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C O N T E N T S

SCIENCE

STUDY OF GLASS-METAL INTERFACE IN AMORPHOUS FERROMAGNETIC MICROWIRES
M.Sc. Kravčák J. PhD. 43

SOURCE SKIN DISTANCE DEPENDENCE OF RESPONSE OF IN VIVO EXIT DOSE DIODE DETECTORS USED IN EXTERNAL RADIOTHERAPY
PhD Student Syrja Baci, PhD. Ervis Telhaj Prof. PhD. Partizan Malkaj 46

THE VOLUNTARY DISTRIBUTED COMPUTING PROJECT OPTIMA@HOME
Kurochkin I.I., Afanasyev A.P. 51

EFFICIENCY AND ECOLOGICAL IMPACTS OF HOUSEHOLD OZONE LAUNDERING
Prof.. Neral B. PhD. 54

STUDY OF THE TILLAGE AND PLANTING INFLUENCE ON THE MAIZE YIELDS.
Bratoev, Kr., G. Vezirska, G. V. Mitev1, G. Gerdjikov 58

BUSINESS

AN OPTIMIZATION MODEL FOR VEHICLE'S SUB-SYSTEM OF CITRUS FRUITS TRANSPORTATION ON THE ROUTE "FARMING ENTERPRISE-REGIONAL AGRARIAN LOGISTICS CENTER"
Prof.Dr. Botsvadze L., Doctoral candidate Sharabidze D. , Doctoral candidate Gudadze A. 62

SELECTION AND STUDY OF AGRO-TOURISM FACILITIES IN THE IMERETI REGION OF GEORGIA
Prof. Dr. Kochadze T.,Assoc.Prof. Dr. Chogovadze D., Assoc.Prof. Dr.Dangadze I ., Master's degree holder Kochadze I. 66

FLEXIBLE PRODUCTION STRUCTURE AS A BASIC REQUIREMENT OF THE GLOBAL MARKET
Prof. dr. Saiensus M.A. 70

SIMULATION MODULE FOR PRODUCTION PLANNING AND CONTROL
Dipl. Mech. Eng. Albina Mucha, Ass. Prof. Dr. Bojan Jovanoski, Prof. Dr. Robert Minovski, Prof. Dr. Valentina Gechevska 72

GENDER DIFFERENCES IN RESPONSE TO EROTIC ADVERTISING
Kozhouharova V. 76

ETHICS OF EROTIC STIMULI IN ADVERTISING
Kozhouharova V. 80

SOCIETY

STATISTICAL PROCESS CONTROL IN OFFICIAL STATISTICS
Prof. Vesna Bucevska, Ph.D. 83

INFORMATION OPENNES OF EDUCATIONAL ORGANIZATIONS IN MODERN RUSSIA
Rezer Tatyana Mikhaylovna 85

INFLUENCE OF ONLINE ACTIVISM ONTO TRADITIONAL MODELS OF POLITICAL PARTICIPATION
Doc.dr Petrović D., Prof. dr Bešić M. 88

TEN THINGS WE NEED TO KNOW ABOUT THE ISLAMIC STATE
Maciej Huczko PhD 92

A REVIEW OF ENTERPRISE SUSTAINABLE DEVELOPMENT MODELS: CRITICAL APPRAISAL
Oželienė D. 97

STUDY OF GLASS-METAL INTERFACE IN AMORPHOUS FERROMAGNETIC MICROWIRES

M.Sc. Kravčák J. PhD.
Faculty of Electrical Engineering and Informatics – Technical University of Košice, Slovak Republic

jozef.kravcak@tuke.sk

Abstract: *In presented contribution two types of glass-metal bond are investigated by scanning electron microscope (SEM) equipped with EDS. Firstly, a mechanical bond, which usually provides weaker random joints. Secondly, chemical interaction, where the oxide layer on the metal surface forms a strong bond with the glass. Additionally magneto-impedance measurements are used to determine surface magnetic properties of microwires with and without glass cover. Considering giant magneto−impedance (GMI) effect, which is mainly a surface effect at higher frequencies, is very sensitive to the rotation of magnetization in the shell of a microwire. Thus GMI measurements are often used to determine magnetic anisotropy, hysteresis and residual magnetic domain structure formed around local defects (pits) on the surface of amorphous ferromagnetic microwires.*

Keywords: FERROMAGNETIC MICROWIRE, AMORPHOUS ALLOY, GLASS-METAL INTERFACE, MAGNETIC ANISOTROPY

1. Introduction

Glass-covered ferromagnetic amorphous thin wires (microwires) of a diameter about 10 μm are prepared by Taylor-Ulitovski technique [1, 2]. During the rapid quenching of microwires a glass-metal interface is formed. Because the coefficient of thermal expansion of metallic core is higher than that of the outer glass cover (Fig. 1), a rather complex inhomogeneous distribution of radial, axial and torsional mechanical stresses is induced in the metallic part of microwires [3]. Axial tensile stresses are dominant in inner part of metallic wire, and compressive stresses are dominant near the glass-metal interface. Magnetoelastic anisotropy of the investigated $Fe_{77.5}Si_{7.5}B_{15}$ microwire is given by axial tensile stresses and positive magnetostriction. Due to the minimization of magnetoelastic energy, the resulting magnetic domain structure of $Fe_{77.5}Si_{7.5}B_{15}$ microwire consists of a single axial domain in the center and radial multi domain structure near the glass-metal interface [3]. On the other hand the relatively small negative magnetostriction of amorphous glass-covered $Co_{70.5}Fe_{4.5}Si_{15}B_{10}$ microwire results in the creation of a wide almost circularly magnetized shell domain structure and a narrow axially magnetized core [4]. The preferential orientation of the spontaneous magnetization (magnetic anisotropy) in the microwire is given by magnetostriction and shape anisotropy. Different mechanical properties of the ferromagnetic metallic central part and of the glass cover of the microwire are responsible for deviation of spontaneous magnetization from circumferential (circular) direction in the shell of the microwire (helical magnetic anisotropy). Additional removing of the glass cover gives the possibility to decrease the helical anisotropy. Glass and metal can bond together by purely mechanical means, which usually gives weaker joints, or by chemical interaction, where the oxide layer on the metal surface forms a stronger bond with the glass. Therefore the detail understanding of mechanical and magnetic properties of the glass-metal interface is necessary for the possible applications of microwires in stress sensors, magnetometers and health monitoring [5].

2. Experimental methods

The scanning electron microscope (SEM) Hitachi TM3000 equipped with energy-dispersive X-ray spectrometer (EDS) Oxford Instruments Swift ED3000 has been used for experiment. We have prepared polished cross-section of $Fe_{77.5}Si_{7.5}B_{15}$ microwire. The atomic concentration of iron, silicon and oxygen in $Fe_{77.5}Si_{7.5}B_{15}$ microwire has been investigating by means of EDS line scan of cross-section. The gradient of oxygen and iron concentration has been detected.

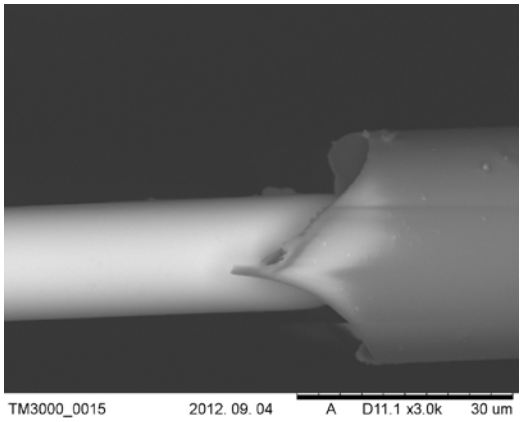


Fig. 1 *SEM image of glass-covered ferromagnetic amorphous $Fe_{77.5}Si_{7.5}B_{15}$ microwire.*

Mechanical glass-cover removing

The glass-covered microwire is usually fixed on a carbon tape during observation in SEM. After pulling down the microwire its glass-cover cracks and flakes away. Removed glass-cover remains glued to carbon tape (Fig. 2). Inner part of glass-cover interface can be visible in SEM and analyzed by EDS. Exposed surface of metallic part exhibits random distributed inclusions (pits) and small glass fragments (Fig. 3, 4).

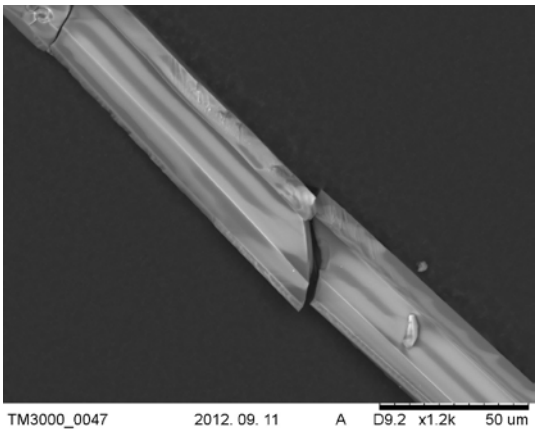


Fig. 2 *SEM image of mechanically removed glass cover from ferromagnetic amorphous $Fe_{77.5}Si_{7.5}B_{15}$ microwire.*

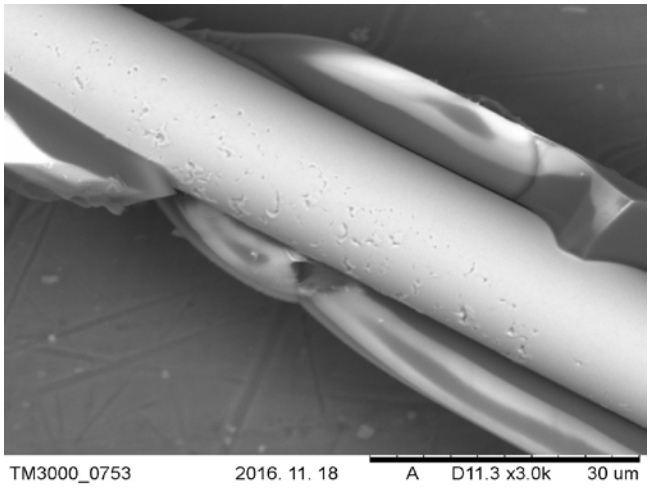


Fig. 3 *SEM image of ferromagnetic amorphous $Fe_{77.5}Si_{7.5}B_{15}$ microwire of a diameter d=17.8 μm with mechanically removed glass cover.*

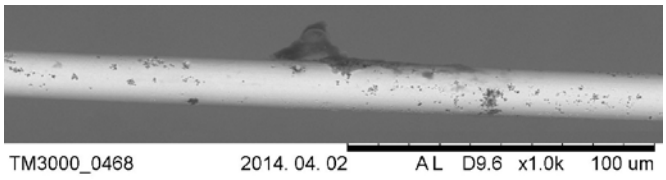


Fig. 4 *SEM image of ferromagnetic amorphous $Co_{70.5}Fe_{4.5}Si_{15}B_{10}$ microwire without glass cover of a diameter d=15.3 μm.*

Cross-section of glass-covered microwire

Cast-resin glass-covered microwire $Fe_{77.5}Si_{7.5}B_{15}$ has been polished and cleaned. SEM image of the microwire cross-section (Fig. 5) revealed the glass inclusions at the surface of inner metallic part. The glass anchored in the metallic part by means of inclusions produces strong axial and torsional mechanical stresses along the microwire (Fig. 6). On the other hand the radial tensile strength depends on the type of glass-metal bond: 1) mechanical bond, which usually provides weaker joints; 2) chemical interaction, where the oxide layer on the metal surface forms a strong bond with the glass. The character of the glass-metal interface can be investigated by EDS line scan of the microwire cross-section (Fig. 7).

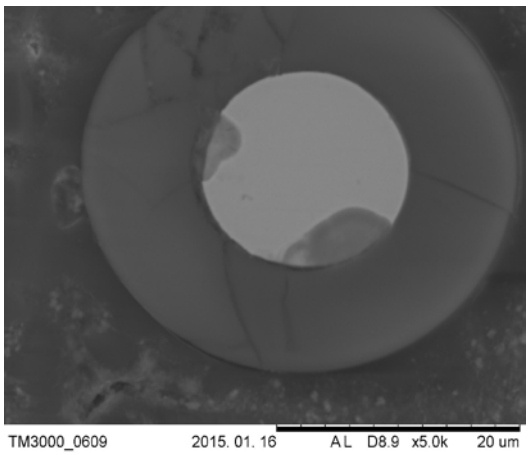


Fig. 5 *SEM image of the cross-section glass-covered ferromagnetic amorphous $Fe_{77.5}Si_{7.5}B_{15}$ microwire.*

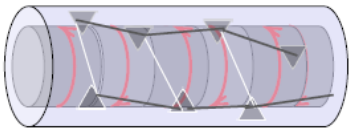


Fig. 6 *Scheme of random distribution of inclusion on the surface of the wire (black triangles). Axial and torsional mechanical stresses resulting from the coupling forces (black and white lines).*

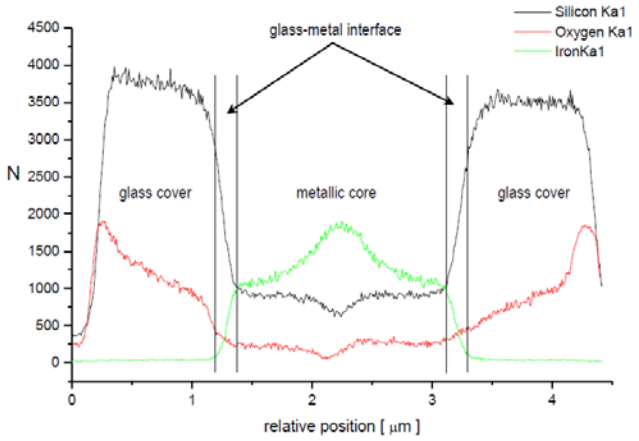


Fig. 7 *EDS line scan of the cross-section of glass-covered $Fe_{77.5}Si_{7.5}B_{15}$ microwire in Fig. 4 (green is iron, black is silicon and red is oxygen relative concentration).*

In Figure 7 the concentration gradient of oxygen (red curve) in glass-cover and the concentration gradient of iron (green curve) are displayed. This indicates that atomic diffusion processes occur during preparation of glass-covered microwire $Fe_{77.5}Si_{7.5}B_{15}$ consisting of rapid quenching and drawing of melted alloy in glass capillary. Glass and metal can bond together by purely mechanical means, which usually gives weaker joints, or by chemical interaction, where the metal oxide in glass-metal interface forms a stronger bond with the glass.

3. Results and discussion

Irreversible magnetization rotation

In case of a circular wire it is convenient to use cylindrical coordinates. Helical magnetic anisotropy is given by a preferential orientation (easy axis) of the spontaneous magnetization $\boldsymbol{M_0}$ of the microwire at zero external magnetic field what can be expressed as $\boldsymbol{M_0} = (0, M_\phi, M_z) = (0, M_s \cos \alpha, M_s \sin \alpha)$, where M_s is the saturation magnetization, α is the angle of deviation of the easy axis of magnetization from the circumferential direction of the microwire (spiral angle, $0<\alpha<90^o$). The angle α determines the shape of the hysteresis loop of the microwire (Fig. 8) during its magnetization along *z*-axis with irreversible magnetization rotation at the critical field [6]. The magnetization curve for $\alpha = 90°$ is without hysteresis (reversible magnetization rotation) and in this case the longitudinal wire *z*-axis represents a hard axis of magnetization.

Surface magnetic domain structure

Details of the metallic surface of the microwires, studied by means of SEM (Fig. 3, 4, 5), revealed surface defects (pits), where the glass cover is bonded to metal. The measured GMI dependences of as-cast $Co_{70.5}Fe_{4.5}Si_{15}B_{10}$ microwire with glass cover and after glass cover removing in Fig. 9 displays the double-peak behaviour [7, 8]. The theoretical explanation is that for very low amplitudes of circular field strength H_ϕ any reversible domain wall motion at higher frequencies (≥1 MHz) is negligible due to strong damping process and magnetization rotation takes place only in the shell of

the microwire. The positions of the couple of sharp peaks ($H=\pm H_m$) are always symmetrical with respect to zero external magnetic fields strength $H=0$ and correspond to the critical field of irreversible magnetization rotation. The dispersion of the critical field altogether with local variation of the easy axis of magnetization affects the peaks shape.

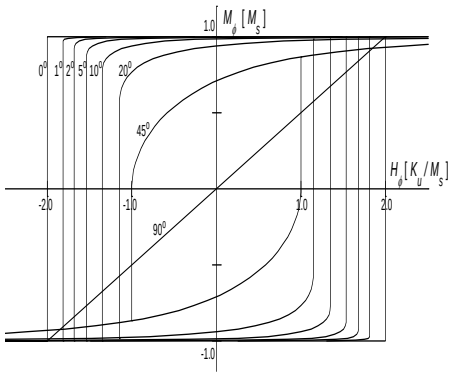


Fig. 8 *Calculated reduced magnetization curves M_ϕ (H_ϕ) in case of irreversible magnetization rotation and helical magnetic anisotropy for various value of α (in degrees).*

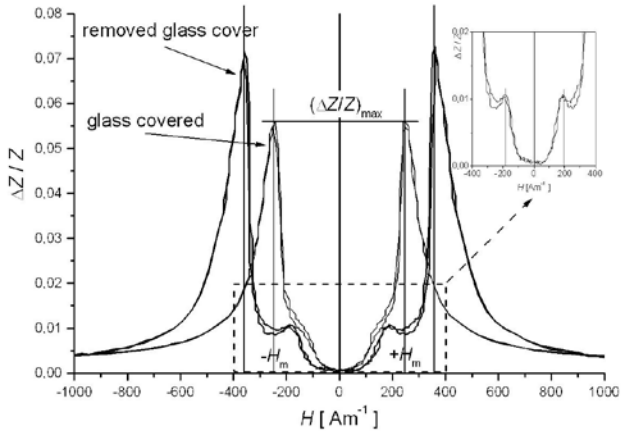


Fig. 9 *GMI dependence measured at the frequency of 1 MHz and at the amplitude i_{ac}=1 mA in as-cast $Co_{70.5}Fe_{4.5}Si_{15}B_{10}$ microwire of a diameter d = 8.1 μm with glass cover and after glass cover removing [7].*

The formation of a secondary small GMI peaks (inset in Fig. 9) has been observed after glass cover removing. The theoretical explanation is that the blade-shaped domains [6, 9], displayed in Fig. 10, are formed on both sides of surface defects (pits) to minimize magnetostatic energy. The blade-shaped domains are also responsible for hysteresis observed in GMI dependence.

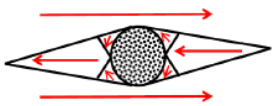


Fig. 10 *Scheme of the blade-shaped domains on the surface of the wire closing the defect (pit).*

4. Conclusion

The atomic diffusion processes occur during preparation of glass-covered microwire $Fe_{77.5}Si_{7.5}B_{15.}$ The glass oxide bond is stronger than pure glass metal bond. The oxide forms a layer on the metal surface during preparation of glass-covered microwire consisting of rapid quenching and drawing of melted alloy in glass capillary. A too thick oxide layer tends to be porous on the surface and mechanically weak, compromising the bond strength and creating glass fragments along the metal oxide interface. Proper thermodynamic conditions are therefore critical for the homogeneous oxide layer creation. Another mechanism is the local glass growing into the metal and anchoring together the metal and glass, forming the inclusions and weaker mechanical bond.

The removing of the glass cover reduces tensile stresses in the microwire, changes the induced helical anisotropy and the angle α. This results in increasing of the critical field and the maximum value of GMI ratio $(\Delta Z/Z)_{max}$ in Fig. 9.

A residual domain structure formed around inclusions and local pinning centers of the glass fragments on the microwire surface manifests itself in formation of a secondary small GMI peaks (inset in Fig. 9).

Despite the fact that occurrence of the hysteresis in GMI dependences is a disadvantage from the application point of view, it introduces a valuable information about the magnetization dynamics and the magnetic behaviour of surface domain structure.

Acknowledgement

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References

[1] Larin, V. S., Torcunov, A. V., Zhukov, A., Gonzáles, J., Vázquez M., Panina, L.: Preparation and properties of glass-coated microwires. Journal of Magnetism and Magnetic Materials, Vol. 249, 2002, p. 39-45.

[2] Vázquez, M.: Soft magnetic wires. Physica B: Condensed Matter, Vol. 299, Issues 3-4, 2001, p. 302-313.

[3] Chiriac, H., Lostun, M., Óvári, T.-A.: Magnetization process and domain structure in the near-surface region of conventional amorphous wires. Journal of Applied Physics, Vol. 109, Issue 7, 2011, Article number 07B504.

[4] Chiriac, H., Óvári, T.-A.: Magnetic properties of amorphous glass-covered wires. Journal of Magnetism and Magnetic Materials, Vol. 249, 2002, p. 46-54.

[5] Praslička, D., Blažek, J., Šmelko, M., Hudák J., Čverha, A., Mikita, I., Varga R., Zhukov, A.: Possibilities of Measuring Stress and Health Monitoring in Materials Using Contact-Less Sensor Based on Magnetic Microwires. IEEE Transactions on Magnetics, Vol. 49, No. 1, 2013, p. 128-131.

[6] Chikazumi, S.: Physics of Magnetism, John Wiley &Sons, Inc., New York, 1964, p. 281.

[7] Kravčák J.: Hysteresis in Asymmetrical GMI Effect in Amorphous Microwires. Acta Physica Polonica A, Vol. 126, No. 1, 2014, p. 132-133.

[8] Kravčák, J.: Relation between helical anisotropy and asymmetric GMI effect. Acta Electrotechnica et Informatica, Vol. 13, No. 1, 2013, p. 53-55.

[9] Tebble, R. S., Craik, D. J.: Magnetic Materials, John Wiley&Sons, Inc., London, New York, 1969.

SOURCE SKIN DISTANCE DEPENDENCE OF RESPONSE OF IN VIVO EXIT DOSE DIODE DETECTORS USED IN EXTERNAL RADIOTHERAPY

PhD Student Syrja Baci[1], PhD. Ervis Telhaj[2] Prof. PhD. Partizan Malkaj[3],
[1]"Eqrem Cabej" University, Gjirokaster, Albania, [2]Hygeia Hospital Tirana, Albania [3]Polytechnic University, Tirana, Albania,
Sbarci2013@gmail.com

***Abstract**: Linear Accelerators and Cobalt units are common source of radiation for external radiotherapy. In Vivo Dosimetry (IVD) is a real time quality control set of methods used in cancer treatment clinics to assure that dose is delivered as prescribed to tumor, while surrounding healthy tissue is spared. Silicon Diode detectors are among most popular detectors used for IVD. In certain clinical conditions, both entrance and exit dose measurements are needed, for quality insurance, to calculate the dose received by tissue or organ inside patient's body. Response of silicon diode detectors depends on multiple factors therefore prior of use in IVD each detector needs to be calibrated and corresponding factors of correction need to be calculated. Correction factors are needed to calculate dose for different field sizes, angle between beam axis and couch axis, skin to source distance (SSD), temperature etc. In this work we present our calculation of exit dose calibration factors for six silicon diode detectors made by PTW Frieburg Germany. Diodes are calibrated for exit dose under either 6 MVor 18 MV beam of photons as designated by manufacturer. Further we study dependence of response of individual diodes on distance from source and calculate corresponding correction factors. It was found that exit dose SSD dependence is pronounced and correction factors are necessary for exit dose IVD with diode detector in clinics.*

Introduction

Oncologists go at great length when planning radiation therapy for their patients by using the best available diagnostic technologies. In clinical practice, however, equipment failure and more often human factor may introduce many systematic and random errors which can lead to patient overdose accidents or therapy failure as result of under dose. Accidents have been reported even very recently, most recent being Scotland case in 2016[3,] and France in 2005. In Vivo Dosimetry, is part of Quality Assurance program in a many cancer clinics. It is basically the process in which medical physicists employed by clinics check the dose received by each patient during treatment.

IVD allows for quick, next radiation session, corrections and therefore prevention of possible accidents. IVD is currently recommended part of Quality Assurance (QA) program in radiotherapy centers by European Society for Therapeutic Radiology and Oncology[6], International Atomic Energy Agency[1] and medical physicist professional organizations[2]. ICRU recommends a narrower discrepancy of 3%, tolerable in clinics between planned and received dose[5]. Semiconductor diodes are a reliable tool for in vivo dosimetry[7] as they offer the advantage of immediate reading and no need for external bias as well as a good spatial resolution.

Semiconductor diode dosimeter is physically a p-n junction device. P-type silicon diodes are preferred for dosimetry in radiotherapy, as they have much smaller leakage current and are more resistant to radiation damage compare to n- type diodes[8]. In absence of light and with no external bias applied, there will no current (except for leakage) flow through silicon diodes. Once silicon diode is irradiated current will flow in the external circuit. Signal will be proportional to dose received by diode up to certain dose level. When recombination of existing minority charges, created as result of radiation, will balance process of production of new charges current will saturate. Signal, or diode response, is measured by charge accumulated or collected in electrometer which is connected in the external circuit. Response is affected by factors such energy, dose rate, source to surface distance, accumulated dose, spatial orientation, temperature, field size, wedges used. Our purpose in this work is to calculate calibration factors for exit dose and respective correction factor for the PTW semiconductor diodes, that are to be used with Elekta Accelerators as part of an IVD dosimetry system. Exit dose is defined as dose transmitted through the body and is measured at d_{max} at the exit surface for the radiation beam by an ion chamber. Exit dose measurements are more difficult than entrance dose measurements because conditions of backscattering are very different. When using a diode IVD detector, we place the detector on the surface (over skin). The dose received in volume inside the body is calculated using a formula[6] that relates dose measured at surface with different geometric factors. Exit dose is very important for IVD with therapy of the pelvis area.

Materials and Methods

One of two Elekta Synergy Accelerators, was used in two modes of energy; 6 MV photons and 18 MV photons for this work. The 0.6 cm^3 PTW Farmer ionization chamber, type 30013 is a waterproof standard chamber for absolute photon and electron dosimetry. PTW, Silicon p-type diodes were connected to a PTW electrometer MULTIDOS with 12 available channels. PTW diodes T60010 MP are color coded yellow by manufacturer. They come with a lead build up cap of 2.0 g/cm^2 and are designated by the manufacturer to be used as detectors for the 6MV photon beam. In Fig.1 left is shown Electa Accelerator used in our work and Fig.1 right is shown a probe of three 6 MV diodes on exit surface of phantom. PTW diodes T60010HP are color coded red. Made with tungsten buildup of 3.0 g/cm^2 they are designated for dosimetry under high energy 18 MV photon beam. PTW made PMMA phantom that allows for in depth measurements in increments of 1 mm was used for this work.

Here we present the work done for calculating calibration factor and correction factors for exit dose, for different source to surface distances, for both 6 MV photon beam and 18 MV photon beam.

.;**Calculation of Calibration Factor**

Diodes were calibrated using pre-calibrated ionization chamber, traceable to laboratory. Actual temperature and pressure correction was made for chamber reading. Diodes were placed on surface of PMMA phantom according to reference conditions; Source to Surface Distance (SSD)=100cm, Field Size was chose FS=20x20 cm^2 which is typical for abdomen measurements. As dose received depends on scattering of surrounding medium, in case of a human body or respectively case of a phantom, dose reaches its maximum at certain depth under the skin or surface. This depth is called maximum dose depth and is marked as d_{max}. In terms of physics of interaction of radiation with matter, this is the depth where electronic equilibrium is reached in medium or, in other words where Dose equals Kerma for the radiation field in the medium.. It is roughly the length of free path of electrons created by photons colliding on skin or surface. The calibration factor F_{cal} in terms of

Gy/C was obtained as ratio of dose measured by ionization chamber at d_{max} with reading of diode positioned at surface[2], when both are measured under reference conditions:

$$F_{cal} = \frac{D^{ref}_{chamber}}{R^{ref}_{diode}} \quad (1)$$

Where $D^{ref}_{chamber}$ is dose as measured by the ionization chamber in reference conditions (SSD=100 cm, FS=20x20 cm^2 vertical beam, temperature: T =20°C, air pressure P=101,325Pa, with no wedges being used) while chamber is placed at depth d_{max} i.e. depth where dose reaches maximum dose for the particular beam. R^{ref}_{diode} is the diode reading in above reference conditions. Correction factors CF_{SSd} are determined as ratios of chamber reading over diode reading in clinical (experimental) conditions normalized to ratio of chamber reading over diode reading in reference conditions. Chamber was placed at 100 cm -d_{max}, where d_{max} is depth where maximum of exit dose is reached for the given beam energy at 100 cm SSD and 0° angle of incidence. For the Elekta Accelerator used in our work in 6 MV regimen d_{max}=1.6 cm; for the 18 MV beam d_{max}=3 cm. Calibration factors for each diode used in respective 6 MV photon beam and in18 MVphoton beam are presented in table 1 and table 2 respectively. Correction factors are to be used in clinical IVD to calculate exit dose received by patient. Exit dose for patient in IVD will be calculated as reading of diode (placed on patient skin) multiplied by calibration factor F_{cal}, and then multiplied by all respective correction factors CF_i, which factors allow for adjustments related to difference in response between diode and ionization chamber in different clinical conditions. CF_{SSD} are calculated using equation 2:

$$CFssd = \frac{\frac{D^{\exp}_{chamber}}{R^{\exp}_{diode}}}{\frac{D^{ref}_{chamber}}{R^{ref}_{diode}}} \quad (2)$$

CF_{SSD} are dimensionless, numeric factors. $D^{ref}_{chamber}$ and R^{ref}_{diode} are defined above, $D^{\exp}_{chamber}$ is dose measured by chamber of ionisation in experimental condition, or, respectively in in clinical settings. $R^{\exp}_{diode}$ is diode reading in the particular experimental conditions. Experimental or clinical conditions differ from reference conditions by having parameters such as SSD, etc[4]. to take values as needed in practice, values that will differ from the selected reference values.

***TABLE 1**. Exit Dose Calibration factors for diodes used under 6 MV photon beam*

Line	Detector ID	Charge (nC)			F_{cal} (Gy/C)
1	00083	-4.121	-4.200	-4.178	$1.453 * 10^8$
3	00082	-4.205	-4.221	-4.230	$1.425 * 10^8$
4	00078	-4.118	-4.135	-4.152	$1.460 * 10^8$

***TABLE 2**. Exit Dose Calibration factors for diodes used under 18 MV photon beam*

Line	Detector ID	Charge (nC)			F_{cal} (Gy/C)
1	00037	-7.541	-7.599	-7.579	$9.740 * 10^7$
3	00035	-7.722	-7.731	-7.669	$9.529 * 10^7$
4	00036	-5.959	-6.003	-6.011	$1.108 * 10^8$

Correction Factors

Response of two PTW diodes was investigated ; one color coded yellow diode of serial number T60010MP, with lab identification number 00082 and the other color coded red of serial number T60010HP, with lab identification number 00037. Manufacturer has color coded y diodes according to their designated beam energy, yellow diodes are made with specific caps for usage with 6 MV. Diodes color coded red were made with specific build up caps for usage with 18 MV photon beam. In this work specific diodes were used only with respective energy beams as designated by manufacturer. Therefore energy correction factor F_{EN} for each diode was assumed to be 1. This work was limited to the study of SDD effect on signal. Temperature dependence of detectors is the same as for the entrance dose and was investigated in our prior published work[4]. Correction factors calculated from data collected on variation of signal with Source to Surface Distance, normalized to reference values, are presented in the Table 1 and 2:

***TABLE 2.** SSD Correction Factors for exit dose*

SSD(cm)	CF_{SSD} ***(00082)***	CF_{SSD} ***(00083)***	CF_{SSD} ***(00078)***	CF_{SSD} ***(00035)***	CF_{SSD} ***(00037)***	CF_{SSD} ***(00036)***
100	1.00	1.01	0.99	1.00	1.00	1.00
105	1.21	1.22	1,11	1.09	1.23	1.24
110	1.23	1.26	1.19	1.18	1.36	1.30
115	1.31	1.33	1.29	1.27	1.42	1.41
120	1.44	1.45	1.37	1.34	1.33	1.49
125	1.51	1.57	1.48	1.48	1.47	1.55

Diode and chamber of ionization readings were taken three times and the average of three respective measurements was used for calculation of correction factors. Error of averages of readings, taken for the same SSD, was between 0.57% and 0.85%. Calculations of values of correction factors (CF_{SSD}) in the table were done according to equation 2. Measurements regarding signal dependence on SSD were made with field size typical for pelvis radiation; of 20cm x20cm. The linear or polynomial fitting for each diode are presented in the respective chart area. Factors of determination R^2 are within 10% of unity.

