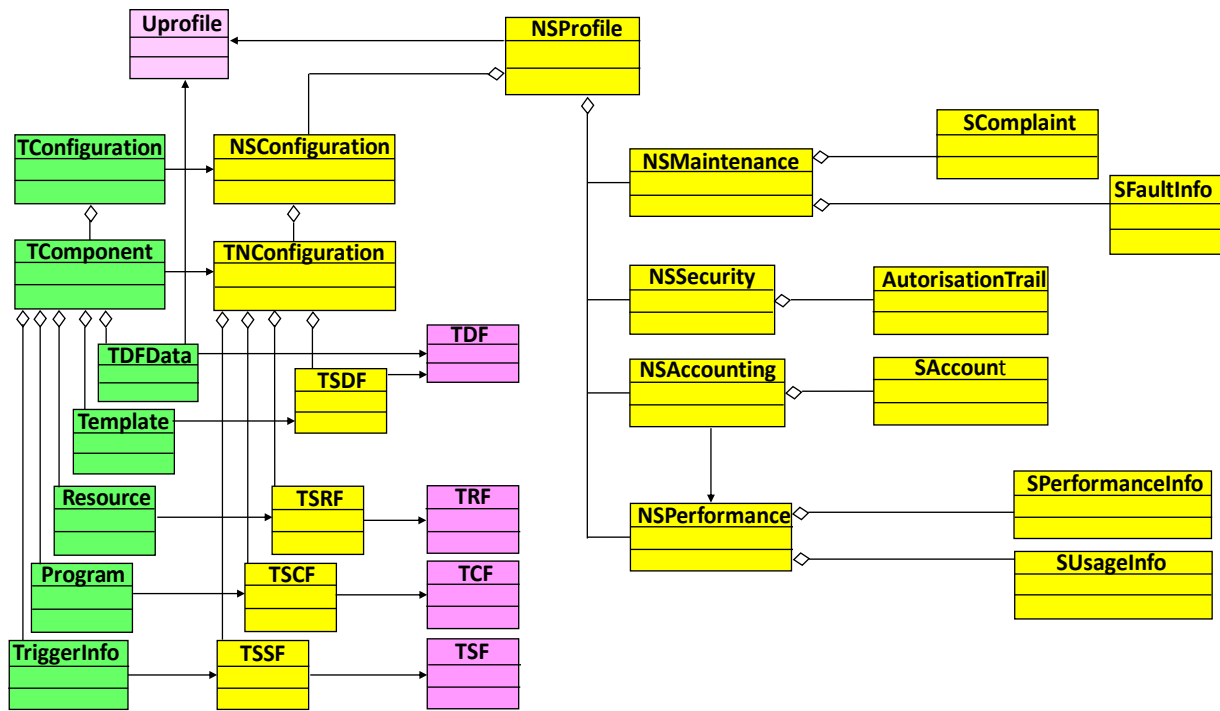


Fig. 7. UML diagram of Managed Objects classes for Network Subscriber control

F. Managed Objects classes for Network Performance

MO BCNPerformance, MO NSPerformance, and MO UPerformance were introduced in subsection A. Managed Objects classes for Network Provision. MO NStatusReport represents report for network status, created on operator's request. MO NetworkUsageLog represents collected entries on network usage. MO TSFUsageLog represents collected entries on TSF usage. MO TRFUsageLog represents collected entries on TRF usage. MO TCFUsageLog represents collected entries on TCF usage. MO SPerformanceInfo contains performance values provided to a Network Subscriber. MO SUsageInfo represents collected usage events from a Network Subscriber. Fig. 6 shows UML diagram of Managed Objects classes for Network Performance.

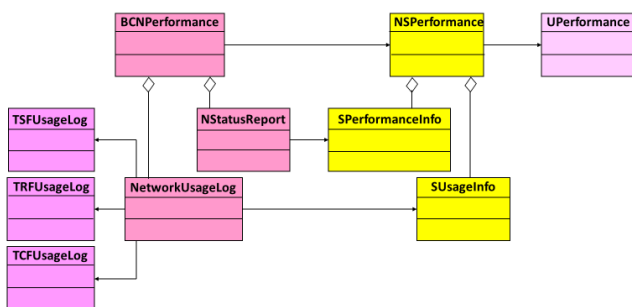


Fig. 6. UML diagram of Managed Objects classes for Network Performance

G. Managed Objects classes for Network Subscriber control

Fig. 7 summarizes all objects included in Network Subscriber control. The objects were represented in previous subsections. One can see that not only the Network Subscriber, but also Network User (Transaction Subscriber) could exercise Subscriber control. Furthermore, the Subscriber control spreads over the function management of Network element.

IV. CONCLUSION

Deployment of blockchain network is still in testing stage. Although the paper represents the management of specialized blockchain – they could be easily scaled, because all endorsements are executed in the network. The problem with separation of transaction and user's identity is considered – through generalization of usage data. The information model represents Managed Objects classes with large granularity. They could serve for user interface development for Network Operators and Transaction Providers. The short-term viewpoint forecasts blockchain development as several business platforms.

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Recognition of Anomalies in the Knee Joint through Neural Networks

Irina Topalova¹

Abstract – The correct diagnosis of anomalies in the knee joint depends largely on the subjective assessment of the physician. This study proposed a method to support decision-making by training a neural network with X-ray images of a healthy and damaged knee joint. The MLP structure is optimized through choosing different MLP topologies and functional parameters. The presented results are discussed and steps for further development of the method are suggested.

Keywords – Diagnosis, Knee Joint, Neural Networks, Deep Learning

I. INTRODUCTION

The most common "reason" for knee arthroplasty are the advanced stages of degenerative disease of the knee joint. Replacement of the knee joint with an artificial one is applied in the advanced stages of knee injury, when the methods of conservative treatment (anti-inflammatory and analgesic drugs, physical therapy and physiotherapy, etc.) have exhausted their opportunities [1].

The anomalies can be seen on X-rays but they alone cannot always make a diagnosis. Instead, doctors may apply magnetic resonance imaging (MRI), which can provide detailed images of bones, [2], [3].

After receiving the images, an interpretation should be made in order to make a diagnosis. The correct diagnosis largely depends on the subjective assessment of the treating specialist. Therefore, the application of intelligent technologies / methods in the final evaluation is essential. The application of artificial intelligence, designed on the basis of neural network training is a prerequisite for independent evaluation of results and avoidance of wrong therapy [4].

This study proposes a method for diagnosing the knee joint, based on deep learning of a multilayer neural network with multiple X-ray images, in order to classify and diagnose "healthy/damaged" cases. Modern development of technologies for fast access to shared databases [5], allows for easy and fast retraining of artificial neural structures. This is an additional prerequisite for the modern dynamic development of methods and algorithms with the application of deeply trained neural networks.

II. THE PROPOSED METHOD

The proposed method involves pre-processing of X-rays obtained images of healthy and diseased knee joint. The pre-

processing aims to calculate the histograms of the images in gray levels. The histogram values are then reduced by selecting only every fifth histogram point. The 40 values, thus obtained form a parametric vector, which serves to supply

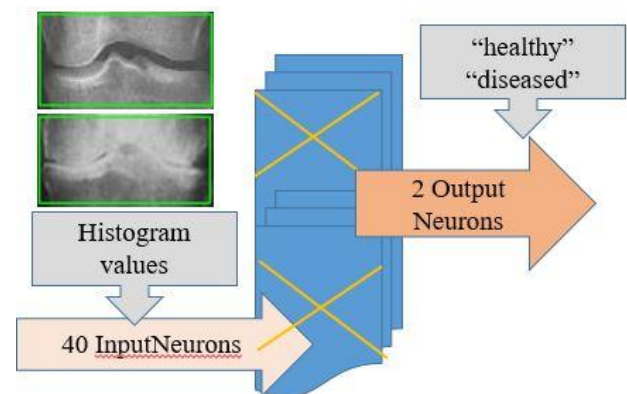


Fig. 1. Functional diagram of the proposed method

these values to the neurons in the input layer of the neural network. The topology of the neural network consists of an input layer and two hidden inner layers. The output layer of the neural network consists of two neurons that are activated according to the recognized class of "healthy / damaged" knee joint. The functional diagram of the proposed method is shown in Fig.1.

A. Selection of input train and test images

The chosen train images for the "health" and "damaged" samples are shown in Fig.2 and Fig.3 respectively. The neural network was supplied with same images in the test (recognition) phase of the neural network, but with added different kind of noise. To some images 5 Pixel or 10 Pixel blur noise was added. To other images 10% to 15 % median or 20% Gaussian filter was added. The histograms of these noisy images were applied in the test phase of the neural network.

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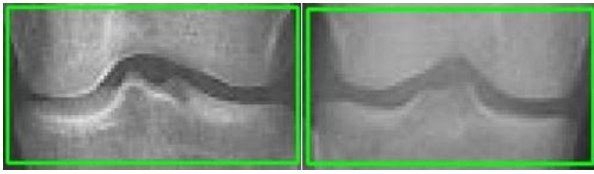


Fig. 2. Train image samples for two “health” knee joint

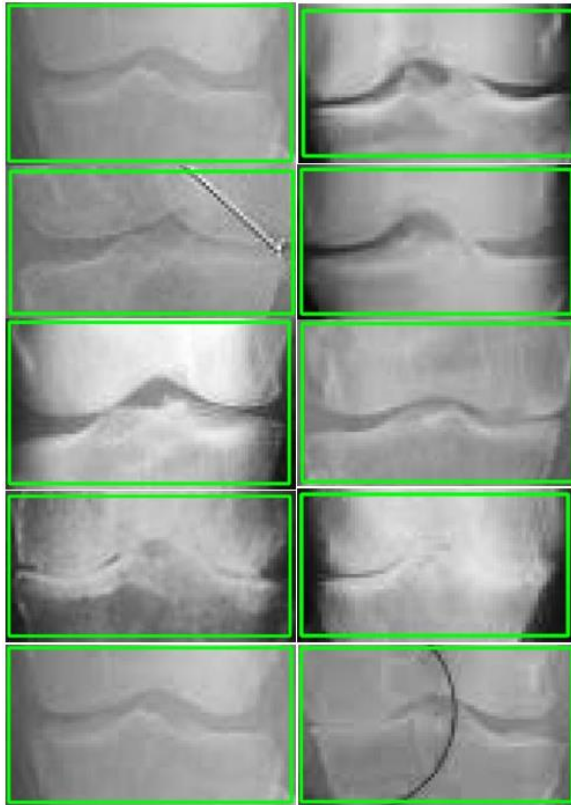


Fig. 3. Train image samples for “damaged” knee joint

III. EXPERIMENTAL RESULTS

The calculated histograms of the two „healthy“ knee joints and of many images of „damaged“ knee joints are shown in Fig. 4 and Fig.5 respectively. The sampled 40 histogram values are prepared for feeding the Multi-Layered-Perceptron (MLP) structure. The structure has a four-layered topology, which was trained in two cases. In the first variant with topology 40-20-10-2, with a given mean square error (MSE) at the outputs of the network $MSE = 0.8\%$, after 1026 iterations, the achieved recognition accuracy was not satisfactory. Therefore, the structure was optimized with topology 40-25-15-2, with a given MSE error at the outputs of the network $MSE = 0.1\%$. In this case, after 1632 iterations, the accuracy achieved as an absolute value was $= 0.0813764$. Fig.6 represents the convergence of MSE error in train phase of MLP structure of 40-25-15-2. Fig. 7 shows the surface change of output.

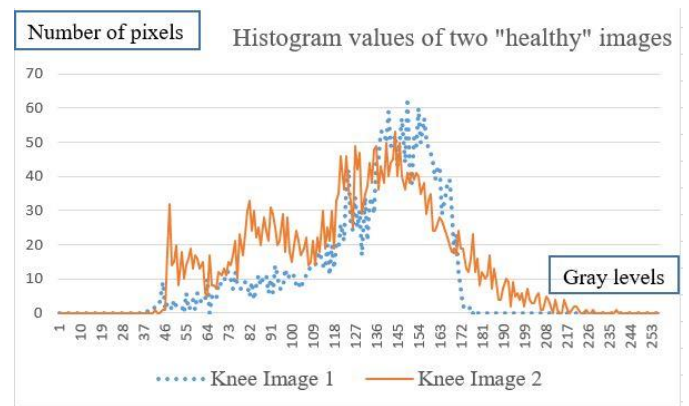


Fig. 4. The obtained histograms of two „healthy“ knee joints (shown in Fig.2)

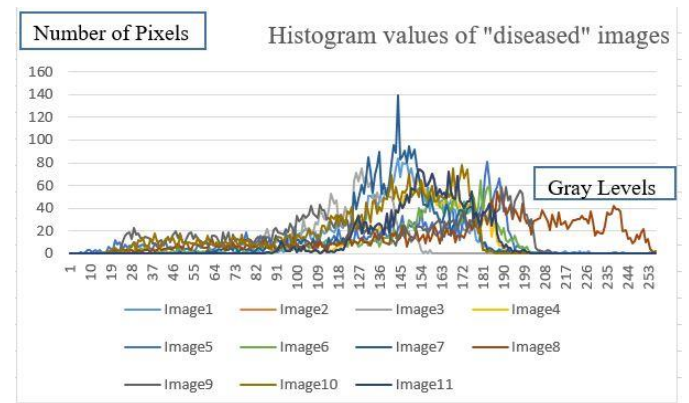


Fig. 5. The obtained histograms of many images of „damaged“ knee joints (shown in Fig.3)

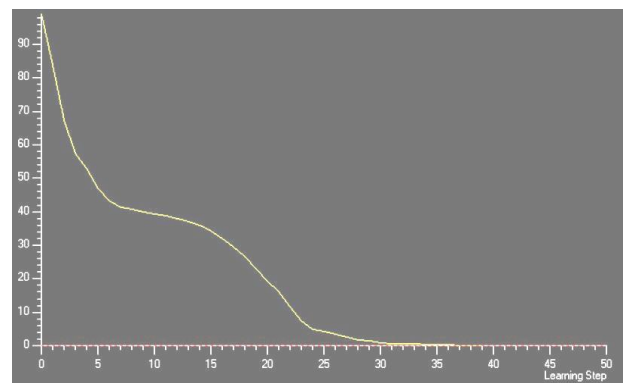


Fig. 6. Convergence of MSE error in train phase of MLP structure of 40-25-15-2

Neuron 1 depending on the variations and combinations between the values of two of the input histogram values. Fig. 8 shows the surface change of output Neuron 2 depending on the variations and combinations between the values of two of the input histogram values.

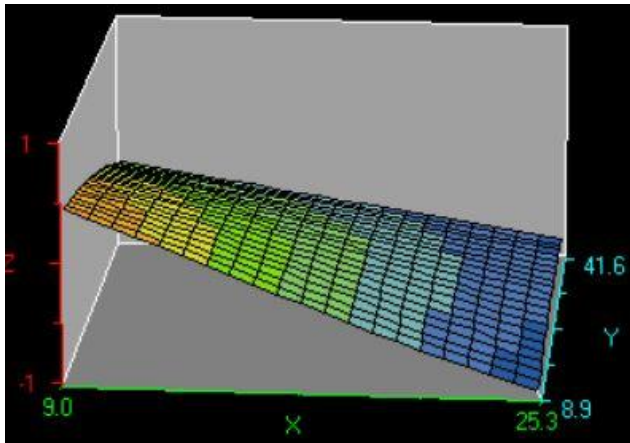


Fig. 7. 3D surface change of output Neuron 1 depending on the variations and combinations between the values of two of the input histogram values X and Y

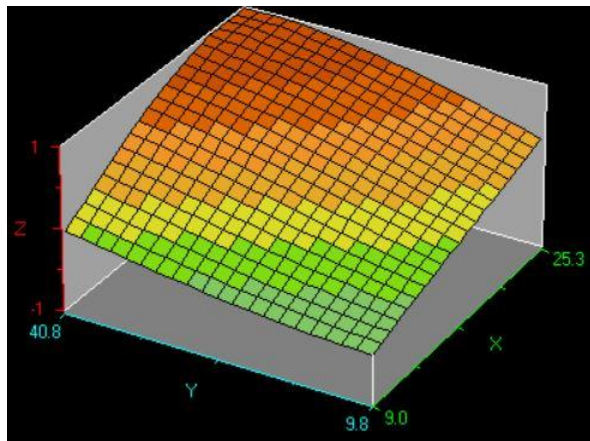


Fig. 8. 3D surface change of output Neuron 2 depending on the variations and combinations between the values of two of the input histogram values X and Y

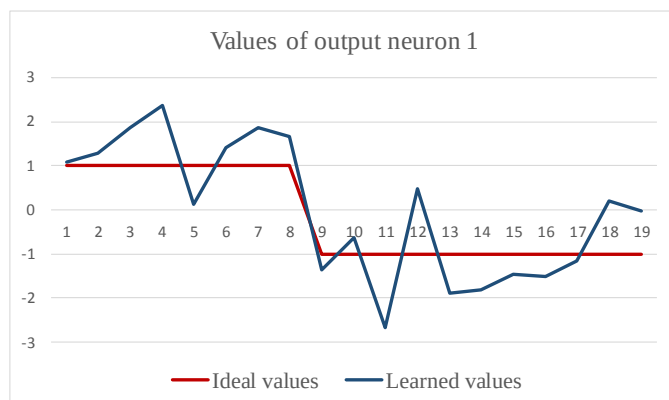


Fig. 9. Values of output Neuron 1 when testing 8 “healthy” and 11 “diseased” knee joint images (MLP topology 40-20-10-2)

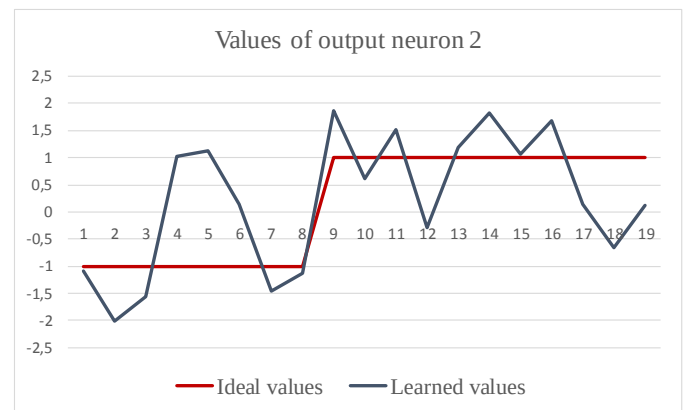


Fig. 10. Values of output Neuron 2 when testing 8 “healthy” and 11 “diseased” knee joint images (MLP topology 40-20-10-2)

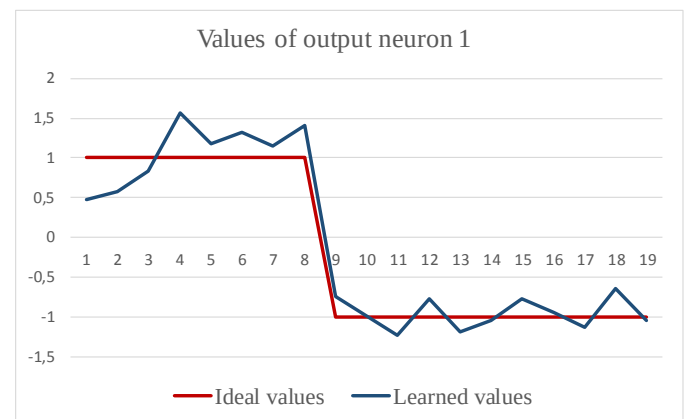


Fig. 11. Values of output Neuron 1 when testing 8 “healthy” and 11 “diseased” knee joint images (MLP topology 40-25-15-2)

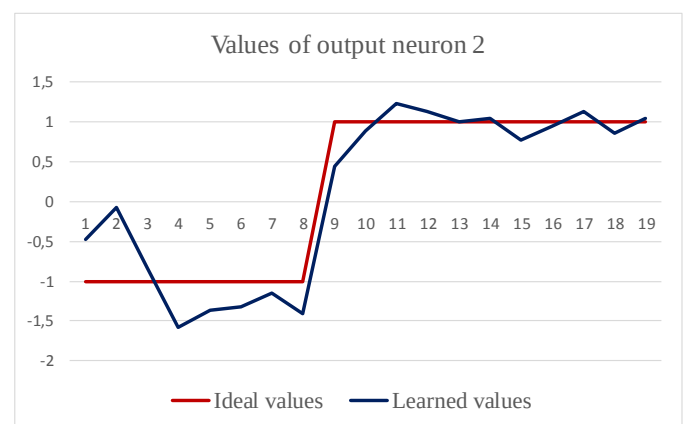


Fig. 12. Values of output Neuron 2 when testing 8 “healthy” and 11 “diseased” knee joint images (MLP topology 40-25-15-2)

The obtained recognition accuracy results according to the chosen MLP parameters are given in Table 1. Obviously, the topology with an increased number of neurons in the two inner / hidden layers gives a better result in terms of the achieved recognition accuracy. Another source of improved

accuracy is the lower value of the set MSE in the topology with the increased number of neurons in the inner layers [6]. The recognition accuracy is calculated for each of the two neurons, according to the difference between the ideal values assigned to the output neurons of the MLP network and the corresponding values obtained in the testing phase.