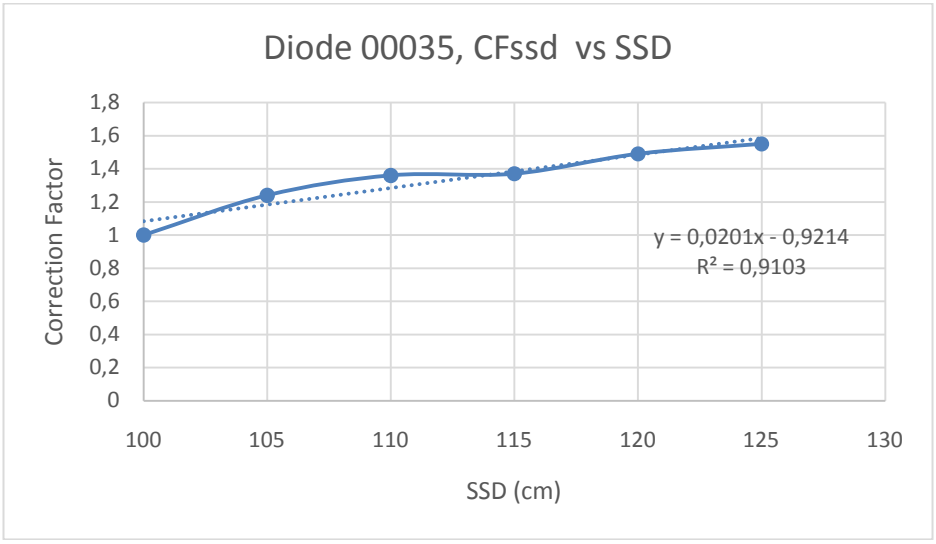


***Figure 1.a**. Exit Dose Correction factors vs SS for respective diodes*

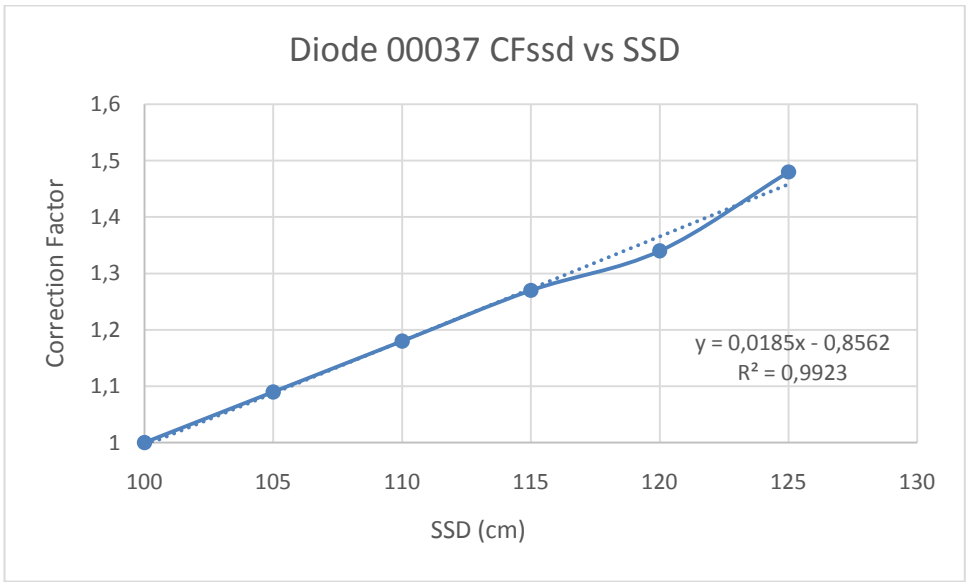


***Figure 1.b**. Exit Dose Correction factors vs SS for respective diodes*

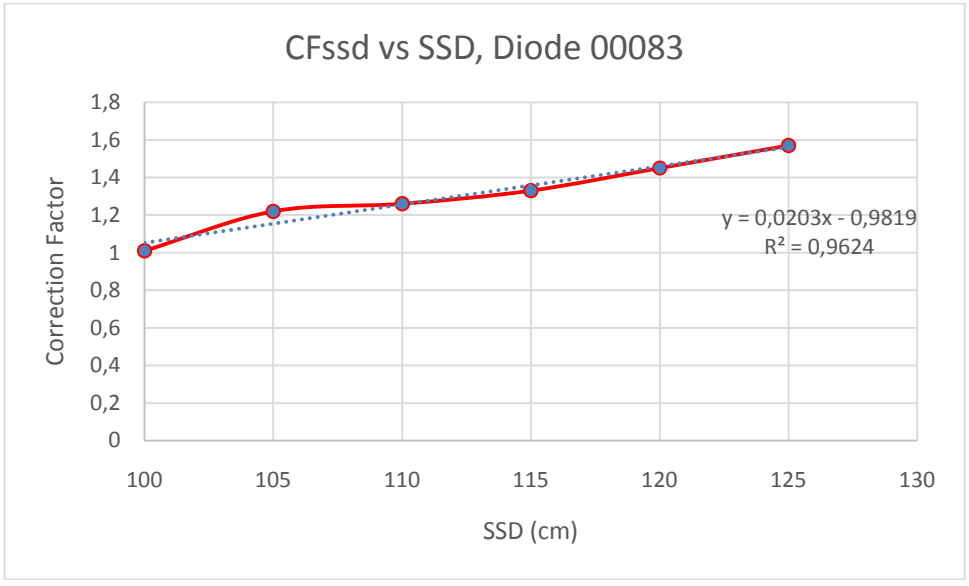


***Figure 1.c**. Exit Dose Correction factors vs SS for respective diodes*

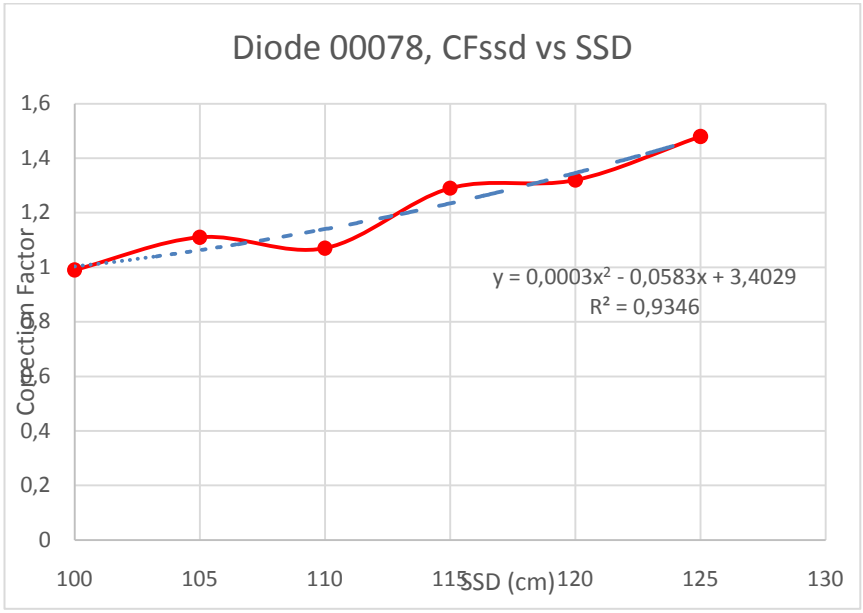


***Figure 1.d**. Exit Dose Correction factors vs SS for respective diodes*

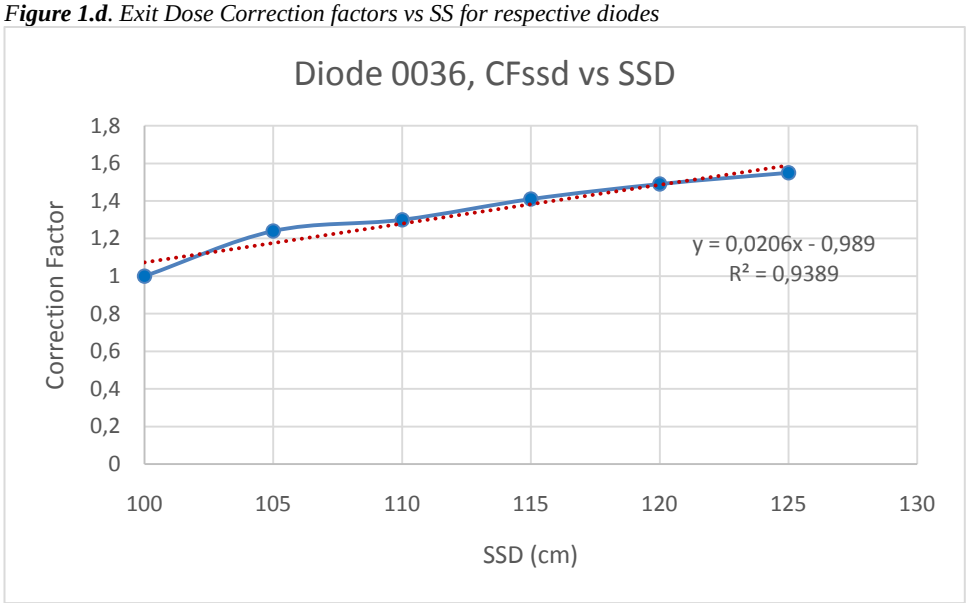


***Figure 1.e**. Exit Dose Correction factors vs SS for respective diodes*

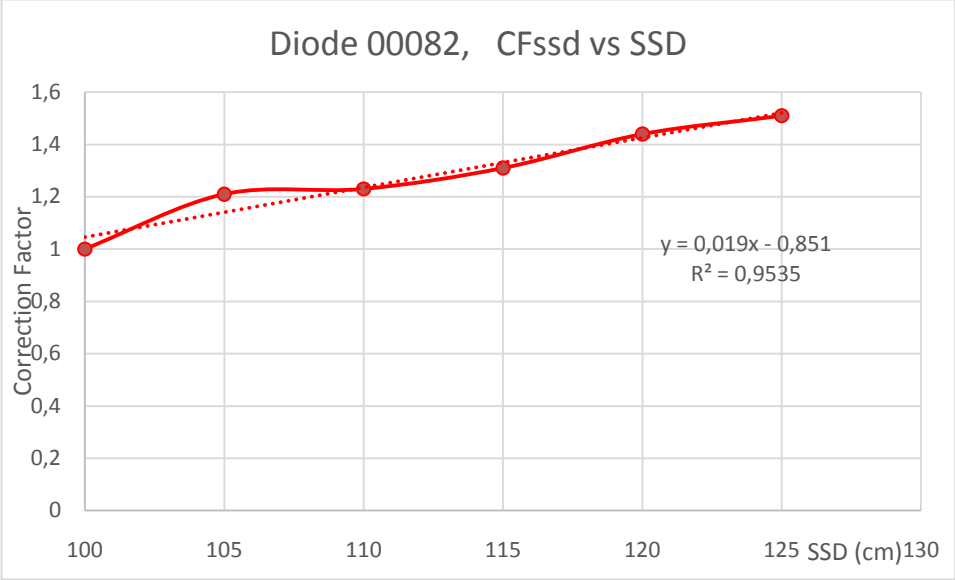


Figure 1.f. Exit Dose Correction factors vs SS for respective diodes

DISCUSSION AND CONCLUSIONS

Variation of diode response in exit dose use with distance SSD was found. Correction factors $CF_{SSD,}$ were calculated as normalized ratio of ionization chamber reading to diode reading. Such variation is caused by dependence of diode response on dose per pulse and secondly by contamination of diode detector with secondary electrons and low energy photons scattered from collimator and air molecules of air between collimator and phantom surface[1,8]. Diodes, placed on the surface of phantom or on skin of patient are directly exposed to secondary electrons and low energy photons. mostly from collimator, as well as secondary electrons scattered from air molecules. As distance to source decreases dose per pulse increases leading to additional minority carriers being created, while recombination centers in sensitive volume of diode remain constant in number. This leads to extra carriers created which contribute to current integrated with time to the charge collected by electrometer. Diode in such distance is made overly sensitive. Ion chamber is placed at depth and therefore attenuation and scatter from layer of PMMA material above chamber of ionization creates a different equilibrium and different response to the increased dose per pulse when distance is shortened. Diode 00078 showed a variance (sharper)on SSD. It was found that commercially available semiconductor diodes made by PTW are suitable for In Vivo Dosimetry

Regarding signal dependence on SSD were made with field size of 20cm x20cm. The standard deviation for diode 00078CFSSD was: σ=0.298, for diode 00037, σ= 0.140. Large deviation indicates a strong dependence of diode reading on distance to source. Such dependence was caused by secondary electrons contamination of dosimeter when dosimeter is placed closer to source.

CONCLUSIONS

REFERENCES

1. IAEA, Development of procedures for in vivo dosimetry in radiotherapy, IAEA Human Health Report No. 8. Vienna, Austria. 2013: International Atomic Energy Agency. 2013.
2. AAPM, Diode in vivo dosimetry for patients receiving external beam radiation therapy. Report of Task Group 62. 2005: American Association of Physicists in Medicine. 2005.
3. Action radiotherapy: http://www.actionradiotherapy.org/cancer-patient-given-radiation-overdose-at-edinburgh-hospital/
4.Syrja Baci, Ervis Telhaj , Partizan Malkaj, AIP Conference Proceedings > Volume 1722, Issue 1 10.1063/1.4944210, 2016 AIP Publishing LLC.
5. Bratengeier K, Markus O, Mark G, Michael F. Remarks on reporting and recording consistent with the ICRU reference dose. Radiation Oncology. 2009; 4: 1-13.
6. J. Van Dam, G. Marinello, Methods for in Vivo Dosimetry in external Radiotherapy (Estro, Brussels, Belgium, second edition 2006) pp. 11-44
7. G. Rikner and E. Grusell, General specifications for silicon semiconductors for use in radiation dosimetry Phys.Med.Biol.32, 1987), pp. 1109-1117.
8. K. Huang, W. Bice, O.H. Salvatierra, Characterization of an vivio dosimetry system for clinical use, (American College of Medical Physics, 2003) pp. 132-139.

THE VOLUNTARY DISTRIBUTED COMPUTING PROJECT OPTIMA@HOME*

Kurochkin I.I.[1], Afanasyev A.P.[1234]
Institute for Information Transmission Problems of Russian Academy of Sciences, Moscow, Russia[1]
2Higher School of Economics National Research University, Moscow, Russia[2]
3Moscow State University, Moscow, Russia[3]
4National University of Science and Technology "MISiS", Moscow, Russia[4]

kurochkin@iitp.ru, apa@iitp.ru

Abstract: *Features of use of the distributed heterogeneous systems for carrying out numerical experiments are considered. The method of the organization of small diverse experiments within one umbrella project of the voluntary distributed computing on the BOINC platform is offered. Benefits of carrying out small numerical experiments are given in the umbrella project.*

Keywords: VOLUNTEER DISTRIBUTED COMPUTING, GRID-SYSTEM, BOINC, UMBRELLA PROJECT

1. Introduction

Use of supercomputers imposes serious financial obligations on researchers as it is necessary to buy time of high-performance cloud system or to buy the supercomputer, and also to organize and support supercomputer infrastructure. In this regard the concept of the distributed computing and use of grid-systems can solve a problem with big computing complexity and do without essential financial expenses.

Within the distributed computing representing a method of the decision of huge computing tasks with use of the computers integrated in the computing system voluntary computing is of special interest. It the distributed computing with use of voluntarily provided computing resources.

There are several platforms for the organization of the distributed computing: Globus [1], Condor [2], but the most widespread is BOINC [3, 4] at the moment.

The BOINC platform (Berkeley Open Infrastructure for Network Computing) is an open non-commercial software for the organization of the voluntary distributed computing on personal computers. BOINC has client-server architecture and consists of client part and server. Is a universal platform for calculations in various areas of science (mathematics, molecular biology, medicine, astrophysics, telecommunications etc.). The client part can be established on all widespread operating systems: Microsoft Windows, Linux, Mac OS, etc. The server part is intended for management of the project – the distributed computing on a certain computing task.(Fig. 1)

Projects of the distributed computing on bases of the BOINC platform share on 2 types:

1. public projects with participation of volunteers [5];
2. closed (internal) projects with use of the available computing means[6].

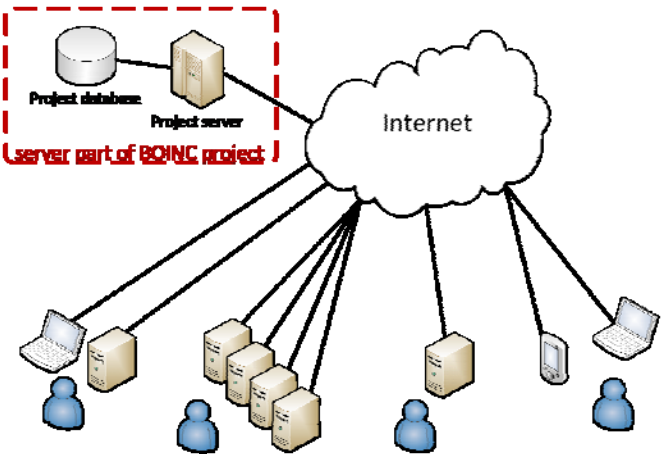


Fig. 1 *BOINC-project scheme.*

On the basis of the BOINC platform in detail about 100 projects of the voluntary distributed computing to which about 14 million computers are connected [4] worldwide. The majority of voluntary distributed computing projects – scientific experiments of the leading world universities and scientific organizations. Total computational capability of computers of volunteers exceeds computational capability of the modern supercomputers in top500.

The projects have the task which can break into a set of independent subtasks. Such type of tasks is called "bag of tasks" [7].

2. Volunteer distributed computing features

However voluntary computation has a row of features which can significantly decelerate computation, and use of heterogeneous grid-system superimposes certain restrictions for the organization of a computing experiment:

- Heterogeneity of nodes of distributed system, and as a result different speed of calculation;
- Self-sufficiency of calculations on different nodes;
- Unreliability of communications and possible switch-off of computing nodes;
- Non-constant time of the continuous operation of a node and difficulty of calculation of the long jobs;
- Impossibility of constant coordination of calculations between nodes;
- Existence of errors and time delays when calculating;
- Complexity of development of computing applications for all types of computing nodes.

The features characteristic of BOINC-projects of the voluntary distributed computing:

- Need of fine setup of loading balancing system;
- Computing complexity of jobs can't be very huge that the average computer could process the job less, than for 8-9 hours;
- Need of validation of results;
- Small size of the input data and result;
- Existence of replication of subtasks (workunits);
- A problem of big tails when the quantity of nodes are significantly higher, than the number of the remained workunits;
- Need of interaction with community of volunteers (crunchers);
- The computing application shall work at the computing nodes without installation of the additional software;

- Upgrade of the computing application for saving checkpoints.

3. Motivation of crunchers

The involvement in projects of voluntary computing doesn't bring to users (crunchers) providing the computational capabilities any advantage and often requires certain costs of purchase of the necessary equipment, payment of the electric power. The pacing driving factors forcing people to participate in projects of voluntary computing are [8]:

- Realization of the participation in discoveries;
- Help to science;
- Sporting interest (just for fun).

For maintenance of interest among volunteers, the credit system granting a certain number of credits, depending on volumes of the executed computation was entered into BOINC. Credit systems in BOINC can vary depending on the project and consider its features that allows to develop the most suitable and objective mechanisms of grant credits.

Some projects imply charge of different virtual prizes (badges) for a contribution of users to computational capabilities of the project. These badges have an appearance of special images which are displayed on the web page of the project opposite to user name.

They show different achievements of the cruncher, for example summary volume of the carried-out computation, an average day value, involvement time in the project.

The following steps are necessary for increase in interest of cruncher in the project:

- The publication of new information on the project website;
- Support of existence of a large number of the workunits ready to be sent;
- Support of back coupling with administration of the project;
- Existence of checkpoints in case of execution of workunits on computing nodes.

4. The umbrella project

The umbrella project is meant as the project in which there are several independent computing applications. In a client part of BOINC there is a functionality which allows to select estimated applications for start.

Frequent mistakes at deployment of projects

- Lack of checkpoints in the calculation application;
- Lack of feedback with administration of the project;
- Lack of the popular scientific description of a numerical experiment on the project website;
- Long absence of new tasks and idle time of the project;
- Lag of computers of volunteers during the work of the computing application;
- Emergence of mistakes when calculating at the most part of crunchers;
- Long time of calculation of tasks (more than 1 day);
- Lack of assessment of operating time of each workunit.

List of tasks

List of tasks in case of deployment and providing of the project:

1. Technical expenses:

1.1. Creation of the computing application with checkpoints;

1.2. Creation of the generator of input data;

1.3. Creation of the validator and aggregator of results;

1.4. Fine setup of parameters of a server part BOINC project.

2. Organizational expenses:

2.1. Registration of the domain;

2.2. Creation of the website of the project;

2.3. General description of scientific and administrative group of the project;

2.4. The organization of competitions in the project.

3. Interaction with crunchers (attraction of new resources and holding of available):

3.1. Popular scientific description of a scientific component of the project;

3.2. The regular popular scientific description of the made numerical experiments;

3.3. The regular publication on the website of the project of the received results;

3.4. Interaction with community of crunchers;

3.5. Blogging of the project and publication of links to scientific articles.

4. Additional expenses:

4.1. Development and deployment of credit system;

4.2. Development setup of system of output of the badges;

4.3. Design of the website and information website of the project;

4.4. Personalization of the received results when the volunteer can learn that he reads at present. Visualization of results, if it possible.

Use of the umbrella project of the voluntary distributed computing allows to reduce significantly costs of the organization and to providing of the project. It is only actually necessary to finish the computing application and to make the small description of the made experiment.

There is an opportunity to make small numerical experiments. At the same time different resources for calculation can use applications (CPU, GPU, Intel Xeon Phi etc.).

The Optima@home project which was initially created as the project for the decision of tasks of finite-dimensional optimization became umbrella now. At present in the project 3 independent estimated applications are tested.

5. Conclusions

Compilation of the activity list and assessment of expenses in case of deployment and providing of the volunteer distributed computing project – guarantee of its successful functioning and increase in computational capability.

Use of the umbrella project allows to make small experiments with the minimum expenses on the existing project with big computational capability.

6. References

1. I Foster, C Kesselman “Globus: A metacomputing infrastructure toolkit”, International Journal of High

Performance Computing Applications 11 (2), 1997, pp.115-128.

2. M.J. Litzkow, M. Livny, M.W. Mutka “Condor-a hunter of idle workstations”, Distributed Computing Systems, IEEE, 1988.
3. D.P. Anderson “BOINC: a system for public-resource computing and storage”, Grid Computing, IEEE, 2004.
4. The server of statistics of voluntary distributed computing projects on the BOINC platform. http://boincstats.com
5. Vatutin E.I., Titov V.S. Voluntary distributed computing for solving discrete combinatorial optimization problems using Gerasim@home project // Distributed computing and grid-technologies in science and education: book of abstracts of the 6th international conference. Dubna: JINR, 2014.
6. Ivashko E., Golovin A. Partition Algorithm for Association Rules Mining in BOINC-based Enterprise Desktop Grid. Lecture Notes in Computer Science. Parallel Computing Technologies 13th International Conference, 2015, 268–272, Springer.
7. Benoit, et al., ‚Scheduling Concurrent Bag-of-Tasks Applications on Heterogeneous Platforms, IEEE Trans. Computers, vol. 59, no. 2, pp. 202-217, Feb. 2010.
8. Yakimets V.N., Kurochkin I.I. The voluntary distributed calculations in Russia: the sociological analysis // In the collection: INFORMATION SOCIETY: EDUCATION, SCIENCE, CULTURE AND TECHNOLOGIES of the FUTURE Works XVIII of the joint conference "Internet and Modern Society" (IMS-2015). ITMO university, St. Petersburg, 2015. P. 345-352.

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EFFICIENCY AND ECOLOGICAL IMPACTS OF HOUSEHOLD OZONE LAUNDERING

Prof.. Neral B. PhD
University of Maribor, Faculty of Mechanical Engineering, Institute for Engineering Materials and Design
branko.neral@um.si

Abstract: *Two different laundering procedures were executed in the research. The first investigated procedure was a classical type of laundering procedure at 40 °C which was performed in a household drum washing machine. A two-bath procedure using ozone was the subject of the second investigated laundering procedure. The efficiency of compared laundering procedures were evaluated (washing performance and cleaning performance indices). Impact Factors for both treatments were collected and evaluated with the help of the LCA/LCI methodology.*

Keywords: TEXTILE LAUNDERING, HOUSEHOLD WASHING MACHINE, OZONE LAUNDERING, ECOLOGICAL IMPACTS

1. Introduction

One of priorities of the European Commission is to increase energy efficiency and, thus, to save 20% of the EU's total primary energy by 2020 [1, 2]. The full savings potential in the household sector is estimated to be 27% energy use. Among the most electricity consuming are large household appliances, like washing machines and dishwashers. Therefore, legitimate expectations are that producers should develop energy efficient household products.

Textile laundering is the most frequent household occupation. Household laundering is a complex process where the synergy of temperature, time, detergent, and kinetic energy combine within water to ensure elimination of impurities. Households in the EU consume 2.53 GWh of electricity and 206 Mm^3 of tap water for laundering 101 MT of textiles per year [3, 4, 5, 6, 7].

Ozone (O_3) is a colourless gas at room temperature, toxic, with a characteristic odour readily detectable at concentrations as low as 0.02 to 0.05 ppm, which is below concentrations of health concern [8].

Ozone is formed in the stratosphere, in the **t**roposphere **(**photochemical smog) and by UV lamps, high voltage electric arcs, and gamma radiation plants [9].

It is a strong oxidising agent (2,07 mV), and, as such, has been used for years for disinfection of drinking water [10]. Ozone removes odour, taste and suspended solids, improves biological degradation, reduces the colour of wastewaters and toxicity. Furthermore, it reduces the ecological parameters partially and degrades microorganisms, viruses and algae successfully [11, 12]. Nowadays it is used intensively for cleaning of industrial wastewaters, in the food, fishing, cellulose, paper and pharmaceutical industries, as well as in agriculture.

In the last three decades, the usage of ozone in hospital and hotel laundries has been increased significantly. In most cases, it was empirically proven that ozone can aid in the reduction of natural resources, energy consumption, and extending textile life [13]. Not so long ago, an extensive research began for proper use of ozone in commercial laundries, as influences of ozone on textile quality and hygiene.

The focus of the research was the analysis of laundering quality and evaluation of those environmental impacts caused by various textile laundering procedures. Classical household (40 °C) and newly-developed ozone (30 °C) laundering procedures were performed in a household drum washing machine and analysed.

2. Experimental part

Classical household washing equipment, a commercial ozone generator, cotton base load, stain test strips, and laundering agent IEC A were used. The laundering phase and the evaluations of the washing performance were followed by further research and comparison between environmental impacts.

Laundry equipment All laundering procedures were performed in a household washing machine SensoCare W8665K Gorenje d.d. (SLO) (Figure 1), with a capacity of 9.0 kg. The classical laundering procedure consists of main-washing (40 °C), two rinsing phases, and spinning. The ozone laundering procedure began with pre-washing with ozone, followed by main-washing (30 °C), rinsing with the addition of ozone, and spinning. In the pre-washing and rinsing phases ozone (10 ppm) was added to the inlet water.



Figure 1*: A household washing machines SensoCare Gorenje (SLO) and ozone-generator OVK-W01 Eco Laundry (CN)*

The investigated laundering procedures were performed according to [14]. Laundering procedures began with loading the washing machine with cotton base load (4.5 kg, sheets, pillow cases and towels) and stain strips WFK (D), followed by automatic dosing of water (conductivity < 10 μS/cm; total water hardness

2,5±0,2 mmol/L = 14±1,12 °n; pH = 7,3–7,7; T = 15±2°C; bath ration 1:5). In the main-washing phase the laundering detergent IEC A, WFK (D), was added, composed from the following ingredients: 77% of basic powder, 20% of sodium perborate tetrahydrate (oxidizer), and 3% of tetraacetylethylenediamine TAED (bleach activator).

In the research, we used the commercial ozone-generator OVK-W01 Eco Luandry (CN), (conc 0.5~1.0 mg/L, water flow: 4.5 L/min), shown schematically in Figure 2. The main components of the ozone-generator are: Water inlet (1), water outlet (2), flow switch (3), mixing chamber, venturi injector (4), static mixer (5), Photo Catalytic Oxidation (PCO) cell (6), control module (7), oxidizing module (8).

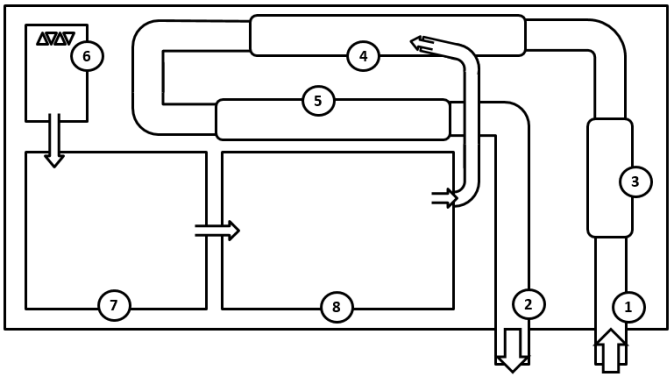


Figure 2*: Scheme of the ozone-generator OVK-W01 Eco Laundry (CN)*

Determination of soil removal efficiency Reflectance measurements of non-laundered and laundered stain strips were determined with the spectrophotometer Datacolor SF600 (CH) under the following conditions: d/8 measurement geometry, measurement wavelength range from 400 nm to 700 nm, measurement area of 20 mm in diameter and SIN-specular included measurement mode. *XYZ*, CIE *L*a*b**, *C** CIELAB 1976 and colour difference $dE^*_{D65/10}$ were calculated with Datacolor Datamaster software (CH) according to [15].

The washing performance q was evaluated in accordance with [14]; meanwhile, the Cleaning performance index CPI_{dE^*} was calculated based on Equation (1) [16, 17, 18, 19],

$$CPI_{dE^*} = \left[1 - \frac{dE^*_{was\,h-unsoil}}{dE^*_{soil-unsoil}}\right] \cdot 100\ (\%) \qquad (1)$$

where

CPI_{dE^*} Cleaning performance index (%)

$dE^*_{wash\text{-}unsoil}$ Colour difference $dE^*_{D65/10}$ between washed soil sample and unwashed unsoiled fabric

$dE^*_{soil\text{-}unsoil}$ Colour difference $dE^*_{D65/10}$ between unwashed soil sample and unwashed unsoiled fabric

Determination of environmental impact factors The goal of the LCA was to collect, evaluate and compare the environmental impact of two laundering procedures. In the study, only the laundering process was included, other life cycle stages (detergent production, all types of transport, packaging, water treatment, etc.) were excluded.

All parameters for each laundering procedure were recorded during the first step. The recorded and collected data were the base for preparing a technological block-diagram with inlets (laundering detergent, water, energy, laundering time), and outlets` parameters. LCI schemes of laundering processes were prepared based on these data. The following environmental impact assessments of laundering procedures (LCIA) were performed by considering the databases of the characterisation and emission factors obtained from the Intergovernmental Panel on Climate Change [20], ELCD database of EC Joint Research Centre, Institute for Environment and Sustainability [21, 22], and the Global Emission Model software package for Integrated Systems [23]. The environmental impact assessments of classical and ozone laundering procedures were done according to the method [24]. The measured energy consumptions for laundering procedures were the base for calculating the greenhouse gas (GHG) emissions of 27 Member States of the European Union (EU27). These calculations took into consideration the structures of the sources for electricity production (electricity-mix), as available in the database [25]. Later, the Global Warming Potential indicator GWP_{GHG} (100 years) and potential Acidification Indicator *AP* were calculated, regarding the GWP_i *and* AP_i factors. The methodology for determining the environmental impact assessments for laundering procedures has been described briefly previously [26, 27].

3. Results and discussion

Two laundering procedures, the classical and the developed two-bath ozone procedure, were carried out regarding washing quality and environmental impact assessments. The laundering quality parameters for both performed procedures are shown in Table 1, whilst the results of the LCA analyses and the environmental impact assessments are in Tables 2 and 3.

The washing performance q for the classical procedure (q=1.097) is slightly higher (0.075 units) compared to the ozone procedure (q=1.022). We can conclude that both procedures ensure efficient and comparable washing quality.

From the results of total colour differences average between unwashed and washed samples with soils and the CPI_{dE^*} average (Table 1) it can be concluded that the ozone laundering removes a somewhat lower amount of stains (8.17%) than the classical. This could be attributed mostly to the solubility of ozone in water, temperature of the laundering bath, low ozone concentration (10 ppm), and the short contact time between ozone and soils (30 min).

It is known that ozone is an unstable molecule that decomposes spontaneously, thus generating free radicals, which react with impurities in water. Basic chemistry research has shown that solubility of ozone declines with a rising water temperature (at 15 ^{0}C= 0.456 LO_3/ L H_2O, at 40 ^{0}C= 0.0112 LO_3/L H_2O, at 60 ^{0}C= solubility of ozone in water is interrupted) [9, 28, 29]. Ozone degrades in 12 minutes in pure water with a temperature of 20 ^{0}C, and in 8 minutes when the water is heated to 35 ^{0}C.

Table 1: *Colour differences dE* CIELAB and Cleaning performance indices* CPI_{dE^*} *for classical and ozone laundering procedures*

Soil	**dE* (D65/10)**		**CPIdE* (%)**	
	Classical	**Ozone**	**Classical**	**Ozone**
Unsoiled	2.79	1.87	--	--
Sebum	12.99	10.80	75.00	63.50
Carbon black/mineral oil	15.99	15.46	41.37	40.18
Blood	42.57	42.05	94.16	96.44
Cocoa	25.80	18.09	74.71	51.65
Red wine	20.95	18.93	73.04	65.65
Average:	20.18	17.86	71.66	63.49

It was found that the most efficient removal (Table 1) for both treatments was noted for blood (pig's blood, fresh and stabilized by the addition of ammonium citrate), followed by moderate soil removal of synthetic sebum (cows fat, wool fat, free fatty acid, cholesterol, squalen, coconut oil, hard paraffin, carbon black, kaoline, iron oxide) cocoa (unsweetened cocoa (22 % fat, not alkalised) with sugar, full-cream cow's milk and water) and red wine (red wine treated with hot air), meanwhile for carbon black (carbon black, oil. paraffin oil) the soil removal was noticeably low.

The most efficient removal after the ozone washing cycle (Table 1), was noted for blood (96.44%), lower for sebum (63.50%), and red wine (65.65%), and the lowest for carbon black soils (40.18%).

The analyses of data in Table 2 showed that the classical laundering procedure consumed 858 kJ of energy, whilst the ozone procedure consumed 61.53% less energy (330 kJ).

Table 2: *Results of LCA/ LCI analysis and environmental impact assessments for classical household and ozone laundering procedures (for 1kg of laundered textile)*

Parameter	**Unit**	**Laundering procedure**	
		Classical	**Ozone**
Energy	kJ	858.00	330.10
Duration	min	110	105
Water	L	14.13	8.40
Laundering agent	g	0.02	0.02

Table 3: *Emissions of greenhouse gases and acidification substances for classical and ozone laundering procedures for the EU27 average (for 1kg of laundered textile)*

Parameter	**Unit**	**Laundering procedure**	
		Classical	**Ozone**
CO_2	g	45.31	17.43
NO_2	g	25.30	9.73
CH_4	g	2.20	0.84
SO_2	g	0.26	0.10
NO_x	g	3.56E-10	1.37E-10
NH_3	g	3.50E-04	1.35E-04
HCl	g	1.43E-09	5.52E-10
GWP_{TGP}	g CO_2Eq	72.80	28.01
AP	g SO_2Eq	0.26	0.10

The classical laundering procedure consumed the most energy for heating the laundering bath to 40 °C during the main-washing (66%) phase, whilst the rest of electrical energy (34%) was consumed during the rinsing phases. With regard to the composition of the second laundering procedure, firstly cold washing with ozone was performed, and with the main-washing at 30 °C, during which the most electrical energy was consumed. The classical laundering procedure lasted about 5 min longer when compared to the ozone procedure. It is important to emphasise that the ozone procedure demanded the usage of only one rinsing phase, whilst the classical procedure needed two phases to assure the final quality of laundered textile (alkalinity). An important advantage of the ozone procedure is the fact that 40.54% less water was consumed compared to the classical laundering procedure (Table 2, Figures 3 and 4).

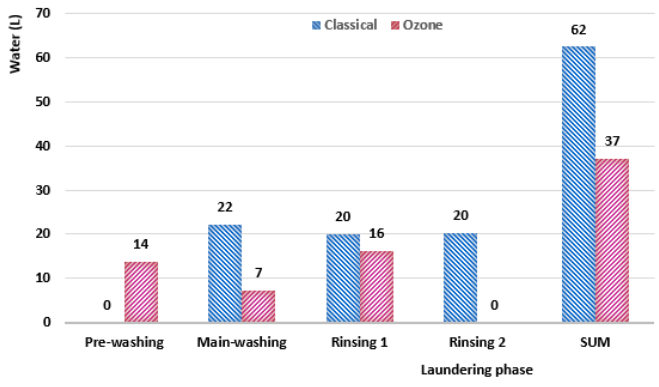


Figure 3*: Water consumption for classical and ozone laundering procedures*

It is important to draw attention to the fact that emissions of greenhouse gases are 61.54% lower for the ozone procedure than those emissions from the classical household laundering procedure (Table 3).

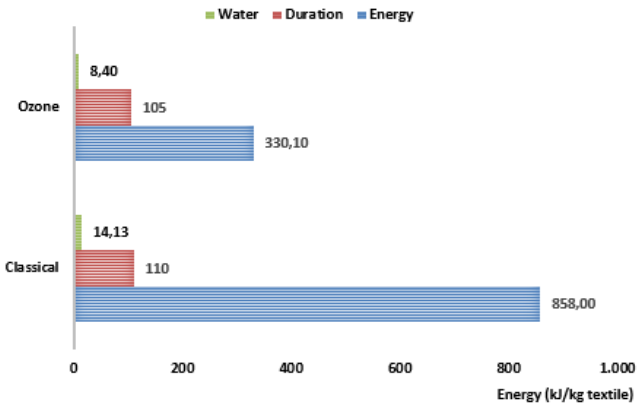


Figure 4*: Duration (min), energy (kJ/kg fabric) and water (L/ kg fabric) consumption for classical and ozone laundering procedures*

4. Conclusions

There is almost no human activity which does not create emissions of GHG that result in climate changes, which is reflected in the rising of average global temperatures, an increase in the average amount of precipitation, sea-level rises, shrinking glaciers, and occurrences of extreme weather events. The fact causing the most concern is that concentrations of GHG in the air, caused by human activities, is increasing much faster than in the natural way [20]. The development of economic and environmental protection is based on the replacement of existing products, and by developing new technologies, on the exchange of fuels and raw-materials, and regarding sustainable production and energy consumption [5, 30, 31,32, 33].

From the results, it can be concluded that all performed laundering procedures proved satisfactory washing performance. The results also show that the two-bath ozone treatment needed 61.63% less energy compared to the classical household laundering procedure. Evidently, the classical laundering procedure has two times higher Global Warming Potential (GWP_{TGP}) and Acidification Potential (*AP*) than the ozone laundering procedure.

Acknowledgments

We want to acknowledge Shelagh Margaret Hedges for the useful suggestions which she gave us during the origin of the present article, as also for the final proof-reading.

References

[1] European Commission, Directorate-General for Energy and Transport. 2020 vision: Saving our energy. Brussels, 2007.

[2] Fonseca P, A. Almeida, N. Feilberg, G. Markogiannakis, C. Kofod. Characterization of the household electricity consumption in the EU, potential energy savings and specific policy recommendations. ECEEE, Summer study, 2009, 781-893.

[3] Pakula, C, R, Stamminger. Electricity and water consumption for laundry washing by washing machine worldwide. Energy Efficiency, 3 (4), 2010, 365-382.

[4] Almeida, A, P. Fonseca, B. Schlomann, N. Feilberg. Characterization of the household electricity consumption in the EU, potential energy savings and specific policy recommendations. Energy and Buildings 43, 2011, 1884–1894.

[5] European Commission. Horizon 2020: Secure, Clean and Efficient Energy. Available from: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/secure-clean-and-efficient-energy.

[6] Hollander, E, A. Roser. Energy Appliances for Low-Income Households. Available from: http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/events/EEDAL15/S22_Appliances2/eedal15_submission_140.pdf.

[7] Ellmer, K, M. Fuchs, U. Bauer, T. Schneider, P. Uwe Thamsen, T. Morgenthal, J. Villwock, A. Hanau. Research project Simulation Waschepflege e Recommendations for Improving. Journal of Cleaner Production, xxx, 2015, 1-9.

[8] United States Environmental Protection Agency. EPA Guidance Manual: Alternative Disinfectants and Oxidants, Chap 3, 1999, 3.1-3.2.

[9] Guzel-Seydim, ZB, AK, Greeneb, AC, Seydim. Use of ozone in the food industry. Lebensm.-Wiss. u. Technol, 37, 2004, 453–460.

[10] Schönweiz, A. Ozone locks for disinfection in the food industry. 47th IDC Conference, WFK - Cleaning Technology Institute, 19 - 21 May 2015, Düsseldorf.

[11] Bauman, N, M. Poberžnik, A. Lobnik. Textile Wastewater Cleaning with O3 and H_2O_2/O_3 Process. Tekstilec, 52 (10-12), 2009, 284-305.

[12] Corina Moga, Ic. F. Pricop, M. Iordănescu, R. Scarlat, A. La Dorogan. Quality monitoring for wastewater generated by the textile finishing. Industria Textila, 64 (4), 2013, 222–228.