TABLE I
MLP PARAMETERS AND RECOGNITION ACCURACY OF OUTPUT NEURONS N1 AND N2

MLP structure	Epochs	MSE	Recognition accuracy- N1	Recognition accuracy- N2
40-20-10-2	1026	0.8%	0,2001078	0,2338544
40-25-15-2	1632	0.1%	0,0651664	0,0813764

IV. CONCLUSION AND FEATURE WORK

Tests performed to recognize real X-ray images of the knee joint, in order to diagnose anomalies and the results obtained show that neural networks can give a good result in terms of recognition accuracy. In this way, some incorrect subjective assessments of knee joint damage can be reduced. The method could be helpful to the physician in assisting his decision making a correct diagnosis.

As a further continuation of this study, a generalization of the method should be realized. To achieve this goal, it is necessary to conduct tests with a larger training sample of images, as well as a larger number of test images.

Another idea for optimizing the method and achieving stability in terms of recognition accuracy is the possibility of including in the input parametric vectors additional to the

histograms parameters determining, the state of the knee joint.

Connecting more neural networks in a hierarchical structure, including a self-learning network of the Kohonen type, would lead to an interesting study involving additional parameters from biological studies of the knee joint.

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Deep Neural Network Based Processing of Medical Records in Cloud Environment

Strahil Sokolov¹

Abstract – In this paper an approach is proposed for design of cloud based systems for processing of electronic medical records (EMR) based on Deep neural networks. An automated or quasi automated system utilizing cloud computing resources is able to aggregate patient data, process it and store it securely. Medical records are usually received via established communication channel and can contain scanned documents that need to be processed and interpreted. Optical character recognition (OCR) is performed on scanned documents, natural language processing using deep learning is then used for the recognized text. The parsed data is stored in the cloud object storage of the system. The proposed cloud environment is modular and has scaling capabilities in terms of computing resources, networking and storage. The architecture consists of cloud components distributed in several layers and is aimed to achieve high availability in public, hybrid and private cloud environments.

Keywords – Deep Neural Networks, Cloud Systems, Medical Records

I. INTRODUCTION

The ever growing volumes of data are driving the Big Data field forward. In recent years the Health sector is constantly incorporating modern technology tools for managing large volumes of patient records. There are examples where expert systems or automated patient classifications are used. The availability of electronic patient records (EMR) is substantial. This type of record is the base for advanced analytics and AI-supported clinical research. There are use cases where the unstructured nature of the EMR involves significant effort to extract meaningful attributes for further research.

The authors [1] used text mining with machine learning to enable automatic classification of unstructured information on smoking status from local EMR data. The use of electronic medical records (EMR) has been increasingly adopted during the past 20 years and is used nowadays in most first world countries for documentation of patient care. EMR data are an integrated part of healthcare to facilitate the sharing of information between healthcare practitioners and document the care of patients, but can also be a source for theoretical research and natural evidence. Data on many important patient attributes are typically only captured in free text fields as case notes in special sections in the EMR systems (Fig. 2). Such unstructured properties of EMR data are the real challenge for real-world-evidence (RWE) and clinical research. The introduction of advanced analytics like machine learning (ML) combined with methods for text mining and algorithms delivers the potential solution for more efficient use of unstructured EMR data for medical research.

Developing algorithms for automatic classifications of patient characteristics, exposures such as smoking, or disease status in defined categories may allow for easier access to real-world data for studies of safety, efficacy, and potentially improved treatment patterns of pharmaceutical substance use in everyday clinical practice. The authors also reported that their machine-learning model performed best with Support Vector Machines (SVM) and Sequential Minimal Optimization (SMO) classifier an reported training set accuracy if over 98% compared to lower accuracy of a rule-based model.

The field of automated EMR processing has attracted many researchers from the commercial area. This can be seen by recent patents filed by famous companies. The inventors [7] claimed a system in which doctors orders are automatically processed. Rather than requiring entry with a user interface in a computerized order entry system, physician orders may be handwritten on a piece of paper or entered on another handwriting device. The orders are scanned or transmitted to their destination. Using a lexicon limited to the Vocabulary of possible orders, handwriting recognition is applied to the scanned order. By limiting the lexicon, the accuracy of the optical character recognition is expected to improve. The lexicon is reported to be further limited by determining a diagnosis and/or treatment or imaging modality for the patient and selecting a lexicon limited to orders associated with the diagnosis or modality. The recognized order is then implemented by an automated computer order entry system.

Recent studies in toxicology [4], [5] show that there is interest in extracting meaningful nutritional data, food supplement use and related medicine usage. The researchers aim to show that there may be a quantitatively measurable risk by a correlation between nutrient toxicants and health issues in Europe.

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Researchers in natural language processing is dealing with the interpretation of the data extracted from EMR text fields. The authors [10] claim to have built a system for decision support that is able to provide medical decisions. It extracts five types of features associated with infection and achieves a decent performance on automatic infection detection based on machine learning models.

Processing of the EMR extracted data in the cloud requires efficient algorithms and approaches which are able to focus on relevant features and make precise classification of the inputs in a computationally efficient way. With the recent focus of deep learning methods, especially long short-term memory (LSTM) neural networks, there have been a number of interesting applications [3]. The true value of deep learning methods [2] in traffic event forecasting is similar to the feed which the sensor data is providing from weather station. There is a need, according to the authors that these methods need to be further exploited in terms of the depth of the model architecture, the spatial scale of the prediction area, and the predictive power of spatial-temporal data.

The authors have proposed a deep stacked bidirectional and unidirectional LSTM (SBULSTM) neural network architecture is proposed, which considers both forward and backward dependencies in time series data, to predict network-wide traffic speed [2]. A bidirectional LSTM (BDLSM) layer is utilized to capture spatial features and bidirectional temporal dependencies from historical data. The authors propose a model which is able to handle missing values in input data by using a masking mechanism. Their model is scalable model and is applied on complex networks.

The rest of the paper is organized as follows: In section II the proposed design Cloud architecture and its components is described; Section III provides details on the used approach for EMR structured data processing; Section IV describes the approach for enhancing the performance of the system by using the selected components in comparison to traditional techniques; In Section V are listed experimental results and discussion.

II. CLOUD ARCHITECTURE DESIGN FOR MEDICAL RECORDS PROCESSING

The proposed architecture is depicted on fig. 1 and provides an overview of the concept. It consists of several layers: The EMR records source which is usually the medical database of a hospital or clinic sends data over the Load Balancing component to the services located in a highly available Kubernetes cluster. The service modules are installed in Docker containers. The applications which run in Docker container have a small footprint and are relatively resilient. The bottom layer is the persistence layer and it is based on CEPH storage. It provides unmatched object storage, high availability and low cost of operation compared to many of the products which we have had experience with so far. More details will be provided below.

Below are some of the features which we are aiming to achieve via our design by incorporating elements of Cloud

Computing technology for processing of EMR and overcome some of the challenges that have been presented in the previous chapter:

- Storage over Internet

One of the features of the proposed architecture is that we achieve Storage provisioning through Software Defined Storage (SDS) mechanism [7]. The core technology which enables the persistent storage for the weather-station data and for the data processing algorithms storage is CEPH [7], [8], [11]. Ceph is an open-source software storage platform that implements object storage on a single distributed computer cluster, and provides simultaneously interfaces for object-, block- and file-level storage. Its main goal is completely distributed operation without a single point of failure, scalable to exabyte level, and freely available. Ceph replicates data and makes it fault-tolerant, [12] using off-the shelf hardware and requires no specific hardware support. The resulting storage subsystem is by design self-healing and self-managing with additional minimization of administration time and other costs.

- Service over Internet

The usage of Docker containers to provide backend services for data processing, presentation services for the processing results, our goal was to achieve high availability and continuous integration and delivery of the services. Docker containers being lightweight and faster than virtual machines are able to provide this type of flexibility [12], [10]. The applications that perform the weather-station data processing are Python based; they run in Docker containers and use the persistence storage layer to read the input values and store the predictions.

- Applications over internet

Our loadbalancing layer is based on haproxy [9]. HAProxy is free software and open source. It is the tool which provides high availability load balancer service in our architecture. for TCP and HTTP-based applications. It is able to distribute requests across multiple backend servers using high performance algorithms and is written in C. This makes this software famous for being fast and efficient.

- Computationally capable

The designed subsystem for weather station data processing is able to handle massive amounts of data fed by the weather stations. It is based on scalable architecture [10]. For automation of the environment while handling greater workload, we have used Red Hat® Ansible®. It is a famous IT tool for automating repetitive tasks that transforms inefficient tasks of software release cycles into predictable, scalable, and simplified processes [9]. It is used in our design to provide automation for configuration management, application deployment, cloud provisioning and service orchestration.

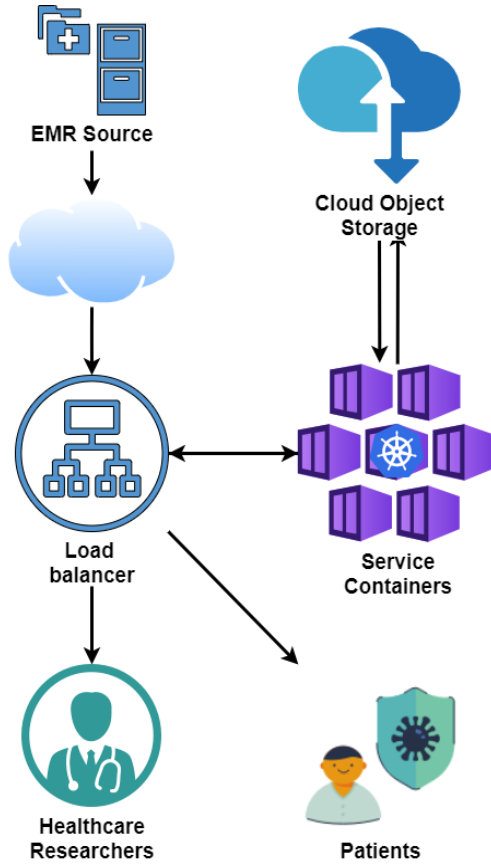


Fig. 1. Cloud environment components and data flow

III. STRUCTURED EMR DATA PROCESSING WITH DEEP NEURAL NETWORK

The proposed architecture relies on the LSTM scalable model [7] to process the input data and provide forecasting for the coming intervals of time. Each value or feature (such as temperature, solar radiation, wind speed) discrete time series from the used sensors can be represented as a vector with n historical steps:

$$X^f = [X_{T-n}, X_{T-n-1}, X_{T-n-2} \dots X_{T-2}, X_{T-1}] \quad (1)$$

Where f is the f -th feature, T is the value of the feature at time T . The prediction of the values at the time T will be represented by the following matrix:

$$X_T^P = [X^1 X^2 X^3 \dots X^P]^T \quad (2)$$

where P is the number of measurements which are provides by the weather station.

Thus, the current snapshot of the data at time T will be designated as (3):

$$X_T^P = \begin{bmatrix} X^1 \\ X^2 \\ \vdots \\ X^P \end{bmatrix} = \begin{bmatrix} X_{T-n}^1 & X_{T-n+1}^1 & \dots & X_{T-2}^1 & X_{T-1}^1 \\ X_{T-n}^2 & X_{T-n+1}^2 & \dots & X_{T-2}^2 & X_{T-1}^2 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ X_{T-n}^P & X_{T-n+1}^P & \dots & X_{T-2}^P & X_{T-1}^P \end{bmatrix} \quad (3)$$

RNN is a class of powerful deep neural network using its internal memory with loops to deal with sequence data. The architecture of RNNs, which also is the basic structure of LSTMs. For a hidden layer in RNN, it receives an input vector X_T^P , and generates the output vector Y_T . RNNs exhibit the superior capability of adapting themselves to predict nonlinear time series problems [2]. Some of the RNNs are bound to reach the vanishing during the Backpropagation (BP) coefficient learning, and thus, become incapable of learning from long time lags, or keeping track of long-term dependencies. It is necessary to consider the above problems when using RNNs and use any of the advanced techniques to deal with them, such as the Long short term memory LSTM architecture and Gated Recurrent Unit (GRU) architecture. According to [3] LSTMs have been shown to work better on sequence-based tasks with long-term dependencies. GRU represents a simplified LSTM architecture being fairly new - is used in the context of machine translation. Out of the many existing variants of LSTM, we have chosen to use the proposed algorithm [8] for processing of the weather station data, i.e. standard LSTM architecture.

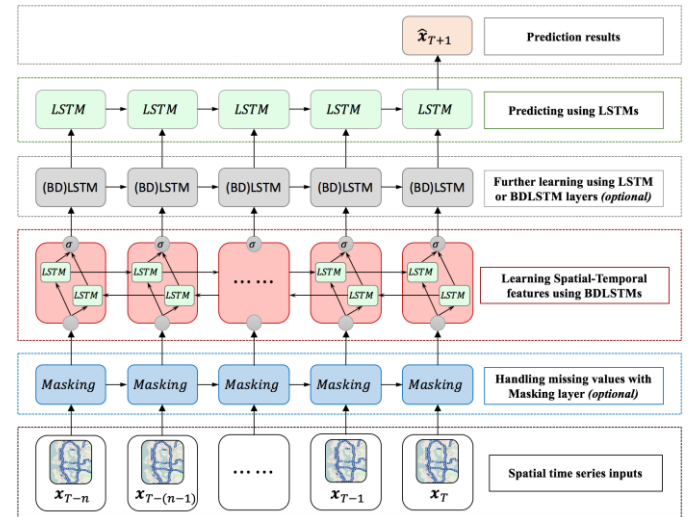


Fig. 2. Standard LSTM model [2]

The image shows a complex electronic medical record form from Bulgaria, 2020. It includes fields for patient name, date of birth, sex, and address. There are sections for medical history, current symptoms, and examination results. The form is filled with handwritten text and checkboxes, indicating a detailed medical record.

Fig. 3. Sample scanned electronic medical record (Bulgaria 2020) [16]

IV. PERFORMANCE IMPROVEMENT OF THE CLOUD INFRASTRUCTURE

The standard approach to building a software delivery process involves supporting a large number of virtual machines, with their own environments and versions. They must be constantly available, which means that they constantly occupy resources, even when they do not perform any tasks, but simply idle. With the proposed dynamic infrastructure, everything is exactly the opposite. Containers are used instead of regular virtual machines. The advantage is that many containers can run on a single virtual machine without much interference. The containers needed to perform a particular processing task – that can be scheduled – are created when they are required, rather than working constantly, borrowing resources. All versions and variables in the environment can be used dynamically, and after the task is completed, the created resources are destroyed. New ones are created as needed.

V. EXPERIMENTAL RESULTS AND DISCUSSION

To measure the performance gain while using of the proposed environment components in comparison to the traditional infrastructure, we have prepared an experiment of multiple deployments of the architecture on our private cloud infrastructure. The speedup which we were able to achieve of container-based deployment vs. virtual machine-based is more

than 2 times measured at up to 10 runs of the automated infrastructure deployment.

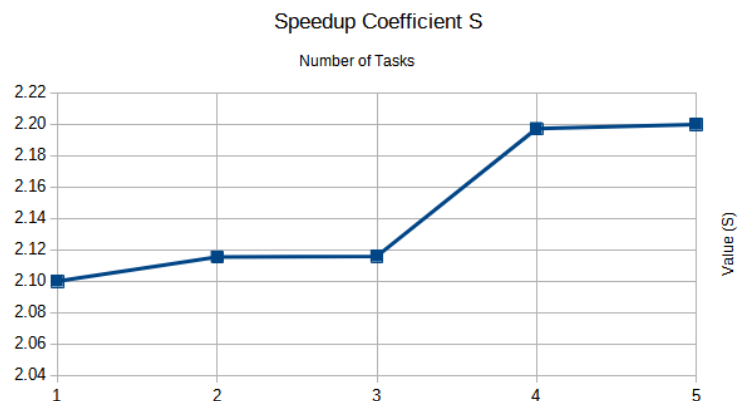


Fig. 4. Speedup coefficient with 10 runs of the deployed architecture

VI. CONCLUSION

A design was proposed for a cloud based system with deep neural network module for processing of electronic medical records that delivers automated processing of the received data, visualization and cloud storage. Two types of open source container virtualization techniques are compare for implementing data processing. It has been evaluated the performance and provided the set of criteria for choosing a container platform. Storing the data in the cloud is an important part and we provide considerations for implementing a particular open source platform that could reduce costs fulfill the requirements for medical data storage. The designed system is expected to be cloud-provider agnostic. The proposed features make the system especially suitable for medical research purposes. The future aim is to combine multiple algorithms based on deep learning and prepare an advanced medical analytics platform with knowledge extraction and service catalog.