[13] Tapp, C. Ozone laundry, a detailed review of the method and science involved in a properly designed cold water wash ozone system. 46th IDC Conference, WFK - Cleaning Technology Institute, 9 - 11 April 2013, Düsseldorf.

[14] SIST EN 60456:2010. Clothes washing machines for household use - Methods for measuring the performance.

[15] CIE 15.3:2004. Colorimetry. Colour of objects Colour vision. Perception of colour.

[16] ASTM D4265-98:2007. Standard Guide for Evaluating Stain Removal Performance in Home Laundering.

[17] Den Otter, W, M, Seiter, M, Wehrl,et al.. Advanced CO_2 cleaning as an ecological process technology = ACCEPT: project periodic report: period covered from September 1st, 2008 to December 1st, 2010. Wiesbaden-Biebrich: Chemische Fabrik Kreussler, 2010.

[18] Neral, B, S. Fijan, S. Sostar-Turk. Advanced CO_2 cleaning as an ecological process technology. 41st International Symposium on Novelties in Textiles and 5th International Symposium on Novelties in Graphics and 45th International Congress IFKT, 501-504, Ljubljana, Maj, 2010.

[19] Sutanto, S., M.J.E. van Roosmalen, G.J. Witkamp. J. of Supercritical Fluids, 81, 2013, 183– 192.

[20] IPCC Intergovernmental Panel on Climate Change. The science of Climate Change. Available from: www.ipcc.ch/.

[21] European Commission. Joint Research Centre-Institute for Environment and Sustainability. European Platform on Life Cycle Assessment. Available from: http://lct.jrc.ec.europa.eu/, http://ec.europa.eu./environment/.

[22] EEA, 2016c, Approximated EU GHG inventory: proxy GHG emission estimates for 2015, EEA Report No 15/2016. Available form: http://www.eea. europa.eu// publications/approximated-eu-ghg-inventory-2015.

[23] Global Emission Model for Integrated Systems (GEMIS) V 4.6., Oeko-Institut e.V., Freiburg. Available from: http://www.oeko.de/service/gemis/.

[24] CML (2016) - CML's impact assessment methods and characterisation factors. Institute of Environmental Sciences (CML), Faculty of Science, Leiden University. Available from: https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors.

[25] Europe's energy position, Market Observatory For Energy - Report for 2009. European Commission, 2010, 23-25.

[26] Eberle, U., A. Lange, J. Dewaele, D. Schowanek. Study and Environmental Benefits for Low Temperature Disinfection Process in Commercial Laundry, *Int J LCA*, 2007, vol. 12 (2), 127-138.

[27] Neral, B., S. Šostar-Turk, S. Fijan. Environmental impacts of various disinfection procedures during laundering. *Tekstilec*, 54 (7-9), 2011, 149-171.

[28] Langlais, B., D.A. Reckhow, D.R. Brink. 1991. Ozone in Drinking Water Treatment: Application and Engineering. AWWARF and Lewis Publishers, Boca Raton, FL.

[29] Gonçalves, AA. Ozone – an Emerging Technology for the Seafood Industry. Braz. Arch. Biol. Technol, 52 (6), 2009, 1527-1539.

[30] EEA, 2016a, Annual European Union greenhouse gas inventory 1990–2014 and inventory report 2016, EEA report No 15/2016, European Environment Agency. Available form: http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2016.

[31] European Commission. Energy Union and Climate change Policy. Available from: http://ec.europa.eu/priorities/energy-union/docs/energy-union-1-year_en.

[32] European Commission. Decomposition analysis of the changes in GHG emissions in the EU and Member States-2016. Available from: https://ec.europa.eu/ clima/ policies/ strategies/progress.

[33] European Commission. Report from the Commission to the European Parliament and the Council, Implementing the Paris Agreement - Progress of the EU towards the at least -40% target, 52016DC0707 - EN. Available from: http://eur-lex.europa.eu.

. STUDY OF THE TILLAGE AND PLANTING INFLUENCE ON THE MAIZE YIELDS.

Bratoev, Kr.[1], G. Vezirska[2], G. V. Mitev[1], G. Gerdjikov[3]

[1] – "Angel Kanchev" Ruse University; [2] – "Agroremproject"Company, Ruse; [3] –PIONEER (DuPont)

Summary:*Sustainability of agricultural production results in reducing the negative trends caused by both climate change and by incorrectly applied technologies for production, which aims to preserve the resource base and maintaining environmental quality. Soils are conditionally renewable natural resource but practically reconstruct in a very long time. Therefore, in order to preserve them relate to non-renewable natural resources. At its core, soil, where they are intended for agricultural use are processed to meet the needs of people and thus change their properties. By applying appropriate ways of tillage and use the potential of plant residues, it is possible to control physical properties. There is a misconception and myth that getting high yields in agriculture can be maintained only with the addition of fertilizer and / or water. High investments made at the entrance of the agricultural production can easily be pointless, if the physical properties of soil are suboptimal or even below the critical level.The physical properties of the soil, it is essential for processing and has its mechanical structure. It closely depend on a number of other properties such as bulk density, ability to retain water, porosity, adhesion, resistance, etc., Which play an important role in the processing and to obtain sustainable yields.*

Introduction

It is estimated that one-sixth of the soils in the world (16-17%) already lost from water and wind erosion, [.....]. This fact has two important consequences in terms of the reduced ability of the public to produce enough food, due to losses in depth and quality of soil and occurrence of side effects such as water pollution and water reservoirs that are associated with erosion.

Drought is a major problem faced by many nations inevitably worldwide. Droughts occur in both regions climate is characterized by heavy rainfall and in areas where rainfall is scarce. Available soil, meteorological, agro-meteorological and hydrological information indicates that droughts have been recorded repeatedly in the 20th century in Eastern Europe and they are part of the climate cycle of Balkan Peninsula, [...]

As a result of the intensification of agricultural production and climate change over the past two decades is increasingly recognized the threat to the Bulgarian and European soils. Only in 2016 reported high values of maximum temperatures during the growing season of plants Figure 1 and in more than 12 vapezha for extreme regions of Dobrich and Ruse, Fig. 2.

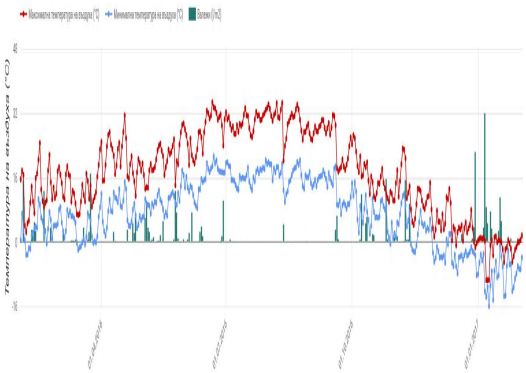


Fig. 1. Maximum and minimum daily temperatures of air region. Lozenets,, Dobrich District

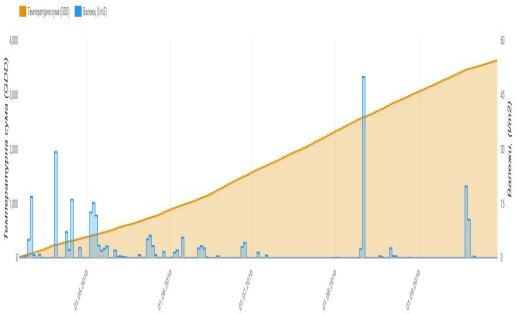


Fig. 2. The act of extreme rainfall and periods of prolonged droughts to the region of. Ruse District

Surveys conducted over the past 10-15 years, as well as regular information studies show a significant reduction in yields. One reason is the general degradation of soil and compacting them at different depths, which covers more than one soil horizon.

However, in modern agriculture there are two worrying trends:

Improving the structure of the machines made in mechanization (compilation of TCM, TLM and MTA) to simultaneously increase the axle load of the running system of energetic machines;

Intensification of crop rotation and move to etc. "Commercial crop rotations."

One example is that legumes have been replaced by cereal such as wheat, barley, sunflower, and partly from maize.

Tillage is one of the main activities of people when growing crops. It is important and invariably unit in all known systems of agriculture - from the most primitive to modern.

By the term "soil tillage" is understood a number of actions to be taken to change the structure in such a way that the conditions for the germination, growth and development of plants are the best in order to obtain optimum yields.

The term "soil structure" is intended to clarify the spatial distribution of soil aggregates, [Dexter, 1988]. What is the purpose of each application to soil to form more large and small spaces (pores), thereby facilitating the penetration of air and water and the development of the root system of the plants.

Tillage is applied between harvesting one crop to the next sowing. The reason is removing the weeds, which is much more modest than crop plants to adverse environmental conditions and develop with higher rates.

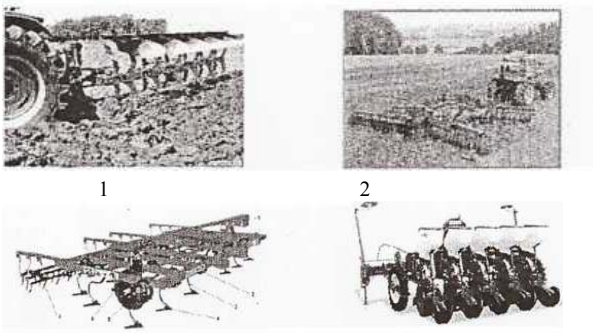
Need more perfect tillage associated with the demands of the times in which we live becomes more urgent as more "cultural" is the cultivation of plants and the higher requirements brought someone in their cultivation.

Material and Method

On the basis of conducted field trials in which it was applied "Strip-till" technology in growing row crops becomes clear that as an alternative, this technology has emerged with high potential, covering the high modern agro-environmental criteria.

The purpose of this study is to justify and determine the influence of mechanical tillage and method of sowing on yield.

In relation to the target is conducted experimental study of tillage and sowing in growing corn.

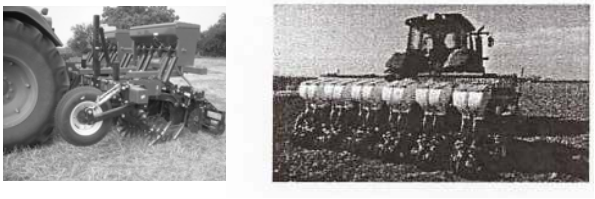


1 2

3 4

***Fig.3**. Machines applied in the classic technology: 1 – plough; 2 – disk harrow; 3 – cultivator; 4 – classic seed drill*

To conduct the study for the corresponding classical and "Strip-till" technology in growing row crops, the experienced equipment is used as shown in Fig. 3 and Fig. 4.



1 2

***Fig.4.** Machines from „Strip-till" technique: 1-strip till subsoiler; 2- twin rows planting machine, [3,4]*

Each technological operation performed by these machines is held in the agricultural period and precisely made adjustments to the machines.

By conducting the dispersion experiment observed the effect of the technology on the yield of corn, which in equal conditions applied will show at what the comparators technology the yields are higher. As control factors in the experiment include: the type of primary soil cultivation (A) and the method of sowing (B). The levels of control factors are consistent with agro-technical requirements for cultivation. Each factor is changed to the following levels: A1 - classical plowing at 0.25 m depth; A2 - strips loosening at 0.25 m depth; B1 - Standard wide row sowing; B2 - chess sowing in twin rows. They were assessed separately with factor A, factor B, and their joint influence. The indicator

Source of distraction	Sum of squares	Degrees of freedom	Rating dispersions	Fisher's Critetion
Factor	SS_A	$k_A = p - 1$	$S_A^2 = \frac{SS_A}{k_A}$	$F_A^2 = \frac{S_A^2}{S_E^2}$
Factor B	SS_B	$k_B = p - 1$	$S_B^2 = \frac{SS_B}{k_B}$	$F_B^2 = \frac{S_B^2}{S_E^2}$
Combined effect on Factor A and factor B	SS_{AB}	$k_{AB} = p - 1$	$S_{AB}^2 = \frac{SS_{AB}}{k_{AB}}$	$F_{AB}^2 = \frac{S_{AB}^2}{S_E^2}$
Casual and non accounted factors	SS_E	$k_E = (p - 1).(p - 1)$	$S_E^2 = \frac{SS_E}{k_E}$	$F_{\alpha,(p-1),kE}$
Summary impact	SS	$\kappa = p^2 - 1$	$S^2 = \frac{SS}{k}$	

(parameter of optimization), which was performed this assessment is grain yield - Y.

The study used the cybernetic approach in which research subject is presented with the "Black box". This approach allows the site to study and manage only by his reactions Yj; j = 1, resulting from the exercise on it externalities called factors - steered (A, B) and unmanaged (w1, w2, ... wq). At fixed values of control factors as a result of the effects of unmanaged factors each of the parameters of the output has a casual nature.

The dispersion analysis express the influence of controllable factors on the parameter by setting separate sums up the basic equation of analysis of variance, which in two factors has the form:

$$SS=SS_A+SS_B+SS_{AB}+SS_E, \quad (1)$$

where: the SSA is the amount that expresses the influence of factor A on the parameter Y;

SSB is the amount that expresses the influence of the factor B, on parameter Y;

SSAB - an amount that expresses the mutual influence of factors A and B on the parameter Y;

SSE - residual sum of squares, which expresses the impact of unmanaged and unaccounted factors on the parameter Y.

To express the amounts characterizing the influence of factors on the parameters is necessary attempts to be hold by a special scheme called "Plan the experiment". The idea of two-factor variance analysis consists in studying the possible reasons for the variation of the parameter Y, which in accordance with the expression (1) may be due to the amendment of any of the selected control factors. In analyzes the factors involved on two levels, which in FFE (full factorial experiment) is associated with carrying too many attempts, and that in the field can be a cause of frustration experiment. Since absent relationship between selected factors and convenience in conducting the trials as experimental plan is approved table shown below. When these factors and their levels, the chosen plan is shown in Table 1 form.

Table 1. Plan the experiment for two-factors dispersion analysis

		Soil tillage (Factor A)	
		A_1	A_2
Planting (Factor B)	B_1	A_1B_1	A_2B_1
	B_2	A_1B_2	A_2B_2

In Table. 1 so the indicated levels of both factors are as follows:

- A1 - plowing
- A2 – stril till
- B1 - classical planting
- B2 – twin rows planting

The study is limited to ascertaining the impact of the selected control factors on the yield of corn. The verification is performed using the Fisher's criteria, calculated as its value for each of the factors is compared with the critical value. The factors for which the computed value of the criterion of Fischer is less than the critical $F_{\alpha,(p-1),kE}$, are considered to be negligible influencing parameter Y.

Conveniently is derived from statistical processing results to be made to the Table of variance analysis (Table 2).

Table 2. Two-way analysis of variance in presence of parallel experiments

Data processing is done by using "Statistica" -10 software product, which significantly reduces the time to analyze the results. The studies were performed in real field conditions, subject to the requirements of the company delivered seed, such as: size of the experimental areas, sowing rates, fertilization rates, etc.

The classical soil preparation includes: primary treatment with mouldboard plow to a depth of 0.25 m; disking to a depth of 0.10 ÷ o.12 m and merged cultivation depth of sowing. Non-traditional soil preparation include strips subsoiling to a depth of 0.25 m in distance between the strips 0.70 m.

Traditional and non-traditional ways of sowing is carried out in wide intelines at the same spacing and observing the same sowing rate - 65000 germinating seeds per hectare. The difference in sowings consists in the fact that in non-traditional sowing rows with plants are paired. In this embodiment the sowing of the crop is staggered in paired rows, whereby plants from the paired lines are out of phase with each other by a distance equal to the required distance Interlinear.

In the experiment, the experimental field is divided in advance into equal size plots, [1]. The number of the plots corresponds to the number of boxes in the plan of the experiment (Table 3), taking into account the double repetition of the experiments. For ease of harvest is well parcels be arranged longitudinally under a scheme as shown in Figure 5.

Figure 5. Prots distribution on the field

Each plot has a 16,8 m width. So in the plot can be planted 24 rows of length equal to the length of the plot-142m.

The subsoiler's traction resistance barcode requires a tractor with a power of 250 ÷ 300 hp, which is enough for Semi-mounted 8-furrow mouldboard plow. Working widths of both tillage implements are respectively 4,2 m and 2,4 m, which in "forehead" of the plot of 16,8 m means cultivating units will perform integer crossings in it. The same goes for sowing aggregates. Movement of shuttle assemblies is such that between the plots shown in Figure 5. Lettering of the plots in Figure 5 corresponds to specified levels of control factors in the experiment.

The reported yield was presented with the average of the duplicate repetitions in partselkite (Table 3) and equated to Moisture 14% (Table 4).

Table 3. Accounted average yield I kg/ha

		Soil tillage (Factor A)			
		Plowing		Strip till	
		1st trial	2nd trials	1st trial	2nd trial
Planting (Factor B)	Classic planting	671	708	887	884
	Twin rows planting	867	937	870	860

Table 4. Croching average yields

		Soil tillage (Factor A)			
		Plowing		Strip till	
		1-ви опит	2-ри опит	1-ви опит	2-ри опит
Planting (Factor B)	Classic planting	667	675	882	879
	Twin rows planting	862	932	865	855

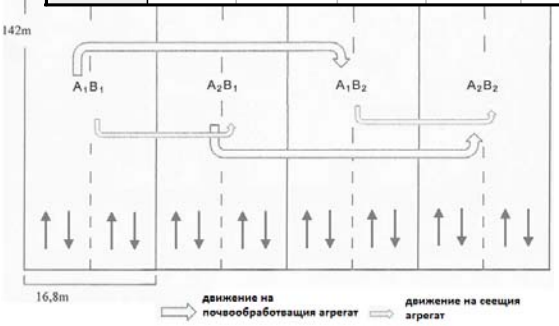
Adduced values of the yields are introduced into a mold of the software "Statistica" -10 (Table 5). Obtained after treatment of the matrix results are presented in a table (Table 6) and graphical (Figure 6, Figure 7 and Figure 8).

Таблица 5. Матрица на експеримента

	1 A	2 B	3 Y
1	a1	b1	667
2	a1	b1	675
3	a2	b1	882
4	a2	b1	879
5	a1	b2	862
6	a1	b2	932
7	a2	b2	865
8	a2	b2	855

Таблица 6. Резултати от дисперсионния анализ

Effect	Univariate Tests of Significance for Y Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	5473086	1	5473086	8630,926	0,000000
A	14878	1	14878	23,462	0,008377
B	21115	1	21115	33,298	0,004477
A*B	30381	1	30381	47,910	0,002286
Error	2537	4	634		



At significance level α = 0,05 shows that the type of soil cultivation and the type of sowing, and the both factors together affect greatly the yield of grain. This follows from the lows of probability p - the kind of cultivation is p = 0,008377; the type of sowing is p = 0,004477, and the joint influence of tillage and sowing is p = 0,002286. All three values are significantly smaller than the level of significance of α = 0,05, as the less is p, the more factors influence the parameter Y. Therefore, the type of drill has a greater influence on the yield of grain on the type of tillage, but the greatest impact on yield has joint interaction of these two factors, [2].

This is evident from the presented graphic relationships. From Figure 6 and Figure 7 it is seen that the level of change of the factor leading to an increase in yield, and for both factors that increase is in their second level. The absence of overlap between confidence intervals at different levels confirms the strong influence of each factor.

Figure 6. Influence of factor A on the grain yield

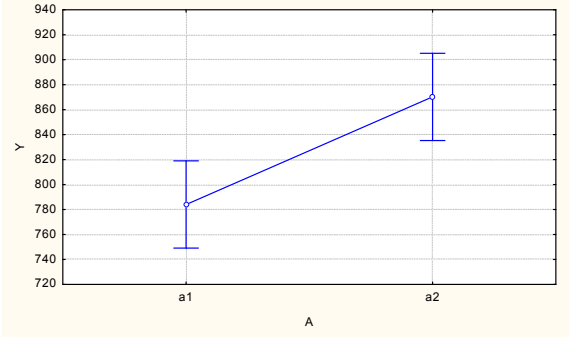


Figure 7. Influence of factor B on the grain yield

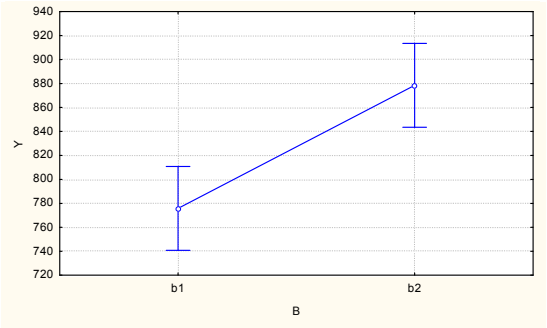
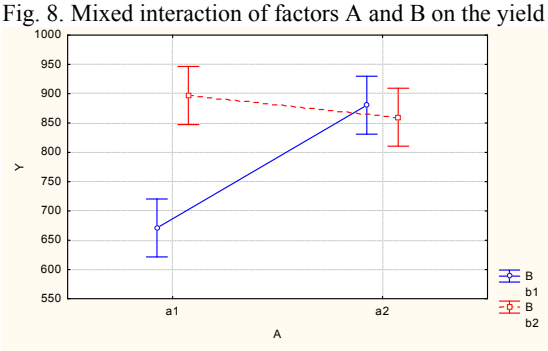


Fig. 8. Mixed interaction of factors A and B on the yield



The most significant experience was conducted on the information they provide graphs of figure 8. The line in blue shows the change in yield in classical sowing and red color - the chess sowing twin rows. At level A1 (classic plowing) the yield can be increased by applying a chess sowing (confidence interval in red is higher located). In the case that apply classical sowing, increased yield can be achieved by applying a ridged tillage (confidence interval sino at level 2 is set higher than that of a1). The yield that is obtained by applying both the ridged tillage and staggered two lines sowing, not statistically different from the said two versions, but as components of a "Strip till" technology, this extraction is combined with a number of other advantages which are not subject to this study but are characteristic of this way of growing row crops, [2].

Conclusion

In conclusion it can be said that the replacement of traditional method of cultivation with "Strip till" technology leads to improved production results, while helping to improve the moisture retention of the soil, breaking plow pan, reduce soil erosion and more. The positive effects that have individual elements of this technology in combination with the classic technology enables farmers to smoothly move from one to the other, gradually replace your existing techniques after full utilization of its resources.

Literature

1. http://login.geoscan.bg/map
2. Software product “Statistica 10”
3. Strip till Machine – Manual for operation.
4. Ägrimaster Seed drill. Manual of operation.

AN OPTIMIZATION MODEL FOR VEHICLE'S SUB-SYSTEM OF CITRUS FRUITS TRANSPORTATION ON THE ROUTE "FARMING ENTERPRISE-REGIONAL AGRARIAN LOGISTICS CENTER"

МОДЕЛЬ ОПТИМИЗАЦИИ ТРАНСПОРТНОЙ ПОДСИСТЕМЫ ПЕРЕВОЗКИ ЦИТРУСОВЫХ ФРУКТОВ ПО МАРШРУТУ «ФЕРМЕРСКОЕ ХОЗЯЙСТВО-РЕГИОНАЛЬНЫЙ АГРАРНЫЙ ЛОГИСТИЧЕСКИЙ ЦЕНТР»

Prof.Dr. Botsvadze L.[1], Doctoral candidate Sharabidze D.[2], Doctoral candidate Gudadze A.[2]
Georgian Technical University, Tbilisi, Georgia[1]; Akaki Tsereteli State University, Kutaisi, Georgia[2]
E-mail: predatori.ag@gmail.com, d.sharabidze@mta.gov.ge , predatori.ag@gmail.com

Abstract: Based on the function of the goal of the considering problem, there has been formalized an optimization mathematical model for road transport of citrus fruits. Also, there has been developed the combined system of the criterion optimality. In accordance with the optimization criterion, there has been developed formalization of the selected mathematical model, study of the parameters, and in response to the developed procedures, there have been selected the parameters and highlighted the value of a studying parameter at the probability level of $P=0.95$.

KEY WORDS: *International Intermodal System of Citrus Fruit Delivery; Agrarian Logistic Center; An Integrated Model of Supply Chain Strategic Management.*

1. Introduction

The export delivery system of fruits is a complex international macro-logistical system. It pertains to the intermodal transport supply chain for export products (citrus fruits). The regional agrarian logistics center (the focal company), where products are processed and manufactured, is the central link in this chain. The agrarian center is located in the center with lots of possible communications with suppliers and customers.

Material flow in the logistics chain is directed from left (upstream: the procurement system – raw materials zone – agricultural enterprises) to right (downstream – the area of supply: the final customer (international market) can order products). After that, the system sets into motion.

An institutional mechanism for the functioning of intermodal transport illustrates the interaction of global supply chain for export cargo (agricultural enterprises, motor transport, agrarian center, sender port, railway and maritime transport, ferry line, destination port, railway transport, distribution center (terminal), motor transport, destination point.

The aim of the logistics chain, as a complex structure, is to develop scientific technical methodology for the creation and development of the best available logistics chain for citrus fruits transportation, on the basis of intermodality, international marketing and the management principles for the supply chains, under conditions of the indefinite impact of environmental factors. Based on this, the type of an optimization model of system has been chosen, which implies common planning of the transport process together with manufacturing process and warehouse operations. As a general model, there has been chosen a combined model of strategic management of the supply chains. This model brings together the optimization models of the location of raw materials zone and trucking activities (on the upstream route "farming enterprise – agrarian logistics center"), as well as the economic-mathematical models of the agricultural center's warehousing refrigerators and technological sites (production area).

To assess the effectiveness of processes in the logistics sub-systems of the supply chain, and to choose one of several alternative options, there has been developed the system of the combined use of a criterion of optimality, which unites a combination of a maximum of discounted incomes, profitability index and internal rate of return $(\max SDS^{ML} \geq 0;\ SI \geq 1;\ SSN^{ML} \geq E^{\text{in}})$ [1].

2. Preconditions and means for resolving the problem

In order to develop a mathematical model, we introduce the designations: the index of citrus production farming enterprise – $(k \in K)$; the index of peripheral reception and production points – $(i \in m)$; the index of the agrarian logistics center's $(j \in n)$ citrus réception and process area $(j_1 \in G_1)$; the index of stores refrigerator for temporary storage of citrus fruits $(j_2 \in G_2)$; the index of packing and material store – $(j_3 \in G_3)$, the index of the canning process area $(j_4 \in G_4)$; the index of packaging and consolidation store $(j_5 \in G_5)$; the index of final product delivery and railway cargo front $(j_8 \in G_8)$; the index of the motor transport's motive power $(\mu \in \xi)$; – the index of rolling stock $(\mu_1 \in \xi_1)$, the index of store for temporary storage of finished products $(j_6 \in G_6)$; $i_1 -$ the index of species of harvested citrus fruits $(i_1 \in \theta)$; the index of species of sorted citrus fruits $(i_2 \in I_2)$; the index of species of non-grade citrus raw materials – $(i_3 \in I_3)$.

The transport sub-system of the farming enterprises comprises: types of transport, freight flow system, road network, and maintenance and repair base.

Types of the farming enterprises' transport are as follows: 1. Technological transport, which operates internal economic transportation; 2. External and intrafactory industrial transport. The internal transport is mostly represented by road goods transport and railroad cars.

When analyzing and planning the transport sub-systems, we have to highlight its functional sectoral structure: warehousing facilities; network of peripheral and manufacturing points; mechanisms and tools for execution of cargo handling operations; packages; containers; unit load devices and containerization.

The main objectives, which must be addressed as a result of optimizing transport services are as follows: 1. Optimal attachment of the customers to the suppliers (transport movement rationalization); 2. Optimizing the use of vehicles; 3. Optimal distribution of vehicles by the routes; 4. Optimizing the arrangement of peripheral reception and production points; 5. Optimizing the transport sub-systems by distributing the principles

on transportation of agricultural raw materials and finished products [2].

Based on the objectives of research, we consider the objectives 4 and 5, as the most important ones.

When formulating the objectives of transporting raw materials of farming enterpsises, the selection of optimality criteria is the most important issue. The problem under consideration is multi-criterial, and in a vector format, it should be written as follows:

$$SDS_j^{SLS} = \left\{\max Q_{\mu i} \max P_{\mu i} \min 3_{\mu i} \max SDS_{\mu}^{\text{ml}}, \max SDS_{\mu}^{\text{saw}}, \min N_{\mu}, \min \tau_{ij}^{i_1}\right\}, \quad (1)$$

where $\max Q_{\mu i_1 ij}; \max P_{\mu i_1 ij}$ – a maximum of freight turnover and transport operation; $\min 3_{\mu i}$, $\min C_{\mu}$ – a minimum of the integral and operating costs; $\max SDS_{\mu i_1 uj}^{\text{ml}}; SDS_{\mu i_1 ij}^{\text{ml}}$ – a maximum of macro- and micro-logistics efficiency from a transport sub-system; $\min N_{\mu ij}$, $\min \tau_{i_1 ij}$ – a minimum of time for transportation of goods and road transport.

The transport sub-system at the enterprise, according to its goals and objectives, is optimized in two directions: 1. The agricultural raw materials sub-system; 2. The finished products transport sub-system.

The output parameters of a mathematical model of the agricultural system's transport sub-system are the state parameters, which define its functionality. They include: the combined indicators of transport-logistics system performance: 1. $Q_{ii_1}^{\text{erT}}$, $P_{\mu i_1}$; $3_{\mu i_1}$, $\Pi_{\mu i_1}^{\text{ml}}$, $\Pi_{p\mu i_1}^{\text{ml}}$, $R_{\mu i_1}$; 2. The value indicators of the selected transportation: $K_{\mu i_1}$, $C_{\mu i_1}$, $C_{\mu i_1}^{\alpha}$, $K_{\mu i_1}$, C_{kii_1}, $C_{kji_1}^{\delta}$; $K_{ijii_1}^{\varepsilon}$. $K_{ijii_1}^{\delta}$, $C_{ijii_1}^{\delta}$; 3. Workforce and specific cost assess indicators: $P_{ii_1}^{\text{br}}$; $P_{\text{ð}\text{ò}\text{ð}}$; $P_{\text{ð}\text{ò}\text{ó}}$; $P_{\text{ð}}$; $P_{\text{ð}\text{ó}\text{ð}}$; $P_{\text{ð}\text{ð}}$; C_{Π}; $3_{\text{ð}\text{ç}\text{ð}}$; ПТ; 4. The quantity and performance indicators of the containers of motive power: N_p^{br}; $r_{\text{ñð}}$; $\Pi_{\text{ôó}}$; $r_{\text{ç}}$; $W_{\mu i_1}^{\text{y}}$; $W_{\mu i_1}^{\text{d}}$; U_{pg}; $q_{\mu i_1}^{\text{я}}$; $q_{\mu i_1}^{\varepsilon}$;

5. Temporal and running characteristics: $L^{\text{ьэгфэт}}$; $L_{\text{tv}}^{\text{saerT.}}$; $L_{\text{tg}}^{\text{saerT}}$; t_{pij}^{br}; $t_{\mu iji_1}^{\text{br}}$; n_{lij}; n_{erj}; $n_{\mu\text{erT}}$; t.

The maximum value of profit of a transport system at the micro-logistics level, is taken an optimization criterion, but at the production level – the maximum value of micro-logistics efficiency [3].

The problem of optimum performance of transport sub-system in a formalized manner have the fololowing form: with the given parameters of conditions of functioning $\vec{X}(t)$ and intermediate parameters $\vec{Y}(t)$, with account for perturbation parameters, we should find such plan

$$\Pi_{\mu i_1} = \left\{X_{ki_1}^{y}, X_{ki\mu i_1}^{y}, X_{kj\mu i_1}^{\delta}, X_{ij\mu i_1}^{\delta}, \overline{X}_{\mu i_1}^{\text{dan}}\right\}, \quad (2)$$

and such parameters $\vec{Y}(t)_{\mu i}$, on all routes of transporting agricultural raw materials, that for the purpose of the efficiuency global criterion, the functions reach their maximum values.

The function of the objective of micro-logistics efficiency takes the following form:

$$SPS_{p\mu ji_1}^{ML} = \max \sum_{j\in n}\sum_{t'\in T'}\sum_{i_1\in\theta}\sum_{k\in K}\left\{\left[\sum_{t=1}^{n}\frac{X_{ki_1t}\cdot Ц_{ki_1t} + \sum_{\mu\in\xi}\left(\sum_{i\in m} X_{ki1\mu jt'}^{\delta}\cdot Ц_{ki1\mu jt'}^{\delta} + X_{ij\mu i_1t'}^{\delta}\cdot Ц_{ij\mu i_1t'}^{\delta}\right)+}{[(1+i)(1+i)]^t}\right.\right.$$

$$\left.+\frac{X_{kj\mu_1t'}^{\delta}\cdot Ц_{kj\mu_1t'}^{\delta}}{[(1+i)(1+i)]^t}\right]-\left[\sum_{\tau=0}^{n}\frac{X_{ki_1t'}\cdot K_{ki_1t'} + X_{ij\mu i_4t}\cdot Ц_{ij\mu i_4t} + \sum_{\mu\in\xi}\left(\sum_{i\in m} X_{kj_1\mu i_it}\cdot K_{kj_1\mu i_it} + X_{ij\mu i_it'}^{\varepsilon}\cdot K_{ij\mu i_it'}^{\varepsilon}+\right.\right.}{[(1+i)(1+i)]^t}$$

$$\left.+\frac{X_{ij\mu i_1t}^{\delta}\cdot K_{ij\mu i_1t}^{\delta} + X_{kj\mu i_1t}^{\delta}\cdot K_{kj\mu i_1t}^{\delta}}{[(1+i)(1+i)]^t}\right]-\left[\sum_{\tau=1}^{n}\frac{X_{ki_1t}\cdot C_{ki_1t} + \sum_{\mu\in\xi}\left(\sum_{i\in m} X_{ij\mu_1i_2t'}^{\varepsilon}\cdot C_{ij\mu_1t''}^{\varepsilon} + X_{kj\mu_1t'}^{\delta}\cdot C_{kj\mu_1t'}^{\delta}+\right.\right.}{[(1+i)(1+i)]^t}$$

$$\left.\left.+\frac{X_{ji_1\mu i_1t'}\cdot C_{ji_1\mu i_1t'} + X_{kj\mu i_1t'}^{\delta}\cdot C_{kj\mu i_1t'}^{\delta}}{[(1+i)(1+i)]^t}\right]+\sum_{i_1\in\theta}\sum_{\mu\in\xi} X_{\mu i_1}^{\text{dan}}\cdot Ц_{i_1}+\sum_{i_1=1}^{r} A_i Ц_i^{\text{sxv}}\right]. \quad (3)$$

When observing the following conditions and restrictions:

1. With demand of agro-centners for production of citrus fruits

$$\sum_{t'\in T'}\sum_{k\in K}\sum_{i\in\theta} V_{ki_1t'} = \sum_{t'\in T'}\sum_{j\in n}\sum_{i_1\in\theta} A_{j_1t_1t'1}\cdot \quad (4)$$

2. When fulfilling the balance between production of citrus fruits and their transportation to the agricultural centers and peripheral reception and production points

$$\sum_{t'\in T'}\sum_{k\in K}\sum_{\mu\in\xi}\sum_{i_1\in\theta}\sum_{i_6\in\varphi}\left[\sum_{j\in n}X_{kj\,i_1\,t'}+\sum_{i\in m}X^{TT}_{ki\mu i_1t'}\right]=V_{ki_1t'}\,, \tag{5}$$

3.
$$\sum_{k\in K}\sum_{i\in m}X_{ki\mu i_1t'}=\sum_{i\in m}\sum_{j\in n}X_{ij\mu i_1t'}\le P_{ii_1}\,, \tag{6}$$

4.
$$\sum_{t'\in T'}\sum_{i_1\in\theta}\sum_{\mu\in\xi}\sum_{i_6\in I_6}\left[\sum_{j\in n}\left(\sum_{k\in K}\frac{X^{\delta}_{kj\mu i1t'}\cdot t^{\mathrm{a}}_{jki_1}}{W_{ki\mu i1}}\right)\right]\le N^{TT}_{k\mu}\,. \tag{7}$$

The conditions (6) and (7) demand that transportation of the planned volume of citrus fruits from *k-th* enterprises to *i-th* points should be performed by means of the technological transport fleets exiting of these enterprises.