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Methodology for Integration of Sensors Data in the Cloud

Filip Tsvetanov^{1,2}, Martin Pandurski²

Abstract – The cloud architecture for data storage is the primary work of cloud structures. Existing cloud storage providers are focus mainly on performance, cost issues, and multiple storage options.

Traditional computational approaches for processing the data received from sensor networks can be replaced by integrating them into a cloud structure by processing and analyzing the data with the appropriate software. Cloud structures provide significant benefits for network-hosted applications that also have special computing and storage requirements. By evaluating and connecting these sensor networks, real-time data conclusions can draw, trends can predict, and dangerous situations can be avoided.

This paper presents a flexible architecture for integrating wireless sensor networks into the cloud. Realized sensor data collection, sharing, and analysis using REST-based web services as an interoperable layer that can be integrated directly into other applications. A real sensor network built, from low-power temperature and light sensors, radio modules, routers, gateways, allowing self-management and use of software that analyzes the data collected from wireless devices through a professional development kit XBee ZB. A suitable cloud has is selected.

A methodology for the integration of sensor data in the cloud is proposed, providing an opportunity for on-line access and analysis of incoming data based on ZigBee 802.15.4 technology. We believe that the implementation of this methodology will be a useful tool for acquiring practical knowledge and skills for the construction of sensor networks and the implementation of modern information technology in the field of telecommunications by students of the Department of Telecommunications.

Keywords – Integration, Internet of Things, Cloud, REST, Wireless Sensor Network, XBee

I. INTRODUCTION

One of the essential elements in the Internet of Things paradigm is the usage of wireless sensor networks (WSNs). These networks consist of intelligent sensor units with built-in processors, low-power radio transmitters, and sensors used to monitor environmental conditions such as temperature, pressure, humidity, vibration, and energy consumption [1]. The importance and the purpose of any sensor network are to provide sensor services to users. Cloud structures are a convenient way to do this. Clouds are flexible, powerful, and cost-effective technology for delivering real-time data to users at all times with great coverage and quality. Cloud structures consist of hardware, networks, services, storage, and interfaces that allow cloud structures to provide as a service [2 C. Alcaraz, P. Najera, J. Lopez, and R. Roman]. Also, it is possible to upload data received from wireless sensor nodes to Web services based on Representational State Transfer (REST) using messaging mechanisms such as HTTP. By evaluating and connecting these sensor networks, real-time data conclusions can draw, trends can be predicted, and dangerous situations can be avoided.

The authors in [3] present their results from the design,

development, and integration of an application using WSN with cloud database platforms. Where the information graphics of different data streams can be displayed, accessible, and shared from anywhere with an internet connection.

The authors in [7] analyzed the wireless technologies, including 3G / 4G, WiFi, LoRa1, and Zigbee, used to build wireless sensor networks, as well as the factors on which the choice of the wireless interface depends. An architecture for the integration of BSM based on IoT technology in a cloud structure proposed.

The data collected from the sensor nodes can be processed, stored, and analyzed on different platforms. The platforms can be with different access Free, Commercial, Open Source, and for different operating systems such as Windows, Mac, Web, iPhone, iPad. Popular platforms for sensory data integration are <https://thingspeak.com/> ThingSpeak™, TFB DS-Log 4.0 IoT, Android Things, Beebotte, DataGekko, The IoT Guru, t6 IoT, Ubidots, AskSensors, Corlysis, IoThook, IoT- Ignite, IoTPlotter, Horavue, thethings.io, Acronis® Cyber Backup, Best Backup Software, dweet.io, Xively, and others.

This article describes the built-in real sensor network of low-power temperature and light sensors, radio modules, routers, gateways, allowing self-management, and the use of software that analyzes the data collected by wireless devices. A professional XBee ZB development kit was used, providing hardware and software tools that allow the rapid deployment of a real network of ZigBee devices and their integration into a cloud structure. A suitable cloud has selected. A methodology for the integration of the sensor network in the cloud proposed. The work aims to implement the proposed

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methodology in the teaching process in the discipline "Sensor Networks."

II. ARCHITECTURE SENSOR NETWORK

The architectural model of the sensor network is composed of three layers, according to Fig.1 [3].

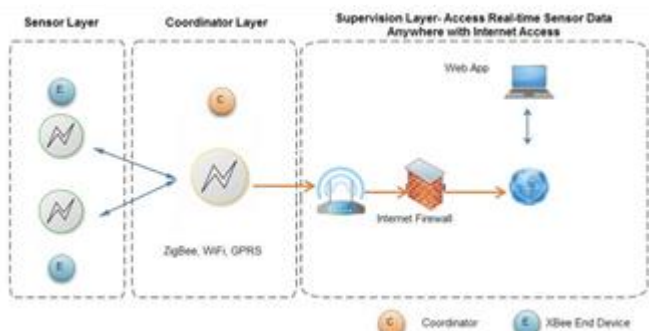


Fig. 1. The architecture of the sensor network

The physical construction of the low power network realized by XBee ZB modules shown in Fig. 2. [11]. A professional XBee ZB kit, shown in Figure 2, was selected, which provides hardware and software tools that allow rapid deployment of a real network of ZigBee sensors and devices [4, 5, 8, 11]. The set includes two XBee modules, one ConnectPort X gateway, one XBee router, Software, Cloud platform, and Accessories.



Fig.2. XBee ZB modules

All hardware components are compatible with the application, which optimized for measuring light and temperature through the router by measuring light and temperature, the router used in a variety of applications, conditions, and environments. Besides, the data received from the router sent to ConnectPort X4 [8], connected to the Internet and uploads the data to the Digi Cloud Platform and ThingSpeak.

A. XBee modules

XBee modules are small radiofrequency devices that transmit and receive data over the air using radio signals. The ability to connect wirelessly is essential when we want to place sensors in places where cables cannot install or where such a connection is undesirable [6, 7]. XBee devices are easily configurable and support multiple protocols, which allows them to use in a variety of applications - from tuning a pair of radios for data exchange to designing a large mesh network with multiple devices [6, 7].

B. Wall Router

The Digi XBee Wall Router used as a network extension that creates the "backbone" of the wireless network or extends the range of the wireless network so that other network devices can communicate with each other seamlessly. The XBee Router used in conjunction with all other devices, such as a gateway or Xbee modules with a compatible XBee RF protocol for data collection and IP connection [6, 7]. It also serves to create multiple pathways, increasing the resilience of network communications to ensure maximum network reliability. In addition to the wireless network extension, the XBee Wall Router also includes integrated temperature and light sensors. Customers using ConnectPort X gateways can retrieve data from these sensors.

C. XBee sensors

XBee Sensors read real-time data, such as temperature, humidity, and light. This data can be retrieved and transmitted via wireless communications in the XBee network infrastructure. Applications include building automation, environmental monitoring, security, and more. XBee sensors used with ConnectPort X gateways, built-in Xbee modules, and other network accessories for XBee end-to-end networks without the need for network infrastructure [6, 7]. There are currently two options available for the XBee sensor:

- XBee Sensor / L / T: Built-in light and temperature sensors;
- XBee Sensor / L / T / H: Built-in light, temperature, and humidity sensors.

D. Gateway ConnectPort X4

The ConnectPort X4 has many features and applications, but in our project, we have focused only on its functions for viewing and changing the type of nodes and radio settings of XBee in their XBee network [8].

The free code ThingSpeak™ cloud structure is selected. The service of the platform for the analysis of incoming data from IoT devices has many advantages, such as the ability to aggregate, visualize, and analyze live data streams in the cloud. The execution of MATLAB® code in ThingSpeak allows for on-line analysis and processing of data coming from the sensors.

III. METHODOLOGY FOR INTEGRATION SENSORS NETWORK INTO A CLOUD

First: Configuration of Xbee modules

The configuration of the Xbee modules is done mainly through the menu of ConnectPort X4 and, more precisely, the XBee Network page, as shown in Fig.3. In this page, we can find the Node Type column, through which we can select a node and change certain of its characteristics, such as encryption, PAN ID, and others. The Node Type column shows the role of devices (nodes) in the network, which depends on the XBee RF protocol.

Select a device to configure:

Node ID	Network Address	Extended Address	Node Type	Product Type
[0000]	!	00:13:a2:00:40:47:6b:c9!	coordinator	X4 Gateway
[35b3]	!	00:13:a2:00:40:47:e0:d7!	router	X-Stick
[9eab]	!	00:13:a2:00:40:5c:2d:b4!	router	Wall Router
[406a]	!	00:13:a2:00:40:a2:41:98!	end device	Unspecified
[55e7]	!	00:13:a2:00:40:cc:06:85!	end device	Unspecified

1 coordinator, 2 routers, 2 end devices

Fig.3 Configuration of Xbee modules

Second: Additional network and communication settings of the devices (Fig. 4).

These settings include firmware type, encryption, PAN ID, the connection of nodes to the network and others, using XCTU software [6, 7].

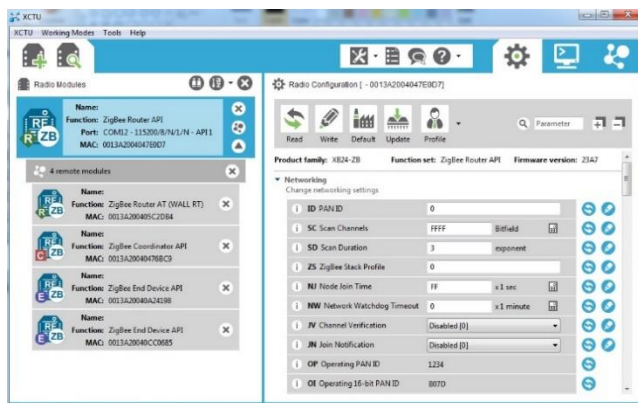


Fig.4 Configuration of Xbee modules with XCTU

Third: Development of iDigi Professional project

Using the Digi ESP software, we can generate the Dia framework software package containing all the files (containing codes) needed for this kit. The main file of the project is dia.yml, which created in Digi ESP for Python software, Fig.5. The essential configurations made in the file. It contains all the elements (devices, services, etc.) involved in the project. The main components used are a gateway, router, sensors, web services, etc. [9, 10].

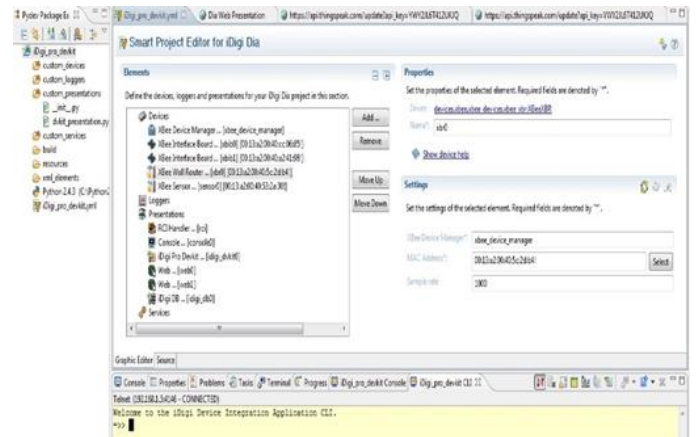


Figure 5. Settings in the dia.yml file

Fourth: Setting up the Gateway

The gateway is accessed to make its settings by entering the IP address of the gateway in the browser, which by default is 192.168.1.1, although the actual address may vary. The home page of the device contains several options for configuration and management, fig.6. The XBee Network option gives access to the configuration of the Xbee modules, such as changing the PAN ID. In the File Management menu, we can add files to the gateway. In our project, we add XIG to the gateway file system to access external web services. XIG (XBee Internet Gateway) is an XBee Internet gateway for Digi ConnectPort X devices. XIG allows us to obtain URLs and ultimately connect to web services and applications [9, 10]. For additional network and communication settings, we use the XCTU software [10].

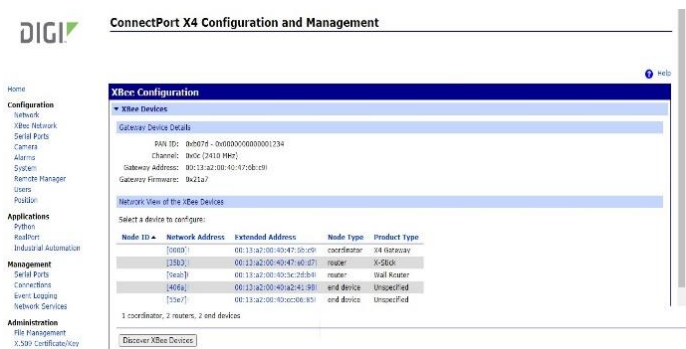


Fig.6. XBee gateway configuration menu

Fifth: communication between the gateway and the iDigi platform

To communicates the Gateway and Digi platform; it is necessary to register on the site of the service provider, Fig.7. To do this, select the gateway configuration, and select the Connect to devise option using the iDigi platform [9, 10]. iDigi's connectivity to the gateway ape tested using the Digi ESP for Python software and the Channel Explorer tool. In the

iDigi platform, you can monitor the status of the gateway and the devices connected to it, on-line.

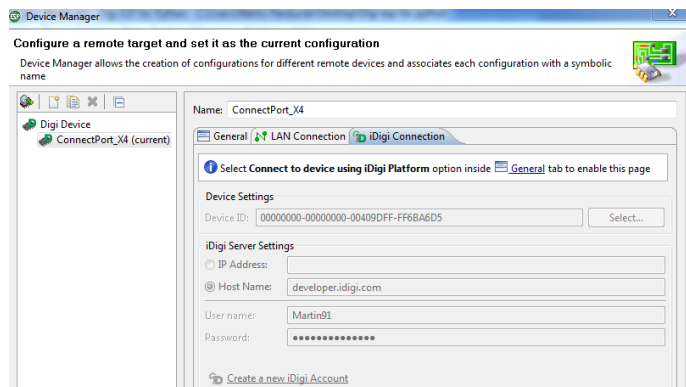


Fig. 7. Registration in the iDigi platform

Sixth: Create iDigi Client Applications

Once the project is started and communication with iDigi established, it is possible to create custom applications for remote monitoring and interaction with the running iDigi or python project. This type of application is called iDigi Client Applications.

For the iDigi Professional Development Kit, there is a personalized client application built into the flash, allowing remote monitoring and interaction with the project. To use it, we need to enter our credentials from the iDigi account [9].

start retrieving data and presenting it graphically, Fig. 8. We can now interact with our XBIB modules and light/temperature sensor remotely using the appropriate controls.

The light and temperature sensor provides a histogram with the latest values obtained from iDigi. You can access it by clicking on the light or temperature icon, according to Fig. 9.



Fig. 9. Histogram of the iDigi Professional Development Kit application



Fig. 8. Launch the iDigi Professional Development Kit application

Once logged in, select from the list of connected devices, our ConnectPort X4, where the iDigi Professional Development Kit project is running [9]. The application will

Eighth: Connect wireless XBee networks to the ThingSpeak cloud via ConnectPort X4 and XIG

ThingSpeak is an open-source Internet of Things application and API for storing and retrieving data from devices using HTTP / MQTT over the Internet or a local area network. With ThingSpeak, we can create apps for sensor registration, location tracking with constant updating of data status. After installing XIG on Connect port X4, it can allow other connected XBee to communicate with the Internet [12].

In this project, we consider the possibilities of using ConnectPort X4 to allow access to web services over a wireless network formed by XBee Series 2 modules. To retrieve web data, we need to upload the XIG Python script to ConnectPort X4. The XIG script developed by Digi and allowed URLs to be downloaded using the HTTP GET method. The XIG script provides the ability to link ThingSpeak URLs to sensor data, analyze data from any website using ThingHTTP, and more. By supporting the HTTP GET method, XIG performs cloud-based data logging without having to run a PHP script. The realization of the whole project is presented by a block diagram, presented in Fig.10.

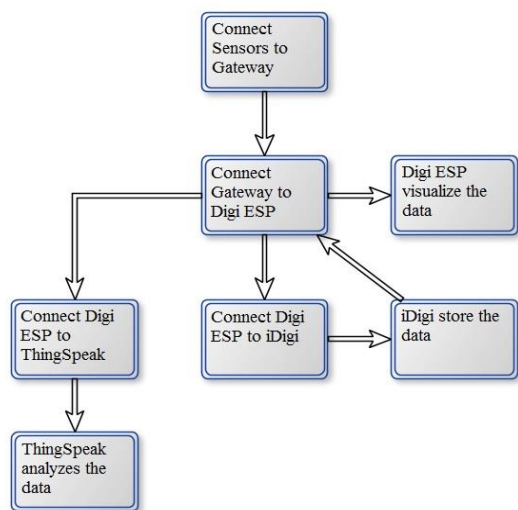


Fig. 10. Block diagram

Ninth: visualization and analysis of measurements

The visualization on the graphs can be indifferent detail, Fig.11. Using one of the Matlab visualization options in ThingSpeak, we can use a histogram to understand the variations in the data or to visualize the directed data with a compass Fig.12.

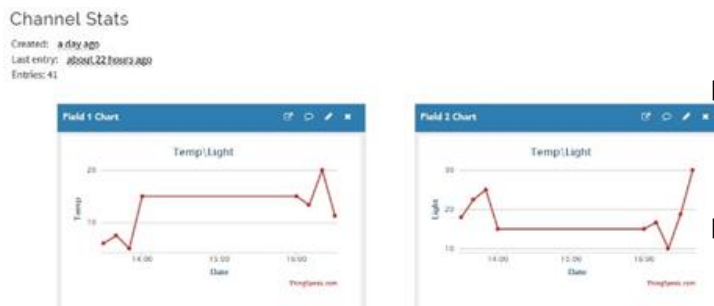


Fig. 11. Results of data measurements in ThingSpeak

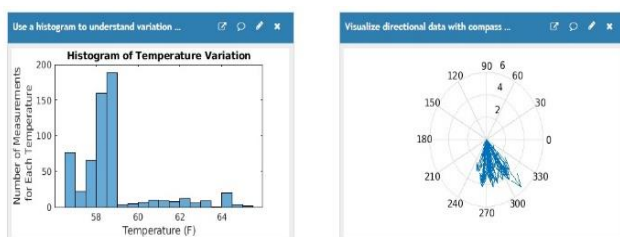


Fig. 12. Matlab preview options in ThingSpeak

IV. CONCLUSION

We presented a flexible architecture for integrating wireless sensor networks into a cloud for sensor data collection and sharing using REST-based web services as an interoperable layer that can be integrated directly into other

applications. We used intelligence in different architectural layers to avoid data loss and network disruption due to the Coordinator's failure.

A methodology for integrating the sensor data in the cloud is proposed, providing an opportunity for on-line access and analysis of the received data. We believe that the implementation of this methodology will be a useful tool for acquiring practical knowledge and skills for the construction of sensor networks and the implementation of modern information technologies in the field of telecommunications.