5. A prerequisite for the use of the motor transport motive power in these agricultural centers and enterprises, is as follows:

$$\sum_{t'\in T'}\sum_{i_1\in\theta}\sum_{\mu\in\xi}\sum_{i_6\in\varphi}\left[\sum_{j\in n}\left(\sum_{k\in K}\frac{X^{\delta}_{kj\mu i1t'}\cdot t^{\mathrm{a}}_{kji1t'}}{W_{\mu kj}}+\sum_{i\in m}\frac{X^{\varepsilon}_{kj\mu i4t'}\cdot t^{\varepsilon\mathrm{br}}_{uij}}{W_{\mu kj}}+\sum_{k\in k}\sum_{i\in m}\frac{X_{ki\mu i1t'}\cdot t^{\mathrm{a}}_{uki}}{W_{\mu kii1}}\right)\right]\le$$
$$\le N_{j\mu t'}+N^{TT}_{k\mu t'}\,. \tag{8}$$

6. A prerequisite for the use of a time limit for being of the motor transport motive power on a trip, is as follows:

$$\sum_{t'\in T'}\sum_{i_1\in\theta}\sum_{\mu\in\xi}\sum_{i_6\in\varphi}\left[\sum_{j\in n}\left(\sum_{k\in K}\frac{X^{\delta}_{kj\mu i1t'}\cdot t^{\mathrm{a}}_{ukj}}{q^{\delta}_{\mu kj}}+\sum_{i\in m}\frac{X^{\varepsilon\delta}_{ij\mu i1t'}\cdot t^{\varepsilon\delta}_{uij}}{W^{\varepsilon\delta}_{\mu kj}}+\sum_{k\in k}\sum_{i\in m}\frac{X_{ki\mu i1t'}\cdot t^{ct}_{\varphi ki}}{q_{\mu ki}}\right)\right]\le$$
$$\le T_{\mu ji1}+T_{\mu ki_1t'}\,, \tag{9}$$

7. A prerequisite for striking a balance between transportation of citrus fruits and their volumes planned in the agricultural centers, is as follows:

$$\sum_{j\in n}\sum_{\mu\in\xi}\sum_{i_1\in\theta}\left[\sum_{i\in m}\left(X^{\varepsilon}_{ij\mu i_1t'}+\sum_{\varepsilon\in\xi}X^{\varepsilon}_{ij\mu i_1t'}\right)+\sum_{k\in K}X_{ij\mu i_1t'}\right]=A_{ji_1t'}\,, \tag{10}$$

8.
$$\sum_{i\in m}\sum_{\mu\in\xi}\sum_{i_1\in\theta}\left\{\sum_{k\in K}X_{kj\mu i_1t'}-\left[\sum_{j\in n}\left(X^{\varepsilon}_{ij\mu i_1t'}+X^{\delta}_{ij\mu i_1t'}\right)\right]\right\}\le 0\,, \tag{11}$$

For any period of citrus fruits picking, the total volume of raw materials delivered to the peripheral points, must be unloaded.

9. A prerequisite for the use of workforce, is as follows:

$$\sum_{t'\in T'}\sum_{i_1\in\theta}\sum_{\mu\in\xi}\sum_{r\in P}\left[\sum_{j\in\pi}\left(\sum_{k\in K}X_{kj\mu i_1rt'}\cdot U_{kj\mu i_1rt'}+\sum_{i\in m}X^{\varepsilon}_{ij\mu i1rt'}\cdot U^{\varepsilon}_{ij\mu i1rt'}+\right.\right.$$
$$\left.\left.+\sum_{\mu\in\xi}X^{\delta}_{ij\mu i1rt'}\cdot U^{\varepsilon}_{ij\mu i1rt'}\right)+\sum_{k\in K}\sum_{i\in m}X_{ki\mu i_1rt'}\cdot U_{ki\mu i_1rt'}\right]\le U_{j\mu i_1t'}+U_{k\mu ii_1t'}\,, \tag{12}$$

where $r-$the index of set of workforce, $r\in R$; $U_{ij\mu i_1rt'}$, $U_{ki\mu i_1rt'}$, $U_{kj_1\mu i_1rt'}-$the standards of *r*-type workforce for performing operations during on the transportation routes; $U_{i\mu i_1t'}$, $U_{k\mu i_1t'}-$existence of workforce in *j-th* agricultural center and enterprises, for services of citrus fruits tranportation;

10. Nonnegativity constraint and integrality:

$$\left.\begin{array}{l}\left(X_{ki\mu i_1t'},X_{ki_1t'},X^{\delta}_{kj\mu i_1rt'},X^{\varepsilon}_{ij\mu i_1tt'},X^{\delta}_{ij\mu i_1rt'},\overline{X}^{\mathrm{dan}}_{ij\mu i_1t'}\right)\ge 0.\\ \forall t'\in T',i_1\in\theta;i\in m;\,j\in n,\mu\in\xi,k\in K;u\in U,i_6\in\theta.\end{array}\right\} \tag{13}$$

A mathematical model (1...13) implementation is carried out by way of its decomposition into the separate blocks. There are considred the mathematical models for the particular tranportation routes, and the problem of bulk and containerized transportations is solved independently. The basic methodological principle for modeling and calculation of these transportations are available in reference literature.

Modeling is performed in accordance with the raw materials transportation schemes in the premises of a real agro-logistical complex. The calculations are carried out by using appropriate software packages. Operator intervention is necessary only during the period of the production of information and interpretation of the results of calculation.

3. Conclusion

1. The export delivery system of fruits is a complex international macro-logistical system. It pertains to the intermodal transport supply chain for export products (citrus fruits). The regional agrarian logistics center (the focal company is the central link in this chain. with lots of possible communications with suppliers (upstream) and customers (downstream);

2. As a generalized optimization model of the intermodal transport system, under conditions of the indefinite impact of environmental factors, it is advisable to choose a combined model of strategic management of the supply chains, which implies common planning of the transport process together with manufacturing process and warehouse operations, and to use a combined system of optimality criteria, which unites a combination of a maximum of discounted incomes, profitability index and internal rate of return.

4. References

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1. agroindustrial complex of Georgia/ Dissertation paper, D. sc. in Engineering. 05.13.01. Control in engineering systems. St. Petersburg - Kutaisi., 1996. – 542 p. (in Russian)
2. Kravtsov V.S., Martynov O.K. Standardization of storage technique and transportation of agricultural products. – M.: Standards publishers, 1986. – 127 p. (in Russian)
3. Zhadan V.Z. Theoretical bases of storage of lush plant raw materials in food manufacturing enterprises. M.: Food Industry, 1986. – 238 p. (in Russian)

SELECTION AND STUDY OF AGRO-TOURISM FACILITIES IN THE IMERETI REGION OF GEORGIA

ВЫБОР И ИССЛЕДОВАНИЕ АГРОТУРИСТИЧЕСКИХ ОБЪЕКТОВ ИМЕРЕТИНСКОГО РЕГИОНА ГРУЗИИ

Prof. Dr. Kochadze T.,Assoc.Prof. Dr. Chogovadze D., Assoc.Prof. Dr.Dangadze I ., Master's degree holder Kochadze I.
Akaki Tsereteli State University - Kutaisi, Georgia
E-mail: Temko1954@mail.ru , Djumberi54@gmail.com , Dangadze55@mail.ru, magika700@gmail.com

Abstract: *Agro-tourism a type of tourism, when the aim of tourist is to live like a local, work with him in the fields, have his meal on the table together with him, i.e. to become part of his family for a certain time period. In order to provide branding of tourism as "a rural tourism" in Georgia, with the support from the Shota Rustaveli National Science Foundation, the home page has been designed on the main web page of the Tourism Geo-Information Center (which is being in the process of constant updating), on which there will be placed the agro-tourism facilities of Georgia with the appropriate itinerary. Also, a single agro-tourism database will be set, which will be available on the Internet.*
KEY WORDS: *WINE AGRO-TOUR; LOCAL VINE VARIETES; FAMILY HOTEL; FISHING.*

1.Introduction

Agro-tourism means taking a rest in a village, with people who run their small family farms, and they themselves are the hosts for the arrived guests, and they possess lodging facilities for them and can offer them various activities, which, for the Imereti region, may include several types of agro-tour, for example, such as: viticulture, cheese-making, pottery (clay), beekeeping, corn, gifts of the forests (blackberry, chestnuts, mushrooms) and other tours, and by involving the visitors in horseback rides, fishing, seeing natural beauties during the process of the execution of this tour.

Agro-tourism is a type of tourism, when the aim of tourist is to live like a local, work with him in the fields, milk cow, make cheese, cultivate land, have his meal on the table together with him, i.e. to become part of his family for a certain time period. In this regard, it is necessary to undertake a study of agro-tourism potential in the Imereti region, as a result of which, the potential tourist facilities must be identified, which are ready qualitative hosting of visitors. In order to ensure receiving on-site services of the desired quality, first it is necessary to correctly select and retrain several families in the service sector [3].

When talking about tourism development opportunities in Georgia, particularly in the Imereti region, it is necessary to study the following circumstances:

- Whether or not there is in existence in the region resources required for tourism development;
- Whether or not there is in existence a tourism market to enter;
- Whether or not there is in the region the need in the region for tourism development to achieve economic development goals;
- Whether or not there is in existence the necessary workforce for tourism development, without attracting additional workforce;
- Whether or not the transport infrastructure development costs are justified;
- Whether or not is possible the emergency of competitors from the existing or potential tourist projects in neighboring regions.

2. Preconditions and means for resolving the problem

Since the end of XX century, agro-tourism has become very popular in Europe. For example, the majority of Italian families have taken a rest in the villages not only during their holidays, but also during weekends. In this regard, Georgia is no exception.

Agro-tourism deserves attention also because of fact that it works during the whole year in Cyprus and Bulgaria. A special program on agro-tourism development has been developed in Cyprus, which restoration and renovation of rural houses, as well as decoration of them in national style by saving the modern comfort and cosiness. Tourists are given the opportunity to get to know about the local culture, traditions, folklore, have a rest in mountain villages and walk by the sea coast at will. They can take part in the grape harvest and its squeezing process, in the harvesting and warehousing of other agricultural crops, to visit the watermills organized on the rivers, and forging and textile shops. In this respect, it is necessary to study and use the unique tourist capacities of the varied natural landscapes and geographical location of districts and villages in the Imereti region.

Bulgaria is one of the important tourist regions in the East Europe. It is known for both seaside and mountain resorts, and it is considered a promising recreation zone at the European scale. Given that to% of the population of Bulgaria live in the villages, it is easy to imagine that agro-tourism here has become very popular. Agro-tourism for the traditional villages does not need large costs. This type of tourism, here, is relatively inexpensive, effective and accessible to all categories of people. The tourists come to the villages from Bulgarian cities, Russia and mostly from Eastern European countries.

For selecting the villages and a particuar host in them for agro-tourism, the tourist companies must have a list of mandatory conditions, after satisfying of which, a particular house will be included in the list of lodging facilities. These conditions are as follows: safe location, beautiful nature and landscape: existence of forest, river, lake or medical waters; it is desirable that peasant farm should have a national style and the infrastructure components as follows: opportunity to have meal in the gost family, the separate bedroom, shower and toilet. Existence of historic monuments and other attractions in the villages is very important for foreign tourists, and restaurant, tavern, or national cuisine dishes must be situated close to the host house.

A study of agro-tourism performed in the Imereti region has shown that there are about twenty facilities, which are mostly fully well-organized. These are locations, where the tourists can spend their weekends and even a whole week. In order to provide branding of tourism as "a rural tourism" in Georgia, with the support from the Shota Rustaveli National Science Foundation, the home page has been designed on the main web page of the Tourism Geo-Information Center (which is being in the process of constant updating), on which there will be placed the agro-tourism facilities of Georgia with the

appropriate itinerary, and a single agro-tourism database will be set, which will be available on the Internet http://www.travelgis.ge).

In addition, there is the Imereti Regional Development Strategy for 2014-2021, which is to contribute to the development rural tourism as well as to the growth in domestic tourism. These activities are, what has resulted, over recent years, in significant increase in the number of tourists interested in mountain resorts and agro-tourism facilities, in parallel to increase in the number of tourists relaxing on the sea [1].

Imereti region is situated mostly in the Black Sea humid subtropical zone. It should be noted that the influence of the sea is reduced in the low-mountain and medium-mountain zones of the region, but the climate is humid here. Winter is cold, but summer is relatedly dry and hot.

The region is situated along the rail and road transport routes and near the sea ports (Batumi – 130 km, Poti – 102 km). Just 10 km from Kutaisi municipality, there is located the David the Builder Kutaisi International Airport, from which the flights are performed intensively to Eastern European countries.

The region is distinguished by the diversity of natural resources, flora and fauna existing on the territory of Georgia. The region has great potential for the development of rural tourism (agr0tourism).

There are more than 250 historic monuments in the Imereti region. Their location under conditions of the beautiful landscape of the Imereti region offers to the visitors a memorable experience. There are developed in the region the discovery and adventure tourisms, such as: the mountain-hiking, horse-riding and caving, rafting and canyoneering tours on the Rioni River (the largest river in the Imereti region), ecotourism and agro-tourism. New prospects for the development of hunting and fishing tourisms in the form a new hunting farm. Particular is to be paid to the wine and cuisine tours [2].

There is no corner neither village in the Imereti region without some remains of the church, bell tower, ruins of fortress, watchtower or the abandoned house. Archaeological artefacts discovered on the Imereti's territory prove that even in the Lower Paleolithic time, man was already settled here. These are the caves of Sakazhia, Chakheti and Deviskhverli, Sataplia surroundings, the Jruchula River Valley in Chiatura, etc.

Imereti is famous for the amazing caves created by nature. Five karstic caves in Sataplia 7 km from Kutaisi are located in the State Nature Reserves of Sataplia. The Sataplia Cave is well-appointed. There is hereabout located the Museum of Speleology, and at the same place there have been found the footsteps of the dinosaurs.

There are also the interesting caves of Kumistavi and Navenakhevi. Also, here, just like in Sataplia, the walking paths for the tourists are made here.

The Katskhi Pillar – a natural limestone rock - is one of the natural wonders, on which the oldest newly-restored small church is located, on the territory of Chiatura district. The height of this rock is 40 meters, and according to the assumptions of some researchers, here was the mansion for the hermit monks.

Georgia has the oldest pottery tradition. The oldest clayware was made in during the old Neolithic period. Pottery trade to this day remains popular in Georgia.

Imereti is also famous for its hospitality. Imeret's cuisine is very versatile. The common foods in this region are as follows: Imeretian cheese, khachapuri, pelamushi (Georgian dessert porridge made of condensed grape juice, mchadi, lobio and different kinds of pkhaleuli (vegetarian dishes made of different plants) similar to spinach. Khachapuri is a fine ornament to the Imeretian table – cheese-filled bread, which is baked in a pan or in an earthenware frying pan/ Mchadi is a popular Georgian cornbread, etc.

It is imposible to imagine the Imeretian table without wine. Vineyards in Imereti are growing in the valleys along the rivers and their tributaries. Exquisite, sparkling and European-type wines are mostly made here of local vine varieties: Tsitska, Tsolikauri, Krakhuna, Otskhanuri, Gzelshavi and other rare Georgian varieties.

Based on the centuries-old folk traditions, the original wine-making rules have been developed in the Imereti region. In contrast to the European wines, wine made by these rules is light and characterized by a pleasant aroma. Inviting the guests to the table to taste wine is considered a sign of respect.

Conclusion

We have studied the wine agro-tours to the Persati Village in Baghdati municipality of Imereti region. The agro-tour passport data are given below.

Wine Agro-Tour to the Village of Persati

Type of tour: Agro-Tour

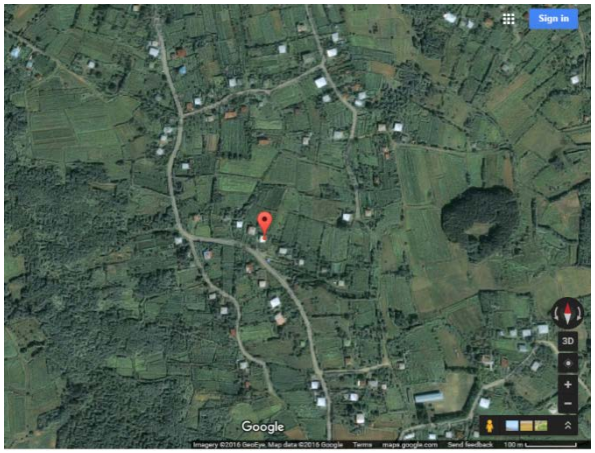
We offer the Wine Agro-Tour to the municipality's village of Persati, where you can spend the night in the fully equipped and finished apartments of the Kipiani family hotel, and in the wine cellar, you will see a complete cycle of winemaking and storage process. If you wish, you can freshen up and catch fish in the mountain river Khanistskali, and enjoy magnificent landscapes of Kvemo Imereti. Address: Persati Village, Bagdati Municipality. Telephone: +995 599216875.

Kutaisi

A city (since 1811) in West Georgia, the administrative center of the Imereti region. It is located along the both banks of the Rioni River. Population –192500 people (2010). From 978 to 1122 CE Kutaisi was the capital of the united Kingdom of Georgia. Kutaisi is one of the most ancient cities of Georgia .Archeological evidence indicates that the territory of the city has been populated already one hundred thousand years ago. The existence of Colchian culture has been confirmed here since the XV-XIII centuries BC. Along the right bank of the Rioni River there are remained traces of the extensive settlement of the VIII-VII centuries BC. Today, Kutaisi is the second largest industrial and cultural city of Georgia.

Persati Village

Persati is a beautiful village of the Imereti region, located in Bagdati municipality, 20 km from Kutaisi, and 4 km from Bagdati, at the left side of the Khanistskali River (the left inflow of the Rioni River, on 260 m above sea level. The community's center – Shubani Village. There are 2463 people living in the village (2014).



Pic.1. Persati village in Google map.



Pic.2. Khanistkali River

The Kipiani family hotel

With the help of the cordial hosts, you can spend a few unforgettable days individually or in group with your family in a full idyllic atmosphere of the Imereti's village, enjoy the natural surroundings and immerse yourself in pleasant positive emotions, have a rest and spend the night in the fully equipped and finished apartments of a four-storey house; have breakfast and dinner on the sundecks on the third and fourth floors, from where you have the magnificent view of natural landscapes; if you wish you can freshen up and catch fish in the mountain river Khanistskali.



Pic.3. The Kipiani family hotel



Pic.4. Family hotel interiors

The Kipiani family's wine cellar

In the wine cellar of the Kipiani family**,** you can knowledge of the Imereti's winemaking technologies ranging from planting of vine to wine reliable storage**.** In the month of October, you will have the opportunity to be directly involved in winemaking technological processes; together with the hosts, to take part in technological processes of care of vine and wine fermentation, to learn the operations of preparing the neck of churi (earthenware vessel for wine storage), churi wine fermentation technologies; with the help of the hosts, you will have the opportunity to have a picnic on the sundeck with barbeque made on the quicksets of vine, hot Imeretian khachapuri and sparkling wine Tsolikauri.



Pic.5. Open churi with kvevrys filled with wine



Pic.6. Vine pergola of Tsolikauri variety

Kutaisi – Persati Village

A good-quality asphalt road leads to the Ajameti Reserve surroundings, then it bends right. Then we go to the bridge on the mountain river Khanistskali and enter the beautiful settlement decorated with the vine pergolas. Then you follow 2-3 kilometers the asphalt road, turn left and enter the well-known in Georgia oldest settlement inhabited by the Kipiani family**.**



Pic. 7. Common barbel fish from Khanistkali River



Pic.8. Pleasant evening with friends

4. References

1. Imereti Regional Development Strategy for 2014-2021, Kutaisi, p. 51
2. A. Okropiridze, M. Vadachkoria, L. Okropiridze. Tourism and hospitality management. Tbilisi, 2011. p. 214.
3. Maia Bliadze – Agro-tourism and its development prospects in Georgia http://mastsavlebeli.ge.

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FLEXIBLE PRODUCTION STRUCTURE AS A BASIC REQUIREMENT OF THE GLOBAL MARKET

ГИБКИЕ ПРОИЗВОДСТВЕННЫЕ СТРУКТУРЫ ОСНОВНОЕ ТРЕБОВАНИЕ МИРОВОГО РЫНКА

Prof. dr. Saiensus M.A. – Odessa National University of Economics, Odessa

Abstract: *The main issues are considered in this topic: Modern production has both quantitative and qualitative flexibility, which is essential in the global market where there is a "dictatorship of the buyer". In such circumstances it is necessary to respond quickly to customer orders. This means that production should be able to quickly change the volume and range of products*

KEYWORDS*: TECHNOLOGY , FLEXIBLE PRODUCTION STRUCTURE, INDUSTRIAL STRATEGY, THE ENTERPRISE MARKET*

In the times of the modern economic conditions we can name a "progressive production" only that which actively and dynamically responds to emerging challenges. Competitiveness and efficiency are the predominant factors in the production enterprises, especially high-tech industries. Therefore, the review of organizational and structural issues relating to operations in production is very crucial. Operational approach to the construction of industrial structures helps them to focus on targeted problems, helps to perpetuate divisions operations in achieving this goal and reduce the number of levels of hierarchy in the company. This approach promotes relationships between departments and creates opportunities for integration, providing complete information on customer needs and the production processes to meet those needs.

This topic was studied in the works of local theoreticians and practitioners such as Mina ES, Dashchenko AI, Poletaev VA, Nakhapetian VG, Goriushkin VN, Vissema H. and others.

The purpose of he given article is to examine the operational approach to structural production decisions and evaluate the need for flexible manufacturing systems.

Structural solution closely linked to production resources such as: People, Plants, Parts, Processes, Planning and control systems (a popular concept abroad "5R production management "). They should review it in close connection with changes in customer's needs, market conditions and the level of development of new technologies in production.

The combination of organizational and structural decisions depends on the goals, strategies and perspective approach to production. There are two types of orientation - orientation to manufacture the product (the traditional approach) and operational approach with a focus on integration of the production process from receipt of client orders to supply it manufactured products (operational approach) [3].

The industrial structure is in constant development influenced by changes in technics, technology and forms of organization of production processes.

During the process of formation of industrial structures, a person must take into account certain factors that determine the requirements for building sustainable structures.

Environmental factors - economic, legal, scientific, technical, socio - cultural, environmental.

Factors for the internal environment include: objectives and development strategy, resource constraints, products, technology, staff, production capacity and so on.

The choice of structural solutions in production is related primarily to the following factors: forms of specialization and cooperation departments; power, scale and orientation of production; development of technology and technology; organizational environment; location production.

There are two main forms of specialization of production units - technological and substantive.

The technological specialization units characterized by a group of similar jobs on the implementation of technologically homogeneous transactions with different products.

Subject specialization characterized by the concentration in the structural units of homogeneous or heterogeneous operations to ensure the completeness of processing.

Considering the orientation of production, we can state that the complexity of the subject specialization leads in turn to increase the number of manufacturing processes for the production of high-tech and capital-intensive products.

The production structure of these companies focused on technology development and requires the formation of production units concerned with the process.

However, there are many companies that manufacture some simple homogeneous products with a focus on the production structure of the product.

Product complexity and difficulty of production form the focus of industrial enterprises have a direct influence on the decision-making structure [1].

The development of techniques and technology as a result of scientific and technical progress leads to change: forms of production processes and their structure, proportions between phases (stages) of production, turnover rate products and its modification.

The development of technic and technology facilitates the implementation of flexible systems (group technology), which with time and experience develops the structure of production systems, combining automation based on all phases of the life cycle of the product [2].

Organizational environment characterizing the potential development of the production structure of the middle and creates conditions for the formation of new business units.

Location manufacture and departments often determined by customer demand for manufacturing products.

In today's technological complexes used in a multiple discrete production, the following requirements should be met: intensification and automation of manufacturing operations; high level of process automation, computerization of all its stages; coordinating the implementation process operations transportation, storage and management.

The need to meet the aforementioned requirements led to the emergence of new principles of organization and management process, which can broadly be described as flexible production systems.

Flexible manufacturing systems (FMS) - the most effective means of automating batch production that allows to move from one type of product to another with minimal time and labor. [2]

Flexible manufacturing system is a combination of a separate unit or process equipment and systems to ensure its functioning in automatic mode that has the properties of automated production changeover on an arbitrary range of products in a set within the meaning of their characteristics. Its use allows to spread the benefits of automation to medium scale production to produce small batches of products and extremely high adaptation to market requirements, the ability to respond quickly to consumer demand. Of course, it should be born in mind that the introduction of flexible automated production at the GMS accompanied by considerable one-off costs. Economic feasibility decision on their use requires careful justification and calculation of effectiveness of the implementation [1].

Economic theory and practice have developed three basic methods for evaluating the effectiveness of investments of financial, material and other funds in various projects:

- Market approach, based on the analysis of the opportunities created by the sale of profitable technology on the market;

- Income approach is based on assumptions of future revenues from enterprise development and project implementation;

- Cost approach, which stems from the assessment of the costs of the enterprise, needed to play the buildings, equipment, cash, securities.

One of the key indicators of the project is the net present value, which determines the absolute result of a joint investment project. Net present value Pt is defined as the difference between the current present value of future income Dt * 1 / at reduced costs and future St * 1 / at:

$$\sum P_t = \sum^{t} D_t * \frac{1}{a_t} - \sum^{t} S_t * \frac{1}{a_t} = \sum^{t} \frac{D_t - S_t}{(1+r)^t}$$

where t - the duration of the product life cycle from the beginning of its operation to the cancellation.

Another important indicator of the economic efficiency of the project has an internal rate of return that determines the condition of equality of income and reduced costs resulting net present value (or net present income) becomes zero.

In addition to key performance indicators that characterize the excess value of the results obtained from the project, the total valuation of the cost of its development and implementation in some cases can be used by additional indicators. In assessing the effectiveness of new technology to create these indicators, in particular, include:

Resulted costs (C), determining unit costs:

C = C + EnKud, (2)

where C - the unit cost, currency; Kood - specific investments, currency .; Yong - normative coefficient of comparative economic performance.

Regulatory profit (Mo) is equal to the ratio of profit (P) to capital investments (K):

Mo = P / K; (3)

The annual economic effect of the introduction of new technology:

Ehod = (Ze - Again) * N, (4)

where Ze and again - given the cost of technology, accepted as the standard and new technology; N - annual release of new technology (and the consumer - the annual volume of products produced using new technology);

Project profitability (R), equal to the discounted income from the project to the discounted cost of the project. , (5)

Payback period (Talk):

Talk = ΣSt / Dt, (6)

where ΣSt - common amount discounted project costs; Dt - yearly discounted income from the project [2].

Technical preconditions that have made possible the emergence of GIS, was the creation of:

• modern automated equipment including numerical control (CNC), on the basis of standardized modular components, and in some cases served robots, manipulators or other types of devices that provide automation support and installation operations;

• devices that provide automated storage, retrieval, transportation and installation Cargo unit using computer equipment management.

• fairly reliable and relatively cheap computer technology that allows you to build a connected and unrelated information and control structure for specific technological units and their complexes.

For such a modern industrial complex is characterized by a high degree of technological parametric and structural flexibility and broad application of the principle of standard technological, managerial and technological solutions [3].

The technological basis of flexible production systems in various discrete production can be divided into two groups.

GVS first group to be issued with high performance large series of narrow range of products, characterized by a high degree of structural and technological similarities (so-called closed families of products. Such technological tasks are using a variety of GIS, called flexible production line. In this line of flow products moves with a given rhythm by working positions located under the technological route and link between internal transport devices for machines. Passage of product production cycle is determined in this case the relevant technological route and this route finding equipment.

For this kind of flexible manufacturing systems typical of what products to switch to another name to stop the flow, complete processing the existing backlog, stop the equipment, to its setup and then restart the flow of products to produce new name. Thus, while in production on a flexible production line can only be products of a single name. [1]

GVS second group intended to release wide range of products, only limited sizes specifications applied equipment, specialization and qualification of production staff and has a range of great technological diversity (open families of products).

For this kind of production characteristic movement of products from one piece of equipment to another by random alternate route with the possibility of interruption. Itinerary products and sequence of technological operations over them are not associated with a hardware or alternation with the same audio system specialized production teams and defined work plan and schedule production complex loading equipment and referral facilities mentioned production brigades, consisting not at once design phase of the production complex and many times during its operation for a specific product. This simultaneous in the production of various kinds of products and does not require mandatory alignment for various products Time on the relevant operations process route, as well as the number of these operations.

FMS second group includes technological complexes of various sizes, degrees of difficulty d level of automation, from flexible sites and shops to flexible automated manufacturing and associations .

Thus a multiple, flexible production, regardless of their nature characterized by simultaneous work on multiple products with the performance of certain operations with technological route to the typical operations of technological equipment. Products and related equipment and personnel when specific operations are moved relative to each other. This is done by moving a product from one workplace (working position) to another according to the schedule load equipment.

Modern production has quantitative and qualitative flexibility, which is essential in a market economy where there is a "dictatorship of the buyer". In such circumstances it is necessary to respond promptly and adequately respond to orders coming. This means that production should have the ability to quickly and widely change the volume and range of products.

We can conclude that the current trend's goal is to ensure that fluctuations in demand for variety and quality controlled by appropriate changes in production capacity. Ability to change the range of products, is qualitative flexibility is achieved by expanding the universalization training production personnel, and through the use of flexible manufacturing overloaded systems.

Scientific and technical development forecast production shows that it is flexible manufacturing systems (FMS) best to meet customer requirements, solve problems of product competitiveness in the world market, provide high profitability and efficiency. These systems avoid unnecessary overstocking products and effective spending of all resources.

References:

1. Analysis of innovative sustainability socio-economic systems, Socio-Economic Research Balletin collection of scientific works №55, 2014-2015, pp.106-113

2. Гоберман В.А., Гоберман Л.А. Основы производственного менеджмента: моделирование операций и управленческих решений: Учеб. пособие. М.: Юристь, 2002. – с. 309, 336 с

3. Питере Т., Уотермен Р. В поисках эффективного управления: Пер. с англ. М.: Прогресс, 1986.

SIMULATION MODULE FOR PRODUCTION PLANNING AND CONTROL

Dipl. Mech. Eng. Albina Mucha[1], Ass. Prof. Dr. Bojan Jovanoski[2], Prof. Dr. Robert Minovski[2], Prof. Dr. Valentina Gechevska[2]
Master student at Faculty of Mechanical Engineering, Ss. Cyril and Methodius University in Skopje, Macedonia[1]
Faculty of Mechanical Engineering, Ss. Cyril and Methodius University in Skopje, Macedonia[2]
bojan.jovanoski@mf.edu.mk

Abstract: *Production planning and control (PPC) system represents a set of decisions on the acquisition, utilization and allocation of resources with the ultimate goal to satisfy customer requirements in the most effective and efficient way. PPC system involves a considerable amount of parameters and synchronizing of a high number of components is a complex process, especially in present business environment where everything has to be decided fast and precisely under an enormous pressure of external factor that undergo through constant change, as so throughout the years a number of methods have been developed with the intention of optimizing the work of PPC systems. One of the methods for optimizing PPC systems which is also used in this case is simulation module for PPC which integrates the parameters involved offering the opportunity of experimenting and analyzing the different possible scenarios in order to find the one that delivers the best possible results without affecting the current actual system and with that reducing the cost and time needed to identify the most optimal solution..*

Keywords: PPC, MODULE, SIMULATION, EXPERIMENT.

1. Introduction

Offering desirable customer service at a reasonable cost requires an efficient flow of materials and services while simultaneously managing the organization's resources that direct and transform these flows. Effective planning and coordination ensures that all resources required to deliver services or produce goods are available in the right quantity and quality at the right time. Such planning and coordination, however, is often very complex. For example, a typical manufacturer is required to track hundreds or thousands of raw materials, components, and subassemblies for effective production. In a similar way, a service provider must ensure the appropriate employees and range of necessary materials are available to fill the needs of multiple market segments, often on very short notice. Effective internal planning and control represents the fundamental "block and tackling" underlying an organization's efficient and effective operations. Planning and control is one of the foundational blocks that contribute to the management of broader operational systems. Forecasting customer demand based on a wide range of business factors is one critical input. Planning for operations then must cover both the long-term planning horizon for overall capacity and process-related resources, such as facilities, equipment, and personnel, as well as detailed schedules to match these to customer needs. And once plans are in place, management must actively control the use of resources to meet customer demands and against budgets. In practice, planning and control is a multistage process, often with iteration to refine the development or acquisition of particular resources.

Production planning and control is one of the most important elements of a successful production system, through which key questions like what to produce, how to produce, where, when, how much to produce and who will produce are answered, (Lödding, 2013, Groover, 2007). The answers are obtained as a result of processes that include product mix planning, material requirement planning, determining quantity and batch size, planning of capacities and deadlines, managing production, (Kotevski et al., 2015). All these planning steps have to be controlled in order for the production flow to go as it is foreseen.

In a static environment where we can make precise forecast of our production and there will not be any external or internal factors that will influence the course, circumstance or result of the production process we would only need to focus on production planning once and the established plans would be valid for long period of time. Since companies around the world operate in a dynamic environment that continuously changes; costumer needs modify, technology improves, competition is always pressuring us, suppliers are not often consistent in quality or delivery time and more global factors that are nearly impossible to have effect on like political, judicial, economic and social policies impose the need of feedback from data analysis gained throughout analyzing and evaluating the data secured during control process. The feedback link is supposed to provide information about the difference in what was planned and what has been achieved in order to gain insight about why didn't our plan go as predicted so the needed adjustments are made for the future production planning to match with the achieved outcome more closely. This in practice is not an easy task, which has resulted in production planning and control developing into a field that is being researched more and more in order to find optimal and improved methods that will result in more thriving achievements, (Jeon and Kim, 2016, Childe, 2012).

2. What is a production planning and control module?

Production planning and control is a complex process and such as that involves a huge number of elements that have to be synchronized and that is not an easy mission. A small inaccurate step can cause the whole process to go wrong.

One of the methods for optimizing production planning and control is using the benefit of software for modeling and simulation such as Tecnomatix Plant Simulation, (Siemens). It can create a module for PPC which could facilitate the process and make it possible to experiment with different parameters of the system, like production scheduling or numbers of machines and the infinite other parameters that are part of the system. The effect of the change in parameters on the outcome of the system is determined, without changing anything in the real system which would lead to a lot of costs and actually the number of experiments that can be simulated with the module are nearly impossible to achieve in the real system without damaging the system, (Wolfsgruber and Lichtenegger, 2016).

Modeling is the process of gaining a deeper understanding of a system through imitation (Banks, 1998). Models imitate the system and reflect properties of the system. Models specify what a system does; that is, how it reacts to stimulus from its environment, and how it evolves over time. Simulation shows how models behave in a particular environment. Simulation is a simple form of design analysis; its goal is to lend insight into the properties of the model and to enable testing of the model, (Robinson, 2004, Law and Kelton, 1991).

The module shown in Figure 1 is a real example of how the long list of objects and options offered with Tecnomatix can be used to model the production planning and control of a production plant. Creating the module of any system even the simplest one requires a deep understanding of the work flow, even though our main focus is on the phase of production planning and control in order to express that phase using the principles of modeling and simulation we have to get sense of how the complete company production process functions.

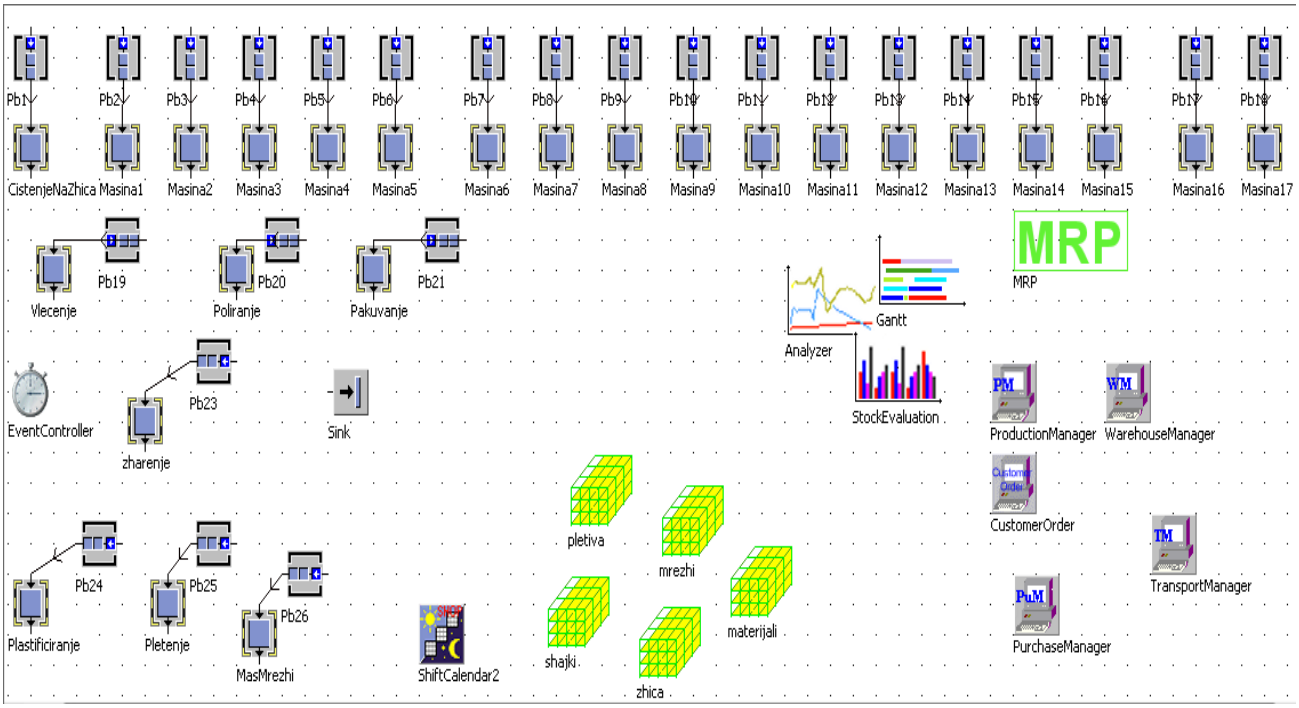


Figure 1: *PPC module*

3. Steps of creating the module

Much the same as most of process simulation the first part is to model the actual system with all its parameters, constraints and resources which (for this model) is done through the following steps(Siemens):

1. Modeling the machines as object station.

This object offers the possibility to model the name of the machine, the operations that occur in it, the cost of the machine per hour for every machine in particular or in groups of cost centers, the availability of the machine in percentage, the mean time for repair, mean time between failures. The protocol of the object takes account for the work order of the machine, product name, batch size, start time of the production as well as setup time, processing time and end time of the production.