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Predictive Models with Spatial Data and Python Programming Language

Lyubena Nacheva-Grigorova¹, Mariyana Dimitrova-Stoitseva¹, Egnar Ozdakililer²,
Hristo Spasov¹ and Nevyan Pekov¹

Abstract – The COVID 19 pandemic, also known as the corona virus pandemic, is an ongoing pandemic of corona virus disease 2019 (COVID 19) caused by severe acute respiratory syndrome corona virus 2 (SARS CoV 2). In this paper is investigated the evolution of COVID-19, a comparison is made between Bulgaria, Italy, Turkey and worldwide. A machine learning models with Python programming language are made to predict the confirmed, recovered and death people from this disease.

For the purposes of the research are used statistical datasets from Our World in Data and John Hopkins University. A predictive models are created to provide further information of Covid-19 evolution of confirmed, deaths and recovered cases for Bulgaria, Turkey, Italy and worldwide. Prediction is created with Python programming language and used an open source library Prophet to trace the trend of confirmed cases of Covid-19 from 31th December 2019 to 8th September 2020.

This paper highlighted the importance of using spatial databases visualization and the machine learning predictive models in our life. We have showing that using the updating data in spatial area is an instrument for solving different problems. Python programming language provides powerful tools for different purposes and use cases.

Keywords – COVID-19, Machine Learning, Spatial Database, Python Programming Language

I. INTRODUCTION

The COVID-19 pandemic, also known as the coronavirus pandemic, is an ongoing pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was first identified in December 2019 in Wuhan, China. This research constitutes a relatively new area which has emerged from this pandemic.

One of the major topics to be investigated in this field is how to visualize the increasing amount of data for the Covid-19 cases, deaths or recovered people, spreading all around the world.

The main problem is that it is necessary to predict number of infected people. In this report we are investigating the evolution of COVID-19 and it is made comparison between Bulgaria, Italy and Turkey. Finally, everything is shown on a world scale. One way to overcome these problems is to use machine learning model with Python programming language. We are using its possibilities to predict confirmed, recovered and deaths cases from this disease.

II. PURPOSED METHOD

The main purpose of this report is to trace the evolution of COVID-19 between Bulgaria, Italy, Turkey and worldwide, as well as to create predictive models of the total confirmed, recovered and deaths cases in Bulgaria and worldwide. The period used for data analysis is: 31.12.2019 - 08.09.2020.

For the research are used freeware Python environments Google Colab[1] and Jupyter notebook[2], datasets from Our World in Data[3] website and Johns Hopkins University[4]. For the analysis and experimental prediction in this research partially used and modified the source code from Edureka[5, 16].

2.1. Workflow:

Several statistical datasets are used to visualize and predict the research of COVID-19 evolution. For some of the analyses are made datasets extracted from the main statistical data (Fig. 1). The statistical DataFrames and spatial datasets are read with *Pandas* [6] – powerful, fast and flexible open source data analysis and manipulation tool, built on top of the Python programming language.

For the visualizations of analyses, prediction and map is used *Plotly Express*. *Plotly Express* [7] is a new high-level Python visualization library: it's a wrapper for *Plotly.py* that exposes a simple syntax for complex charts.

The *plotly.express* module (usually imported as *px*) contains functions that can create entire figures at once, and is referred to as Plotly Express or PX. Plotly Express is a built-in part of the *plotly* library, and is the recommended starting point for creating most common figures. Every Plotly Express

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function uses graph objects internally and a `plotly.graph_objects` figure instance [8].

The software package used to work with countries' names and countries' codes is *Pycountry*. It provides the ISO databases for the standards of world countries' codes.

To show valuable visualizations of the results is used *Choropleth Maps* in Python. A [Choropleth Map](#) [9] is a map composed of colored polygons. It is used to represent spatial variations of a quantity.

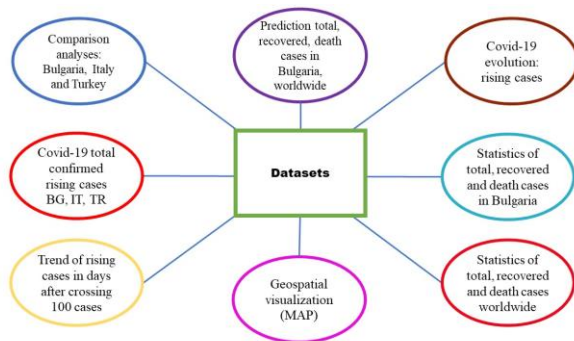


Fig. 1. Workflow of the process

2.2. Comparison analyses between Bulgaria, Italy and Turkey

A comparison analysis of confirmed cases is made between Bulgaria, Turkey and Italy. The results are visualized on (Fig. 2) where x = timeframe for the period between 31.12.2019 - 08.09.2020, y = number of total confirmed cases by date. The result from analysis shows that Turkey is leading country with 284943K confirmed cases, on second place is Italy with 278784K, as well Bulgaria is on third place by number of confirmed cases 17435K.

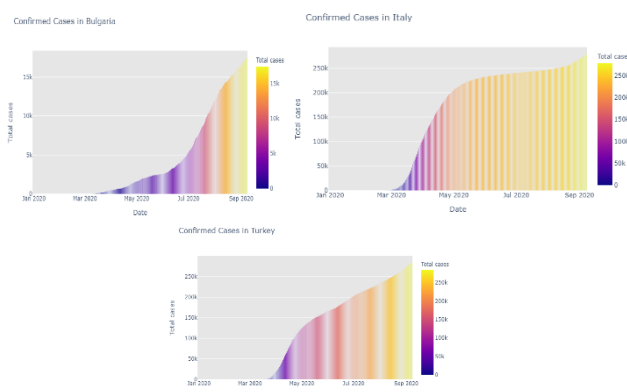


Fig.2. Covid-19 confirmed cases: Bulgaria, Italy, Turkey

Total confirmed cases are shown on Fig. 3. It visualizes the comparative analysis between Bulgaria, Italy and Turkey in terms of the number of increasing cases of Coronavirus infection the period being the same as indicated in the above

Comparison - rising cases: Turkey, Italy, Bulgaria

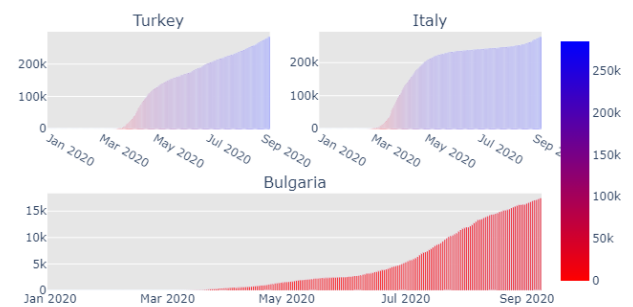


Fig. 3. Covid-19 total confirmed rising cases Bulgaria, Italy, Turkey

The graphic clearly shows that Turkey is leading country by total rising cases, while in Italy cases are normalized, in Bulgaria there is increasing of the total confirmed cases from the beginning of July when in the country a national protest has started.

The trend by ill people with Coronavirus after crossing 100 cases is shown by days on (Fig. 4). Where x = days after crossing 100 cases and y = rising cases. The countries are colored as follow: Bulgaria - blue, Turkey - red, Italy - green.

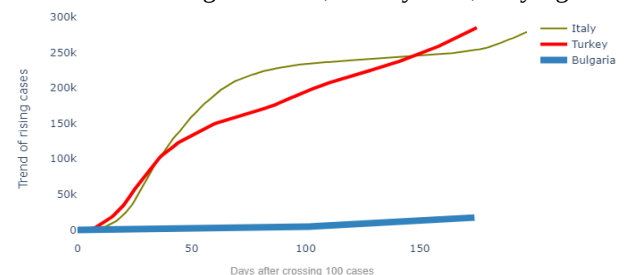


Fig.4: Trend of rising cases in days after crossing 100 cases

2.3. COVID-19 evolution:

Based on the above comparative analyses with the same DataFrame is tracked the evolution until September 2020 of Coronavirus disease in Bulgaria, Italy, Turkey and worldwide. The curve of exponent is with extremely growth character on all graphics as is shown on (Fig. 5).

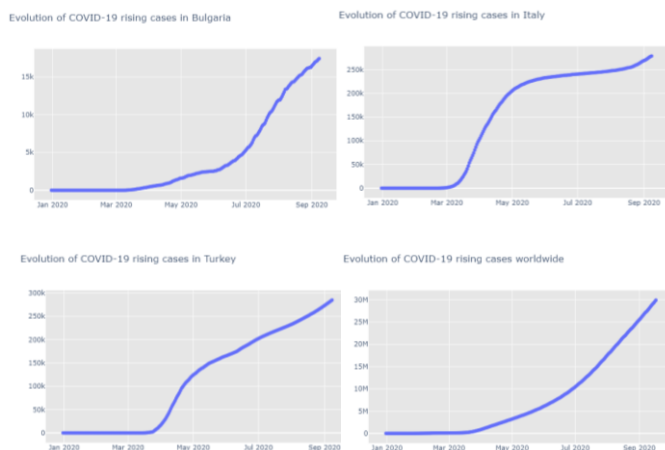


Fig.5: Evolution of Covid-19 rising cases

III EXPERIMENTS

3.1. Predicting Models Covid -19 evolution with python and prophet

For the purposes of the research is used statistical DataFrame free for use for educational and academic research purposes from “John Hopkins University”. In the experiment are created predictable models to track future evolution of COVID-19 for next three months of confirmed, recovered and deaths cases for Bulgaria and worldwide. The Prophet library was developed by Facebook as an open source product. It can be downloaded for free from the official website or using a package manager [10].

A powerful python API, Prophet allows a forecast for different time intervals based on an additive model with non-linear regression stands for yearly, weekly, daily, and holiday effects.

Prophet provides high accuracy and high performance. Used in many applications to create reliable predictable models. According to various studies, Prophet performs significantly better than other alternative products.

Fully automatic: provides reliable prediction, even with inconsistent information, without the need for pre-processing of data. Prophet is resistant to both missing data and abrupt changes in measurements over the same period.

Ability to configure forecasts provides many opportunities to improve predictable models. Additional knowledge-based parameters can be used to improve results. Prophet is compatible with popular programming languages such as Python and R, making accuracy and performance predictions guaranteed.

As a proof of the listed qualities of the library, a quarterly forecast for COVID-19 can be given, and despite the lack of additional parameters and more than one seasonal observations, the accuracy of the obtained forecast reaches 95%. Accuracy is maintained at different periods of the study.

Prophet method calculation: The input to Prophet is always a data frame with two columns: ds and y, where the ds

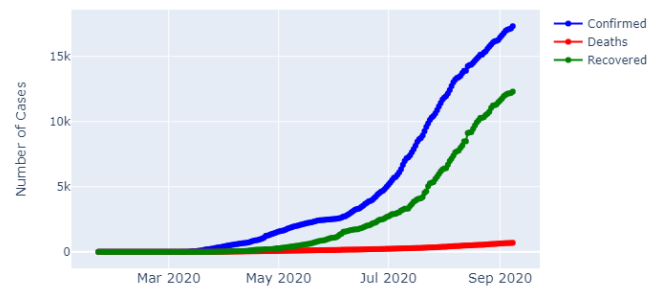
= date stamp column should be of a format expected by Pandas library as follow: YYYY-MM-DD for a date or YYYY-MM-DD HH:MM:SS for a timestamp and the y column is numeric = represents numeric the measurement of desired predictable model. [11, 12, 13, 14].

3.2. Statistics of total cases

Confirmed, recovered, deaths for Bulgaria and worldwide cases:

Pandas library visualizes the DataFrame as shown on (Fig. 6). The graph represents the statistical data for the period from 31.12.2020 to 08.09.2020 as confirmed cases in blue color, recovered cases in green color and deaths in red color. For Bulgaria the number of total cases is as follow: confirmed - 17.313k, recovered - 12.297k, deaths 692. In worldwide the number of total cases are as follow: confirmed - 27.57074 M, recovered - 18.52439 M, deaths - 897 383k.

Bulgaria COVID-19 Cases



Worldwide COVID-19 Cases

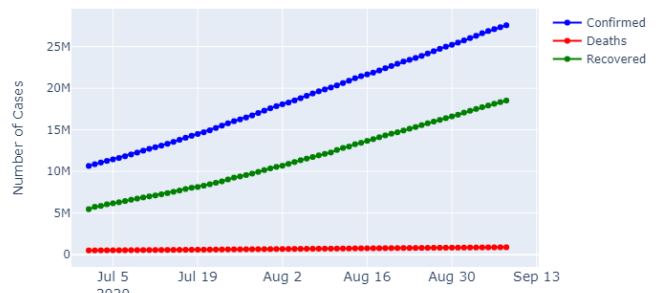


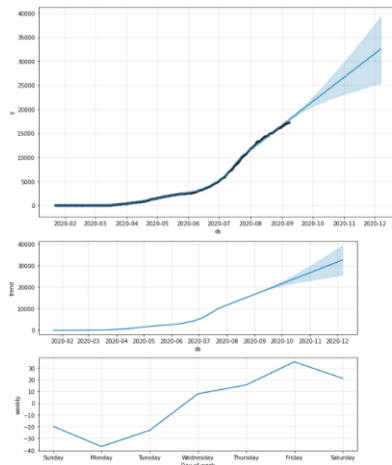
Fig.6. Statistics of confirmed, recovered, death cases

3.3. Predictive models experiments

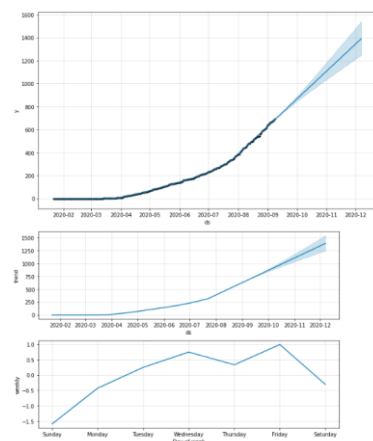
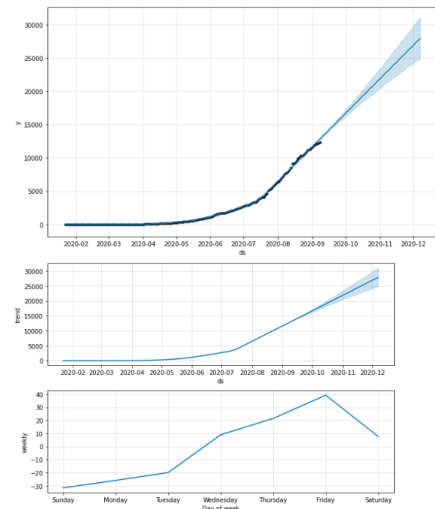
The input parameters for Prophet must be with two parameters from the dataframe. In this case 'ds' for the timestamp and 'y' for the intended numeric forecasting measurement. The predictable model is created to generate a prediction to the end of 2020 ahead forecast of confirmed cases of NCOVID-19 using Prophet API, with 95% prediction interval. For this purpose from the base calculation model are disabled yearly and daily seasonality from the seasonality-related parameters and additional regressors.

Prediction total confirmed cases for Bulgaria:

The predict method will assign the rows in future a forecasted value which it names 'yhat'. The prediction object creates a new dataframe which includes the column 'yhat' with the predicted numeric data. On (Fig. 7) the predicted value of total cases is measured in thousands. The result shows the overall raising infected with Coronavirus cases will be around 35000K. The curve of trend is extremely rising up. Weekly growth of infected cases by days shows that in Friday will have higher value of the COVID-19 cases.

**Fig.7. Prediction of the total cases in Bulgaria**

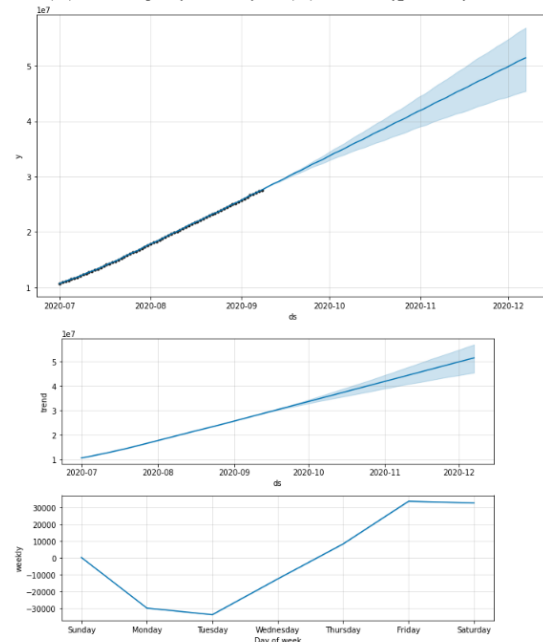
Respectively the result of deaths cases from COVID-19 also have growing character. The predictive model shows around 1400 total deaths on (Fig. 8). The results from the prediction with the recovered cases are visualized on (Fig. 9), it is also with raising character as the previous calculations. Total number of recovered cases from COVID-19 to the end of the year will be around over 25000.

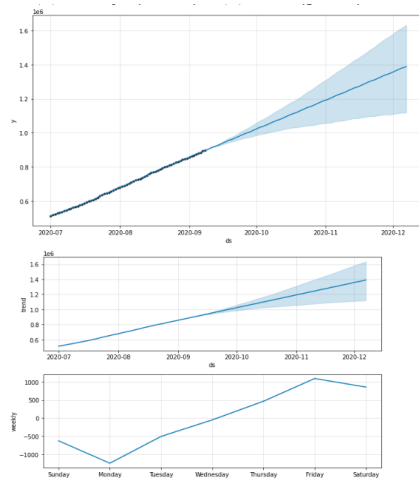
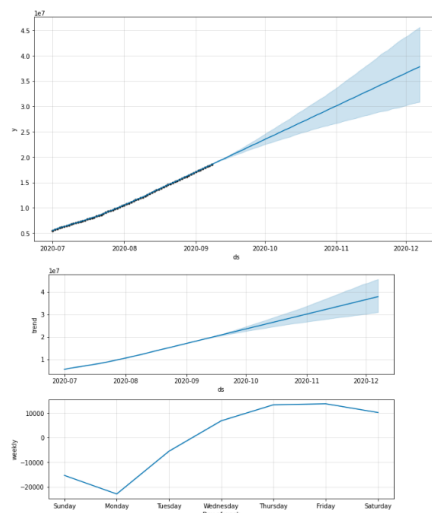
Prediction death cases BG:**Fig. 8. Prediction of the death cases in Bulgaria****Prediction recovered cases BG:****Fig. 9. Prediction of the recovered cases in Bulgaria****Worldwide prediction:**

The experimental forecast calculations for worldwide Coronavirus situation is with growing trend like the calculations for Bulgaria. The calculations are measured in millions. The results from experimental prediction are shown on (Fig. 10, 11, 12)

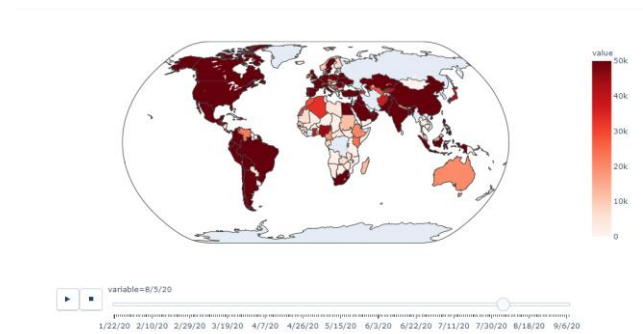
Prediction total cases Worldwide:

INFO:fbprophet:Disabling yearly seasonality. Run prophet with yearly_seasonality=True to override this.
INFO:fbprophet:Disabling daily seasonality. Run prophet with daily_seasonality=True to override this.