2. Material requirements planning (MRP)

The MRP object includes three sub-objects: Master data, forecast and planning.

With the option of forecast we model the expected sales of products if we have the data of probability the module has an integrated algorithm that translates the submitted probability based on our estimations into calculating the expected sales in the future periods according the mathematical principles of probability theory.

With the help of master data the biggest number of information are defined, including all the products, parts that are produced in the company, as well as the ones that are supplied from other companies. Components of every product/part are defined, also the operations through which there are processed and the processing time of the operations.

The information that are modeled in this phase are grouped into the following columns:

1. productId
2. product name of the product/part
3. PT (procurement type)
4. BOM (bill of material) - the bill of materials of the product/part is modeled into the module through defining position of the part during assembly, defining the product/part into which is being assembled, factor respectively the number of same parts that are assembled into the product/part and unit.
5. Operation plan - the operation list is a table that withholds information about the operations through which the product/part is processed using operation number, operation name, setup time, processing time and personal time (additional time that is not foreseen with setup time nor with processing time)
6. Inhouse production time – notes the production time of the parts that are produced in the company
7. Calculated production time – this column is automatically estimated using the data from the operation list we have fulfilled for the product/part we are modeling, respectively it adds up the processing time of the different operations through which the product/part is produced
8. Calculated setup time – this column as well as the previous one is automatically estimated using data from the operation list but this one adds up the setup time of the different operations through which the product/part is processed
9. Lot size data – models information about the batch size which can be:
   - fixed: according to this rule (option) we model a production system that can only produce a fixed number of product in a batch and every order bigger than this fixed number is split into two or more batches depending on the number we can produce at once

- exact: according to this rule every order is processed in the way that the batch size is equal to the ordered number of products
- replenish: modeling a production system that when deciding the batch size focuses on maximum utilization of the capacity of the system
- profile: choosing this rule means that we choose to create a table in which we appoint a batch size for the appropriate order (the table that we create has only three column for maximum value of the order size, minimum value of the order size and the batch size into which the appropriate rang is translated into)
- kanban: even though it is listed as a rule for batch size it actually represents and functions as a strategy for production management, but because it has influence on the batch size it is listed here, (Golchev et al., 2015)

10. Delivery Time – notes the time for delivery of the products that are produced by external suppliers
11. Warehouse - the table for the warehouse has the information about the name of the warehouse, unit of the product, security stock (this is the value under which the stock for product should never go below),
12. Costs - the table for costs enlists information for the price by which we supply the part (if we purchase it form a supplier) or the production cost (if we produce it into the company), number of parts for which these costs are spent on.
13. Fixed inhouse productionTime – since we don't have data all the time about the processing time of every operation, we can model a system by listing an approximate value for the duration of the production.
14. Shift calendar – this column is fulfilled only in the case when for producing a certain product/part we work with a different shift than with standard products/parts

4. Results of discussion

The number of different experiments that can be conducted with this module are closely related to the number of the parameters ergo the complexity of the system, meaning the more parameters the production system the more elements can be changed and combined the bigger the number of the experiments. This in no way means that if the module is used for simpler systems with fewer parameters we can conduct only a small number of different experiments, but that with complex systems the number is huge and the time to conduct all the experiments we have in mind is considerable.

When working through the steps of creating the module, one starts to get sense of the experiments that can be conducted, for example simple variation with the number of machines and seeing the effect it has on the outcome.

Experiments can be conducted with replacing more machines with a work station of newer technology to see if its profitable to go for the new work station, changing the number of shifts adding or subtracting a shift, changing the number of transport vehicles, the layout of the machines/work stations, the capacity and the number of warehouses, changing the rules of order of production, combining them. When we list them like this it sounds like actually there isn't much experiments that can be conducted but if you take into consideration that with only combining the production rules you get 560 combinations that would have different effect on the results of our production system.

For the experiments to make sense, we have to have tools that show the variations that are produced depending on the changes we make in our experiments, the module offers the following tools for analyzing the system:

Analyzer

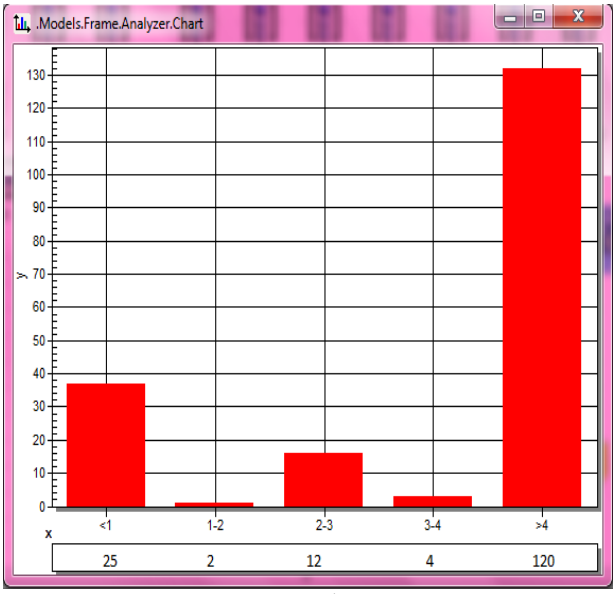
- Lists late orders
- Costs with cost center and cost groups split up by: Order costs, set-up costs, and processing costs
- Statistics of the individual stations: Utilization, set-up times and processing times
- Throughput times

Figure 2 shows the number of late orders we get during the following combinations of the entry queuing rules:

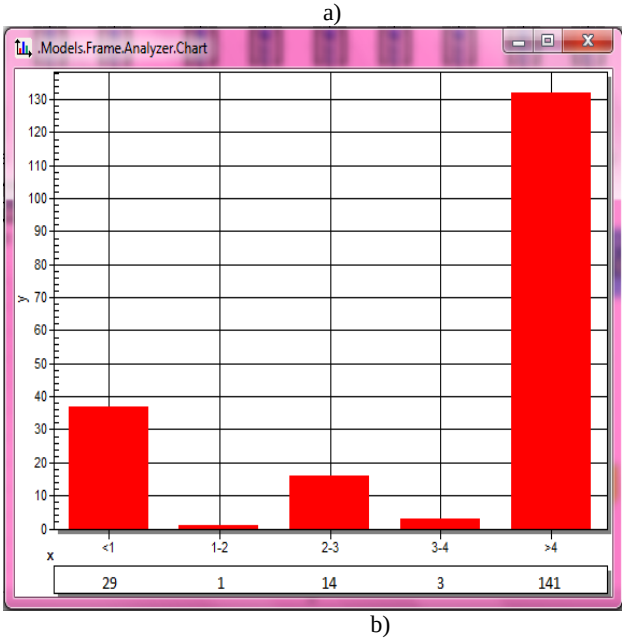
a) Order disposition: Due date
Process disposition: Longest waiting time
Station disposition: Minimum available capacity

b) Order disposition: Order in the sequence
Process disposition: Delivery time
Station disposition: First suitable

-



a)



b)

Figure 2: *List of late orders*

If we compare only the late orders for these two combinations it's clear that the first combination produces a smaller number of late orders ergo the first combination would be a better choice. But making decisions about the entry queuing should not be based on only one comparison, this is simple a small example of what can be analyzed through the module.

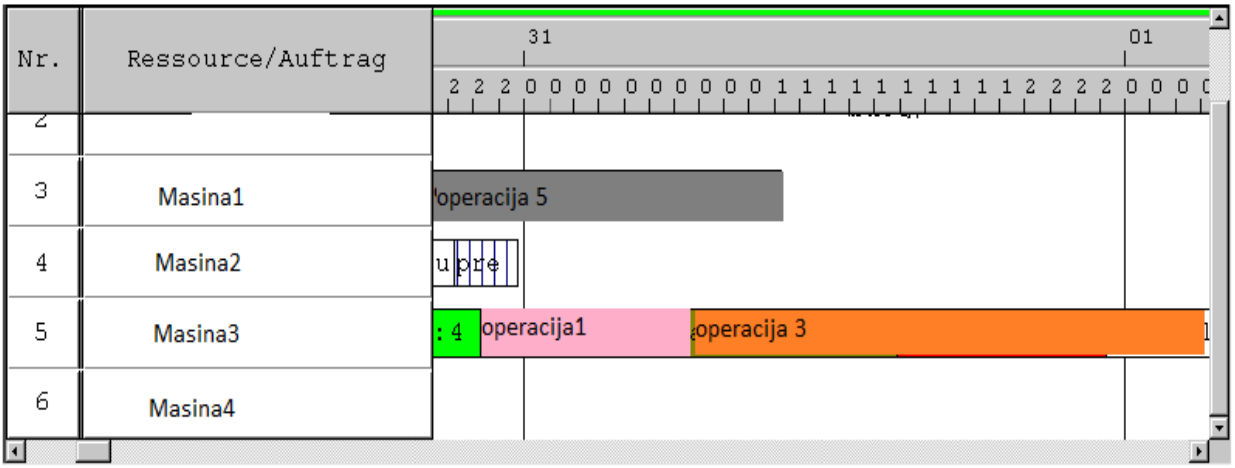


Figure 3: *Gantt chart*

Stock Evaluation

- Shows the circulating stock and the total stock.
- Total or interval-related
- Product-specific

Gantt (Figure 3)

- Start date
- Shows data as graphics or in lists.
- Start time and end time of the operations.
- Shows the utilization of resources.

5. Conclusion

Most of the benefits are already pointed out through explaining the possibilities of the experiments and the analyzing tools but in general the benefits of the module can be grouped in four main points:

1. Optimizing the system of production planning and control
2. Testing the feasibility of the production plan
3. Experimenting with different scenarios
4. Creating detailed production plans based on existing data

Creating a module of production planning and control is not easy, its time and energy consuming, it generates considerable costs, but as they say nothing worth comes easy and the perspective we get from how changing different parameters affects our production system and getting an insight for improving our system through the module is surely worth having.

References

BANKS, J. 1998. *Handbook of simulation*, Wiley Online Library.

CHILDE, S. J. 2012. A new schedule for PPC. *Production Planning and Control: The management of operations,* 23**,** 1-1.

GOLCHEV, R., JOVANOSKI, B., GECHEVSKA, V. & MINOVSKI, R. 2015. KANBAN simulation model for production process optimization. *Journal of Engineering Management and Competitiveness (JEMC),* 5**,** 55-60.

GROOVER, M. P. 2007. *Fundamentals of Modern Manufacturing (Materials, Processes and Systems)*, John Wiley & Sons, Inc.

JEON, S. M. & KIM, G. 2016. A survey of simulation modeling techniques in production planning and control (PPC). *Production Planning & Control,* 27**,** 360-377.

KOTEVSKI, Z., JOVANOSKI, B. & MINOVSKI, R. 2015. Simulation Model for Improved Production Planning and Control Through Quality, Cycle Time and Batch Size Management. *Journal of Engineering Management and Competitiveness (JEMC),* 5**,** 40-45.

LAW, A. & KELTON, W. D. 1991. *Simulation Modeling and Analysis*, Singapore, Mcgraw Hill.

LÖDDING, H. 2013. *Handbook of Manufacturing Control. Fundamentals, description, configuration.*, Berlin, Springer.

ROBINSON, S. 2004. *Simulation: The Practice of Model Development and Use*, John Wiley& Sons Ltd.

SIEMENS. *Plant Simulation* [Online]. Available: http://www.plm.automation.siemens.com/en_us/products/tecnomatix/plant_design/plant_simulation.shtml.

WOLFSGRUBER, C. & LICHTENEGGER, G. 2016. Optimal Configuration in Production Planning and Control. *BHM Berg- und Hüttenmännische Monatshefte,* 161**,** 221-224.

GENDER DIFFERENCES IN RESPONSE TO EROTIC ADVERTISING

Kozhouharova V.
Sofia University "St. Kliment Ohridski"

valentina_kojuharova@abv.bg

Abstract: *Companies make use of sexual appeal in advertising more now than ever. The purpose of this article is to gain a better understanding of how men and women perceive sex in advertising. Articles suggest that young men are not as affected as young women concerning buying behavior and self-confidence by the sexual appeals in advertisements.*

Keywords: EROTIC STIMULI, ADVERTISING, GENDER, GENDER DIFFERENCES

1. Introduction

People all over the world are bombarded every day with an increasing number of advertising messages on different channels such as television, radio, print, posters, internet and social media channels. Advertising can be defined as any paid form of non-personal promotion transmitted through a mass medium. The key difference between advertising and other forms of promotion, such as personal selling, sales promotion and publicity is that advertising communicates with large numbers of people. That is why advertising is of interest both to marketers and psychologists.

Humor, fear, guilt and sex are the most commonly used techniques for presenting and delivering a massage to the recipients of the advertisement. Humor evokes positive emotions and smiles across the recipients. Fear is especially effective as a tool of enhancing motivation. Guilt is powerful since it motivates emotionally mature individuals to undertake responsible action leading to a reduction in the level of guilt. Through all of the techniques, sex is considered to be one of the most influential tools for influencing the recipients in order to buy the items that are advertised.

The use of sexual information in messages has maintained a presence since the very beginning of advertising. Images of sexual marketing content range from faint suggestions to provocative behavior to outright nudity. Undoubtedly erotic stimuli act as an initial attention lure and retain awareness for a longer period. They improve recall of message points when there is a suitable relationship with the advertised product. They evoke emotional responses, such as feelings of arousal and even lust.

But erotic stimuli must not be considered as panacea for selling products and items. In some recipients erotic stimuli can elicit negative feelings such as embarrassment, disgust, or uneasiness. That is why it is of high importance advertisers to think wisely how to present the erotics to the audience.

2. Erotic stimuli in advertising

There are a lot of theories and definitions regarding the usage of erotic stimuli in advertising. But mostly common used are the definitions made by Lambiase and Reichert (2003). According to the authors there are five different types of sexual information in advertising: nudity, sexual behavior, psychical attractiveness, sexual referents and sexual embeds.

Lambiase and Reichert (2003) state that displays of bodies constitute a crucial source of sexual information. The term nudity does not imply that models are completely unclothed, a suggestive dress is often represented by open blouses with partially exposed cleavage, tight fitting clothing that highlight the body.

Lambiase and Reichert (2003) believe that although sexual content in mainstream advertising leaves out the sex act, it does include sexually provocative behavioral displays. Sexual behavior can be diversified into advertisements in two ways: as individual behavior or interpersonal interaction. In the first form models can behave sexually in advertisements by making eye contact, using different facial expression and inviting smiles with the viewer, flirting, and moving provocatively. In these ways the authors further claim that models can communicate sexual interest with the viewer or simply try to bring out sexual arousal. The second form of sexual behavior involves two models (or more) engaging each other in sexual contact. The degree of explicitness of the encounter can vary from simple displays of affection, to inferred intercourse.

The authors state that physical attractiveness among humans is a trait that is central for foreseeing interpersonal attraction and mate selection. Features of physical appearance, including facial beauty and complexion, play a great role in sexual interest and desire. For this reason, physically attractive models in advertising can be, and most often are, considered examples of sex in advertising. Determination of attractiveness levels is made by a comparison by mean ratings and this rating is considered from the model's hair, face, complexion, eye contact, physique and behavior.

Images and words that refer to sex or activate sexual thoughts, can be considered examples of sex in advertising. According to the researchers sexual referents in advertising can be defined as message elements, visual or verbal, that serve to bring forth or develop sexual thoughts.

According to Lambiase and Reichert (2003) sexual embeds are defined as referents or forms of sexual representation designed to be perceived subconsciously. Common types of embeds include objects that are shaped or positioned like genitalia and small hidden messages of naked people and body parts. Sexual embeds are integrated into images by advertisements creators and are planned to go undetected by those people who are viewing the advertisement.

That is why marketers and psychologist must use different tools for segmentation and for choosing the right images and massages according to the specifics of the auditorium they are reaching out.

In this train of thoughts, gender - or the social and cultural meanings, associated with the maleness and femaleness imposed and expected by society - is crucial factor in developing marketing strategy and in building an advertising campaign.

3. Gender in Psychology

Gender has been studied from many perspectives in the psychological literature but we are going to discuss the major factors that drive the behavior of males and females.

The first dichotomy between the genders is the so-called achievement – affiliation orientation (Dahl, Vonhs, 2014)

Achievements orientation involves the drive to accomplish external goals. To be successful, assertive, independent and most of all, self-centered. On the other hand, affiliation involves concerns for other people's feeling, seeking approval from others, creating nurturing relationships with others and interpersonal harmony.

Men are more self-focused which is expressed in such traits as aggressiveness and orientation towards achievements. Men put their pleasures and their activities tin he center of the their world. Communal orientation is expressed in being oriented towards the others, concerned with social acceptability, and being altero-centrist Women center their feelings, their enjoyment, and their ambitions on something outside themselves (Chivers, et. al, 2004).

McClelland et al. found that women were unmoved by references to leadership and intelligence but if they were socially

rejected, their achievement motivation increased as measured in the standard way. By the opposite, men we unaffected by social rejection on the achievement dimension. (McClelland, 2004)

Also there are gender differences in interests, preferences, and attitudes. Anastasi summarized these findings. According to the author males tend to excel in speed and coordination of bodily movements, spatial orientation and other special orientation and mechanical comprehension. Females tend to surpass males in manual dexterity, perceptual speed and accuracy, memory, numerical computation and verbal fluency (Anastasi, 1997).

In terms of intellectual capability females tend to do well in verbal parts, communication, speech and literature. Males by implication tend to do well in quantative aspects of learning skills. Males also do much less of self-disclosure while women are also the bigger recipients of seld-disclosure by others (Dasgupta et al., 2004).

In most forms of aggression tests men score higher than woman. Researchers state that males display more physical and verbal aggression while women tend to repress their anger and hostility. They tend to express it through masochistic behavior, by inhibiting aggression and by developing anxieties about aggression (Enbom, 2005).

According to studies men and women also have different beliefs about the purpose of sexual activity and base their decisions for engaging in it on different motives.

The premise that women and men have different motives regarding sex receives theoretical backing from both evolutionary and socialization models of human sexuality.

The evolutionary view of sexual motives is based on the model of differential parental investment. That theory states that because females in the human species must invest far greater resources to produce offspring than do men, they tend to be correspondingly more selective in their choice of sexual partners. Rather than engaging in casual sex with a large number of men, women select mates who are likely to commit long-term resources to help with the nurturing of offspring. Men, on the other hand, benefit reproductively by taking advantage of opportunities to engage in sexual intercourse with a large number of women, with little regard to long-term consequences (Prakash, 1992).

Men tend to emphasize physical gratification and views sex as an end in itself. Their attitude towards sex is recreational. In contrast, women tend to adopt a relationship-based orientation to sexuality, an approach that emphasizes the importance of intimacy and commitment in a sexual relationship (Hill, 2002).

4. Gender in Advertising

Advertisers are interested in similarities and differences in how men and women receive and evaluate information. One difference involves the actual creation of meaning from a given advertisement. Men look directly at the primary message of a given advertisement Women not only evaluate the primary message, but they also pick up multiple clues from the message and weave together threads to intuit and infer the inner meaning of the message (Popcorn & Marigold, 2000).

Once the meaning from an advertisement has been determined, men and women differ in how that meaning is used. These different decision-making processes are related to whether the process is linear or more nonlinear in nature. Men process messages and make decisions more quickly than women do, perhaps because men focus on the primary message of a given advertisement and take in little other information during the process. This is due to the observation that men have a linear thinking and reasoning style, and men tend to have a more task-oriented focus than women have. Women, on the other hand, process the information in an advertisement quickly and from many levels and sources, including music, visuals, voice-over, and text. Women also tend to evaluate and weigh the various sources to process the message and determine what steps to take next. Women's reasoning processes are less task-oriented and more compartmentalized than men's are. Women's decision-making processes are characterized as being incremental reasoning processes, where each piece of information builds on the previous information that is taken in. This non-linear approach to reasoning allows women to think in terms of interrelated factors, not straight lines. The observation that women evaluate multiple sources supports this reasoning style (Sheehan, K., 2004).

Women and men respond to entirely different stimuli when viewing and evaluating advertising messages (Popcorn & Marigold, 2000). Men respond positively to male imagery, and women respond positively to female imagery.

Given that men and women differ in many ways, it should not be surprising that advertisements portray men and women differently.

Women are much more likely to be pictured as dependent in advertising, and much more likely to be pictured at home than males (Paek, Nelson, & Viella, 2011)

Women tend to be portrayed in decorative roles much more often than men suggests that advertisements do not render a realistic depiction of the female gender role (LaTour, 1990). Specifically, many decorative depictions of women tend to show women in sexual or alluring positions. A sexual depiction is often an explicitly aggressive image of a woman that focuses on her lips, breasts, or groin area. An alluring depiction is less explicit and might feature a woman reclining submissively on a piece of furniture or on the floor or looking at the camera with her lips suggestively parted.

Decorative roles are seen as arguably representing society's view of the appropriate place for women in society: taking a passive position (LaTour, 1990).

When decorative and sexual imagery is used, advertisements often include nonverbal cues as an indication that women lack authority and possess less power than men (Simmons, 1986). Probably the most important scholar in the area of nonverbal cues is Erving Goffman, whose book Gender Advertisements (1979) explored a range of portrayals of women and men in terms of power. Goffman's findings include that women are gener- ally pictured at a smaller relative size, especially height. Men tend to be pictured as taller than women, putting them in a position of power, authority, and rank. Body language often suggests that women are submissive toward products, such as the woman lying on the floor with her Burberry trench barely covering her body, whereas men are dominant over products.

Women are also seen as more tactile than men; that is, they more often are touching, cradling, and caressing objects. Goffman sees this type of touching as ritualistic, as opposed to more utilitarian aspects of touching such as touch that grasps, manipulates or holds. Again, this suggests the more passive nature of women in advertising.

Similarly, women tend to appear removed from the social situation of the activity pictured in the ads. Often, their gaze is averted. Goffman (1979) refers to this as licensed withdrawal.

The overarching concern with decorative and sexual portrayals is that the individuals involved in such portrayals may become objects, similar to the objects that the people are trying to sell. With passive portrayals, there is a disconnection between the person and the object and possibly even between people. Such feelings may pass on from the advertisement to the world, creating general feelings of disconnectedness among those who see the ad (Wollin, 2003).

5. Gender Differences in Response to Erotic Stimuli in Advertising

There are a lot of empirical evidences that support the notion of a gender differences in motivations regarding sex and in responses towards erotic in advertising.

Sexual appeal is a strong psychological appeal, second only to self-preservation. In humans, as in all animals, sexual desire is an instinctive reaction as we search for the perfect mate (Reichert, 2003). Sexual imagery has been shown to have a stronger persuasive ability for men than for women.

When exposed to erotic stimuli males report a greater overall arousal towards the ad while women are aroused by romantic, emotional stimuli.

Sexual imagery has been shown to have a stronger persuasive ability for men than for women. It may be because men have a different set of criteria for selecting a mate than women do: Men traditionally tend to recognize that a woman who is young, healthy, and beautiful will be a good mate. Therefore, many advertisers use sexual imagery to get a man's attention and then associate buying the product with getting a mate (Reichert, 2003). These types of messages focus on instinctual or physical types of meaning in messages.

For women, the persuasive power of sexual imagery works on a somewhat different level. A healthy, fit male model will attract the attention of many women and may even create desire for the product. Women, though, also pay attention to the long-term potential of a man—for example, his ability to be a good father and to provide them with money, power, and prestige. All these factors are almost impossible to put into any single advertisement (Reichert, 2003).

Arguably, then, it is difficult for advertisers to use sex successfully to sell to women. Instead, advertising uses romance to make a sexual connection with women. Romantic images are less blatant and more ambiguous than traditional sexual messages: They pro- vide images of courtship, relationships, and the process of falling in love. Sexual imagery in advertisements directed toward women becomes much more intellectual than physical (Reichert, 2003).

Females are more likely than males to label the stimuli as pornographic and give ratings of disgust and disapproval of the images that are used. Woman also tended to evaluate erotic stimuli more favorably and erotica depicting less conventional sexual acts less favorably than males.

Heterosexual males prefer female nudity and vice versa.

Regarding provocative advertising, men believe that they do not see a major problem with it. Most men are not specially affected since they are used to provocative advertising. They believe that it is acceptable to a certain limit but if it exaggerated they can experience it as slimy and meaningless (Lanseng, 2016). Based on that data we can conclude that men have a more positive attitude toward a mild sexual appeal ad than a strong sexual appeal ad. That data showed that most men are affected by idealized models in advertising, but men do not compare themselves with models in ads as much as women do. Men understand that the models in the ads are not realistic in the way that they are not representative to the public. Due to this fact, men are able to enjoy ads in the same way as they enjoy movies and television. Men believe that people in general do not look like models in ads and models are only exceptions. Men perceive idealized models as role models and goals more than threats. The ideals seem to posses something that men are striving for.

Idealized models affect men in the way that they encourage them to go the gym and become more fit. Although men sometimes compare themselves with models, they mainly relate to the feeling and situation in the ad (Davis, 1990). Men show positive attitudes towards idealized female models in ads since they prefer to look at beautiful and fit models. Idealized models do not affect their perceptions of women in general. Even if they think that the models in the ads are looking good they do not comparing them

Researches show that the effect of sexual stimuli in print advertising often create more favorable responses on the brand recall and intention to purchase. One risk with provocative advertising is that men would care more about the models in the ads than the actual product or brand advertised.

Advertising involving idealized models leads to more attention and increase men's liking of the products. In contrast, advertising using less attractive models could make the products feel less serious. The importance of using idealizing models differs depending on the products, for example it is more important to use an attractive model for an underwear ad.

Men's attitude toward products is influenced by the ad. Products that are advertised by more sophisticated and classy ads create a higher value for men, and will lead to that they experience the products as more expensive. One risk with sexual appeal ads is that men focus too much on the sexual nudity so that they miss the product.

5. Conclusion

Gender is increasingly implicated in consumer and market behavior.

Differential response by males and females to erotic stimuli imply that effective use of this device is dependent on the ad's targeted audience. Addressing these differing reactions, erotic ads should be part of the overall strategy built by the professionals in the fields of marketing and psychology and not an end of itself.

Literature

Aaker, D.A., D.E. Bruzzone Causes of Irritation in Advertising in Journal of Marketing, 1985, 47-57

Anastasi, A. Psychological Testing, Prince Hall International Editions, 1997, 1-305

Baker, M. J., Churchill The Impact of Physically Attractive Models on Advertising Evaluations in Journal of Marketing Research, November 1977, 538-555

Belch, M. A., B.E. Holgerson, G.E. Belch, J. Koppman, Psychophysiological and Cognitive Responses to Sex in Advertising in Advances in Consumer Research, vol. 9, 1982, 424-427

Chivers, M.L., G. Reiger, E. Latty, J.M. Bailey A sex difference in the specificity of sexual arousal, Psychological Science, 2004, 197-211

Dahl, D.W., K. Vonhs. Sex in Advertising: Gender Differences and the Role of Relationship Commitment in Journal of Consumer Research, 2014, 215-231

Dasgupta, S., D. Sinha, S. Chakravarti, S. Media, gender, and popular culture in India: Tracking change and continuity, Journal of Consumer Research, 36(2), 2010, 1–31.

Davis, S. Men as success objects and women as sex objects: A study of personal Advertisements in Sex Volumes 23, 1990, 43-50

Enbom, J., S. Gustafsson Sexually provocative advertising and how young men respond to it , Industrial Marketing and E-commerce, 2005, 1-63

Goffman, E. Gender Advertisements, Harper Torchbooks, 1987, 1-47

Hill, C. A. Gender, relationship stage, and sexual behavior: the importance of partner emotional investment within specific situations. *J. Sex Res.* 39, 2002**,** 228–240

Lanseng, E. Relevant Sex Appeals in Advertisng: Gender and Commitment Context Differences In Frontiers in Psychology, Volume 7, 2016, 268-314

LaTour, M.S. Female Nudity in Print Advertising: An Analysis Of Gender Differences in Arousal and Ad Response in Psychology and Marketing, 1990, 65-85

LaTour, M. S., R.E. Pitts, D.C. Snooker-Luther, Female Nudity, Arousal, and Ad Response: An Experiemental Investigation in Journal of Advertising, 1990, 97-113

Madden, T. C.T. Allen, J.L. Twible Attitudes toward the Ad: An Assesment of Diverse Measurement Induces Under Different Processing in Journal of Marketing Research, 1998, 242-252

McClelland, D., D. Burnham Power is a great motivator in Harvard Business Review, March-April 2004, 117-126

Paek, H., Nelson, M., & Vilela, A. Examination of Gender-role Portrayals in Television Advertising across Seven Countries. Sex Roles, 2011, 192-207.

Popcorn, F., L. Marigold, L. EVEolution: The eight truths of marketing to women. New York: Hyperion, 2002, 107-127

Prakash, V., Sex Roles and Gender Differences - Sex roles and advertising preferences in Journal of Advertising research, 1992, 43-52

Reichert, T., J. Lambiase, J., Sex in advertising: perspectives on the erotic appeal. New Jersey: Lawrence Erlbaum Associates, 2003, 2-307

Reichert, T. Does sex in advertising work? A review of scholarly research informed by professional opinion. Advertising & Society Review, 2007, 243-271

Sheehan, K. Controversies in Contemporary Advertising – Second Edition. SAGE Publications, 2004, 79-84

Wolin, L. Gender Issues in advertising – An Oversight Synhthesis Of Research: 1970-2002 in Journal of Advertisng Research, 2003, 111-129

ETHICS OF EROTIC STIMULI IN ADVERTISING

Kozhouharova V.
Sofia University "St. Kliment Ohridski"

valentina_kojuharova@abv.bg

Abstract: *The use of erotic stimuli in print advertising has become almost commonplace in the advertising practices. But the employment of erotic communication appeals in advertising continues to be a controversial topic. While the use of such stimuli may draw additional attention to the ad, the outcome of the use of such high degrees of erotic stimuli may, in fact, be negative. Sexuality in advertising is a major area of ethical concern, through surprisingly little is known about its effects or the norm of its use. The article is focused on providing a basis for making ethical choices about the use of sexual appeals in advertising.*

Keywords: EROTICS, EROTIC STIMULI, ADVERTISING, PSYCHOLOGY OF ADVERTISING, BRAND

1. Introduction

Erotic stimuli in advertising invoke any message which, whether is brand information in advertising contexts or persuasive appeals in marketing contexts, is associated with sexual information. It has long been an accepted believe that this form of advertising is very effective at attention-grabbing, considered by some commentators as a powerful step in reaching one's target market, especially in the current clutter of 21st century marketing and communications (Reichert & Lambiase, 2003).

Erotic stimuli are an increasingly common advertising tool used in mainstream media as a means for consumer products and brands to gain attention and arouse emotions, which in most cases provokes behavioral response by the customers. It is therefore assumed to be more effective at generating sales, one of the main objectives of commercial marketing activities. Based on that marketing practitioners mulled over the notion that "sex sells" everything (Solomon, 2014).

Advertisers use sexual images for a number of obvious reasons: to attract attention to their messages, to appeal to audiences that approve of its use, and to demonstrate the outcomes of buying and using the brand.

Indeed, effects research generally supports the efficacy of sexual stimuli on consumer processing and emotional responses or example, research points to increased attention toward sexual ads, but indicates also that the sexual information can distract viewers by monopolizing processing resources. Depending on the audience, context, and intensity of the sexual content, sex in advertising can be evaluated favorably and these feelings can influence attitudes toward the brand. On the other hand, people who are conservative, sex-negative, or older typically, respond less favorably to sexual appeals.

Provocative advertising operates through three constructs: distinctiveness, ambiguity and transgression of a social or cultural taboo. It is important to note that not all of these elements of provocative advertising must necessarily elicit negative responses

Research has shown that distinctive stimuli can have a positive effect on attention to the ad, memory, and retrieval and on brand evaluation. It has also been argued that ambiguity – the extent to which an ad is open to different interpretations - can lead to further processing and provide the opportunity for an aesthetic experience.

2. The role of ethics

In order to understand the positive and negative consumer reactions and ethical dilemmas arising from the use of sexual stimuli in advertising, we must review the fundamental concepts contained in normative ethical theories of moral philosophy.

According to Murphy and Laczniak normative ethical theories in moral philosophy can generally be classified as either teleological or deontological (LaTour & Henthorne, 1994). The principal difference between those two frameworks is in their basic focus.

Teleology focuses on the effects and consequences of behavior on individuals, while deontology focuses on the moral rightness or wrongness of behavior, regardless of the consequences (Gould, 1994).

Teleological philosophies are defined as philosophies concerned primarily with the moral worth of an individual behavior. Their focus is on the consequences of individual actions and behaviors in the determination of "worth". Teleological philosophies believe that the individual should examine and determine the probable consequences (in terms of goodness or badness) of alternative actions and behaviors in a specific situation. A particular behavior is considered ethical if it produces the greatest balance of good over bad when compared with all alternative actions (LaTour & Henthorne, 1994).

Deontological philosophies focus on specific actions or behaviors of the individual without regard to the consequences of the actions. Thus, deontology opposes the principal tenet of teleology. Deontological theory states that the rightness or wrongness of actions and behaviors should be judged by the actions themselves without regard to the outcome (LaTour & Henthorne, 1994).

Hence, we can consider the use of sexuality in advertising both teleologically in terms of its consequences and deontologically in terms of its moral rightness or wrongness.

From a teleological point of view, the use of sexual appeals in advertising often is not appealing to viewers and may produce potentially negative side effects such us sexual obsessions and gratuitous sex. Therefore, the consequences (in terms of unwanted or unintended side effects) of the use of sexual appeals in advertising, as well as the fundamental moral rightness or wrongness of its use are of concern (Gould, 1994).

The deontological approach to sexual appeals in advertising focuses on whether such appeals are morally appropriate, apart from their effects. In practical terms according to Gould research is focused on the views, norms and values of all parties included. There are likely to be values segments for the ethics of sexual advertising that parallel those found for pornography.

Another important deontological consideration is whether sexual appeals are used with good intentions by advertisers, or whether they use them in an exploitive and degrading way to appeal to consumers' "base instincts" and to cause consumers to buy "un-needed" products. A related point concerns the advertiser's sexual ideology. Are sexual appeals merely a marketing tool, interchangeable with other appeals such as humor and fear, or are they used to promote a demoralizing agenda.

According to Gould deontological research must address both the audience of sexual advertising and the people who create and use it (Gould, 1994).

Deonotological research must address both the audience of sexual advertising and the people who create and use it. Researchers must explore a host individuals difference variables that may affect how an audience member views and interprets sexual appeals.

The fundamental component in teleological theories is the amount of good or bad contained in the consequences of an act, whereas the essential component in deontological theories is the inherent rightness of an individual act. But it is not realistic to believe that individuals make ethical decisions or judgments strictly on the basis of either teleology or deontology.

Another important variable to be explored is the trait of erotophilia-erotophobia. Erotophilic people have positive attitudes toward sexual matters while erotophobic people have negative attitudes toward sexual matters (Gould,1992). This trait is reflected in a host of sexual attitudes and behaviors ranging from the use of contraceptives (erotophilic people are more likely to use them regularly) to having favorable attitudes toward erotic films (erotophilic people are more likely to have favorable attitudes. Other variables that could also make a difference in one's ethical stance on sexual appeals in advertising are one's lovestyle (e.g., being more sexual versus seeking more companionship from one's love partner), sexual experience, and stage of sexual development, as well as one's general religiosity, political views and ethical stances (Gould,1992).

Gender is another variable that must be further investigated by the professionals in the field of psychology and marketing. Men have generally been found to be more receptive to sexual appeals, though this observation may be attributable to the fact that such appeals have largely been targeting on them (LaTour, 1990)

Research is also needed about sexual advertising in terms of its morality, conditions of use, and effects on audiences.

3. Effects of provocation and nudity in advertising

There are different types of sexual appeals who consist of a variety of elements. There is a considerable body of evidence to suggest that the use of nudity and sexual stimuli and/or provocation in advertising has, at best, little impact, or, at worst, a negative one. It is important these elements to be considered because they may determine whether people think a sexual appeal is ethical or unethical. For example, ads that are using physically attractive models are acceptable for the society. But major part of the society would probably oppose nudity in general advertising.

Reasons for the use of such stimuli include efforts to gain attention, increase recognition and recall, and improve sales figures. There is conflicting evidence regarding the achievement of these objectives. Support exists for the effect of increasing attention and recognition but most studies have concluded that sexual content in ads actually reduces consumer recall and recognition of a brand. The same is not necessarily true of provocation, which has been found to increase recognition of a brand while also risking the creation of a negative effect (De Pelsmacker and Van Den Bergh 1996).