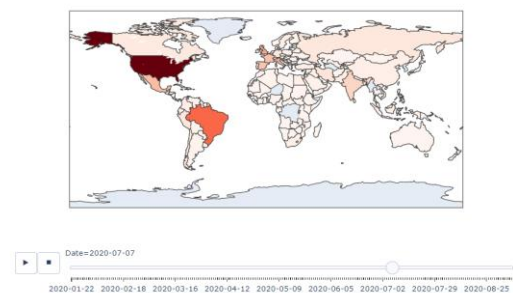
**Fig.10. Prediction of total cases in Worldwide**

Prediction deaths Worldwide:**Fig. 11. Prediction of deaths worldwide****Prediction recovered cases World:****Fig. 12. Prediction of recovered Worldwide****Map visualisation – Covid-19 world confirmed cases:**

We used commercially available bibliotchs of Python programming language to show the evolution of confirmed cases of Covid 19 from 22th January to 6th September 2020. The data set that we use [6] has the records the countries worldwide with coordinates, country code and confirmed cases for every single date. Our steps proceed very much in the same way as the article of Joe T. Santhanavanich - Create COVID-19 Map Animation with Python in 5 Minutes [7]. We have proceeded the following steps during the visualization: prepare Python Libraries; load the dataset; clean the dataset; create map animation with Plotly Express. The figure visualize the evolution of the disease worldwide during the whole year until the current data of this study:

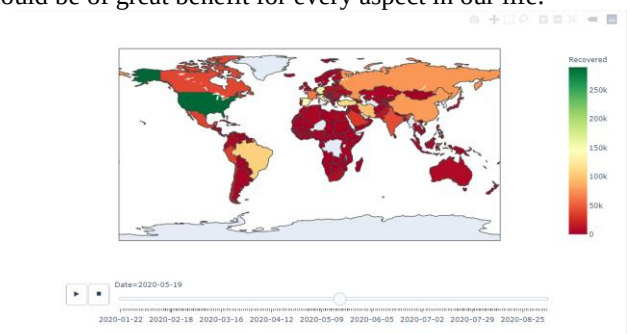
**Fig. 12. World Evolution of Confirmed Cases Covid 19****MAP VISUALISATION – WORLD DEATHS CASES:**

The following figure shows the evolution of confirmed cases of Covid-19 from 22th January to 25th August 2020. The data set that we use [5] has the records for all confirmed, recovered and deaths cases during this period.

**Fig. 13. World Death Cases Covid-19****Map visualisation – World recovered cases:**

We observe the evolution of recovered cases of Covid-19 from 22th January to 25th August 2020. Figure 19 presents the data for recovered people in every country.

This visualisation, in particular, is quite interesting to watch as the number of recovered cases grow and shrink over time. This would appear to indicate that spatial databases could be of great benefit for every aspect in our life.

**Fig. 14. World Recovered Cases Covid-19**

IV. RESULTS

The following results extend our knowledge of using spatial databases, machine learning predictive models and possibilities of Python programming language. The significant results from our research are:

1. Evolution of Covid-19 confirmed, recovered and deaths in Bulgaria, Turkey, Italy and worldwide.
2. Statistics plot of Covid-19 confirmed, recovered and deaths in Bulgaria, Turkey, Italy and worldwide.
3. Prediction plots of Covid-19 confirmed, recovered and deaths in Bulgaria, Turkey, Italy and worldwide.
4. Animated spatial visualization map for the evolution of Covid-19 total cases, deaths and recovered worldwide.

V. CONCLUSION

In the fight against COVID-19, the GIS technologies have played an important role in many aspects, including the data integration, and geospatial visualization of epidemic information, spatial tracking of confirmed cases, prediction of regional transmission, and many more. These provide support information for government sectors to fight against the COVID-19 spreading [8].

This paper highlighted the importance of using spatial databases visualization and machine learning predictive models in our life. We have showing that using the updating data in spatial area is an instrument for solving different problems. Python programming language provides powerful tools for different purposes and use cases.

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Creating Skills with E-learning and Remote Laboratories

Georgi Georgiev¹, Ivan Nedyalkov²

Abstract – E-distance learning is becoming an alternative to classical education due to its continuous development. It allows pupils, students, teachers and lecturers to have access to an unlimited amount of information and multimedia content, which makes teaching and learning much easier. The paper presents the different types of e-learning. The eight most used e-learning and distance learning platforms are shown. It is also noted the need to increase its share or switch entirely to such (for certain periods of time) compared to the traditional, due to viruses (COVID 19), crises, wars and more. The advantages of e-learning are pointed out, such as the lack for furnishing of expensive laboratories, etc. Simulation tools provide significant cost savings in Education. Some simulators that can be used for the learning process in distance learning platforms are presented. Examples of remote lab exercises are shown.

Keywords – Distance Learning, E- Learning, Remote Management, Simulators

I. INTRODUCTION

With the help of telecommunication and information technologies there is a borrowing of all major part of distance e-learning at the expense of the traditional. In 2020, there is a complete replacement of the traditional with distance learning to prevent the possibility of COVID 19 infection when large masses of people occur in one place. In many universities academic years and conducting of exams has been done entirely remotely.

Because of COVID-19, many governments are implementing measures that limit the number of people who gather in public places. Such measures disrupted the normal functioning of schools and universities. As the duration of such measures is likely to last a very long time until a vaccine is received, leaders of public and private educational institutions have introduced alternative methods for students and teachers to continue the learning process. These new methods make schools and universities fit to work in a safe environment. Although the number of students with access to digital devices and Internet may not be high in most countries. Government support for creating effective forms of online learning will free up institutional capacity and resources to shift the focus on providing alternative methods of training for those students who do not have such opportunities [13].

According to [17], in the field of education, different types of e-learning have been identified according to the learning tools. Others have chosen to focus on various indicators such as synchronicity and learning content. These are the 10 different types of distant e-learning

- Computer Managed Learning (CML);

- Computer Assisted Instruction (CAI);
- Synchronous Online Learning;
- Asynchronous Online Learning;
- Fixed E-Learning;
- Adaptive E-Learning;
- Linear E-Learning;
- Interactive Online Learning;
- Individual Online Learning;
- Collaborative Online Learning;

In [18] the top-8 online distant learning platforms are presented:

- *Canvas*. Adaptable, reliable, customizable, easy to use, mobile and time saving. Canvas is designed to remove restrictions and allow teachers to pursue what they want - as if teaching in front of their students, not remotely over the Internet;
- *Moodle* is one of the most widely used free distance learning management platforms. It provides teachers with an open source solution that achieves scalability, customization and security;
- *Edmodo* is the second global educational network for distance learning. It provides tools for communication, collaboration and learning, allowing all students to reach their full learning potential;
- *Schoology* is a distance learning management system for schools, universities and even corporations;
- *Sakai* is a 100% online open source distance learning platform. It provides a wide range of features and tools that teachers, students, researchers and project managers need to build an online classroom. The standard set of basic tools provides opportunities for discussions, messages, file management, a grade eBook and many more. The platform is designed for the system of higher education and academic institutions;
- *Showbie* is a classroom with a focus on distance learning, not technology. The platform combines all the

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basic tools needed to create a remote classroom in one easy-to-use application;

- *iTunes U* is often compared to Showbie because iTunes U, like Showbie, is an application. This makes them easier to use on mobile devices than other distance learning platforms;
- *Google Classroom* is a free web-based distance learning platform that integrates the Google account for G Suite for Education with all G Suite services such as Google Docs, Gmail and Google Calendar. Students can use Google Docs and sites to store them in a specific location. Sharing is very easy.

Internet-based distance learning is nowadays used as another face-to-face learning opportunity. In fact, its use increases in proportion to the number of students. This has led educators to put a lot of effort into helping learners get interactive content full of multimedia, as it has been shown to have a significant effect on the learning process. The impact of blogs and wikis has also been studied on learners' collaboration and reflection, and both have been reported to have a positive effect. Although e-learning tools and distance learning itself have been around for more than a decade, in the field of educational research, not enough attention has been paid to the study of student motivation under the influence of e-learning. E-learning is becoming increasingly important as an educational tool, just as technology has evolved and advanced over the years. Interestingly, more efforts have been made to improve technology than to try to understand the learning needs and styles of individual learners and learning design. The 21st century has seen rapid progress with things like the Internet and online learning [6].

Currently, distance e-learning is considered an alternative to higher education. To improve online learning, a number of open universities have been set up in many countries. Many traditional universities also offer distance learning courses through e-learning. Although many distance e-learning courses are limited to the arts and business, some universities also offer distance online science and engineering courses. Engineering courses usually involve a remote laboratory. For remote laboratory sessions, most of these institutions will have to hire laboratories and equipment from other higher education institutions (such as universities or polytechnics) [7].

Virtual and remote labs provide many benefits, such as 24-hour access, flexibility, and the freedom to learn at your own pace in a safe environment. The remote labs provide new learning opportunities [8].

In engineering training, an analysis of the response of the system is performed at different parameters of the input and output signals (such as waveform, periodicity, etc.). Without proper visualization, remote labs can make it difficult for many students to understand. In addition, interactive remote labs should allow the student to simultaneously visualize the actual response of the lab at each change introduced by the student. Observing a change in the response of the system in real time in response to user interaction is what really helps

the student to develop a useful practical idea of the theory of the principle of operation of the studied device [10].

Innovations in information and communication technologies (ICT) facilitate the sharing of knowledge between people who are separated by long geographical distances [11].

Over the last decade, online learning platforms have developed a lot, but several comparative studies have been developed before [14], [15], [16]. They are abandoned as their life cycle ends [12].

Figure 1 shows a summary model of the Learning Management System (LMS).

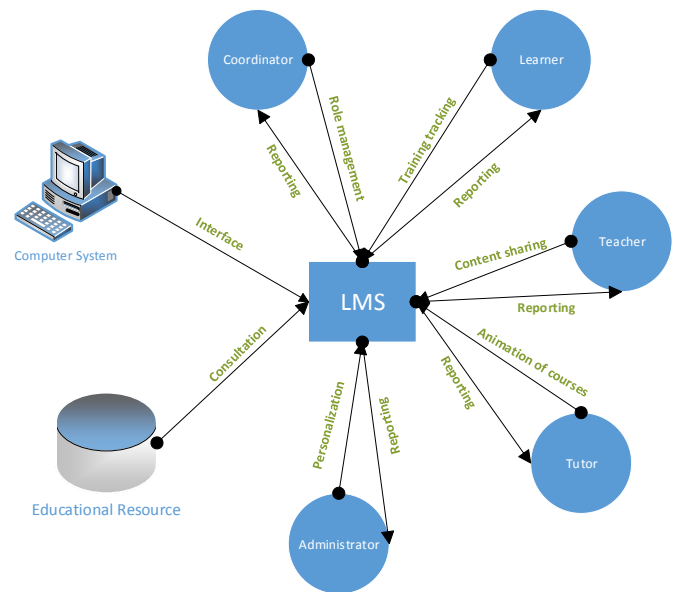


Fig. 1. General architecture of an e-learning platform LMS

II. E-LEARNING BASED ON SIMULATION PROGRAMS

In the engineering sciences for the various disciplines, a large number of laboratories must be equipped in order to be able to carry out practical exercises. This equipment is very expensive and not all universities can buy it. Such equipment is offered by large companies that manufacture it, as well as measuring instruments. In order to be able to carry out the training, software simulators are used. These simulators should be as close as possible to real devices and systems. Simulators are convenient to use for conducting remote e-learning, as they can be downloaded from the used online platform. Thus, training in a given discipline can be carried out remotely.

Visual learning is the use of graphics, images and animations to improve learning in science and technology. When using visual learning, ideas, concepts, data and other information are linked to images and animations while the subject is represented graphically. For example, networks, mind maps, and animations are used in visual learning to improve thinking and learning skills. The advantage of using visual learning is that students can understand the subjects

they are learning in much more easily if they can see or even touch them. Through the visual learning and the functionalities it offers, it helps students to open their minds and think graphically. The links between images and some kind of information can help to remember better and use the acquired knowledge or information [5].

Packet Tracer is a visual, interactive tool for teaching and learning for IP networks. It is implemented in the form of software for computer network simulation. The program is designed to facilitate teaching on computer networks. Through it, students can create their own IP network, select the most appropriate network equipment (such as routers, switches, servers and more). Through the use of the program, students will learn how to configure network equipment from Cisco - one of the largest manufacturers of network equipment. *Packet Tracer* offers a unique combination of realistic simulation and visualization capabilities, through which students will be able most easily to understand how computer networks work, what are the most common problems in this communication network and more.

Figure 2 shows a logical network topology simulated using a Cisco packet tracer

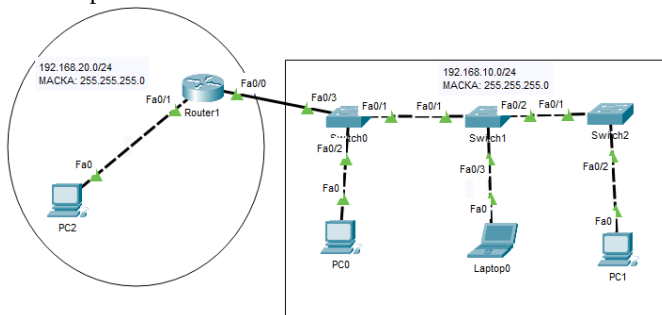


Fig. 2. Logical Topology View

Wireless networks are spreading everywhere. Wi-Fi hotspots can be found in most public places. This type of communication network must be able to be maintained and developed. That is why it is necessary to have people who can do this work. *Packet Tracer* offers the creation and simulation of this type of communication networks. The program can be used to create online courses for designing, configuring and maintaining such communication networks [3].

Circuit Simulation Programs (SPICE) - Understanding the behavior and interactions between basic parameters such as voltage and current in magnetic elements, capacitors, and other circuit elements requires in-depth knowledge. In practice, many pupils and students have difficulty with this, as these parameters cannot be observed. They are monitored through the use of special measuring instruments and oscilloscopes. Animations and simulations provide the best way to visualize the processes that take place in a power electronic circuit. When these visualizations, obtained from the simulation studies are available online, the student can learn at his or her own pace, regardless of time and place. This will make it easier to understand the processes in an electrical circuit [1].

MMT - Mathematics, modeling and tools. They are designed to help students increase their knowledge and skills in mathematics on the one hand and modeling and simulation on the other. These simulations are based on mathematical modeling. By introducing a system of equations or other mathematical expressions, the tools visualize the processes and the principle of operation of the studied device. With this type of simulators it is possible to model almost absolutely anything, as long it can be described with some mathematical expressions. A similar product is *MATLAB* [2].

The use of mathematical simulators, circuit simulators and simulators for network communication equipment has been constantly evolving in recent years. New simulators such as *GNS3* are also appearing. It eliminates the shortcomings and limitations of the Cisco packet tracer by adding new features such as working with virtual machines, the ability to connect and collaborate between the modeled network and a real communication network, integrating tools for monitoring IP networks and other features [19].

III. EXAMPLES FOR REMOTE LAB

Figure 3 shows the appearance of the proposed for remote lab exercises programmable DC power supply [20].



Fig. 3.RD6006

The presented DC power supply is suitable for use in remote laboratory exercises. It has the ability to connect to an IP network via a Wi-Fi module. Figure 4 shows the setting of the network options of the device.

By using the network functionalities of the presented power supply, it is very easy to create a remote laboratory stand for testing various DC - DC converters. Through the application for remote control of the proposed DC power supply, different input voltages of the studied DC - DC converter can be set by the students. Using a computer-based oscilloscope, the signals from different control points of the tested DC-DC converter can be observed. Thus, students will be able to observe in real time and remotely the reaction of the studied converter, as if they were in the laboratory, in front of the converter itself. Figure 5 shows a screen of the program with which the presented DC power supply is configured.

Apart from remote laboratory models available via the Internet, distance learning can also be realized with the help of simulation programs. Such a program is the *LTSpice* [21,22].

It can be used to simulate various circuits of any electronic circuit such as: DC - DC converters, DC - AC converters, rectifiers and many other circuits.

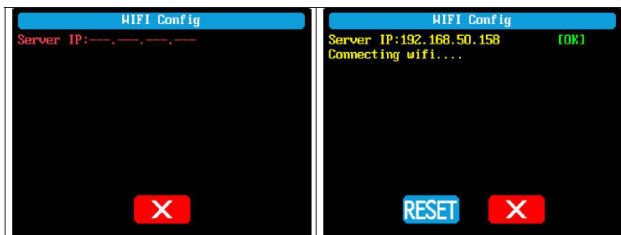


Fig. 4. Setting the IP options



Fig. 5. Front panel of the application

Figure 6 shows the circuit of a step-up DC-DC converter implemented using the LTC1700. With the help of this program, students will be able to explore the operation of various electronic converters, using simulation models at home, without the need to attend classes.

Figure 7 shows the shape and value of the current and voltage at certain control points, which are important in the study of DC - DC converters: input voltage V (in), output voltage V (out), current through the inductor I (L1), current through the transistor switch I (Q1) and the current through the diode realized by a MOS transistor I (Q2). As it can be seen from the time charts, the step-up converter functions normally.