To appreciate the role that mild erotic sexual imagery may play in influencing brand attitudes, it is important to understand how such a process might occur. There are two differing models of how attitude to an ad affects attitude to a brand. The first, the indirect effects model suggests that attitude towards the ad impacts attitude towards the brand through affect transfer, so that attitude towards the brand is formed from brand attribute information already held by customer, combined with ad picture content. It was found that attitude towards the ad has a direct effect on brand choice and an indirect effect through attitude towards the brand. Crucial to this last picture is the implication that ad disliking does not necessary lead to brand rejection. Although attitude towards the ad may have a detrimental effect on attitude towards the brand positive feelings about a brand might moderate or even remove negative impact of attitude toward the ad on attitude toward the brand.

While it has been established that sexual stimuli in ads can increase consumer arousal (LaTour, 1990) this arousal has been found to have a negative effect on attitude toward the ad. This is not to deny that nudity can make an ad more interesting but that some evidence would also suggest that this interest does not enhance the communication ability of the ad. In fact it may actually detract from positive feelings (LaTour, 1990). Provocation appears to reduce attitude toward the ad but the effect on attitude toward the brand is still open to question.

4. Ethical concerns about using erotic stimuli in advertising

Despite all the positive effects that erotic stimuli in advertising have, researchers in the field of psychology and marketing have identified a range of unintended effects.

Investigators and commentators have stated that repeated exposure to such images may contribute to a broad range of social problems, including sexist attitudes and beliefs, sexual harassment, violence against women, eating disorders, and stereotyped perceptions of and behavior toward men and women. Erotic advertisements tend to reflect a more limited representation of gendered roles which lead to creating negative portrayals. Such portrayals inaccurately depict men's and women's roles in society and may ultimately influence individuals to believe that the portrayals are accurate. Thus, negative stereotypes are created (Ferguson et al., 1990).

In studies done to compare gender stereotyping, it was found that female characters are less in a working roles and they also are treated as sex objects, as objects of the desires of men (Schroder, Wulf, & Hofstee, 2002). The female bodies are shown in exaggerated and provocative postures. Highlighting on the importance of the physical appearance of women, focusing on their body parts. The bodies are exploited to attract attention. This leads to a process of objectification which is demeaning and dehumanizing.

Erotic advertising is criticized as well for producing distorted body images by setting unrealistic standards of female beauty and thinness.

Women that are shown in the ads usually are thin with perfect bodies. This leads to an unrealistic ideal both for men and women about the way that a woman should look. In one hand men are provoked to pay attention to the physical appearance of women and in order to face those unrealistic standards women usually start having problems with eating disorders.

That portrayals of beauty in ads play a causal role in shaping women's perceptions of and satisfaction with their bodies. Researches have shown that exposure to highly attractive female images in most common cases increases body dissatisfaction among women. The effects are that women exposed to sexist ads perceive themselves as heavier than women exposed to nonsexist ads. Women exposed to sexist ads exhibit a greater discrepancy between actual and ideal body size. Also, women exposed to sexist ads overestimate both men's and other women's desire for a thin body size.

But those ads increase in most common cases the body dissatisfaction among men. Ads that portray women as sex objects also portray especially attractive, athletic, or muscular men and thereby cause men to feel insecure about their bodies through social comparison.

Men tend to perceive themselves as underweight (and as thinner than they actually are) and report a desire to be larger and bigger. Men also overestimate both women's and other men's preferences for a large, muscular physique for men. They exhibit a greater discrepancy between actual and ideal body size, as well.

Other negative effects of using sexually explicit materials in advertising are that they may lead to sexual preoccupation, sexual violence, hostility toward women, forming gender stereotypes in youngsters.

Another issue concerning the use of sexual stimuli in advertisements is whether it affects consumer's perception of the company portrayed in an ad. This perception is often conceptualized as corporate image.

In advertisements with nudity, the associated company is deemed to be less reputable and the producer of a lower quality product. It has also been found that a company that uses nudity in advertising would be perceived to be discriminatory in its employment practices.

5. Conclusion

Although sexual themes and erotic stimuli have been largely used in advertising, they continue to be a controversial topic. Sexuality in advertising is a major area of ethical concern as evidenced by quoted theories and researches.

Advertisers should reduce the provocation level of commercials with sensual. It would decrease the risk of hurting the sensitivity of individuals and avoid the creation of negative emotions. Advertisers should use prominent levels of erotic content in print advertising. Care and consideration should be directed to predetermining the reaction of their particular target market to print ads containing high levels of erotic content.

Additionally, advertisers must consider the likely exposure of individuals outside of the selected target market and the subsequent possible negative social consequences (e.g., perceived sex objectification (Ford and LaTour, 1993), perceived degradation of women (Gould, 1994), increased promiscuity (Boddewyn and Kunz, 1991), negative word of mouth to the exposure.

Literature

Armstrong, G. M., M. Brucks Dealing with Children's Advertising: Public Policy Issues and Alternatives. Journal of Public Policy & Marketing, 7, 1988, 98-113.

Boddewyn, J.J. Controling sex and decency in advertising around the world. Journal of Advertising, 1991, 25- 25

Ferguson, J.H., P.J. Kreshel, S.F. Tinkham In the Pages of Ms.: Sex Role Portrayals of Women in Advertising. Journal of Advertising, 1990, 40-51

Gould, S.J. The Production, Marketing, and Consumption of Sexually Explicit Material in Our Sexually Conflicted Society: A Public Policy Dilemma, Journal of Public Policy & Marketing, 1992, 135-148

Gould, S. J. Sexuality and Ethics in Advertising: A Framework and Research Agenda, Journal of Advertising, 1994, 81-89

LaTour, M.S. Female Nudity in Print Advertising: An Analysis of Gender Differences in Arousal and Ad Response, Psychology and Marketing, 1990, 65-85

LaTour, M.S., T.L. Henthorne. Ethical Judgements of Sexual Appeals in Print Advertising, Journal of Advertising, 1994, 51-62

Lavine, D., D. Sweeney, S.H. Wagener. Depicting women as Sex objects in Televisoion Advertising: Effects of Body Dissatisfaction, Personality and Social Psychology Bulletin, 2013, 1049-1058

Nooh, N.M. Advertising Ethics: A review, The Journal of Commerce, Vol. 3, 2007, 33-43

Pelsmacker, D. P., D.V. Bergh The Communication Effects of Provocation in Print Advertising. International Journal of Advertising, 1996, 97 – 110

Reichert, T., J. Lambiase Sex in advertising: perspectives on the erotic appeal. New Jersey: Lawrence Erlbaum Associates, 2-307, 2003

Schroder, G.O., Wulf, K. & Hofstee, N. Is gender stereotyping in advertising more prevalent in masculine countrie? A cross-national analysis, International Marketing Review, 2002

Solomon, M. R. Consumer Behavior – Global Edition, 2014, 2-608

Wilson, R.D, N.K. Moore. The Role of Sexually-Oriented Stimuli in Advertising: Theory and literature review. Advances In consumer research, 1979, 55 - 61

STATISTICAL PROCESS CONTROL IN OFFICIAL STATISTICS

Prof. Vesna Bucevska, Ph.D., University „Ss. Cyril and Methodius", Faculty of Economics-Skopje, Republic of Macedonia
vesna.bucevska@eccf.ukim.edu.mk

Abstract: *The concept of quality control is becoming more and more important in the field of official statistics. In the last decade many national institutes of statistics adopted a systematic approach to quality. The paper deals with the issue of applying the concept of statistical process control (SPC) to official statistics. Process approach allows developing and improving the effectiveness and efficiency of a quality management system to meet the needs of all stakeholders. In the paper we focus on:*

- Identification of statistical processes and establishment of links between them and

- Tools and methods for managing the statistical processes.

Keywords: OFFICIAL STATISTICS, STATISTICAL QUALITY CONTROL, STATISTICAL PROCESS CONTROL, QUALITY CONTROL

1. Introduction

Official statistical data is of paramount importance in assessing economic, social, cultural or environmental issues and plays a crucial role in building polices both at macro and micro level. Unlike the private business which became aware of the importance of quality management more than 50 years ago, it has been since several years an increased awareness of the importance of quality work in the national statistical institutes. Eurostat (2017), OECD (2017) and other national statistical offices have identified various sets of data quality components and have adopted a system of quality management to improve their organizations and the quality of the data produced.

Until fairly recently the quality of statistical output has traditionally been viewed in terms of accuracy. However, quality as employed in other activities has generally included broader interpretations According to Forbes and Brown (2012) official statistics "need to be used to be useful". Eurostat (2017) proposed a definition on quality which encompasses several issues (relevance of statistical concept, accuracy, timeliness and punctuality in disseminating statistical results, accessibility and clarity of the information, comparability and coherence and completeness) and as such is appropriate for official statistics. The OECD uses seven dimensions for quality assessment: relevance, accuracy, timeliness and punctuality, accessibility, interpretability, coherence, and credibility.

Fig. 1 *Working principle of 3D the printer EOSINT M 270*[1].

2. The difference between statistical quality control and statistical process control

Although the main principles of the different quality management systems are common, there is a difference in conceptual purpose applied to the use of such systems. The traditional quality control focuses on the product. It monitors the product quality and reworks or scrap off-spec product. "Statistical process control (SPC) is a powerful collection of problem-solving tools useful in achieving process stability and improving capability through the reduction of variability." (Montgomery, 2009) So, SPC focuses on the process, and not on the product. SPC is a strategy that focuses on quantifying, classifying, and reducing variability in the process. It is based on the philosophy that making the right product in the first place is better than trying to rework the wrong product.

What are the benefits of adopting and implementing SPC? SPC provides surveillance and feedback for keeping processes in control. Statistical techniques provide an understanding of the business baselines, insights for process improvements, communication of value and results of processes, and active and visible involvement. SPC provides a mechanism to make process changes and track effects of those changes to establish controllable process baselines. Once a process is stable (assignable causes of variation have been eliminated), SPC provides process capability analysis with comparison to the product tolerance. So, SPC optimizes the amount of information needed for use in making management decisions and focuses management on areas that really need improvement. These benefits of SPC cannot be obtained immediately by the national statistical institutes. SPC requires defined processes and a discipline of following them. Above all it requires a strong management commitment.

3. Identification of processes and defining quality standards

The key steps for implementing Statistical Process Control are:

1. Identify the processes;
2. Identify measurable attributes of the process;
3. Characterize natural variation of attributes;
4. Track process variation;
5. If the process is in control, continue to track;
6. If the process is not in control;
7. Identify assignable cause;
8. Remove assignable cause;
9. Return to "Track process variation".

In the production of the statistical output a number of processes are performed sequentially. "Processes are first defined and classified according to their different nature, e.g. statistical vs. organizational ones, taking into account both the management control literature and the UNECE Generic Activity Model for Statistical Organizations (GAMSO)". (Brancatoet. al, 2016).

The phases of the statistical business process (statistical value chain or statistical cycle) are best described by the "Generic Statistical Business Process Model" (UNECE, 2017). It is based on the Generic Business Process Model of Statistics New Zealand and Statistics Canada. However, a number of other related models and standards exist. The relationships between these models are depicted in Figure 1.

After the processes have been identified, the next step is "to define a set of quality characteristics applicable to the statistical processes and sub-processes and to some organizational processes… They are the pillars for the further definition of measures to monitor quality and performance and to assess them against given targets." (Brancato et. al, 2016)

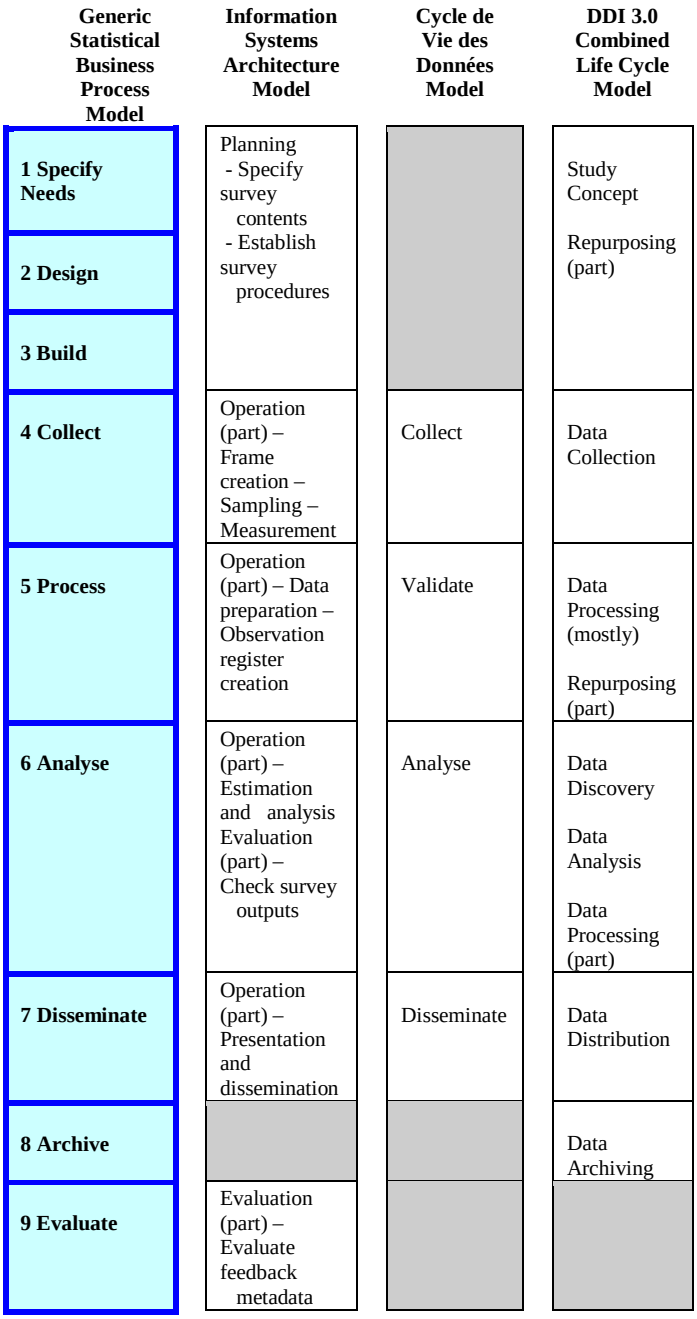


Figure 1: Relationships between statistical business process models (Source: UNECE)

A quality standard should be specified for each process. The standard is a minimum base which can be refined and revised through time on the basis of the obtained feedback about its strengths and weaknesses. It has two objectives: 1. To inform the managers of NSI about the efficiency of resources spent to attain optimal allocation and 2. To inform users about the risk involved in making decisions based on the different statistical products.

The quality standards for the producers (NSI) should include: description of the process and inputs in the process, list of the processes that result from that process, what are the necessary skills for operation of the process, metrics for measuring the performance of the process, what should be done if a standard is not being achieved, the name of the person who can change the process and a change control procedure for modifying the process. (McKenzie, 2006) The standards for the statistical production processes should be specified in the framework of the statistical design phase which covers several processes (sample design, response rates, imputation and estimation). The main tool for monitoring of quality of statistical production process is self-assessment by the operational managers who should also develop quality standards for administrative processes. (McKenzie, 2006) The quality standards for data management processes should be built into the production system which should provide metrics that allow the operator to assess whether the standard for the process has been completed correctly. In monitoring and decision making processes quality standards should be clearly specified. The standard should define the minimum response rate required for each category and the key respondents from which a response must be received. The analytical stage of the process model is an area where the "inspection" that is the bane of the quality management gurus cannot be avoided. It requires more human judgement so it will be more difficult to set up standards.

4. Conclusion

In the last several years most of the national statistical institutes (NSI) worldwide have worked very hard on developing quality management strategies. One of these strategies is the statistical process control (SPC). In this paper we have presented the phases in the process of adoption of SPC by official statistics, focusing on the first and the most important phase -the identification of the statistical processes. We have also presented the proposed list of statistical quality standards for these processes.

The most important lesson to be learned from SPC is its basic idea of shifting the emphasis of quality thinking from a single statistical product to the whole statistical process and wider to the whole management process of NSI. Activities of NSI should be seen as processes where the needs of the customers on the one hand and the capabilities of the staff on the other hand play the crucial role. Successful adoption of SPC requires not only identification of the processes, but a discipline of following them and above all a strong commitment from the top management of NSI.

References

1. Brancato, G., D'Assisi Barbalace, F. Signore, M and Simeon, G. (2016). "Introducing a framework for process quality in national statistical institutes". *Statistical Journal of the IAOS*, Vol. Preprint, no. Preprint, pp. 1-6,
2. EUROSTAT. (2017). http://ec.europa.eu/eurostat/web/quality (accessed 17th January, 2017).
3. Forbes, S. and Brown, D. (2012). "Conceptual Thinking in National Statistics Offices." *Statistical Journal of the IAOS* 28: 89–98. Doi: http://dx.doi.org/10.3233/ SJI-2012-0751.
4. Giovanini, E. (2008). Understanding Economic Statistics. Paris: OECD Publishing. Available at: https://www.oecd.org/std/41746710.pdf (accessed 19 January, 2017).
5. Mckenzie, R. (2006). "Managing Quality During Statistical Processing, *Proceedings of Q2006 European Conference on Quality in Survey Statistics*, Cardiff, United Kingdom, 24-26 April 2006.
6. Montgomery, D.C. (2009). *Statistical Quality Control: A Modern Introduction*, 7th ed., John Wiley & Sons.
7. OECD. (2017). http://www.oecd.org/std/qualityframeworkforoecdstatisticalactivities.htm (accessed 17th January, 2017).
8. UNECE Secretariat. (2017) http://www1.unece.org/stat/platform/display/metis/The+Generic+Statistical+Business+Process+Model (accessed 13th January, 2017).

INFORMATION OPENNES OF EDUCATIONAL ORGANIZATIONS IN MODERN RUSSIA

ОТКРЫТОСТЬ ОБРАЗОВАТЕЛЬНЫХ ОРГАНИЗАЦИЙ В СОВРЕМЕННОЙ РОССИИ

Rezer Tatyana Mikhaylovna, Doctor of Education, Professor, Ural Federal University named after the first President of Russia B.N. Yeltsin, Professor Ural State University of Economics

Abstract: Openness of education organizations can be considered as a component of information openness of society. The article overviews content fullness at official web-sites of vocational education organizations against the requirements of regulatory legal acts through the example of those in Sverdlovsk region. Problems arising during web-sites content provision were considered from legislative point of view.

***KEYWORDS**: VOCATIONAL EDUCATION ORGANIZATIONS, OFFICIAL WEB-SITE, INFORMATION OPENNESS.*

1. Introduction

Issues on information openness are widely discussed in all spheres of life: from politics and state administration to the social service of the population. On the one hand, implementation of the principle of information openness in all spheres of life provides access of citizens to information concerning their rights and obligations, ensures transparency of activities of public authorities and educational organizations, the possibility of responsible choice [1], and on the other hand, formalizes the activities of educational organizations and educational authorities. At the same time the adaptability of information openness, based on the use of network information technology, electronic information resources, especially resources of the Internet, acts as a major factor of the openness in modern education, which can be considered as one of the strategies of development of educational organizations. However, as practice shows, this resource is used in certain specific manner and do not always meet the requirements of legal and information culture. The diversity of types and kinds of educational organizations, conditions and requirements of education complicates the process of choice of education for many people. In this situation people search for necessary information using modern computer technology. Factors that stimulate the transition to a new format of interaction between the citizen and society, are: the increased attention from society – the subject of education is interested by each individual; thinking about education – it is a reflections about own future.

Thus, the subject of present research on the one hand, was due the request of the information society for full information about educational organization and on the other hand, the practical necessity of studying the implementation by secondary vocational education organizations the requirements to the information openness at their official websites.

The relevance of this research is confirmed by the following circumstances. First, the most important tools for ensuring information openness of secondary vocational education organizations are the official websites in information and telecommunication network Internet, that meets the requirements of the state educational policy. Secondly, the official website of the educational organization is created in order to inform about its' activities and for interaction with the public. The website enhances a public image of the educational organization, allows to show the success of the educational organization. Thus, the site of educational organization is the visiting card, information leaflet, newsletter and self-promotion that can be considered from the perspective of development strategy. Third, active government policy in a field of information openness of education is manifested by adopted relevant regulatory legal acts, which must be implemented in full in accordance with the established rules.

2. Definition of research problem

An obligatory requirement for availability of official website, strict regulation of its structure and content, clear definition of information content and formats of its' representation defined by modern approach to information support at educational organizations websites. Based on the data prevailing in the education system of Russia during the last 3-5 years, namely, from monitoring, sociological surveys, conducted by the National research University "Higher school of Economics" it is established that the information openness in education system grows and approaches to 100 %. We can say that in this respect the education sphere is ahead of other social services [2].

However, during analysis of decision efficiency of the state tasks in the field of information openness of secondary vocational education organizations revealed that their openness is not effective enough, which led to the main problem of present research. Practice shows that the regulatory requirements to the content of information important for supplying to the websites of educational institutions at present are not implemented in full. Information needs of citizens in obtaining reliable data on educational organization and the quality of education are stay unmet. So there is a need to study the existing problems in the field of information openness of secondary vocational education organization from the standpoint of development and formalization of such activities.

3. Research methods and their substantiation

The implementation of the information openness in educational institutions is carried out within the frameworks of the Concept of openness of Federal Executive authorities of Russia [3]. The informational openness of educational organizations, as one of the factors of public participation in the management of education and formation of educational policy, ensures rights of consumers of educational services and is one of the most important factors of competitiveness and development of educational organization. Information openness – the list of information, which is subjected to obligatory disclosure by educational organizations. It is necessary to meet the needs of citizens for information concerning the activities of educational organization, as well as for the feedback between educational organization, members of the public and consumers of educational services in order to improve the efficiency and performance of organization's activities. Important tools for implementation of information openness and transparency in secondary vocational educational organization's activities are their official websites. Openness of education is currently one of the key condition for development of education system, as well as the most important condition for realization of the state guarantees of quality education. Information openness is a satisfaction of information needs of consumers of educational services by providing full and accurate information about the organization, its activities, by providing opportunities for the feedback from the consumers of educational services with the purpose of increasing organization's efficiency [4]. Secondary vocational education is provided by educational organizations, usually colleges and technical schools, including in small towns of Russia, which has its own characteristics and specificity [5]. Management of educational organizations of this type is subjected to the specific regulations established by the Federal law No. 273-FZ dated 29 December 2012 "On education in Russian Federation" and other normative legal acts. Paragraph 1 of article 29 of the Federal law No. 273-FZ

defines that "educational institutions provide open and accessible information resources, containing information about their activities, and ensure access to such resources by placing them in the information-telecommunication networks, including at the official website of the educational organization in the Internet. Paragraph 2 of article 29 of the Federal law No. 273-FZ determines the list of required information that must be available and accessible [6]. As an enhancement of article 29 of this law there is paragraph 4 of the resolution of the Russian Federation Government No. 582-ПП dated 10.07.2013 "On approval of Rules for submitting information at official website of educational organization in the information-telecommunication network Internet, and information updates about educational organizations" which stipulates that information at the official website can be represented in text and tabular forms, and in the form of copies of documents according to the requirements to the structure of the official website and to the format of the information representation established by the Federal service for supervision in education and science [7].The main tool of methodological support of secondary vocational education organizations in respect of observance of applicable legislation requirements to publication of information at their official websites is Rosobrnadzor order No. 785 dated 29.05.2014 "On approval of requirements to the structure of the official website of the educational organization in the information-telecommunication network Internet and the format of information representation" [8]. In accordance with this order the website of the educational organization must include a special section containing following subsections: "General information", "Structure and management bodies educational organization", "Documents", "Education", "Educational standards", "Management. Pedagogical (scientific-pedagogical) staff", "Technical support and equipment of the educational process", "Scholarships and other types of available financial support", "Paid educational services", "Financial and economic activity", "Job vacancies for employment (transfer)". Updating information at the official website of the educational organization is carried out in accordance with amendments to the current legislation, organizational structure of educational organizations, as well as in local regulatory legal acts of the organization. Requirements of Rosobrnadzor order No. 785 dated 29.05.2014 formed the basis of performed research and subsequent analysis of compliance of the official website of secondary vocational education organization to the requirements of the information openness. Using the method of documents analysis 11 approaches for information support of the official website was examined. Each approach includes several sections. Thus 67 sections was analyzed. Using expert interviews method 23 executive employees were interviewed. The aim of the interviews was to identify the attitude to fulfillment of government requirements for information openness at the official websites of secondary vocational education organizations as to a strategy for organization development or as to the way of formalization of organizations' activities. The main criteria for information openness of the official website is the presence of information object at the official website of the secondary vocational education organization. The availability of an information object is a quantitative criterion which describes the fact of placing information on the website. Rating of information object availability has two values: 1 point - available, 0 points - not available. Negative rating means that the information availability has the minimum value. The maximum number of points – 67 points equal to the number of sections for information support at the official website that according to a scoring system is equal to 100 %. On the basis of availability of information a Coefficient of information availability (K) was applied. Analysis of this parameter was carried out according to the criterion of "Availability/absence". The procedure of assessment through the assignment of the Coefficient of information availability was performed for each of the official websites of the educational organizations of secondary vocational education in the Sverdlovsk region out of selected set of sites. An integral assessment of information openness of official websites of educational institutions was calculated in percentage (table.1).

Table 1

Coefficient of information availability

No.	Criterion	Assessment	Description
1.	K = 90-100 %	High degree of information availability	All set of required data is represented and all required information is available in full
2.	K = 50-90 %	Medium degree of information availability	All set of required data is represented but required information is available not in full
3.	K = 30-50 %	Low degree of information availability	Only fragmentary information is represented

Ranking of information openness of official websites of educational organizations was formed based on calculated K-values from the first to the last in descending order of values of the Coefficient of information availability. In the case that two or more sites have the same K-value, they occupied the same place in the ranking by alphabetical order. Ranking of information openness of the official websites of educational organizations of secondary vocational education was the main result of the present research and determination of problems existence in the structure and content of the website.

4. Results of educational organizations openness research

The research generated a list of 98 secondary vocational education organizations in the Sverdlovsk region, under the competence of the Ministry of General and professional education of Sverdlovsk region. During the process of analysis of informational support documents at the official websites revealed that only 14 educational organizations of secondary vocational education are almost fully submitted the required information on their official websites having information openness over 90%. Six organizations of secondary vocational education have a very low degree of available information and their information openness is less than 50%. Thus 66 educational organizations representing 67% of the total number of examined organizations do not provide version of their official website for visually impaired people, which is prescribed by the letter of Rosobrnadzor No. 07-675 "About forwarding of methodical recommendations on supplying information about educational organization in the public resources taking into account requirements of the legislation of education" [9].

The highest rates of information compliance to the requirements of the legislation showed 6 official websites of educational institutions of secondary vocational education in the Sverdlovsk region, they are: Ekaterinburg Commerce and economic College, Kamensk-Uralsky Polytechnic College, Baranchinskiy Electromechanical College, Ural College of construction, architecture and entrepreneurship, Ekaterinburg Energetics College, Ural mining and metallurgical College named after Demidovs. Informational openness of their official websites ranges from 93% to 96%. The lowest number of points according to the analysis of the documents scored two official websites of educational organizations, they are: North teachers College and Sysertskiy Socio-economic College "Rodnik". These educational organizations have the lowest degree of information availability and informational openness of their official websites is 19% and 39% accordingly. The overall quality of researched websites according to the criterion of information availability can be evaluated as "satisfactory". A maximum of 100% achieved none of the participants in ranking. As shown by the analysis of the documents the main reasons is the lack of required information or the required information is provided with violation of applicable legislation requirements to its representation.

Thus, despite the fact that information at the official websites of educational institutions of secondary vocational education of the Sverdlovsk region is close to full openness, however, access of citizens to certain documents and information still remains limited.

Process of documents analysis revealed: lack of critical information about the educational organization, discrepancy of information appearance to specified requirements, irregularity of its updates, which hampered the research process. In progress of the research 23 executive employees were asked before and after the analysis of information openness at the official website the same question: "Do You think that the implementation of the requirements in full to ensure the provision of informational openness at official website is the way of development of educational organization or another formalization of its' activities?". Before the research the majority of answers (76%) of the respondents were inclined towards a strategy of development as they linked the future of educational organization with image, satisfaction of consumers of educational services, competitiveness and public recognition of the success of educational organization and etc. When interviewing after the research the respondents were inclined towards to formalization of the activities, due to understanding by organization's executive employees the need to fulfill government requirements for information openness at the official websites. This will require additional administrative, financial, personnel, technological and technical resources, as well as common understanding by all participants of the educational process the need for compliance of the information provided by the official websites to the applicable legislation.

5. Conclusions and suggestions

The analysis of the 67 sections of the information support at official websites of secondary vocational educational organizations by the example of those in the Sverdlovsk region allowed us to formulate the existing problems, including:

1. Violation of Federal law – information about the activities of education organizations at the official websites is not provided in full.
2. Implementation of provisions of the Federal law № 152-FZ "On personal data" limits the excessive amount of information, so the consumer cannot contact interested structural unit or a particular teacher, since the official website of the organization does not specifies particular contact details. It hinders the feedback between the consumers of educational services with the educational organization.
3. Discontent of information needs of citizens in obtaining reliable information due to incomplete degree of information openness.
4. The need for specialists having new competences, legal and information culture, as well as experienced in information and educational technologies.

In our view, overcoming the problems identified in the research is possible with the formation of structural units responsible for the informational openness in educational organizations, or training specialists who will have the necessary knowledge in the field of information technology, experience in research activities in the field of ensuring access to information about the activities of secondary vocational education organizations. Such specialists needed to be trained in the monitoring of the official websites, and also have the opportunity to participate in seminars and webinars, promptly obtain advices and information support and participate in regional contests for the best website of educational organizations of secondary vocational education. Currently, the information openness of educational institutions should be considered as a powerful vector of development of the organization itself, because when providing information openness then integration of all types of resources occurs: administrative, personnel, technological, technical and social, which are united by a common purpose to obtain the complete and accurate information. The research demonstrates that the website of the educational organization is a powerful technological resource and a tool for ensuring information openness. At the same time all types of information documents provided on the website must comply with state requirements and applicable legislation, and it requires first of all to study of the regulatory frameworks in this field. Only when these conditions are met, there is a possibility of implementation of full and reliable information openness by the educational organization from the perspective of its' development strategy, ensuring a positive image of the educational organization and formation of new traditions in educational process and pedagogical practice.

Reference list

1. Matveev V. U. Development of legal regulation of informational transparency of educational institutions. - Education openness: various views - common values. Moscow. Publishing house of the Higher school of Economics, 2013,. pp. 121-131.
2. Mertsalova T. A., Kosaretsky S. G. Informational openness at official websites of regional bodies of education management: the main results of the study. - Education openness: various views - common values. Moscow. Publishing house of the Higher school of Economics, 2013, pp. 13–27.
3. On approval of the Concept of opennes of Federal Executive bodies: resolution of the government of the Russian Federation No. 93-R dated 30.01.2014. – The official website of "Consultant Plus", available at: http://www.consultant.ru/search/?q=4.%09Об
4. Mertsalova T. A. Information openness in education system: the effectiveness of public policy – education 2015, No. 2, pp. 40-75.
5. Rezer T.M. Specifics of development of small cities in the Sverdlovsk region. - The issues of state and municipal management, 2013, № 1, pp. 225-233.
6. On education in the Russian Federation: Federal law No. 273–FZ dated 29.12.2012. – The official website of "Consultant Plus", URL: http://www.consultant.ru/document/cons_doc_LAW_140174/
7. On approval of Rules for submitting information at official website of educational organization in the information-telecommunication network Internet, and information updates about educational organizations: resolution of the Government of the Russian Federation No. 582 dated 10.07.2013 – The official website of "Consultant Plus", URL: http://www.consultant.ru/search/base/?q=Об
8. On approval of requirements to the structure of the official website of the educational organization in the information-telecommunication network Internet and the format of information representation: Order of Rosobrnadzor of the Russian Federation No. 785 dated 29.05.2014. – The official website of "Consultant Plus", URL: http://www.consultant.ru/document/cons_doc_LAW_167061/
9. About forwarding of methodical recommendations on supplying information about educational organization in the public resources taking into account requirements of the legislation of education: letter by Federal service for supervision in education and science No. 07–675 dated 25 March 2015. – The official website of "Consultant Plus", URL: http://www.consultant.ru/document/cons_doc_LAW_177135/

INFLUENCE OF ONLINE ACTIVISM ONTO TRADITIONAL MODELS OF POLITICAL PARTICIPATION

Doc.dr Petrović D.[1], Prof. dr Bešić M.[2]
Faculty of Transport and Traffic Engineering – University of Belgrade, Serbia[1]
Faculty of Political Sciences - University of Belgrade, Serbia[2]

d.petrovic@sf.bg.ac.rs;

Abstract: *There are a lot of disputes regarding the real potential and influence of online activism onto offline world events. In line with that the aim of this paper is to establish the relationship between online activism and potential for social activism in the events that are manifesting in the real world. For that purpose we have conducted a survey of a nationally representative sample of Serbia (around 1200 respondents). Online activism is measured through both usage of the internet as the main source of information, as well as usage of Facebook used as a tool for political participation. On the other hand, real world social activism is measured through belonging to different citizens and political organizations, as well as participation in different kinds of social protests. The results of our research revealed an interconnectedness between the intensity of online activism and the potential for offline social activism.*

Keywords: Online activism, political participation, protesting, social network sites, Twitter, Facebook

1. Introduction

From the time when the modern internet had emerged there has been a lot of discussion regarding its political role. On the one side there were and still are those who believed that the internet can be a very important if not a decisive factor in a political battle, while on the other side there are many of those who were much more pessimistic about the internet as a political tool. Through the eyes of the optimist (Ayres, 1999) the internet has been seen as a miraculous tool which will revive the citizen's participation and social activism after a long period of political apathy caused by disappointment in the liberal democratic political system. It was assumed that the internet with its capability to provide information and new means of communication and cooperation will once and for ever change the role of the ordinary people in the modern political arena. Especially after the introduction of WEB 2.0 platforms (Chadwick, 2012) the capacity for social activism through the internet seemed almost limitless. However, through pessimist lenses the internet failed in fulfilling many of the early day's expectations. Instead of argued discussion, the public spaces of the internet. i.e. forums, blogs, social networks sites (SNS) are polluted with aggressive and violent voices. This could be a consequence of the so called *online disinhibition effect* (Suler, 2004) claiming that when people discuss over the internet they are not in physical contact and they tend to express their opinion in a more raw form. In line with that, the internet became the number one tool for extremist parties and movements, both from the left and right ends of political spectrum (Tateo, 2005; Zhou et al, 2005; Garret, 2006; Caiani and Parenti, 2009). Furthermore, some claimed that the internet nurtures a specific type of pseudo activism – slactivism (Morzov, 2009) which means that people, especially the young ones, are much more prone to give likes and shares instead of protesting in the real world. Also, authors like Putnam (2001) point to a possible phenomenon known as cyberbalkanization, or the problem of forming groups of people over the internet who are sharing the same ideology and consequently becoming isolated from people who think differently. In the end, the legitimate question still is how the internet will fulfil its revolutionary role if more than half of the world's population is still not using it (ITU, 2016). So, the problem of a digital divide is also one of the big obstacles for wide impact of the internet onto everyday political life (Dean, 2003; Min, 2010).

In order to investigate the real potential of internet use in the context of social activism the aim of this paper was to establish a relationship between online activism and the capacity for social activism in the events that are manifesting in the real world. For that purpose we have conducted a survey on a nationally representative sample of the Serbian population.

2. Theoretical and analytical framework

The internet is much more than plain technology. Some form of subversivness has been installed in its very roots as a result of the atmosphere of social movements and activism during the sixties and seventies. The real creators of the modern internet were young anti-establishment oriented people predominantly educated in the very liberal environment of universities in California, especially in Silicon Valley (Castells, 2001).

Another inherent characteristic of the internet as a technology is that it is, maybe more than any other technology, suitable for creative appropriation (Feenberg, 1999) by its users. This is a result of its unprecedented flexibility which allows constant variation and innovation of its features and ways of its usage. Similarly, but in different context, Castells believe that the appearance of the internet was crucial for the rise of a new form of societal communication, i.e mass self-communication. (Castells, 2009). He claims that this new form of communication is mass communication because it can potentially reach a global audience. It is also multimodal, as the digitization of content and advanced social software, often based on open source programs which can be downloaded for free, allows the reformatting of almost any content in almost any form, increasingly distributed via wireless networks. It is also self-generated in content, self-directed in emission, and self-selected in reception by many who communicate with many. This is for Castells a new communication realm, and ultimately a new medium, whose backbone is made of computer networks, whose language is digital, and whose senders are globally distributed and globally interactive. What is even more important, the rise of this form of mass self-communication increases the autonomy and freedom of communicating actors. Now, they have a tool and consequently the power to organize themselves and promote alternative agendas in opposition to the power elites (Castells, 2012.) In another words, trough autonomous mass self-communication citizens are empowered to permanently challenge one of two fundamental source of rulers` power, the power of communication.

In line with the abovementioned if our goal is to understand the social activist role of new information-communication technologies (ICT) we should analyse it on three levels: 1) As a tool for finding, processing and disseminating of information; 2) as a tool for organizing and coordinating social action; and 3) as a public sphere.