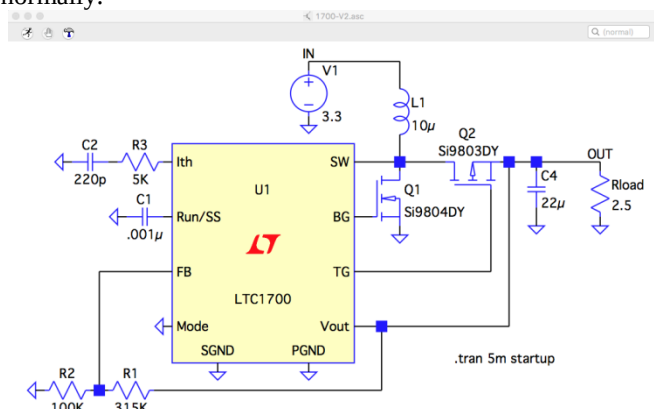


Fig. 6. LTC 1700

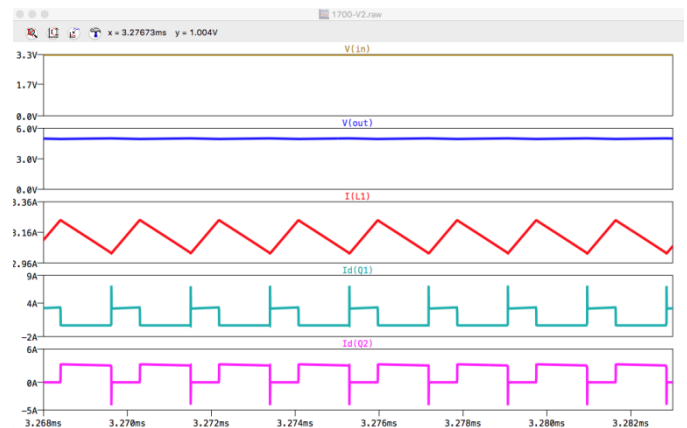


Fig. 7. Time charts

IV. SKILL FORMATION

The advantage of using the presented programmable power supply is the possibility to build laboratory stands with the possibility of remote use like a remote lab. Thus, through these stands it will be possible to study various electronic converters remotely, without the need of the presence of students in the laboratories. Another advantage is the free software that can be used with the power supply. For example, a similar stand can be implemented with LabView, the use of which requires the payment of licenses and the creation of a virtual tool to perform the functions of proposed power supply. The disadvantage of the proposed device is the lack of possibility for simultaneous use by a huge amount of students. This problem can be solved by making a schedule in the used distance learning platform, where it will be clear which students are online and will be able to be divided into subgroups so that everyone can work with the device.

Another way to implement distance learning is through the use of simulation programs. Through these programs, students will be able to participate in the whole process of researching a circuit - from its design to simulating its work. By using these programs different cases that students must try to solve themselves can be created. Thus, they will gain the necessary knowledge and competencies. Disadvantage of using such programs are the high hardware requirements for the computers on which the simulations will be performed; most of them are paid; some of them are very complicated to use.

Using online learning, students can acquire a range of skills, competencies and knowledge in a variety of areas. With the help of simulation and modeling programs, which are constantly evolving and getting closer to realizing the functions of real devices, circuits, networks, etc. distance learning will be closer to classical teaching.

On the other hand, the use of such programs will allow schools or universities that cannot afford the purchase of such expensive equipment to conduct effective training.

V. CONCLUSION

The use of e-distance learning increases the interest in learning. Facilitates teaching by using many different methods and tools for illustration. The training can be realized anywhere and at any time, only if there is a stable and high-speed Internet connection.

The types of e-learning are presented in detail. Examples of the use of a hardware device for performing stands for remote laboratory exercises and the use of programs for simulation of electronic circuits are shown. Thus, the expensive equipment for laboratories is not necessary for the implementation of the distance learning.

As noted in 2020, without e-learning, the academic year would not be over. Thanks to online distance learning, all educational organizations have switched to it.

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Section 3

IT & SECURITY TECHNOLOGIES

The Correlation between Online Telecommunication Tools and Various Types of Social Engineering Attacks

Diana Ilieva¹

Abstract – The paper addresses phenomena owing their existence to some weaknesses of human behaviour while using technology and telecommunications tools rather than the presence of inherent vulnerabilities in computer systems – phenomena such as social engineering, phishing, spear-phishing, whaling, vishing, smishing, and spoofing. Etymological, derivative, semantic and functional aspects of the mentioned phenomena have been analysed; the terms have been considered in a comparative plan, indicating their main similarities embedded in the essence of social engineering, an umbrella term encompassing the above, characterised by the use of manipulation in all its forms and the accompanying disinformation and fake news. Conclusions have been drawn on the correlation between both the aforementioned phenomena and the telecommunications tools used in their execution.

Keywords – Telecommunications, Manipulation, Social Engineering, Phishing, Spear-Phishing, Whaling, Vishing, Smishing, Spoofing, Fake News

I. INTRODUCTION

The last information revolution has given us the opportunity to take advantage of high technology and telecommunications, without which no area of our daily lives seems conceivable. Undoubtedly, the benefits of using them in the information society in which we live are enormous, but do they only offer us advantages? The question becomes rhetorical if we remember the maxim: "When you win, you don't know what you lose, and when you lose, you don't know what you win" and in particular its first part. - What do we lose after having won the opportunity to fully harness the abundance of technological achievements this century has to offer. It turns out that in many cases we lose the freedom to safely use technology and various telecommunications devices, especially in, but not limited to, the cyber environment. Cybercriminals counteract every useful invention with at least one more malicious development for financial, political or other gain. There are many manifestations of cyber threats to the individual, social groups and organisations: the creation of virtual worlds that replace reality, manipulation of human consciousness and behaviour; replacement of goals and values, of our traditional way of life with imposed external standards, as well as distortion of information. Quite often fake news and/or clickbait go hand in hand with other phenomena related to information in/security,

representing threats in the cyber environment, access to which we constantly seek on various occasions in the modern technological world - threats such as social engineering, phishing, spear-phishing, whaling, spoofing, vishing, smishing, etc.

II. EXPOSÉ

A. Social engineering - etymology, semantic features and deviations in different discourses

More and more often lately, with the growing use of telecommunications in everyday life and addiction to communication on social networks, we encounter phenomena such as misinformation, manipulation, fake news and social engineering. To the untrained reader the latter combination of two words is rather strange and doesn't say much. On the contrary - the initial association is with engineering sciences, which after checking and studying the semantics of the term turns out to be completely wrong. Many reputable dictionaries reflect only one meaning of the term which is related to social science: „an attempt to change society and to deal with social problems according to particular political beliefs, for example by changing the law“ [1], “the practice of making laws or using other methods to influence public opinion and solve social problems or improve social conditions” [2] „the use of planned measures, for example, measures that affect people's social or economic position, in order to create a desirable society“ [3], “management of human beings in accordance with their place and function in society: applied social science [4]. The latter dates the usage of the phrase with the specified semantics back to 1899. From the above definitions it can be summarised that the use of the phrase in the social sciences implies a change in society and the role of man within it on

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the basis of refined laws in order to improve, on the one hand, social conditions and on the other - leadership styles in this regard.

Interesting to note is that in one of the definitions of the social role of the individual in society *manipulation* stands out: "the manipulation of the social position and function of individuals in order to manage change in a society [5].

In the most modern (or those that have undergone a new edition) dictionaries another meaning of the term "social engineering" is mentioned: "(in the context of information security) the use of deception to manipulate individuals into divulging confidential or personal information that may be used for fraudulent purposes" [6]. Here again manipulation that goes hand in hand with fraud in order to obtain necessary information for one's benefit is highlighted. A specialised definition of the commented combination of words is available in Webster's New World Telecom Dictionary: „(Computer Definition) - The use of deceptive or fraudulent means that rely on expected human behaviour, often used to gain access to information such as a computer access number, password, or user“ [7]. Duping and diddling are carefully pre-designed scenarios that are to influence human behaviour, to "loll" the attacked person's attention that the information is illegally requested from them and it is designed to be used maliciously. The use of fraudulent practices to overcome cybersecurity by manipulating human behaviour, relying on well-researched psychological tactics, is embedded in another definition of social engineering: "The practice of tricking a user into giving access to sensitive information, thereby bypassing most or all protection" [8].

The same source (with the most complete definitions of the studied phrase from different discourses) indicates its use in the field of political science for *propaganda* (and, of course, the implication of *disinformation* for this discourse): "(political science) Use of propaganda by a government to sway perceptions and attitudes of its own citizenry".

Analysing the use of the word combination "social engineering" in various discourses, it becomes clear that the main semantic relationship between them is the presence of *disinformation* (in some cases - propaganda) and *manipulative mechanisms* to achieve fraudulent goals. Strange as it may seem, such a conclusion can be made even when using this combination of words in the discourse of social sciences, where the main implication is not aimed at these phenomena. Though, as evidenced by these definitions, in some of them manipulation as a special tool is indicated quite explicitly. Manipulation and disinformation are the main means of achieving fraudulent intentions and benefits (of a person, organisation, party, etc.) in the use of the term in computer science and cybersecurity. It should not be forgotten that these techniques are also at the heart of fake news, which is another bridge between the phenomena under consideration and others that are very topical today, spread mainly through the widely used telecommunications and social networks.

When it comes to protecting our computers and other telecommunications devices, most users focus on purchasing and installing newer versions of antivirus software. Efforts are

usually focused on the technologically best means of cybersecurity. And very often the human factor is pushed to the background. Yet with increasing frequency the efforts of the malefactors are directed to this very weak link in the system. These are people who do have some knowledge in the field of computing and cybersecurity, but who use for their purposes mainly other in-depth knowledge - in the field of psychology of human behaviour. They are very observant, have extensive experience in social communication and are subtle connoisseurs of the human soul.

Social engineering rises to the rank of the *art of manipulating people* to divulge confidential information. Social engineering attacks are the practice of obtaining such information by using methods to manipulate legitimate users, most often using e-mail and telephone, and hacking, of course. The different types of information that criminal "engineers" look for may differ - passwords, personal or banking information, anything that could grant them access to the victim's computer (sometimes through installing malicious software), but the "handwriting" of each illegal scenario is very similar.

A very precise definition of the phenomenon is given by the professionals from Kaspersky Lab - the largest European company specialising in the development of anti-virus software and, of course, dealing with all kinds of cybersecurity problems: "Social engineering is a manipulation technique that exploits human error to gain private information, access, or valuables. In cybercrime, these "human hacking" scams tend to lure unsuspecting users into exposing data, spreading malware infections, or giving access to restricted systems. Attacks can happen online, in-person, and via other interactions." [9].

B. Social Engineering and Hacking - Brief Juxtaposition

Having mentioned hacking, it is necessary to clarify its relationship with social engineering. There are some similarities between the two phenomena: the acquisition of unauthorized access to systems or sensitive information for the purpose of fraud, identity theft, industrial espionage, political discrediting or causing other harm. *The main difference*, however, is that social engineering uses mainly psychological methods, namely the natural tendency of man to trust, to obey superiors and to carry out orders without thinking, to be easily flattered and complimented, etc. What social engineers are able to do, the technological hackers are not; the latter do not even strive to apply the methods of manipulation to achieve their goals (For skilled social engineers it is much easier to break security by taking advantage of the human factor's weakness to obtain the desired information by simply calling for example Katya from accounting asking for her password, instead of using their technical skills; sometimes this works - especially if proven tactics such as flattery, being obsequious, etc. are applied.) The typical targets of such attacks are well-known corporations, telecoms, financial and insurance institutions, military and government organizations, hospitals.

C. Some Examples of Social Engineering

Psychological techniques for obtaining valuable information bring significant income to practitioners. Within two years (2016-18), about \$2 billion were stolen from just 100 banks using these techniques [10].

An example of social engineering is related to The Ubiquiti Networks: no one hacked into operating systems, no one stole data. Just in 2015, the safety rules were violated by the collaborators themselves. The cyber thieves sent an *e-mail* on behalf of the top manager of the company with a request to the financiers to transfer a large amount of money to a specified bank account. This is how the method of social engineering works, taking advantage of human weakness - to serve the boss, for example.

Obedience to authority is also the basis of a social experiment conducted by psychologists (for more details about it - Robert Cialdini's book "Influence: The psychology of persuasion") [11]. In this case, the technical device was a *telephone*: psychologists called nurses on behalf of the chief physician, instructing them to give the patient a lethal dose of a drug. Of course, the nurses were aware of what was going on, but in 95% of the cases they carried out the order (at the entrance of the ward they were stopped, of course, by the authors of the study). And the strange thing is that they did not even try to verify the identity of the doctor. But there is good news, in this case it comes in threes: firstly - it was just a social experiment and no-one was hurt; secondly - the psychological experiment clearly proves how great the power of manipulation is even in such serious cases, when not only health but also people's lives are endangered; and the third one, stemming from the latter good news - this experiment further spotlights the experts' attention on the disastrous opportunities on which social engineering relies.

Another case of social engineering, this time carried out *via social media*: on April 23, 2013, a fake message appeared on the Twitter account of *The Associated Press*: "Hot news: Two explosions in the White House, Barack Obama is injured", which dealt a serious blow to the world economy. Stock market indices collapsed. The situation only recovered when the White House made a rebuttal. The Syrian Electronic Army has assumed responsibility. In order to carry out their plan, hackers reportedly sent a letter to a "colleague" from the agency asking them to click on an important link. The user had to log in by entering a username and password. The purpose of the attackers was to obtain the data from the personal accounts of the editorial staff.

Criminals use social engineering tactics because it is usually much easier to take advantage of inherent human weaknesses or the natural human attitude to trust than to look for ways to "hack" someone's software. As mentioned, it is much easier to trick someone into giving you their password than to try to crack it (unless the password is really very easy, i.e. with a low level of protection) [12].

Security is always about who and what to trust. It is important to know when to believe someone's words and when not to, and to develop the ability to understand when the

person you are communicating with is exactly who they say they are and when they are not. The same goes for online communications and website use: when and whether at all to believe that the website you are using is legitimate and safe to provide your information to (here things have a lot in common with fake news and clickbait).

Every security professional is aware that the weakest link in the security chain are humans - they often accept a person or scenario at face value without much thought.

In addition to the psychological level, social engineering attacks also occur on the physical one - targeted are offices, even trash cans, etc. The "social engineer" can easily dress up as a maintenance person visiting the office and find a lot of useful information from stickers on the wall, message boards, desks, etc. - account numbers, personal data, passwords. Trash bins are another rich source of company information. Lists of telephone numbers, organizational tables, company policy manuals, calendars and meeting notes, printouts with personal data or login details - discarded sheets can contain everything one needs to reproduce the structure of the organization, the way it works, and to obtain access to its network.

D. Types of Social Engineering Attacks:

Phishing is a form of social engineering and one of the most common methods of obtaining confidential information, which has recently been gaining momentum. The term is formed from the play on the words "password harvesting fishing", metaphorically "password fishing". It is a type of computer fraud that uses social engineering to obtain sensitive information. "Phishing attacks use email or malicious websites to solicit personal information by posing as a trustworthy organization" - says the concise definition of the phenomenon given by the Department of Homeland Security of United States [13].

Phishing is one of the best ways to obtain sensitive data, as it does not rely on vulnerabilities in a computer or system but instead avails itself of "vulnerabilities" in the user's own knowledge or their momentary distraction. It's well known that the software and hardware of computers are designed the way that each given command is executed exactly, by prior prescription; in contrast, consumers are human, and the adage that "All humans make mistakes" is also well known.

The design of a phishing attack is to be widespread - the more attackers spread it, the more people will be lured, so they will obtain more people's accounts. Thus, usually phishing attacks are not aimed at specific people or specific organisations, but at any and many users at once.

The efforts of cybercriminals in another type of social engineering - **spear-phishing** - are not directed at the mass user, but at specific individuals or organisations. Attempts at this type of fraud are not usually initiated by random hackers and at random; they are carried out purposefully to extract financial profit by disclosing trade secrets or even military information. For this purpose, the attacks are highly personalised, so the chance of their success is very high. In these attacks, cybercriminals spend a lot of time researching

their targets with the goal of personalising the attack so much that it ultimately looks legitimate and plausible.

A typical example: an email has been received, apparently from a trusted source, but it leads the recipient to a fake website full of malware. Emails of such kind often use well thought out tactics to draw victims' attention. Cybercriminals carry out such attacks for direct financial gain or in order to resell confidential data to private individuals - competitors of others in a particular industrial niche, to private companies or even to governments. A few years ago, for example, the FBI warned of phishing scams, which at first glance appear to be from the National Center for Missing and Exploited Children.

As mentioned, cybercriminals use individually crafted approaches and techniques for social engineering to effectively customize messages and websites. As a result, the attention of even high-ranking targets in organisations, such as top executives, has been lollled and they open emails that seem safe at first glance. Recently, this type of attack, aimed specifically at the top management that holds power in companies - CEOs, CFOs or other CEOs who have full access to sensitive data, has been given its own name - not just **phishing** (figuratively speaking "fishing"), but **whaling** (metaphorically - "catching the top figures in the company on the rod"). Understandably the phenomenon is called "whaling" because of the size of the targets compared to typical phishing attacks (the latter targeting even the smallest fish); "whales" are carefully chosen because of their authority and level of access in the company's hierarchy. Whaling emails and websites are very highly customized for their respective purposes and often include names, position, and other such details to make them look as legitimate as possible. Cybercriminals also use fake email addresses and real corporate logos, phone numbers to give the impression that documents come from trusted organisations such as business partners, banks or government agencies.

Whaling attacks are more difficult to detect than ordinary phishing attacks precisely because of the high personalisation; To personalize their attacks, cybercriminals often collect the personal information they need from social media such as Facebook, Twitter and LinkedIn, profiling corporate information about targeted senior employees, information about the specifics of work and the names of colleagues or business partners.

Many companies have fallen victim to these hard to spot attacks in recent years, owing to the difficulty and time necessary to carry them out. Some examples: in 2016, the social media app *Snapchat* became a victim of a whaling attack when a high-ranking employee was sent an email by a cybercriminal posing as the CEO; the employee was misled into disclosing information about employees' salaries. *Snapchat* sought help from the FBI to uncover the incident, while offering employees affected by the leak two years of free identity theft insurance.

Another similar incident occurred in March 2016, when the CEO of *Seagate* (Seagate Technology PLC - an American storage company) accidentally responded to a whaling email requesting W-2 forms (Internal Tax Form revenue used in the

United States to account for salaries paid to employees and taxes withheld from them) for all current and former employees. The incident violated the Income Tax Data Protection Act for nearly 10,000 current and former *Seagate* employees, making those employees vulnerable to tax refund fraud and other identity theft schemes [14]. Considering this, "additional measures are mandatory" [15], some of them are introduced in the mentioned paper.

In addition to phishing mainly through emails and websites, there are two other varieties – **vishing** and **smishing** (SMS Phishing). **Vishing** (**voice phishing** = vishing) is a relatively new term that has not been included in etymological dictionaries yet, but its meaning can easily be "deciphered" by the merging of parts of two words (indicated respectively in bold and italic) and acquiring a common meaning. The term is also known as *voice phishing* and "*VoIP phishing*"; it is the voice analogue of phishing and is a form of criminal telephone fraud that uses social engineering through telephone services to gain access to personal and / or financial information for financial gain. In fact, it has existed since telephone services via the Internet appeared as a service. Instead of the user being redirected via e-mail to a website (as in ordinary phishing), the e-mail message requires the user to make a phone call. The call triggers a voice response system that requires the user's credit card number. The initial bait can also be a phone call with a recording that instructs the user to call a specified short phone number. In Western countries, people are used to entering credit card numbers, insurance policies, health insurance and more over the phone and therefore in both cases this technique can be effective. *Voice over IP (VoIP)* is easy and fast to be used: caller IDs can be created as spoofing numbers (numbers are very similar to the real numbers of reputable institutions) and the whole operation can be started and completed in a much shorter time compared to the one accomplished via a regular telephone line [16].