When it comes to information, accessing the internet can be seen as a hybrid medium which combines the elements of traditional media, i.e newspapers, radio and television. But, the internet is not just the simple aggregation of traditional media elements, but much more than that. In contrast to all of them, the internet is a two-way media with a highly decentralized structure which makes it suitable for new forms of information exchange, such as citizen journalism (Chadwick, 2012; Vergeer et al., 2013).

But the internet is not just for media, it is a powerful tool for communication and cooperation. Platforms for social networking like Twitter or Facebook are especially important tools for communication and it is fair to say that they have become inseparable from contemporary social activism. Numerous

researchers confirmed that these platforms can play very important roles in organizing social actions (Petrović, 2013; 2016).

On the third level, the internet can be seen as a tool for revival of the public sphere as Habermas saw it. He defined the public sphere as a virtual or imaginary community which does not necessarily exist in any identifiable space. In its ideal form, the public sphere is "made up of private people gathered together as a public and articulating the needs of society with the state" (Habermas, 1991). Especially in the early days of the internet many had hoped (Kellner, 1997) that this new virtual space would be ideal for the awakening of, in a liberal democracy, disappointed citizens. Although, this optimistic spirit has largely vanished by now (Dean, 2003; Papacharissi, 2009), we still cannot deny that the internet played an important role in providing a new political arena for those who would not be able or at least would not be motivated to participate in debate in any other way.

3. Data and measurement

In order to investigate the real potential of internet use in context of social activism we have conducted a survey on a nationally representative sample of Serbia (around 1200 respondents). Online activism is measured through both, usage of the internet as a main source of information, and usage of Facebook as a tool for political participation. On the other hand, real world social activism is measured through both, belonging to different citizens and political organizations, and participation in different kinds of social protests.

The first concept we measured was *the internet usage*. This concept is operationalized through three five point scale items that has been used separately in the analysis, and these are usage of Twitter, Facebook and Forums and Blogs (Table 1). As we expected, Facebook is used by the majority of our respondents while Twitter is regularly (weekly level) used by only 12.1% internet users.

Table 1. Internet Usage (%)

	Every day	**Few times a week**	**Few times a month**	**Less often than that**	**Never**
Twitter	8.7	3.4	2.3	3.2	82.4
Facebook	39.4	9.4	2.9	2.4	45.9
Forums and Blogs	7.9	9.0	7.7	7.5	67.9

As a measurement for *Political Activism on Social Networks Sites* (PA_SNS) we constructed a scale based on five items measuring the frequency of following: liking, sharing, commenting and posting on SNS (Table 2). The frequency for each PA_SNS activism is measured on a five point ordinal scale, i.e. from never to everyday, while the overall scale of PA_SNS is formed as a regression factor score.

Table 2. Political Activism on SNS (%)

	Every day	**Few times a week**	**Few times a month**	**Less often than that**	**Never**
Following	22.9	13.7	6.6	7.0	49.9
Liking	9.1	8.2	5.8	8.8	68.2
Sharing	3.8	4.3	5.6	9.7	76.6
Commenting	5.0	5.0	5.4	10.2	74.3
Posting	3.9	4.4	4.2	9.7	77.9

The concept of *Online Political Activism* (OPA) is formed also as a factor regression score based on six items: using alternative web portals as a source of information, using special political portals as a source of information, participation in online discussions, connecting with organizations, groups and movements, signing petitions on the internet, and organizing social and political actions on the internet (Table 3). For each item a five point ordinal scales is used, as well. As we can see, the most common OPA is informing through alternative portals while other forms of OPA are much less present.

Table 3. Online Political Activism (%)

	Every day	Few times a week	Few times a month	Less often than that	Never
Using alternative web portals	39.4	18.4	5.1	3.1	33.9
Using special political portals	8.4	8.9	9.0	9.0	64.6
Participation in online discussions	2.4	3.6	4.8	8.7	80.5
Connecting with organizations, groups and movements	2.3	3.2	4.0	8.9	81.6
Signing petitions on the internet	2.0	2.0	7.9	15.5	72.7
Organizing political actions on the internet	1.7	1.7	2.4	6.5	87.7

Our two main dependent variables, which were about measuring Political activism in real life, were produced by realization of factor analysis (Maximum likelihood and Promax rotation), based on eight items (Table 4). Each item is operationalized on a three point frequency scale. As a result of the factor analysis we identified two concepts i.e. *Political Activism* (PA) and *Activism Through Communication* (ATC) (Table 5). Correspondingly, we formed regression factor scores for these two concepts.

Table 4. Offline Political Activism (%)

	I did that	**I could do that**	**I would never do that**
Contacting media	9.7	36.8	53.4
Contacting politicians	10.4	34.1	55.4
Contacting public servants	14.8	37.0	48.2
Contacting organizations	8.4	38.4	53.2
Participation in unofficial strikes	11.3	28.7	60.0
Participation in legal strikes	16.8	36.8	46.3
Participation in political events	19.0	27.7	53.2
Occupying buildings	4.4	17.0	78.7

Table 5. Offline Political Activism items – Factor Pattern Matrix

	Factor	
	ATC	**PA**
Contacting media	.858	
Contacting politicians	.824	
Contacting public servants	.812	
Contacting organizations	.807	
Participation in unofficial strikes		.916
Participation in legal strikes		.753
Participation in political events		.647
Occupying buildings		.636

4. Results and discussion

First, we tested bivariate correlations among the whole set of variables. The data can be found in Table 6. The strongest correlation we have observed between PA_SNS and OPA. In other words it could be said that the more people are politically active on the internet, the more they are active on SNS, which is quite an expected result. Also, we have observed a very high correlation between PA and ATC, which is also an expected result. Namely, there is a strong correlation between the two concepts of political activism in real life. Also, we have observed a rather strong correlation among three variables of internet usage. The weakest correlation is identified between ATC and three types of internet usage.

Table 6. Correlation matrix among all the variables

	PA_SNS	OPA	ATC	PA	FB	TW	F&B
PA_SNS	1	.787**	.420**	.418**	.538**	.433**	.431**
OPA		1	.432**	.432**	.514**	.439**	.483**
ATC			1	.664**	.151**	.210**	.146**
PA				1	.185**	.224**	.170**
Facebook					1	.422**	.511**
Twitter						1	.549**

** p < 0.01

The hypothesis that was tested was the predictability of internet usage (IU), i.e. frequency of using Twitter, Facebook and Forums & Blogs of ATC and PAI, which are dependent variables. The results are presented in the Table 7

Table 7 Regression analysis – IU variables as Predictors of PA and ATC

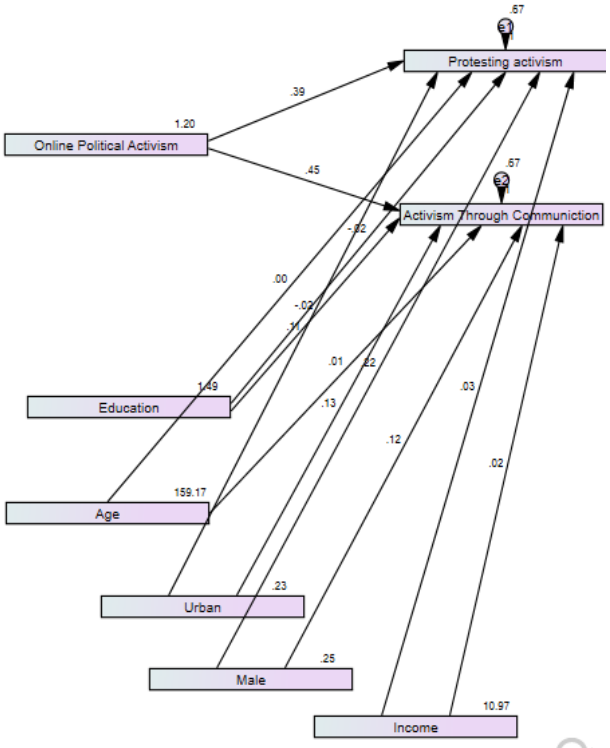
	Twitter		F&B		Facebook	
	PA	**ATC**	**PA**	**ATC**	**PA**	**ATC**
Intercept	.671**	.579**	.463**	.365*	.256	.136
Male	.330**	.299**	.337**	.306**	.336**	.307**
Age	-.002	.002	-.002**	.002	-.001	.005*
Income	.035**	.025**	.035**	.025**	.033**	.023*
Urban	.187**	.208*	.200	.221**	.200**	.217**
Twitter	**.125****	**.131****				
F & B			**.076****	**.083****		
Facebook					**.075****	**.087****
R^2	0.11	0.085	0.094	0.068	0.095	0.072

** p < 0.01
** p < 0.05

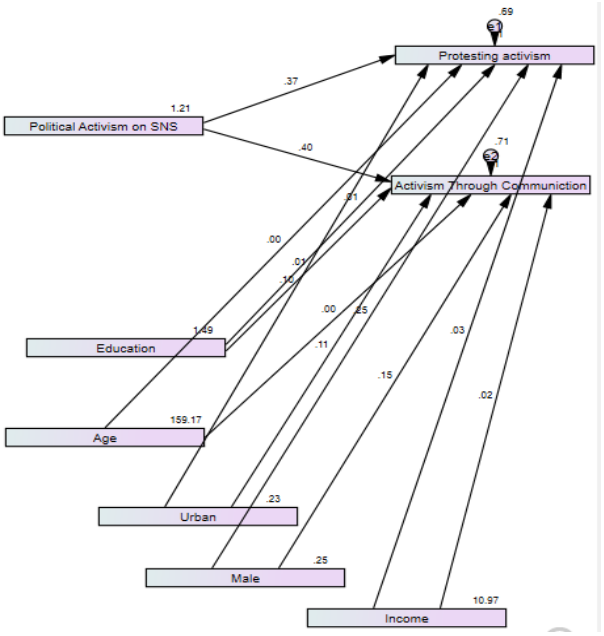
As we can observe from table 7, being male and living in urban areas are strong predictors of both, political activism and activism through contacting. After introducing Male, Age, Income and Urban as controls, we identified the predictability of the IU variables onto Political Activism in Real life. First, we find that using Twitter is the best predictor of Political Activism, seemingly, to some extent using Twitter is a stronger predictor of PA compared to ATC. But, also, using Forums and Blogs is connected to Political Activism in real life, and the level of relation is very similar. In both cases, predictability of ATC is somehow stronger compared to PA. So, we conclude, using Twitter, Forums and Blogs, as well, as Facebook is connected with Political Activism in real life.

By testing OPA and PA_SNS as predictors of Political Activism in Real life (Graph 1 and Graph 2), we identified strong predictability of both predictors onto both dimensions of Activism in Real Life. Presumably, OPA and PA_SNS are somehow stronger predictors of ATC compared to PA. So, we conclude that being politically active online, as well as being politically active on SNS, will increase the potential for Protesting Activism, as well as for Activism Through Communication.

Graph 1. Online Political Activism as predictor of Activism in Real Life



Graph 2. Political Activism on SNS as predictor of Activism in Real Life



Our findings are in line with numerous research which showed that people who are politically active online are also more politically active in the real world (Petrović, 2013; 2016). It is important to note that we have detected two different forms of political activism in the real world, activism in the classical sense (through protesting) and some sort of individualized activism which is based on direct contacting of different actors (media, politicians, etc). But, both of these types of offline activism are, more or less, equally associated with online activism even though one could expect that "contacting" activism would be much more empowered by the internet as a communication tool. This is probably due the

fact that this contacting activism is primarily occurring through traditional interpersonal media like the telephone.

As several researchers already confirmed, Twitter is proved to be the most important SNS for political activism (Feezel Jessica et al, 2009) and our findings are pretty much in line with that. We can assume that Twitter compared to Facebook is more suitable for social activism because it is typical, public sphere, interactive media and it has a decentralized structure of networks that is resistant to control and censorship. Anonymity is rather characteristic of Twitter more so than Facebook. As such, Twitter is employed by the people to promote their causes, organize protests and to disrupt and circumvent the official flows of information stemming from traditional media or economic and governmental institutions (Lindgren, 2013). In other words, through Twitter usage of all three levels of the internet as a social activism tool are employed: it is a source of information, a communication tool and a public sphere.

5. Conclusion

The aim of this paper was to test the relationship between online activism and the potential for social activism in the events that are manifesting in the offline world. For that purpose we have conducted a survey on a nationally representative sample in Serbia. Our results have shown that using Twitter, Forums and Blogs, as well, as Facebook is associated with Offline Political Activism in real life. We also concluded that activity on Twitter is the best predictor of Political Activism. Furthermore being politically active online, as well as being politically active on SNS, will increase the potential for Protesting Activism, as well as for Activism Through Communication. These findings are in line with numerous studies claiming that online activism is beneficial for political battles in the real world. We can assume that online activism is an important part of real world social activism because it provides more autonomy and freedom for communication among actors compared to any other media. Today, contemporary activists have a tool and consequently the power to organize themselves and promote alternative agendas compared to power elites. In other words, trough autonomous mass self-communication which is possible because of the internet, citizens are empowered to permanently challenge one of two fundamental source of rulers` power, i.e. the power of communication.

References:

Ayres, Jeffrey (1999). From the streets to the Internet: The cyber-diffusion of contention. Annals of the American Academy of Political and Social Science, Vol. 566(1):132–143

Castells, M. (2001). *The Internet Galaxy-Reflections on the Internet, Business and Society*. Oxford University Press.

Castells, M. (2009) *Communication Power*, Oxford University Press.

Castells, M. (2012). *Networks of Outrage and Hope-Social Movements in the Internet Age*. Polity

Lindgren, S. (2013). The potential and limitations of twitter activism: mapping the 2011 Libyan uprising. TripleC: Communication, Capitalism & Critique. Open Access Journal for a Global Sustainable Information Society, Vol. 11(1): 207-220.

Feenberg, Andrew (1999), *Questioning Technology*. Routledge, New York, USA

Chadwick, Andrew. (2012). Recent Shifts in the Relationship Between the Internet and Democratic Engagement in Britain and the United States: Granularity, Informational Exuberance, and Political Learning. in Anduiza, E., Jensen, M and Jorba, L (eds.) *Digital Media and Political Engagement Worldwide: A Comparative Study*. Cambridge University Press, pp 39-56.

Suler, J (2004) "The Online Disinhibition Effect", *Cyberpsychology & Behavior*, Vol. (7)3:321-326

Tateo, L. (2005) "The Italian extreme right on-line network: An exploratory study using an integrated social network analysis and content analysis approach", *Journal of Computer-Mediated Communication*, Vol. 10(2)

Zhou, Y., Reid, E., Qin, J., Chen, H. & Lai, G. (2005) 'U.S. domestic extremist groups on the web: link and content analysis', IEEE Intelligent Systems, vol. 20, no. 5, pp. 44–51.

Garrett, R. K. (2006) „Protest in an Information Society: A Review of Literature on Social Movements and New ICTs", *Information, Communication and Society*, Vol.9(2):202-224.

Caiani, M. and Parenti, L. (2009) "The Dark Side of the Web: Italian Right-Wing Extremist Groups and the Internet", *South European Society and Politics*, 14(3):273-294

Morozov, Evgeny (2009), The Brave New World of Slacktivism, *Foreign Policy* (19. May), pristupljeno 15.12.2015. na web adresi: http://foreignpolicy.com/2009/05/19/the-brave-new-world-of-slacktivism/

Putnam, Robert D. (2001) *Bowling alone: The collapse and revival of American community*. Simon and Schuster,

Dean, Jodi (2003), Why the net is not a public sphere. *Constellations*, Vol. 10(1):95-112.

Min, Seong-Jae (2010), From the Digital Divide to the Democratic Divide: Internet Skills, Political Interest, and the Second-Level Digital Divide in Political Internet Use. *Journal of Information Technology & Politics*, Vol. 7(1):22–35

Petović, D. (2016) Društveno-aktivistički potencijal platformi za društveno umrežavanje. Sociološki pregled, Vol. 50 Issue 3, pp. 397-430.

Petrović, D. (2013). Specifičnosti političkog delovanja u saber prostoru, u Jelinčić i Ilić (ur.), Politički ekstremizam u saber prostoru Srbije, Centar za razvoj civilnog društva, Zrenjanin, str. 12-33

Papacharissi, Z. (2009). The virtual geographies of social networks: a comparative analysis of Facebook, LinkedIn and ASmall World. *New media & society*, 11(1-2), 199-220.

Kellner, Douglas (1997). Intellectuals, the new public spheres, and techno-politics. *New Political Science*, pp. 169-188.

Feezell, Jessica T., Meredith Conroy, and Mario Guerrero (2009), Facebook is... fostering political engagement: A study of online social networking groups and offline participation. *Fostering Political Engagement: A Study of Online Social Networking Groups and Offline Participation*

Lindgren, Simon (2013), The potential and limitations of twitter activism: mapping the 2011 Libyan uprising. TripleC: Communication, Capitalism & Critique. *Open Access Journal for a Global Sustainable Information Society*, Vol. 11(1): 207-220.

Vergeer, M., Hermans, L. and Sams, S. (2013) Online social networks and microblogging in political campaigning : The exploration of a new campaign tool and a new campaign style, Party Politics, Vol. 19(3): 477-501.

Habermas, J. (1991). *The Structural Transformation of the Public Sphere: An Inquiry into a category of Bourgeois Society*. Cambridge, MA: MIT Press,

ITU (2016) Fact and figures 2016. https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf

TEN THINGS WE NEED TO KNOW ABOUT THE ISLAMIC STATE

Maciej Huczko PhD

Warsaw School of Economics, Warsaw, Poland

mhuczko@sgh.waw.pl

Abstract: The Islamic State (IS) (arguably the most successful terrorist group ever, or at the very least, the terrorist group which has attracted the most media attention) has declared itself a state, seized territories, and implemented a quasi-government. Widely recognized by their black flag, white pickup trucks, and horrendous executions broadcast live; the IS is a terrorist organization that because of its goals, methods, and appeal to young people, is worrisome to global leaders and decision-makers.

But what do we know about the IS? How is it possible that such a phenomenon came into existence let alone became capable of threatening global powers, obtaining continued funding, staging military actions, and grabbing media attention as it has done so far?

To explain the above question one must look at many different strategic issues that were not managed properly and therefore allowed Abu Musab al-Zarqawi, a Jordanian dropout and petty criminal, to create such a deadly organization. Today the IS plays an important role in the Middle East and is capable of carrying out deadly terrorist attacks not only in its home region but also in Europe, the United States, and Asia.

The name, funding, controlled territories, roots, religious affiliation, and many other factors must be explained in order to fully understand the IS; the terrorist group of the 21st century.

Keywords: The Islamic State; Terrorism; Syria; Iraq; Conflict; USA; The Middle East.

The 9/11 Al-Qaeda attacks on the United States marked a completely new chapter of terrorism. These attacks introduced us to global terrorism, where remotely-based terrorist groups are capable of carrying out deadly attacks on civilians all over the world. But, in its consequences, targeting American landmarks (WTC the Pentagon, and possibly the White House or the Capitol), killing nearly 3,000 people demanded from president George W. Bush and his administration immediate and decisive action against the authors of the attack Al-Qaeda severely crippling the potential of the terrorist organization.

American efforts aiming at fighting global terrorism to a certain extend were successful, mainly since Al-Qaeda as an organization has been curbed and its mastermind Osama bin Laden eliminated. But this success had its side effects. Among the most serious was destabilizing Iraq which led to the creation of a completely new global and regional menace, mainly the Islamic State. Since its establishment, the Islamic State has had a major impact on Middle East politics and security planning globally. News about this organization has dominated the media and generates interest among readers. According to Google Trends, the Islamic State, in 2014, ranked second, just after Ebola, in terms of new terms' popularity search (Fryer-Biggs, 2015). Therefore, explaining this new terrorist phenomenon through ten basic criteria will allow us to understand it and help separate truth from the misconceptions presented in the media.

1. Name of this terrorist organization

Despite the fact that addressing a terrorist organization properly is less important then understanding why and how such an organization carries out its deadly actions, certain clarification in this matter is essential. The New Year's Eve Reina nightclub terrorist attack in Istanbul was initially assigned to the Kurdish Working party (KPP) but has now been claimed by the Islamic State. Yet, opinion-forming media (e.g. CNN, Al Jazeera, Reuters) named the gunman to be a member of the IS (the Islamic State), ISIS (Islamic State in Iraq and Syria) and also ISIL (Islamic State of Syria and the Levant) causing ambiguity. President Obama in numerous speeches referred to this organization as ISIL or more pejoratively Daesh (2015). All of the above depict one, self-proclaimed terrorist organization based in Syria and Iraq and the caliphate it aims to establish.

The name which has not been used for over a decade now is AQI (Al-Qaeda in Iraq) and was used by violent groups fighting an insurgency against Americans in Iraq since 2003. Together with losing its leader, AQI renamed itself ISI (Islamic State in Iraq) showing territorial ambitions and claiming the establishment of a caliphate. Later, in 2011, this terrorist organization expanded into Syria when this country was destabilized by a civil uprising against president Assad leading to the Syrian Civil War. Gaining territory for the caliphate in Syria resulted in the organization acquiring another name, ISIS (Islamic State in Iraq and Syria). Not only the evolution of this terrorist organization influenced its name but also different decoding of commonly used abbreviations. The two most popular names of the organizations are the Islamic State (IS and the Islamic State in Iraq and Syria (ISIS), but the latter one is translated by terrorists themselves as Islamic State in Iraq and Al-Sham, where Al-Sham in Old Arabic refers to Syria but also more of the Middle East once known as Greater Syria. The word Al-Sham translates into Levant in English, which explains the ISIL – Islamic State of Iraq and Levant. Obama's choice for addressing the Islamic State as Daesh, an acronym for al Dawlah al-Islameyah fi Iraq wal-Sham. This acronym has a negative and pejorative meaning – "a bigot" or "to trample down and crush."

The above depiction of this terrorist group's name aims at clarification of the issue, but the name which is most commonly and widely used by different media is the Islamic State. This name not only is most common but also seems adequate since it prescinds from the geographical notion which is dynamically changing, focusing on the uniqueness of phenomenon that a terrorist organization has a state. A self-proclaimed state that holds territory which it administrates.

2. Founder/leader of the Islamic State

As presented above, IS has its roots in Al-Qaeda in Iraq, a major player or even the leader of the insurgency against the US-led operation in Iraq which toppled president Hussein. AQI was started in 2004 by a Jordanian Islamist Abu Musab al-Zarqawi also known as "Shaykh of the slaughterers" (Weiss, Hassan, 2015). Born to an impoverished family, he withdrew from high school early and started life on the streets of Zarqa, an industrial town in Jordan carrying out petty crimes and also as a procurer of prostitutes. Zarqawi gained his first military skills fighting the

Soviet Union in Afghanistan on the side of Afghan Mujahideen. There Zarqawi met Osama bin Laden, who by then was successfully building Al-Qaeda in Afghanistan. The two did not come to an understanding due to Zarqawi's extreme position on numerous issues mainly the justification of killing other Muslims who are non-believers, in practice not orthodox enough. After return to Jordan he was imprisoned for possessing guns and explosives. In prison he radicalized both his political and religious stance. After king's amnesty, Zarqawi traveled back to Afghanistan where he managed to convince the Al-Qaeda leader and bin Laden to sponsor his terrorist training camp in Iran. Zarqawi perfected his military skills fighting the coalition forces in Afghanistan with the Taliban and Al-Qaeda fighters. From Afghanistan he moved to Iraq, where he started to organize first a resistance and then later an insurgency against American forces. Zarqawi's Al-Qaeda in Iraq (AQI) targeted Americans, but was also hoping to further destabilize Iraq, Iraqi civilians, government institutions, and mosques. This terrorist used the media to show the decapitation of American entrepreneur Nicolas Berg, a tool of promoting fear the IS later became known for. By 2005 Zarqawi had become most wanted man by the US government in Iraq with a bounty as high as $25m for information leading to his capture, the same as in the case of bin Laden. In mid 2006 Zarqawi was eliminated by two American guided bombs.

Leadership of ISI was taken over by Aby Ayyub al-Masri, an Egyptian, and an active local leader of the Sunni insurgency against American led military activity in Iraq. Like Zarqawi, al-Masri also gained experience and climbed the terrorist ladder in Afghanistan. After Zarqaqi's death he was named his successor and the American administration posted a bounty of $25m for information on this terrorist. As a leader of ISI he was not highly-valued and his leadership led to a certain fragmentation of the organization into smaller and more local groups. Al-Masri was killed during an American and Iraqi operation in Iraq, on the outskirts of Tikrit in 2010.

His successor and the current leader is Abu Bakr al-Baghdadi. First a local general supervisor of ISI and a member of the senior consultative council elected 1st Emir of ISIS in 2014. Al-Baghdadi, an Iraqi, educated Islamic cleric, who obtained a PhD in Islamic studies from the University of Baghdad. Known for being shy, secretive, a recluse, and highly interested in studying the Koran. The process of his radicalization accelerated after the 2003 US invasion of Iraq. He established his own extreme Sunni group which led to his arrest and was sentenced to detention at the Camp Bucca Detention Facility in Iraq, where he continued the recruitment of terrorists through his clerical activity. After the US forces left Iraq in 2011, al-Baghdadi continued his insurgency action being the mastermind of numerous terrorist attacks across Baghdad and the whole of Iraq targeting Iraqi institutions, officials, and also civilians. Under al-Baghdadi ISI took advantage of the civil war in Syria, and took over a local terrorist organization formerly associated with Al-Qaeda. His brutal methods, targeting other Muslims, caused Al-Qaeda to denounce ISI which inspired Al-Baghdadi to announce the establishment of a worldwide caliphate in 2014 (the Islamic State) with its headquarters in Iraq and Syria and himself a caliph. Today, al-Baghdadi is the top US target in the Middle East and possibly worldwide but due to al-Baghdadi keeping a low profile, hiding among IS followers and changing his location on a daily basis, he is still operating and leading IS.

3. b

The goals of the Islamic State can be named as immediate and ultimate, where the immediate are local and ultimate ambition should be understood more globally. The local goals which are realistic and, under current circumstances of the Arab Spring and its consequences, empirically achievable, is establishing a caliphate in the region, erase man-made borders, and remove secular and not orthodox enough leaders (Lister, 2015). These steps would allow the IS to establish a new state based on a distinct interpretation of the Koran. This territorial ambition and authority is the one of the most essential differences from the goals of bin Laden's Al-Qaeda, which never claimed territory.

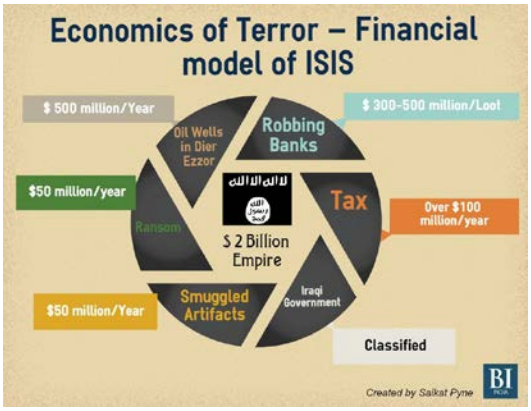
The global ambition of the IS is to take appropriate measures to establish a global caliphate. While this goal is not viable, a caliph can only govern if he launches a jihad, an Islamic war against nonbelievers. This jihad materializes globally in the form of different terrorist attacks: as the shooting in the Reina nightclub or in Paris, driving a lorry into passersby as in Nice, or recently in Berlin, suicide bombings in many cities in Turkey, and planting bombs in cars or even planes. Such malicious actions will not result in the establishment of a global caliphate but have a more direct effect, mainly spreading fear among Western societies and will have a strong propaganda effect in helping to atract new recruits.

4. Funding of the terrorist organization

The above presented IS aims require extensive financing. Both local and global terror activities require funding. The terrorists and their families need to finance everyday existence, recruits and fighters must be trained and equipped and above others the caliphate, a state needs to finance its administrative activities. In parallel, financial and trade sanctions have been imposed on the IS and their territory is under constant aerial and land bombardment making many fund generation operations challenging. This terrorist organization has managed with theese obstacles by developing a complex, multichannel financing system, outside of the legitimate banking system, choosing cash, crude oil and contraband as basic currency (Faeg, 2014). There are numerous different sources of fund raising and the most essential among them are the crude oil trade, money from private donors, taxation on occupied territories, looting banks on its territory, kidnapping and ransom and black market antiques sales.

Oil, the black gold feeding the black flag, is the predominant source of funds for the IS. With control of nearly 60% of Syrian oil fields and some in Iraq (which they are now losing due to international intervention), the IS, at times, was capable of producing and selling oil of $40m value monthly. Offering its oil at about 50% of current market price, the IS was able to smuggle and sell its oil to neighboring countries, mostly Syria and Assad, and used Turkish middlemen who are capable of finding other customers in the region.

As can be seen from the Business Insider chart below, including oil, other sources of financing contribute to $1,5b IS earnings yearly (Pyne, 2015):



Above is the value of each additional source of funding, but the other key aspect is reliability and continuity of it. While territorial control of the Islamic State is changing, so is the oil output but together with taxation these two sources are kept at a

stable level. But the overall share of taxes in the IS funding model is low, making oil the main source of funding for IS terrorists.

5. Territory of the Islamic State

At first it must be stated that the IS is self-proclaimed and no other nation recognizes its existence. As stated above a caliphate can only exists if it holds territory, if it can be geographically determined. But the challenge with the IS is that at first, after its establishment, it gained control and spread its influence to new territory at a rapid rate. But into late 2016 it has started losing its territory at an equally high speed. Therefore, it is difficult to precisely say where the IS is. First, the terrorist organizations which were later transformed into the IS, claimed territory, six provinces, in Iraq. Together with the further destabilization of Syria, it claimed expansion into this country in early 2014. These two countries are mostly and correctly associated with the Islamic State, but al-Baghdadi, in late 2014, announced that his caliphate has expanded its reach into provinces of Libya, Algeria, Egypt, Yemen, and Saudi Arabia. In 2015 the IS claimed to be present and operating in Afghanistan, Nigeria, and the North Caucasus. If all this territory would have been conquered by al-Baghdadis terrorists, the success and effectiveness of the IS would have been indisputable. But this expansion was due to more external than internal factors, mainly radical terrorist organizations throughout the Middle East decided to declare their support for the Islamic State and pledged its allegiance to al-Baghdadi as the caliph and the black flag. Among others, this was also the case with Abubakar Shekau's Boko Haram, the Nigerian terrorist group famous for kidnapping 276 schoolgirls in Nigeria.

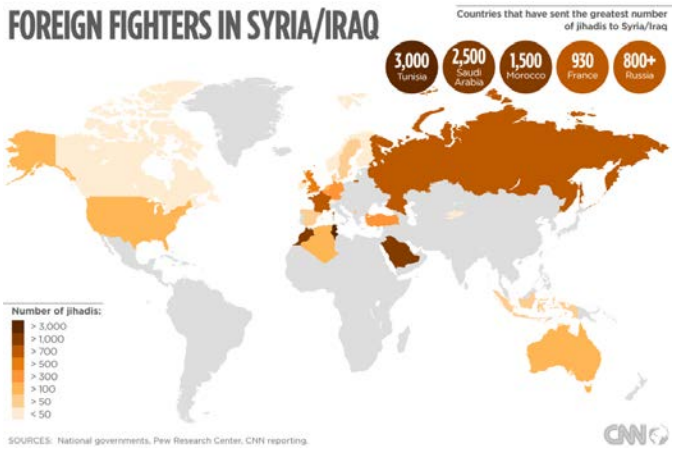
According to the Pentagon, the IS, by May 2015, had lost 45% of the territory it once held in Iraq and about 20% in Syria. This data has been modified on numerous occasions, following the intensification of the military offensive carried out by the Iraqi armed forces Kurds and also international coalition. The Islamic State's caliphate is shrinking and al-Baghdadi's governance project is failing. While this setback is an expected outcome of widely coordinated actions against the IS, it has also had negative side effects. The most visible one is the increasing activity of lone-wolf terrorists (a terrorist outside any command structure yet ideologically committed) and small groups caring out attacks on civilians across the Middle East and outside.

6. Foreigners in the Islamic State

While discussing the number of fighters of the IS and foreigners that joined the group we must rely on estimates, since precise data is not available. The overall estimate of the IS terrorists is between tens of thousands to two hundred thousand. Not only there is lack of data but also this number has been fluctuating. In 2014 the group's forces grew rapidly attracting fighters from other insurgent groups but also civilians from conquered territories. For many, joining the terrorist structure means obtaining a certain level of stabilization since the IS fighters receive food, housing, petrol and regular wages equaling about $50 monthly.

Foreigners who travel to Iraq and Syria to join the IS have different motives than many local fighters who might do it for materialistic reasons or lack of choice. For foreigners from outside of the Middle East, the primary driver for joining the caliphate was radical ideology. While these fighters were offered food and accommodation they were not receiving remuneration.

The following chart presents an estimated number of foreign recruits of the IS (Thompson, Green, Torre, 2014):



Today, since the IS is in decline, the number of foreign fighters is decreasing significantly. According to the Pentagon, the above numbers have dropped by 90%. This support is also decreasing among Muslims of the region, and the IS is experiencing a wave of desertions. Yet, together with the continuing inflow of refugees from the Middle East especially to Europe, there is a threat that some terrorists might infiltrate Europe as well and plot to carry out attacks on the continent.

7. Media and the Islamic State

The Islamic State is the one of the first (if not the first) terrorist organization to employ new media for recruitment, spreading propaganda, and striking fear into the minds and hearts of people worldwide. The terrorists were quick to learn Web 1.0, take advantage of Web 2.0 and master Web 3.0 in order to become more effective and powerful while simultaneously increasing its own security. Evolution of the internet from simply a source of information (Web 1.0) to a more interactive one (Web 2.0) where the users could upload content, share it and also communicate freely online became a completely new and attractive frontier for the terrorists. The launch of Web 2.0 giants such as Facebook and Twitter (the biggest social networks) in mid first decade of the 21st century coincided with the birth of the Islamic movement is Iraq that later transformed info the Islamic State.

Just like in the case of the Arab Spring, also in the case of building the caliphate, social media played a major role. Both phenomena have proven that access to the internet is high all over the Middle East and local societies (especially the younger generations) prefer this media channel to traditional ones.

The Islamic State's media efforts have several aims and target both sympathetic and hostile audiences as well. The paramount one is the recruitment dimension. This is being done at three levels: 1) new recruits who are willing to travel to Syria and Iraq, 2) gain new sponsors who will co-found the IS and finally 3) inspire lone-wolves who will carry out terror acts in their homelands. Another reason for using social media by the IS is to generate fear (showing spectacles of beheadings) among opponents on the ground giving the IS an advantage on the battle field and also among the civilians. Finally, there is this basic informative dimension. A caliphate, a state, to gain acceptance (at least in the minds) must be present and visible, must document its success and achievements. Many of the above are spotted and broadcast further by mainstream media.

Apart for the presence in the social media, the IS 's media arms include the al-Hayat Media Center, the al-Furgan, al-I'tisaam and Ajnad Media Fundation and the A'maq News Agency producing different media content in English, Arabic, Russian, Urdu, Turkish, and Hebrew. These agencies are located in remote places (in and outside of the IS territory), and are often relocated, prepare lengthy videos, publish magazines, newspapers and radio

programs. The productions are often of high technical quality and even employ cinematic tricks.

Finally, the IS has also employed techniques of communicating that rely heavily on access to the internet yet, since they are secured, functioning at a level not available to everyone. The popularity and attractiveness of smartphone applications has inspired the caliphate to create its own application. One such application dedicated for Android devices, discovered by the intelligence, is *The Nasher*. It's a hidden application that has to be downloaded manually, it cannot be found through the Google Play Store, and it channels the latest news and videos concerning the caliphate, it's also possibly used as a means of recruitment. It is assumed that the IS uses not only the widely available solution but also relies on the dark net/deep net – not visible to unauthorized users without specific software, configurations, and access authority.

8. Weapons used by the Islamic State

The types and amounts of weapons the caliphate possesses is one of the reasons why this terrorist organization has been so successful. Weapons that are available to IS fighters predominantly come from Iraqi army stocks and are of Soviet, Chinese, and American origin. Similarly, Iraqi and Syrian stockpiles have also been partially repossessed by the terrorists. In addition to the acquired arsenal, the IS is also developing and producing less advanced military equipment such as: ammunition, rockets and bombs.

The captured weapons come from Saddam Hussein's stockpile which he was building and upgrading for over two decades when serving as president of Iraq. More advanced military equipment the IS managed to seize were weapons given to the Iraqi army by the Americans after toppling Hussein's regime. The unexpected and rapid fall of Mosul in 2014 served as an example of how modern military equipment was acquired by the IS. The fleeing Iraqi forces left behind in Mosul 2,300 American Humvee armored vehicles, dozens tanks and also artillery equipment (Porter, 2015). Also in Syria, military equipment provided by the United States and Saudi Arabia to the Free Syrian Army was lost to the caliphate when the terrorists were seizing military bases.

The manufacturing of weapons in the caliphate is carried out in different locations, which for strategic reasons are being often relocated. The IS has established an authority, Central Organization for Standardization and Quality Control, which is issuing guidelines and manuals for weapons production and manufacturing quality controls. The standards of this production is equal to those of national armies and even include packaging and labeling specifying place and date of production. Presumably the IS is engaged in the black market weapons trade.