Another type of phishing is **smishing** (SMS Phishing) - a form of criminal activity that also uses social engineering techniques similar to phishing. The term is coined again by merging parts of two words SMS and Phishing, which creates an integral meaning of the new token. Instead of sending a forwarding e-mail, as is the phishing tactic, a text message containing a fraudulent link is sent to a mobile device. Users are less suspicious of the SMS they receive, making smishing an effective fraud technique.

Close to the techniques of phishing are those of **spoofing** for several reasons – their genesis (originating in English), derivatively (they are composed of elements of two or three words and have the same second part), and semantically. What is the etymology of the latter term? – Its etymological roots trace back to 1889 when its first use is noted with the meaning as a noun "hoax, deception" and as a verb "to hoax, deceive, trick", and a quarter of a century later – in 1914 it is used as a verb having another meaning – closer to amusement: "to parody or satirize" [17]. Since then in the field of entertainment the word is often used in the sense of a parody of a show or performance. That's why when its use is

perceived as a blend of the old and newer meanings, it's associated with the act of a person posing as someone else, usually in an attempt to defraud. The word "spoof" is often used in the field of entertainment in the sense of a parody of a show or performance. Thus, in the field of cyber security, especially with regard to types of social engineering, "spoofing" is used in terms of imitation of a person or service in order to access sensitive data and information such as usernames, passwords, bank account numbers, personal data, etc.

One of the oldest forms of spoofing is a fake logon program, long popular with older versions of Unix (a family of multi-operational, multi-user computer systems dating back to the original AT&T Unix, created in the 1970s in the research Bell Labs Center by Ken Thompson, Dennis Ritchie, etc.). The purpose of this program was to "remind" the users to enter their username and password, to encourage them to do it several times as if they have made a mistake. Regardless of whether and what the user had entered, the program returned an attempt message for invalid data, after which it gave back the control to the actual authentication program/logon. Thusly the spoofing program recorded the received username and password to a file, which could potentially be used to gain access [18].

The term is also used to denote the action of substituting an IP address for a computer on the network in order to disguise its identity and replace it with another that belongs to another host on the network.

Phishing and spoofing are like two similar icebergs: above the water they look alike, but their differences are hidden underwater. How? - "<The first one> downloads malware on your computer or network, and the other one tricks you into disclosing sensitive financial information to a cyber swindler. Phishing is a method of extraction, while spoofing is a means of delivery" [19]. Data protection company DomainTools, DNS (Domain Name System) researches five of the UK's most popular sites: BBC News, Sky News, ITV News and the Guardian's and Daily Mail websites. Of the more than 197 domains surveyed, 70 are at high risk of spoofing such as: bbcnew [.] info; theguarsian [.] com; synews [.] co; ifvnews [.] cn; dailymail [.] cm. This tactic usually relies on users to mistype their favourite site's URL and thus inadvertently find themselves on the fake version. Known as "URL hijacking" this tactic can be used to generate revenue from inbound ads, gather information about users, or even covertly download malware to the victim's device.

In this case, it is clear that those behind the illegitimate registrations often seek to impersonate the relevant news sites in order to benefit by spreading fake news. To avoid this, Internet users should pay more attention to the URLs they visit; it is good practice to hover the cursor over the link to see it in detail. Inserting additional letters into a well-known domain, such as Yahooo [.]com or omitting others, such as in .cm instead of .com, and using the combination of letters *rn* to look like *m*, etc., already mentioned, are common techniques. We cannot disagree with Tim Helming, the director of product management at DomainTools "These malicious domains are a

double whammy, as they can be involved in both spreading fake news and distributing malware" [20].

III. CONCLUSIONS

After the comparisons and analyses of the phenomena studied in the paper, the following conclusions are drawn regarding the correlation among these phenomena and the tools for conducting manipulative attacks using telecommunications and other means:

1. Although social engineering and its various subtypes are invariably linked to technology and telecommunications, they do not address vulnerabilities in cybersecurity, on the contrary – they address various weaknesses in human behaviour using manipulation, disinformation and fake news. In this respect, the various up-to-date measures for cyber security are not relevant: in the studied phenomena human factor is essential.

2. Social engineering rises to the rank of the "art of manipulation."

3. Among the varieties of social engineering, three types of attacks are characterised by using common tools but they stand out with varying degrees of targeting: phishing campaigns target random and numerous individuals or organisations, spear-phishing attacks are aimed at specific individuals or companies, and whaling attacks - single, elite representatives from the top of the hierarchy of a particular company or organization with the most access to sensitive information. There is a proportional dependence: the more time it takes to prepare for the elite whaling attacks and the more difficult they are to be spotted, the greater the financial results expected of them; and respectively - phishing attacks require minimal time, but the proceeds from them are insignificant compared to whaling (in this case the swindlers rely on the mass targeting - relatively small amounts of a large number of identically prepared tools).

4. Vishing and smishing - other types of phishing - have common features: both are relatively newer phenomena and are similar in their tools of choice - the attacks are carried out mainly using a telephone; they differ in the way of communication - by voice or by an SMS.

5. Phishing and spoofing attacks have common features (by genesis, derivative and semantic) but differ functionally. Phishing is a *method of retrieving sensitive information* from a user *through social engineering* (sometimes in symbiosis with a fraudulently spoofed domain, malware is downloaded on a user's computer), while spoofing is *not a social engineering tool* but a *manipulative method of fraudulently purporting to be a legitimate site by way of imitation* used by cyber criminals for financial gain or to spread fake news.

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Free tools for Testing the Security of Web Services in the UTP Network

Pavlinka Radoyska¹ and Maya Atanasova²

Abstract – An important factor in assessing the security of LANs and servers is the use of hacking tools. In this paper, with the help of three tools for hacker attacks: LOIC, Slowloris and HULK the three UTP servers are attacked. The results of the performed experiments are presented.

Keywords – Network Attack, Free Tools For Network Attack, LOIC, Slowloris, HULK

I. INTRODUCTION

We live in an era of ever-increasing cybercrime aimed at compromising corporate security, compromising national security or extorting huge sums of money. Organizations defend themselves by updating their hacking prevention tactics by installing various security technologies. For this protection to be more effective and for all holes to be found in advance, it is necessary to use specialists with hacking skills, called ethical hackers. Ethical hacking is used to assess security vulnerabilities. Information about security vulnerabilities is collected by performing automated and manual testing of the target zone. The collected data is then used to eliminate the detected vulnerabilities. The most common vulnerabilities that ethical hacking can detect are authentication gaps; security misconfigurations, the possibility of injection attacks, vulnerabilities allowed by developers, free access to sensitive data.

Detailed classification of DDOS attacks is proposed by Douligieris and Mitrokotsa [1]. The classification is quite comprehensive, although it lacks some new types of attacks such as Low-rate Denial of service (LDoS) attacks [2][3].

The most popular and effective tools for automated hacker attacks are presented in [4] and [5]. Both sources put SolarWinds DDoS Attack tool first. The malicious activity between the command and control server can be detected successfully by this tool. While the authors of [4] puts HULK (HTTP Unbearable Load King) on the second position, according to [5] this tool occupies fourth position. HULK is mainly used to generate large amounts of traffic directed to web servers. It can bypass the cache server, making it difficult to reflect. Generates unique network traffic and is suitable for research purposes. The authors of [5] put LOIC (Low Orbit

ION cannon) on the second position and HOIC (High Orbit ION cannon) on the third. LOIC is open-source software and perform HTTP, TCP, and UDP flooding attacks to the server. HOIC is also a free tool, based on HTTP flooding attacks and is designed to attack up to 256 websites at once. It is compatible with Linux or Mac OS. LOIC ranks fifth in [4], and HOIC is not in the rankings. Instead, Xoic is in sixth place in the rankings. Xoic is similar to Loic, but in addition it can perform ICMP attacks. Suitable for attacking small sites. Tor's Hammer is third in [4] and ninth in [5]. This tool uses Tor network and allows to hide the identity of the attacker. It holds open HTTP POST requests and connections for 1000 to 30,000 seconds. Slowloris is in fourth place in [4] and does not persist in [5]. This tool generates attacks via slow rate HTTP Get requests. This traffic is classified as abnormal and the attack is relatively easy to mitigate. PyLoris ninth in the ranking of [4] and sixth in the ranking of [5]. PyLoris uses Python script and supports Windows, Mac OS, and Linux. The attack can be made on HTTP, FTP, SMTP, IMAP, and Telnet. It can support up to 50 threads with 10 connections on each. DDoSIM (DDoS Simulator) is seventh in [4] and fifth in [5]. This tool performs TCP flooding attack on random port. It creates a complete TCP connection with the server and uses both valid and invalid requests. The tool is written in C++ and is compatible with Linux OS. RUDY (R-U-Dead-Yet) is eighth in both the [4] and [5] rankings. It is an easy to use tool for cloud applications DDoS attack. This tool browses the target website to detect the embedded web forms and sends long-form field submission. The next three tools persist only in [5]. The OWASP (Open Web Application Security Project) HTTP Post software is used to test the network performance of the web applications but can be used to test applications against the application layer attacks. DAVOSET is the command line tool, supports cookies and performs attacks using XML external entities. GoldenEye tool is written in Python, can use user agents and is based on HTTP GET and POST request to the server and KeepAlive messages.

II. FREE TOOLS AND ATTACKS

This report will examine the security of three UTP servers:

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two from the internal UTP network and one, hosted on external place, with the help of 3 free tools for hacker attacks. The objectives are two: 1) to test the ability to examine the security of a local network using free attack tools and 2) to assess the security of the internal network of UTP. The following tools were used for this purpose: Loic, Slowloris and Hulk. The chosen tools use different approaches to attack the servers and this is the reason why we focus on them.

A. Loic

LOIC [6] works with UDP, TCP and HTTP flooding attacks. The attack machine floods the target server with a large amount of UDP requests to a selected port during UDP flooding attacks. The server checks to see if there is an application waiting for requests on this port. If there is no such application, the server responds with an ICMP message - destination port unreachable. The OS is overloaded and if the fake requests are large enough, there is no time left to respond to the actual requests. Botnet networks (zombies) are used to get a really heavy load on the target server. TCP flooding attacks work on the same principle as UDP flooding attacks. HTTP flooding attacks are more complex to implement. They require in-depth knowledge of the attacked site. Uses "normal" packages. It does not work with malformed, fake or reflected packets, which makes the attack more difficult to mitigate.

LOIC allows botnet networks to be created and DDOS attacks to be performed using the HIVEMIND function. Many machines on which LOIC is installed connect to an IRC (Internet Relay Chat) server via an IRC client and create a channel or join an already created one. IRC (RFC 1459) is a standard for real-time communication on the Internet. To launch an attack, a member of Anonymous enters a specific IRC server and issues the attack command. Any Anonymous member connected to IRC with LOIC operating in HIVEMIND mode can immediately launch an attack on the target. AnonOps Network IRC Server DNS Names are shown in [7].

B. Slowloris

With the help of Slowloris [8], Slow Headers attacks are performed. This is a type of DOS and DDOS attack in which the attacking machine or zombies establish multiple TCP sessions to the target server. After that, they send a "normal" HTTP request to the server. But this request is divided into multiple TCP segments instead of being sent through one or two TCP segments. Each of these segments is sent sequentially, but over a long period of time. The time interval is large enough to slow down the server and small enough so that the time out does not expire and the server terminates the session due to a poor connection. Each TCP session takes up one thread from the server. Threads cannot complete until the entire HTTP request arrives.

Slowloris software waits for sockets to be released from legitimate requests and captures them one by one. Slow attacks consume a small bandwidth, so only one computer can

block a high-end server. Slowloris can prevent the creation of logs during the attack and thus avoid leaving traces.

C. Hulk

The Hulk was created for educational and research purposes. This tool makes it easy to understand the process of DoS attacks, to investigate security vulnerabilities in servers and to improve security. HTTP Unbearable Load King (HULK) is a type of flooding attack that uses different models and thus becomes difficult to recognize [9]. Using Python, Java, PHP, or another script (HULK scripts), attacks can be created to simulate multiple user machines. The mechanism of action of the Hulk attack includes two phase: passive (network investigation) and active attack [10].

III. EXPERIMENTS

A. Slowloris Attacks

The slowloris attacks will be implemented on 4 servers: one public, two servers from the internal network of UTP and one server of UTP, but with external hosting.

Experiment 1

The type of attack is SLOW HEADERS. The number of connections (socket pairs) is 500 - requests are sent on behalf of 500 different applications, 500 connections are created to the server. 200 requests for new connections are sent per second. The duration of the attack is 240 seconds. In FIG. 1 shown a diagram of the behaviour of the target server for the first 11 seconds of the attack. After that, the graphs do not change. It can be seen that in the second 2nd all entry points are occupied and the server is inaccessible. The red line shows the connections that are in standby mode at the server. At the 5th second, saturation is reached and all 500 connections are in standby mode.

The server returned to operating normally after the attack ended. The IP address of the attacking machine was blocked until the circumstances were clarified.

Conclusion. Administrators on this server must use tools to protect against slow speeds and many requests. This server is not from UTP's internal network, but is included in the paper to demonstrate a poorly secure server. As will be seen below, all UTP servers successfully deal with LOW HEADER attacks.

The following experiments were performed with the knowledge and permission of UTP system administrators.

Experiment 2

unicloud.utp.bg, which is a server from the internal network of UTP, is attacked using Slowloris. The attack is performed from the external network to test the behaviour of the UTP firewall and the server itself. The conditions of the attack are the same as in experiment 1. The results for the first 14 seconds are shown graphically in fig. 2. It can be seen that the server is available throughout the attack. The connection level in standby mode is very low during the first 5 seconds and 0 during the rest of the attack. This means that the server

is well protected from slow attacks. After the 10th second, all connections from the attacker are closed.

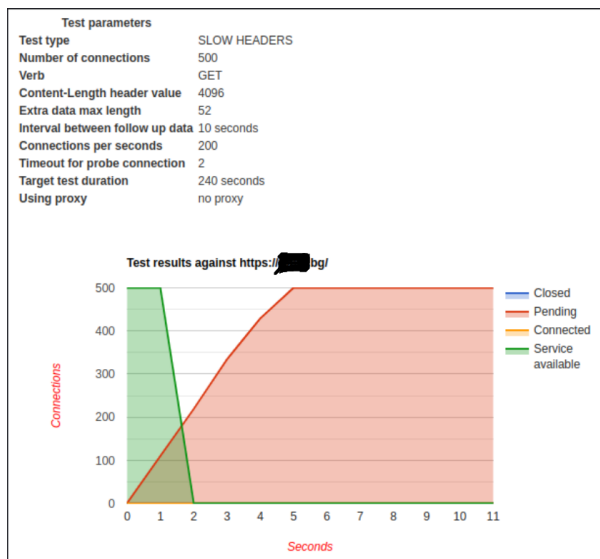


Fig. 1. Graph of links with the public server in SLOW HEADERS attack

Conclusion. The UTP server and firewall successfully mitigate the SLOW HEADERS attacks.

Experiment 3

unicloud.utp.bg is attacked using Slowloris. The attack is performed by the internal network to test only the behavior of the server. The firewall does not currently protect servers from internal attacks. The conditions of the attack are the same as in Experiment 2. The results are almost identical to those in Experiment 2.

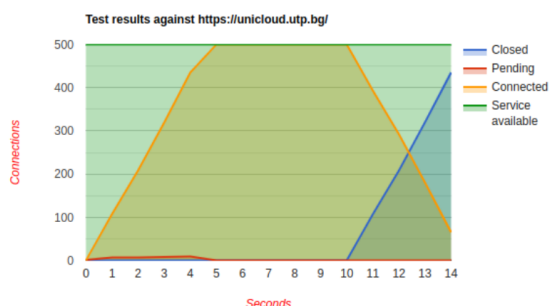


Fig. 2. Graph of the connections made in the server unicolor.utp.bg in case of an attack from the external network

Conclusion. The UTP server is well protected and successfully handles Slowloris SLOW HEADERS attacks. After comparison with the results of the attack from the external network, it is seen that the results are completely identical. It can be concluded that protection against SLOW HEADERS attacks is performed only by the server. The firewall does not have this type of attack configured, or the protection is weaker than that of the server.

Experiment 4

elearning.utp.bg, which is the next server from the internal network of UTP, is attacked using Slowloris. The attack is performed from the external network. The conditions of the attack are the same as in Experiment 1. The results for the first 81 seconds are shown in fig. 3, after which the curves stabilize. There is an interruption in the availability of the server from the 3rd to the 27th second and from the 36th to the 63rd second. It is noticed that most connections are in standby mode in the first 10 seconds of the attack. Then a process of forcibly closing the connections is activated.

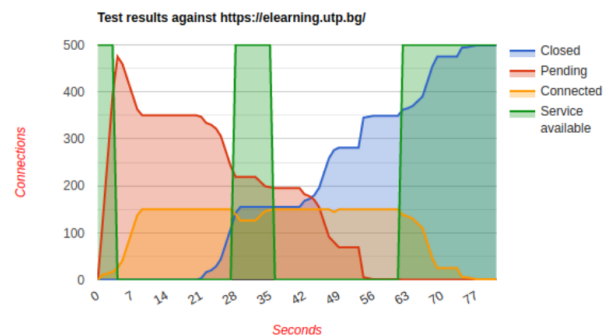


Fig. 3. Graph of the connections made in the server elearning.utp.bg in case of an attack from the external network

Conclusion. The server and the firewall of UTP managed to deal with the SLOW HEADERS attacks only after the 63rd second. Server behaviour is better than the one shown in Experiment 1, but worse than Experiments 2 and 3.

Experiment 5

UTP server elearning.utp.bg is being attacked with the help of Slowloris. The attack is carried out by the internal network. The results are identical to those of Experiment 4. The conclusion confirms that the protection of servers from SLOW HEADERS attacks is performed mainly in the servers.

Experiment 6 and 7

egateway.utp.bg, which is the last server in our experiments and is situated in the internal network of UTP, is attacked using Slowloris. The attack is performed from the external network. The conditions of the attack are the same as in Experiment 1. The results for the first 11 seconds are shown in fig. 3. After the first minute the server becomes inaccessible. The same results are observed in an attack from the internal network. This is the least secure server in terms of SLOW HEADERS attacks.

B. LOIC Attacks

The LOIC attacks will be implemented on 3 UTP servers: two internal and one external. Ports 80, 8080 and 443 were attacked. Fifteen sources were simulated. The hardware parameters of the attacking machine do not allow the simulation of a larger number of sources. The graphical interface of the LOIC tool in case of an elearning.utp.bg attack is shown in Fig. 4.

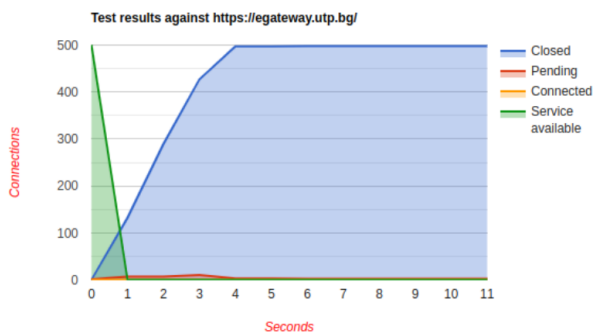


Fig. 3. Graph of the connections made in the server egateway.utp.bg in case of an attack from the external network

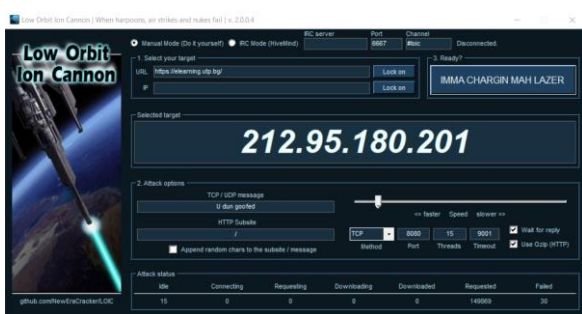


Fig. 4. LOIC attack to the elearning.utp.bg

The LOIC attack showed that all three servers were well protected from such attacks.

C. HULK Attacks

The *HULK* attacks will be implemented again on 3 UTP servers. The results are very interesting. In the first group of experiments, the three servers were attacked by both sides: the internal UTP network and the external network. All three servers became inaccessible for the duration of the attack. Their functionality was restored after the attack was stopped. A month later, the experiment was repeated. All three servers mitigate the attack without compromising their availability. It is necessary to conclude that the protection of the servers has improved during the past period.

IV. CONCLUSION

The results of the experiments can be summarized in table 1.

In conclusion, it can be said that all three UTP servers show resistance to the types of attacks carried out and are much better protected than the public server from Experiment 1. The three tools used allow for a realistic assessment of the security of different servers from popular DOS and DDOS attacks.

TABLE I
EXPERIMENT RESULTS

	unicloud.utp.bg	elearning.utp.bg	egateway.utp.bg
Lois	Good protection		
Slow-loris	Best protection. Accessibility is not compromised.	Availability is restored after the 63rd second.	Weakest protection. The server is unavailable after the first second.
Hulk	Good security after software upgrade		

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Information - Main Object of Security

Zahari Biserov¹

Abstract – On July 16, 2019 in Sofia, Bulgaria, a hacker attack caused a data leak by the Revenue Agency. Nearly 5 million citizens were affected. As it turned out, after this event, we have already been exposed to harmful influences at a high state level in terms of protecting the security of information files and communication and information systems and networks.

Keywords – Information Security System, Communication and Information Networks, Cyber Security, Hacking Attacks

I. INTRODUCTION

It is impossible to comment on the big topic of security without taking into account the processes and facts concerning the security of information and the security of communication and information networks. In this regard, it is logical to state and clarify some initial definitions concerning basic processes and phenomena in security. For clarity and consistency, we will consider the matter from the big and the general to the small and the private, assuming that we analyze and comment on the processes from the point of view of security. As we have already had the opportunity to comment on, "The state of the modern security environment clearly confirms that security actors are losing the battle with the factors that generate insecurity. It should be clear that the efforts of individual security actors are designed and required by law to provide a satisfactory security situation for security facilities.

II. EXPOSITION

We will consider the population, the institutions, the business entities and the infrastructure as the main objects of security ". To the specified security objects it is necessary to add the information as an object of security, taking into account that it is, in order of importance, to date immediately after the people. Possession and use of information is an integral part of human activity. This is the time to state that human activity needs to develop in a state of security. We have already written that "the condition, the level of security, of protection, is decisive for the work of any system and for the vitality and efficiency of the individual or group of people. A satisfactory state of security cannot be achieved if a number of elements and systems do not synchronize their actions in order to identify threats, monitor hazards, analyze and assess risk, make decisions and impact with "sufficient human and material resources" on risk factors ". In other words, it is correct to think of security as a product produced by a "system

or integrated community of interconnected elements." In connection with the above, it is clear that security is a product of the action or inaction of authorized security entities united in a higher organization, as modern society is organized, exists and develops within a common entity, which we call the state. Thus, we come to the point where we need to indicate who is responsible for achieving a satisfactory state of security at the state level. We call this supreme body responsible for achieving a state of security a System for the Protection of National Security. The national security protection system should be able to control the harmful effects against the main security objects listed above. Later in the statement, it will become clear that when it comes to information as an object of security, control faces a number of threats and often the protection of information, information systems and networks is in question. As we stated at the beginning of the presentation, in today's security environment, information is the main object of security, positioned in importance immediately after the human resource. If we refer to what is stated in Wikipedia, then "information (from Latin: informatio - explanation, exposition, awareness) is a concept, related to the objective property of material objects and phenomena (processes) to generate a variety of states that can be transmitted to other objects through interactions and be sealed in their structure. Information is available, usable knowledge, but there is no single definition, but there is a relatively wide range of meanings in different areas of knowledge.

Why information is ranked second, we think it is clear - information is the knowledge of the world around us, the state of its quantitative and qualitative parameters. Possessing this knowledge enables us to be prepared and competitive in the environment in which we live and work. Knowing information about facts, circumstances and processes helps us survive. Of course, information is a force when used by a certain circle of people, when it is available to everyone it is just knowledge. In this regard, "an integral part of any security system is the unit or subsystem responsible for the security of information and information systems and networks. The information is a result of the perception and processing in the human consciousness of the processes, phenomena and their material and immaterial basis taking place in our environment. Based on human consciousness, this information becomes knowledge. Because it can store a limited amount of

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information in the human mind, storage requires a material medium. Once it appears and is based in an information array or information system, the information could be subject to harmful effects. Adverse effects can be divided into two main categories:

Intentional adverse effects are targeted and planned effects aimed at violating one or more characteristics of the information. In these impacts, there is a subject who conceives and applies the harmful impact.

- Unintentional harmful effects are accidental effects that lead to deterioration of the main characteristics of the information. In these impacts, the subject does not intend or act on any risk factor.

Objects of influence can be all carriers of information and elements of communication and information networks /CIM/, namely:

- technical information carriers, the transmission medium for communication objects, the technical means of the communication network, the technical means of the information network, the software of the technical means of KIM, the cryptographic means of protection and keys.

For example, the US National Security Agency (ANS), as well as the British service / GCHQ - Government Communications Headquarters /, dealing with cryptography, data transmission and telecommunications intelligence have focused on the overall construction of the Internet in a global scale:

- vitreous cables for transmission of digital signals, distributors, servers, routers, spare parts, etc.

Of course, the security services of Russia, China, Israel and others do the same through their respective units. Considering that we have declared the information as the main object of security, we must identify the possible risk factors that would attack the information arrays and communication and information systems and networks. From the above it is clear that information has a dual "behavior", at one point it is our first assistant, but at another time, used in a criminal way and in the interest of criminal purposes, it is capable of causing great damage. On July 16, 2019, it became clear that in Sofia, Bulgaria, "a hacker attack caused a data leak by the Revenue Agency. Nearly 5 million citizens are affected. The National Revenue Agency and SANS have launched an investigation into the case. As it turned out, after this event, we are already exposed to harmful influences at a high state level, in terms of protecting the security of information files and communication and information systems and networks. As a result of the electronicization of the information, we see that the scale of the damage in the event of a successful attack on it is appalling. It is clear that security protocols, workplace culture and other internal and regulatory rules of security policy have been violated. According to Associate Professor Vladimir I. Yarochkin, "the threat to the confidentiality of information are actions that represent:

- obtaining confidential information in various ways and means without compromising its integrity;

- change of the information for criminal purposes, as partially or significantly changes the composition and content;
- destruction of information, such as an act of vandalism, for the purpose of causing material damage.

As a result of the realized threat to the security of the information, information can be obtained about the composition, the condition and the actions of the protection of the site and about the personnel, the material and financial values and the information resources themselves. The danger for the information is expressed in violation of its integrity, confidentiality, completeness and accessibility. Competitors, criminals, administrative bodies can be a threat. Illegal acquisition of information can be obtained from the source itself, from a breach of technical means or from unauthorized access to the stored information. Sources of confidential information are people, documents, publications, technical media, technical means ensuring production and labor, production and production waste. The main directions in the protection of information are the legal, organizational and engineering-technical protection of the information, as elements of the complex approach in ensuring the information security. The means of information protection are physical, hardware, software and cryptographic methods. Human activity is unthinkable today without the use of huge databases, some of which are official, state and corporate secrets. The interest of competing entities will be directed precisely in this direction - gaining access to these databases containing sensitive information. In other words, every owner of sensitive information should expect and be prepared to face cyberattacks aimed at obtaining valuable information. Process management in a corporation is associated with identifying various problems and timely offering and implementing solutions to them. Practice shows that the lack of connections, interaction and coordination between the subjects of security, almost always leads to incompleteness of the information picture, gaps in the security protocols, and hence the emergence of vulnerable spaces for penetration of harmful effects. An unpleasant example in this regard is the cyber attack against the National Revenue Agency, from which personal data of more than five million Bulgarian citizens were downloaded. Previously, a number of sites of state institutions were attacked, which led to a breakdown in their activities and inconvenience to citizens and businesses. Indicative is the fact that the "Cyber Security Act" was adopted in December, 2018. Objects of attack are daily companies and corporations, attacked business and corporate secrets, correspondence, transactions of trading partners. Corporate cybersecurity providers need to recognize that human resource training is essential. Recently, corporate and criminal entities have turned their attention to employees, as a starting point for a breakthrough in the information systems of companies. Training gaps, weaknesses in the workplace culture, as well as human shortcomings such as greed, propensity for a comfortable life and other addictions are used

by competitors and outright criminals to penetrate communication and information systems and networks through the assistance of disloyal employees. At the state level, it is already recognized that the prevention of cybercrime must also revise the penalties for such crimes.

III. CONCLUSION

In conclusion, we should summarize that this report is a small part of the big topic of information security and information and communication systems and networks. For its part, the system for the protection of information, communication and information systems and networks is an extremely important subsystem of the System for the Protection of National Security. In this regard, the training of students in this discipline is relevant and timely, as the need for specialists and experts in cybersecurity will continue to grow.

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Problems and Threats for the Citizens’ Rights in Performing of Biometric Identification

Dragomir Krastev¹

Abstract – The widespread use of biometric technology began at the beginning of the first decade of the 21st century. It is linked to the growing threat of terrorist acts in many countries around the world. Biometric technologies are used to identify subjects by physiological, biological, and behavioral characteristics.

Keywords – Citizen Rights, Biometric Identification, Security

The widespread use of biometric technologies began in the early first decade of the 21st century. It is associated with the growing threat of terrorist acts in many countries around the world [1]. The biometric technologies are used to identify subjects by physiological, biological and behavioral characteristics such as facial geometry, fingerprints, DNA and gait [2].

These characteristics are directly related to individuals and in most cases constitute personal data, enforcing the decrees of the relevant legislation.

E. Kindt, author of one of the few researches in the field of legal regulation of the processing of biometric personal data in the EU, emphasizes the need of fast identification of additional categories, because when classifying biometric information as a regular category of personal data, the characteristics of this type of information is not taken into account, which leads to significant threats of violation of the rights of subjects [3].

The biometrics can also be used in cases of discrimination; for example, the information contained in DNA makes it possible to establish the predisposition of the individual to certain diseases, which can subsequently be used in the field of employment, insurance, etc. [4]. However, these data are already assigned to a special category of personal data like the information on the health status of the subject. Similar regulation applies to the automated processing of information about the race of the subject, and although biometric technologies may be used in such a situation, the processing of this data will also apply to the provisions for the protection of information related to a special category of personal data. In this case, the sensitivity of biometric personal data is determined by their properties.

First, biometric characteristics are unique and universal,

for example DNA, fingerprints, facial geometry (in most cases) are unique to a person, which allows the identification of an individual and significantly restricts the right to privacy. Second, such information, as well as the tangible medium, become available for collection and analysis by others during the daily activities of the subject, regardless of his will, which allows this information to be accumulated and processed secretly without the person shall be notified thereof.

Third, unlike other personal data, such as surname and first name, which are assigned by other entities or the state and can be further changed, biometric characteristics are virtually unchanged, which can lead to negative consequences if they are used illegally by third parties. Likewise, the use of biometric data for criminal purposes, their dissemination and the difficulty of proving innocence in the case of the detection of fingerprints or biological material of a crime scene suspect also speaks to the sensitivity of this information [5].

The above circumstances allow us to consider biometric personal data as sensitive information, the processing of which must be regulated by special rules. This is also confirmed by the models of national legislation, where biometric information is considered sensitive information under the data protection legislation of the Czech Republic, Italy, Estonia and France.

In connection with the development of information technology, increasing the number of processed information for citizens, as well as the various identifying potentials of this information, in the scientific literature there is a dispute about the need of use an objective or subjective approach to personal data processing [6].

The objective approach assumes that information is recognized as personal data, regardless of whether the operator has the ability to identify the subject [7].

The subjective approach assumes that the operator must be reasonably able to identify the object on the basis of additional information at its disposal or that information may obtain from others [8].

Thereby to special and biometric categories of personal data, this approach is transformed into the need to establish

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the purpose of the processing of the relevant information by the operator. When processing the subject's personal data, such as a photo of him, based on a literal interpretation of the law, the operator will also process information related to the special category of personal data, as the person's image characterizes the subject's race and may also reflect his health. Such a formal approach has been criticized by a number of authors due to the lack of knowledge on the part of the operator of which type of personal data it processes [9].

According to Zahari Biserov, "Gathering information as a problem has begun to give way to another accelerating problem. This is the problem of information protection. With transferring the information in to electronic form, a number of complications arose concerning its protection." [10].

Biometric identification gives the opportunity for a distance virtual access of bank service to the citizens. That way they could "visit the bank" at any time of the day and will save their free time.

But this distance identification convenience by photo or voice is valued not only for the bank clients but also for the cybercrimes.

In spite of the developers desire to improve the technology and to make it safer, the explorers all the time reporting about the new methods of similar systems.

Biometric identification has functions that makes it different from the well-known combination user/password or "safe" 2FA.

1. Biometric data are public. You could find photos, videos or audio records of almost everybody around the world and use this information for identification.

2. It is impossible to replace a face, voice, fingerprint or retina in the same way like a password, phone number or 2FA designation.

3. Biometric identification confirms personality with a probability close to, but not equal to 100%. In other words, the system admitted that every human could be different to a certain extent from its biometric model in the database storing [11].

The main problems related to the biometric identification consist frauds, thefts, low quality of the collected information, as well as repeated data collection of one person from different organizations.

To prevent biometric systems of taking pictures of people, they use the so called "liveness" detection technology, a set of various checkup that allows to define that in front of the camera is a real person and not his photo.

But this technology could be misled.

In the BlackHat 2019 report named "Biometric Authentication Under Threat: Liveness Detection Hacking" announced about the successful conquer of liveness detection in Face ID with the help of glasses, placed on a sleeping person, introducing forged audio or video streams or other

methods. For example: Face ID is operated if a person place on sunglasses. At the same time, the light in the eyes decreases, so the system couldn't create a 3D high-quality model of the eyes area. Because of this finding glasses, Face ID doesn't give a 3D information and present it like an abstract model - a black area with a white dot in the center.

Some banks started their own biometric system before EBS start working. After giving his biometric data, a person believes that he can use the new service technology in other banks as well, but when he understands it is not like this, he should make it again.

The availability of several parallel biometric systems led to the following risks:

- A person who has submitted his biometric data twice probably could make it again and that way will become a victim of cybercrime.

- In the future there will be more frauds because of increasing the possible data access.

Generally, the biometric system doesn't keep photos and voice records, but sets of numbers that characterize a person - a biometric model. And now let's talk about this in more details [12].

To build a face model, the system finds anthropometric reference points specified its individual characteristics. The calculating algorithm of these points is different than the system and this is a developers' secret. The minimum checks of control points are 68, but in some systems their number is 200 or more.

Based on the found reference points is calculated a descriptor - a unique set of face characteristics, nevertheless of hair, age and make-up. The received descriptor (massif of numbers) is a biometric model that is stored in the database. The original picture of the model is impossible to restore.

To identify the user, the system builds its biometric model and compares it with the descriptor stored in the database.

There are important consequences of the model building principle:

1. The use of data stolen from one biometric fraud system to another is unlikely to succeed due to different reference point search algorithms and serious differences in the obtained model.

2. It is also impossible to deceive the system with the help of stolen data - identification requires the presentation of a photo or audio recording, which will already be used to build the model and compare with the standard.

Even if the database stores not only biometric models, but also photos and audio on which they are built, it is impossible to mislead the system with their help "on the forehead": the algorithms for checking for "vitality" consider the results completely incorrect with the same descriptors.

Thus, the use of leakage biometric data will not help cybercriminals to quickly obtain material benefits, which

means that they are more likely to look for simpler and more reliable ways to enrich various types of material and financial resources.

Protection measures

The EU Directive PSD2, comes into force on 14 September 2019, also known as Open Banking, requires banks to apply multi-factor authentication to ensure the security of remote transactions performed on any channel. This means the mandatory use of two of their three components:

- **Knowledge** - some information known only to the user, such as a password or security question.
- **Ownership** – a device that only the user has, for example, a phone or tag.
- **Uniqueness** - something inherent in the user and uniquely identifying the person, for example, biometric data.

These three elements must be independent so that the compromise of one element does not affect the reliability of the others [13].

Regarding to the bank practice, this means that biometric transactions must be accompanied by additional checks using a password, token or PUSH / SMS codes.

CONCLUSION

Biometric authentication has great prospects, but the dangers that come into our lives with them seem very realistic. System developers and legislators should study the results of the latest vulnerability research on biometric systems and instantly finalize both identification decisions and regulatory acts settled their work.

Banks need to take into account the situation of deep errors and other methods of fraud with biometric systems, using a combination of traditional methods to identify users with biometric data: passwords, 2FA and USB tags can still be useful.

The situation is difficult for the bank customers. On the one hand, biometric identification has been developed for their convenience as an attempt to expand the possibilities for obtaining banking services at any time with minimal formalities. On the other hand, in the event of a successful attack, they risk their money, and regulators and developers of biometric systems are not responsible for hacks.

In this connection, a logical recommendation to bank customers is not to rush to provide biometric data, not to pay attention to aggressive calls. If you cannot avoid biometric identification, use it in together with multifactor authentication to be able to at least partially reduce the risks.

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