9. Military intervention against the IS

Since the Islamic State is a threat to many: domestically, locally in the Middle East, and also globally, it is being fought by many countries and groups simultaneously. The global fight against the caliphate, practically lasting since this self-proclaimed state came into existence, and with different intensity has continued until this day. The international coalition fighting the IS is led by the United States and consists of more than 60 countries. Members of the anti-IS coalition decide in what way and to what extent they wish to engage themselves. Some nations such as the U.K., Australia, France, Canada, and also regional coalitions from Jordan and Morocco, launched airstrikes in Iraq and Syria. Yet, other forms of engagement are retarding money supply inflow, preventing new recruits from joining the IS or contributing to humanitarian aid for refugees.

Airstrikes are conducted through CENTCOM (United States Central Command) therefore it is difficult to estimate how much each nation is contributing and individual countries' reporting varies in extent, precision, and timing. According to Airwars, a collaborative NGO reporting on air campaigns against the caliphate, there were over 17,000 coalition airstrikes – nearly 11,000 in Iraq, and 7,000 in Syria, which delivered about 65,000 bombs and missiles. Countries often decide to join the coalition as a response to the Islamic State's actions against their country, as it was first with Jordan (Jordanian pilot was burned alive by the terrorists) and later France (after terrorist attacks in Paris).

Since the terrorists are highly mobile and mix among civilians relying only on air strikes without engaging on the ground is not possible. Therefore, different anti – IS forces are also present in Iraq and Syria. A key group that is in operation on the ground is the Popular Mobilization Force (PMF) consisting of Iraqi Shia and Sunni Muslims, Christians, and Yazidi. Mostly equipped by the Americans and trained by foreign experts, PMF fighters are aiding Iraqi military forces. Similarly, Kurds fighting ISIS receive military and training support from the Americans allowing them to be highly effective. Yet, American support for Kurds is straining US – Turkish relations, since Turkey (a vital partner in fighting the IS) considers the Kurdistan Working Party a terrorist organization. Coalition forces also have troops on the ground, mostly Americans, but these forces are supporting the local anti-IS fighters with intelligence, training, and also special forces operations. On the ground operations are mostly carried out by the Iraqis supported by different groups from the region with foreigners only aiding these efforts.

Russia entering the conflict and their efforts to fight the caliphate in Syria is controversial, since according to experts and observers, it is only targeting anti-Syrian/ Assad rebels not the IS terrorists.

10. the United States and the caliphate

Fighting the Islamic State has been declared a priority by president Obama and repeated by the new president, Donald Trump. This situation has a multiple dimension explanation ranging from economic or strategic, some widely understood while other less visible, yet equally interesting. The caliphate is an aggressive organization at the doorstep of two American strategic partners in Israel and Saudi Arabia. The IS as an offspring of Al-Qaeda, is continuing to pose a threat to the Western world, carrying out terrorist attacks, and attacking Western civilizations verbally. Also, the caliphate is located and is destabilizing a region which is rich in natural resources and is of strategic importance for the United States.

While explaining reasons why the US is engaged in fighting the caliphate now can be done by providing several arguments, an explanation of American failures which created an environment that allowed the IS to be created seems more vital. The paramount reason is the 2003 US intervention in Iraq which led to the removing of Saddam Hussein. The fall of Hussein's dictatorship led to the destabilization of the whole country, religious clashes, and an influx of terrorists posing a challenge to the newly formed Iraqi forces not ready for such challenges. The American removal of Hussein without a coherent plan for a post-Saddam Iraq created a vacuum which was exploited by insurgents and terrorists. Further destabilization of the region, mainly the part of Syria bordering with Iraq, only magnified the problem.

Finally, a certain pattern of negligence by American intelligence can be identified. Negligence which enabled terrorist leaders such as bin Laden, al-Zarqawi, and al-Baghdadi. Both the FBI and the CIA and even the Clinton administration failed to cooperate with Sudanese intelligence which was trying to provide files on bin

Laden in the early 90's (Miniter, 2003). Bin Laden, later became the mastermind of a terrorist organization that attacked the United States and because of that, two American interventions were carried out that further destabilized the Middle East and Afghanistan. Similarly, American intelligence, despite certain documents available, failed to elevate al-Zarqawi to Al Qaeda man in Iraq who is aiming at organizing a terrorist group in Iraq. Finally, al-Baghdadi, today's self-proclaimed caliph of the IS, was detained by Americans at Abu Ghraib and also Camp Bucca detention centers in 2004, where he was recruiting future terrorists, but still was labeled a "low level prisoner" and released. Such failures of American intelligence, and their repetitive manner, is worrisome since the consequences are of the highest degree.

Understanding the Islamic State is far from easy since this organization is hermetic for any infiltration. Is uses the media to spread information about itself but also uses this tool for misinforming. The ground it holds, number of fighters and recruits is constantly fluctuating, and even its goals are constantly being modified. By the end of 2016 it became clear that the IS has been retreating and it is only a matter of time before it falls. A cohesive, multinational action is required to eliminate this threat. Yet, the biggest challenge is organizing Iraq, or helping Iraq organize itself once the caliphate ceases to exist. The Middle East chessboard has always been complicated. The Islamic State and the civil war raging in Syria complement each other and solving only one of these challenges will not stabilize the region. Stabilizing the region and halt the export of terrorists from the region requires solving the Syrian crises, elimination of the IS and these both can be dealt with by collective international engagement, not only at military level but also humanitarian one.

Bibliography and netography

Fryer-Biggs Zachary, *Are the Media Feeding the ISIS Monster*, Newsweek, 2015, http://europe.newsweek.com/feeding-isis-monster-321982?rm=eu

Faeg Binar, *How does ISIS Fund its Reign of Terror*, Newsweek, 2014, http://europe.newsweek.com/how-does-isis-fund-its-reign-terror-282607?rm=eu

Lister Tim, *What does ISIS* really want?, CNN, 2015, http://edition.cnn.com/2015/12/11/middleeast/isis-syria-iraq-caliphate/

Miniter Richard, *Losing bin Laden*, Regnery Publishing, Washington, DC, 2003

Porter Tom, *Isis seized 2,300 armoured vehicles in Mosul alone, reveals Iraqi PM*, International Business Times, 2015, http://www.ibtimes.co.uk/isis-seized-2300-armoured-vehicles-mosul-alone-reveals-iraqi-pm-1503773

Pyne Saikat, *Economics of Terror – Financial model of ISIS*, Business Insider, 2015, http://www.businessinsider.in/Economicsof-Terror-Financial-model-of-ISIS/articleshow/48811725.cms

Thompson Nick, Greene Richard Allen, Torre Inez, *ISIS: Everything you need to know about the rise of the militant group*, CNN, 2014, http://edition.cnn.com/interactive/2014/09/world/isis-explained/

Weiss Michael, Hassan Hassan, *ISIS, wewnątz armii terroru,* Burda Publishing Polska, Warszawa, 2015

The White House, 2015, *Remarks by President Obama and President Hollande of France in Joint Press Conference*, https://obamawhitehouse.archives.gov/the-press-office/2015/11/24/remarks-president-obama-and-president-hollande-france-joint-press

A REVIEW OF ENTERPRISE SUSTAINABLE DEVELOPMENT MODELS: CRITICAL APPRAISAL

Oželienė D.
Department of Social Economics and Management, Faculty of Business Management, Vilnius Gediminas Technical University, Vilnius, Lithuania
Department of Tourism, Faculty of Business Management, Vilniaus kolegija/University of Applied Sciences, Vilnius, Lithuania
E-mail: danguole.ozeliene@dok.vgtu.lt

Abstract. *Sustainable development has become a widely used concept and an important global issue. Enterprises aiming for sustainable development must combine economic interests with environmental and social needs, while keeping economic profit as a priority. A variety of different models of sustainable business issues have already emerged. The major challenges of enterprises include choosing particular model and assessing the sustainable development performance. The purpose of this article is to analyse and critically evaluate various models of enterprise's sustainable development, identify advantages and limitations of existing models and propose procedural model suitable for manufacturing and service enterprises. The enterprises sustainable models will be analysed by covering economic, social, environmental and technological aspects of sustainability. Research will be carried out using analysis of scientific literature and synthesis of various approaches.*

Keywords: SUSTAINABLE ENTERPRISE, SUSTAINABLE DEVELOPMENT, SUSTAINABLE BUSINESS MODEL, TECHNOLOGICAL ASPECT.

Introduction

Climate change, overpopulation, resource depletion, environmental degradation etc. are global trends clearly signaling for a need of sustainable business. Business needs to learn to do more with less because less used resources means less impact on the environment. 30 years ago G.H.Brundland (WCED 1987) defined Sustainable Development as "a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations". Companies have always been the engines for economic development. M. Wilson (2003) claims that the contribution of sustainable development to corporate sustainability is twofold. First, it helps to set out the areas that companies should focus on. Second, it provides a common social goal for companies, governments, and civil society to work towards: environmental, social, and economic sustainability. The need of business to be sustainable is not subjected to discussion as developed countries have already progressed to a state at which critical question is how could organizations be transformed, leading to its contribution to sustainable development. As stated by S. W. Bocken et al. (2014) it is not always clear how delivering social and environmental value might translate into profit and competitive advantage for the company. In order to enable the enterprise to develop sustainability, all processes of the enterprise have to be transformed under the action of dimensions of the sustainability (Ciemleja 2010). G. Ciemleja (2010) concludes that the sustainability of the enterprise depends on its management system and all the processes supporting sustainability of the enterprise are mutually connected, interact, and functional process of each management level is being implemented through dimensions of sustainability. Schaltegger *et al.* (2016) propose the following definition of a business model for sustainability: a business model for sustainability helps describing, analyzing, managing, and communicating a company's sustainable value proposition to its customers, and all other stakeholders, how it creates and delivers this value, and how it captures economic value while maintaining orregenerating natural, social, and economic capital beyond its organizational boundaries.

Research object – models of enterprise's sustainable development.

Research objective – to analyse and critically evaluate various models of enterprise's sustainable development, to identify advantages and limitations of existing models and to propose procedural model suitable for manufacturing and service enterprises.

Research methods – a systematic analysis of scientific literature and the synthesis of various approaches.

Literature Review related to Enterprise Sustainable Development Models

For a long time the traditional responsibility of companies has been simple – just economic survival in a free market context. As pointed out by Freeman (1984) – the only business of business is to do business (Freeman 1984). However, society has changed fundamentally. Organizations are not held responsible for delivering high quality and high–end products and services. They are expected to meet the needs of stakeholders and to ensure that negative social, environmental impact is reduced to a minimum (Jonker, Witte 2006). Business model might provide a structured way for sustainable business thinking by mapping the purpose, opportunities for value creation across the network, and considering possibilities to generate revenue in companies. It provides the conceptual logic, which connects functional activities in a business (such as finance, marketing, R&D, procurement, product design and manufacturing) to one another (Bocken *et al.* 2014). The following academic databases were used forthe literature search: Scopus, EBSCO Publishing, Emerald Management, Taylor and Francis, Science Direct.The author evaluated whether existing models and frameworks found in the literature could be used as an idea to develop new one model.

Models based on three aspects of sustainability

Triple Bottom Line (TBL) typology has been launched by John Elkington in 1997. The aim of the model is to support the decision-making process integrating 3P: People, Planet and Profit. People stand for social well-being and social equity, Planet for environmental quality and Profit for economic prosperity (Figure 1).

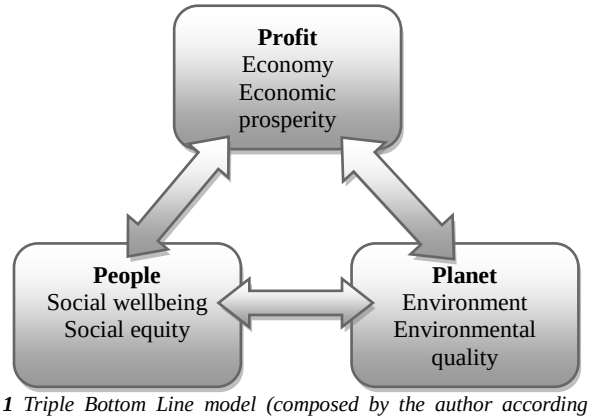


Fig. 1 *Triple Bottom Line model (composed by the author according to*

Elkington 1997)

Though profitability is essential for the survival of organizations, sustainable businesses take two other bottom lines into consideration: natural capital and social capital.

The TBL is an accounting framework which has changed the way businesses, non-profits and governments measure sustainability and the performance of policies. Major problem with the triple bottom line is that the three separate accounts cannot easily be added up. It is difficult to measure the planet and people accounts in the same terms as profits. T. F. Slaper, T. J. Hall (2011) identifies challenges by putting the TBL into practice. These challenges include measuring each of the three categories, finding applicable data and calculating a policy's contribution to sustainability. Making an index that is both comprehensive and meaningful as well as identifying suitable data for the variables that compose the index is another challenge. L. Dagilienė (2014) notes that despite the complexity of the calculation methodology TBL had a huge influence on the Dow Jones index development. Beyond the foundation of measuring sustainability on 3P, the flexibility of the TBL allows organizations to apply the concept in a manner suitable to their specific needs. The companies like DHL, Seventh Generation, EnviroPure Systems, The Eco-Laundry Company, Patagonia and many others are proof that triple bottom line operations *are* possible and inspiring others in the process.

J. Jonker, M. Witte (2006) presented 3H (Head, Heart, Hands) model created by F. Bergmans (2006) which is very similar to 3P. Author notes that managers respond with their intellect (head), feelings (heart) and knowledge about behavioural practices (hands). These three perspectives can be visualised as a triangle; each side has its own meaning:

- Head-Heart: Who are you? (the balance between rationality and feeling);
- Heart-Hand: How do you do it? (the mutual influence of feeling and action);
- Head-Hands: What is the impact? (the evaluation of whether it works as you want).

The integration of the 3P triangle and the 3H triangle leads to three other triangles that show in visual terms the decision-making process (Figure 2).

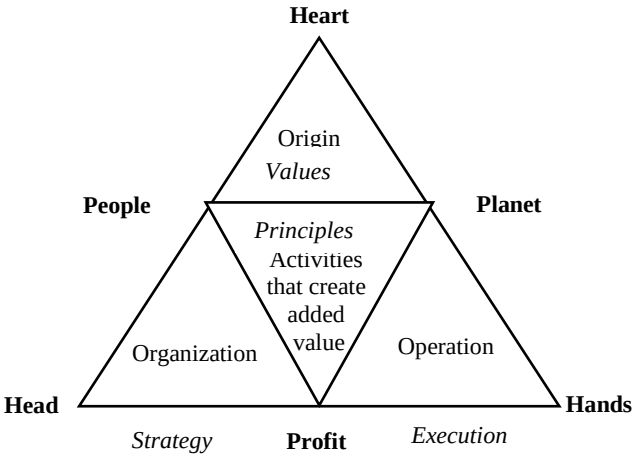


Fig. 2 *Head, Heart, Hands Model (composed by the author according to Bergmans 2006)*

Figure 2 shows that this new triangle also includes the following corner segments:

- Operation: What are we going to do?
- Organisation: How are we going to do it?
- Origin: Why are we going to do it?

Integrating People, Planet and Profit means bringing coherence to the threeperspectives: origin, organisation, and operation. To successfully achieve thislinking process it is important to understand the driving forces behind the three perspectives. The aim of 3P model is to support the decision-making process in integrating People, Planet and Profit. By defining six driving forces in three perspectives, management and staff can focus discussion on the essence of sustainability for their company. According to G. Brazdauskaite (2010) the big challenge is to formulate a mission statement which really touches the hearts of the people involved in the company. Belonging to the company makes people feel proud and subsequently leads to shared ambitions. The mission is made alive through the devotion and commitment of the staff to their work.

Models based on the Deming Cycle

Occasionally companies may find it difficult to identify actions that should be taken in order to reach sustainability. The SIGMA model provides a principle based framework to organize, understand and deliver more effective sustainable development management. The four phase framework enables organizations to apply existing management approaches and systematically manage sustainability issues in an integrated way. It is important to note that organisation may enter the cycle at different points and work through the phases at different speeds according to their particular circumstances and existing systems (Guidelines 2015).The Deming cycle (Plan, Do, Check, Act) plays a major part in many standards and frameworks that can be linked to sustainable development. The SIGMA Management Model uses Deming cycle as its basis to ensure compatibility with these standards without incurring excessive duplication in any of their core elements.The SIGMA Guidelines consist of two main parts (Guidelines 2015, Jonker, Witte 2006):

- Guiding Principles – support the development of organisation specific principles and enable practitioners to understand what their organisation might look like if it was sustainable.
- Management Framework – enable a systematic approach to be taken to the development, delivery, monitoring and communication of an organisation's sustainable development strategy and performance.

Model is represented by four phases:

- Leadership and Vision - defining the vision for sustainability and ensuring leadership,
- Planning - deciding what needs to be done to improve performance,
- Delivery - improving performance,
- Monitor, Review and Report - checking that performance is improving and communicate results (see Figure 3).

This enables alignment to established management processes, systems and standards. The key difference between SIGMA and any other management systems is that SIGMA is underpinned by the guiding principles of the five capitals and accountability, which provide the basis for all sustainable activity. An organisation is required to maintain and enhance natural, human, social, manufacturing and financial capitals, as well as accountability (Brazdauskaite 2010).

The COMPASS methodology is also based on a Plan-Do-Check-Act management cycle.

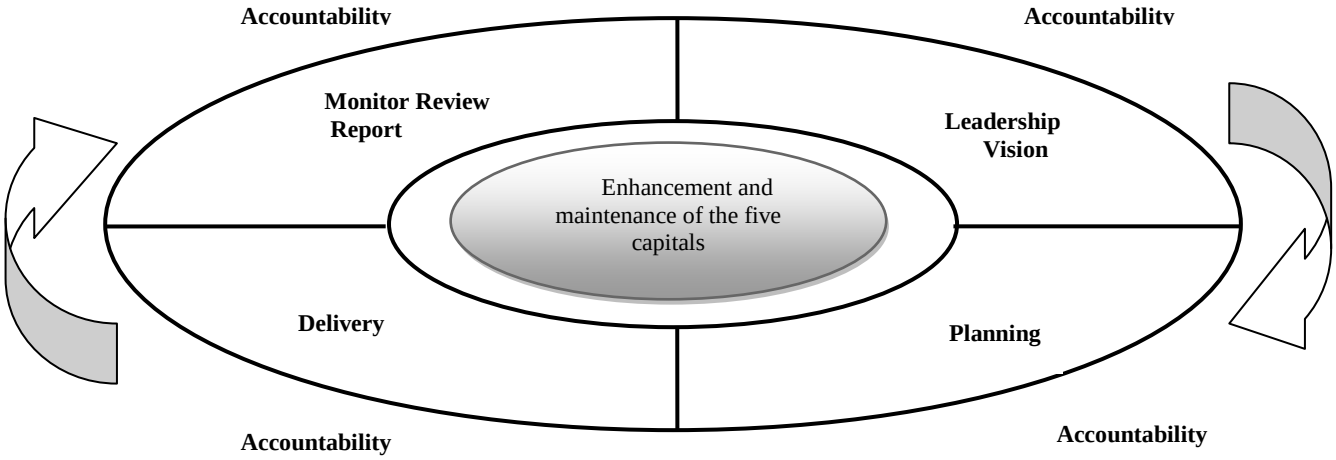


Fig. 3 *The SIGMA Management Model (composed by the author according to by Knight 2006)*

The COMPASS means path to Sustainability of COMPAnies and Sectors. This methodology is a management system designed by M. Kuhndt and C. Liedtke in 1999 (Kuhndt, Liedtke 1999). It combines the five elements: COMPASSprofile, COMPASSvision, COMPASSanalysis, COMPASSmanagement, and COMPASSreport (figure 4). G. Brazdauskaite (2010) notes that it is a methodological framework for applying the normative concept of sustainability at the micro-level. COMPASS profile aims to describe the state of knowledge about economic, social and environmental performance issues within the organization or sector and the expectations of different stakeholders facing the organization or sector. In its vision COMPASS sees combination of available knowledge, alignment of different levels of knowledge, qualification and motivation of employees from different hierarchy levels, phrasing of visions, guidance and concrete targets. COMPASS analysis comprises the actual measurement of performance and thereby identifies particularly critical and important technical and organisational improvement areas. COMPASS management finally ensures the translation of the target set and indicators selected into decision-making processes by oviding suitable management instruments (Jonker, Witte2006). In conclusion, sustainable development relates to an unlimited time horizon and is an ongoing dynamic process.The outcomes can be used at the corporate level as internal benchmarking, product and process innovation, monitoring value creation.

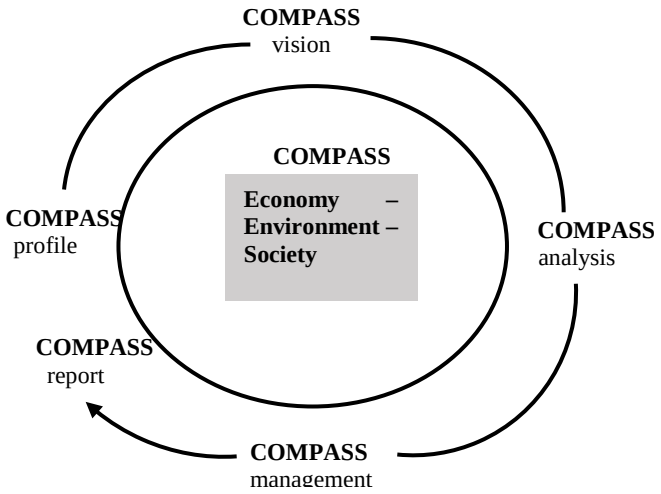


Fig. 4 *The COMPASS model (composed by the author according to Kuhndt, Liedtke 1999)*

Model based on Balanced Scorecard approach

According J. Jonker, M. Witte (2006) RainbowScore take into account all strategic aspects of the company and measuring the outcome. The company and its basic dimensions are viewed as a rainbow. Seven colour frame is described by seven business and people aspects and present an explicit value creation structure. Model provided in Figure 5.

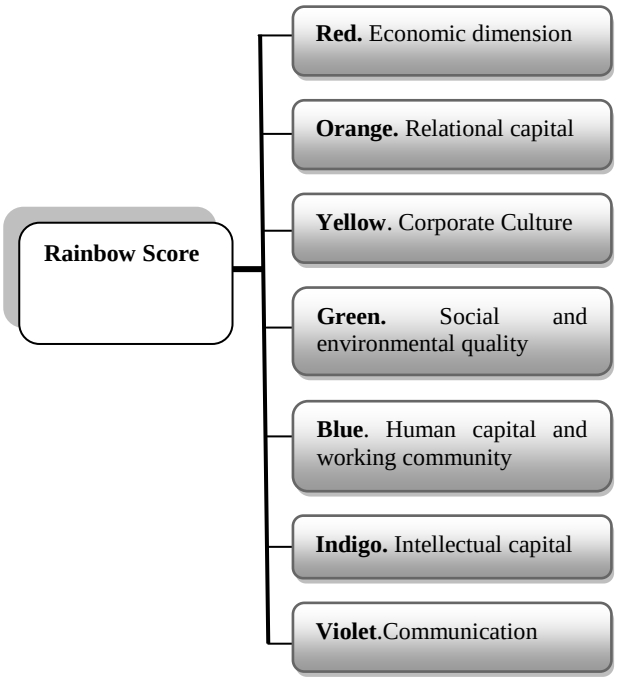


Fig. 5 *RainbowScore Model (composed by the author according to J. Jonker, M. Witte 2006)*

RainbowScore supports innovating and planning steps, making available figures to verify and check a path to achieving strategy. It is noted that the RainbowScore will create greater awareness and effectiveness, thus resulting in tremendous benefits for the company. However we cannot expect every aspect to be equally successful at the same time. Initially it might seem that RainbowScore complicates company's life but in reality RainbowScore helps to explain the reasons for the company's success and suggests actions to improve it. It should be noted that Balanced Score provides no explicit reference to sustainability, but focus on profitability of a company in relation to other corporate objectives.

Integrated Models

The Molecule Model was designed by Folkerts and Weijers in 2004. The aim is to help firms integrate the concept of sustainable development into their strategies and every day operations and provide a starting point for a company to renew its strategy and redesign its operations, and hence to find and achieve new,

distinctive business propositions (Jonker, Witte. 2006). The model consists of seven related key words that can be developed step bystep. It is symbolised by a molecule consisting of seven atoms (Figure 6).

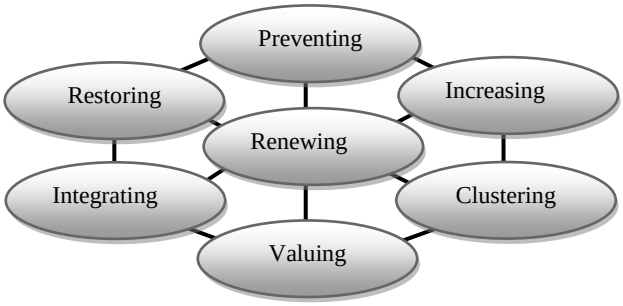


Fig. 6 *The Molecule Model (composed by the author according to Folkerts, Weijers 2004)*

The model gives companies a better understanding of sustainability, and helps them to define their position and develop their strategy.

The Global Compact Performance Model is a framework designed to systematically guide companies in their ongoing efforts to implement the Global Compact's ten principles in the four areas of human rights, labour standards, the environment and anti-corruption. Model has been designed to appeal to the widest number of businesses, from large multinational Corporations to small and medium sized enterprises, wherever they are based or are operating, and regardless of their industry sector.The Global Compact Performance Model is composed of ten elements of business practice (see Figure 7), each of which is represented by a separate segment of the diagram.

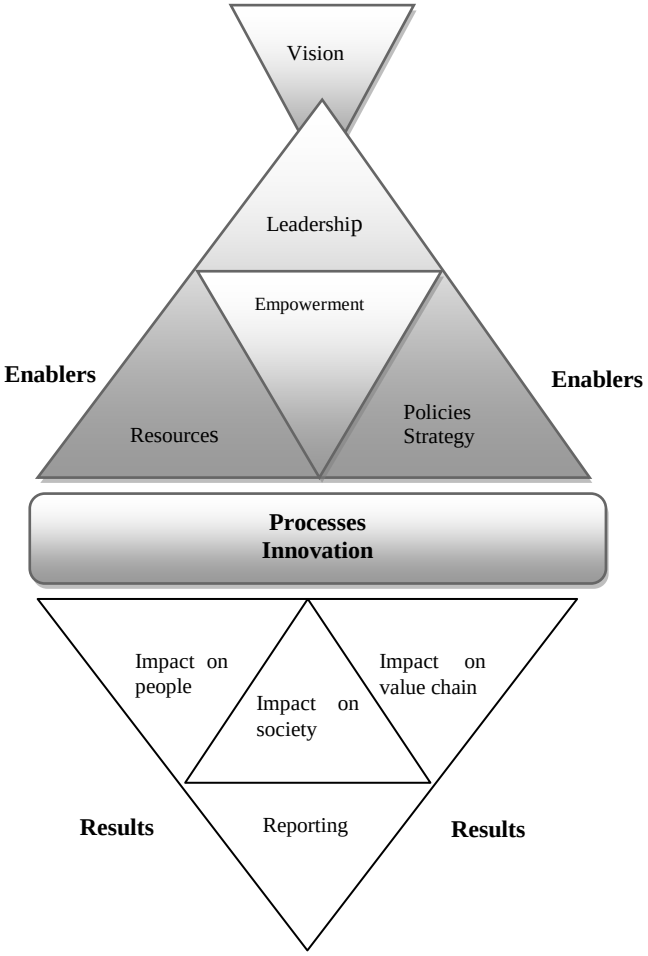


Fig. 7 *The Global Compact Performance Model (composed by the author according to Fussler 2004)*

Model divided into two parts - „enablers" and „results". „Enablers" are the foundational elements that help create an enthusiastic, focused, winning organisation capable of achieving its vision. Whereas „results" – define the key outcomes sought.Companies that have signed onto the Global Compact are expected to worktowards implementation of the ten principles and to communicate with their stakeholders on an annual basis regarding work progress. The accessibility and relative simplicity of the Performance Model are particularly useful for companies that do not know how to implement the principles into practice. 9269 companies participants from 166 countries are now involved in the Global Compact's – the world's largest corporate sustainability initiative (Global Compact Network 2017). Companies are looking for reliable, objective guidance to begin their efforts to embrace corporate sustainability. Research confirms that companies who explicitly consider sustainability topics widen their company's view on risks and opportunities and therefore increase long-term value creation. There are a number of ways to inform the society about enterprise activities and the achieved results in the area of sustainability. One of them is the *Global Compact* – the world's largest voluntary enterprise social responsibility initiative pursuing two major objectives:

1. To help enterprise to implement the principles of "the Global Compact" into the enterprise strategy.

2. To encourage cooperation and partnership between different sectors within or outside the country when seeking universal objectives of global development.

It should be noted that Global Compact high level principles generally refers to human rights and environmental standards. Whereas link to economic sustainability is uncertain.

Wayne McPhee (2014) presented Sustainable Activity Model which is very similar to the process for using M. Porter's value chain where the firm's activities are evaluated within each element of the model and also looking at how the elements can work in harmony to create additional value. The model consists of sustaining activities and product- focused actvities. Sustaining activities are not directly included in the productlife-cycle, but they can create value directly by supporting value creation across the organization. The model recognizes that the resilience and long-term value of a firm are not just created by a collection of products but by the people, systems and ideas that form the foundation of a company.

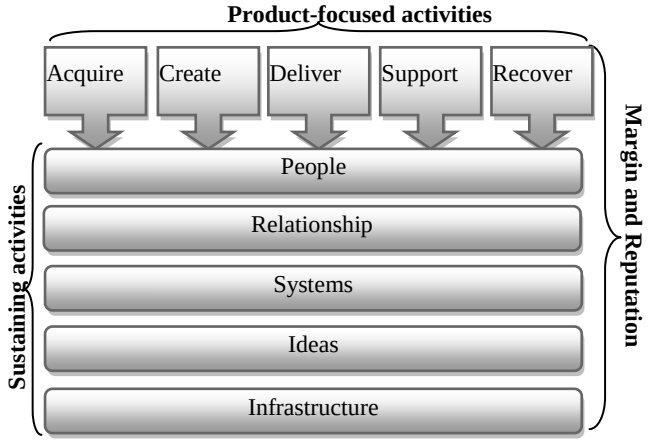


Fig. 8 *Sustainable activity model (composed by the author according to Wayne McPhee 2014)*

Using this model that includes all of a company's core activities allows both practitioners andmanagers to identify all of the areas where there are opportunities to create value and manage risks.

Sustainable Value Creation models

Value creation is at the heart of any business model. An enterprise is a complex system satisfying not only the needs of consumers but also the expectations of all stakeholders. L. Michelini (2012) distinguishes two global phenomena. The first phenomenon is an evolution from the concept of Corporate Social Responsibility to the Creating Shared Value approach. The second phenomenon is the increasing role of emerging market economies in the global economy and the growing importance of the bottom of

the pyramid market segment. M. Porter, P. Kramer (2011) have highlighted the mutual dependence that exists between corporations and society, implying that both business decisions and social policies must follow the principle of creating shared value with choices benefiting both sides. M. Porter, P. Kramer (2011) suggest three aspects creating shared value:

- reconceiving products and markets;
- redefining productivity in the value chain;
- building supportive industry clusters.

Reconceiving products and markets means rethinking company's products with regard to society's needs and the benefit or harm which is inherent to them. Considering the needs of society incentive corporate innovativeness and hence leads to new opportunities for differentiation. According to L. Michelini (2012) creating shared value approach means a connection between private enterprises and the public interest that produces profitable and sustainable change for both sides. J. Schmitt (2013) notes that shared value is closely linked to sustainability issues. On the company level, shared value enhances the productivity of employees and the productivity within the value chain. On the societal level, the active internalization of social needs by business helps to better customize products and services to the needs of customers. By integrating society's needs into the value creation activities, shared value helps to improve direct working and living conditions along with company's supply chain. M. Yunus *et al.* (2015) distinguish three key characteristics of modern business: first of all, is a seek to alleviate social problems, including all forms of poverty, second of all, company should be run sustainably but it should not lose money and the third – profits are reinvested in the business rather than funneled back to shareholders. J. Schmitt (2013**)** claims that current sustainability approaches do not consider creating value in a way that also contributes to promoting society. P. Bilge *et al.* (2014) propose value creation framework (Figure 9).

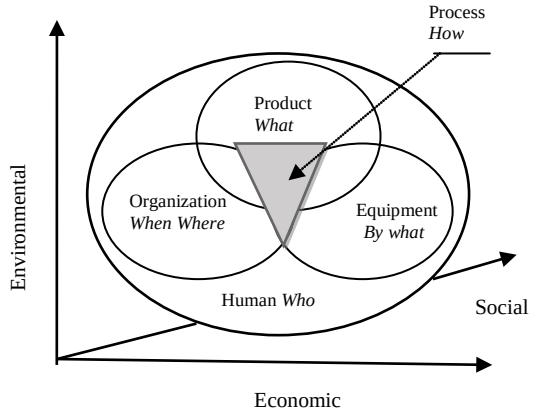


Fig. 9 *Value creation model (composed by the author according to Bilge et al. 2014)*

Companies create value by satisfying customer needs and shareholder requirements to deliver products or services while securing shared benefits for all stakeholders: suppliers, manufacturers, distributors and customers.

Limitations of existing models

Enterprises should promptly react to changes in order to remain competitive in the present globalization process. Literature review shows that in order to enable continuous growth and competiveness of the company, implementation of sustainable development principles should be considered. However, sustainable development is not based only on economic, social and environmental aspects. Proper technology of processes is also essential for successful development of every company. Goals, employees and technologies are the basic units of an organization. People utilize technologies to reach organizational aims. Moreover, utilizing technologies that are sustainable grants more benefits for the organization, such as reduction of consumption of natural resources, increased

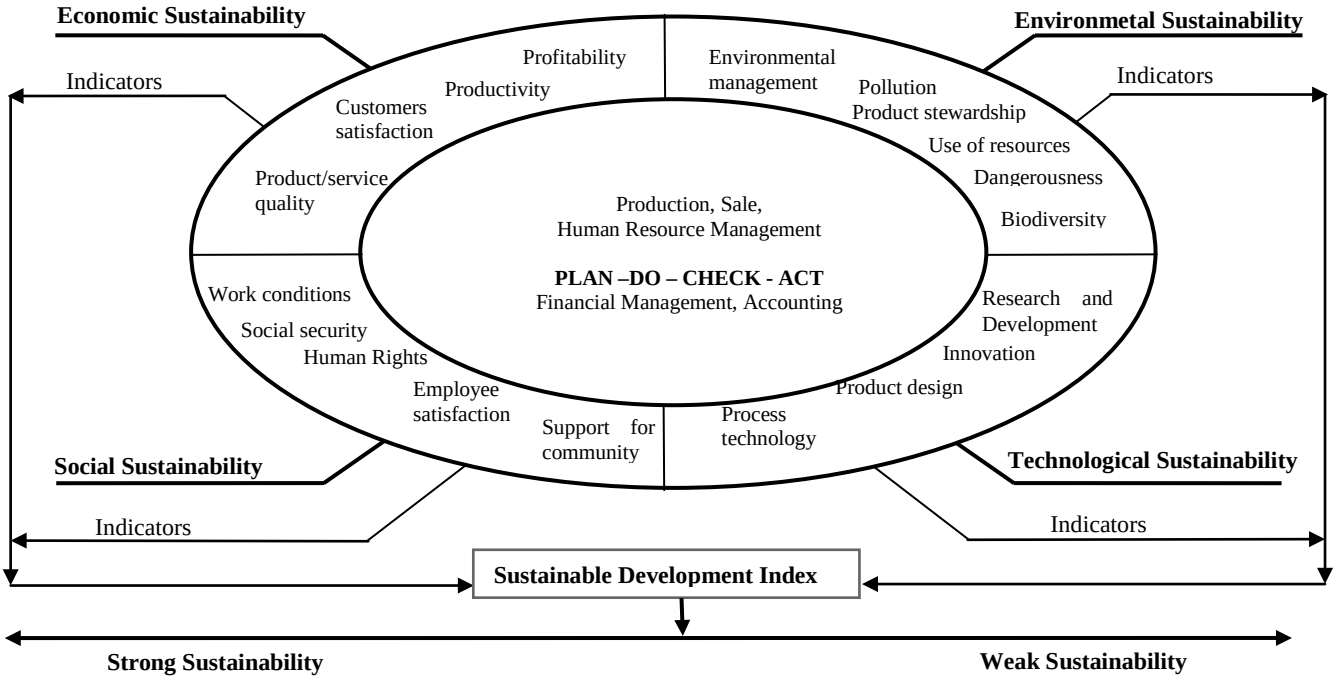


Fig. 10 *Sustainable Enterprise Model (composed by author)*

economical profit and competiveness, improved quality of a product and reliability of service. Therefore, organization receives social, environmental and financial benefit. Technologies are important in both, production and provision of services as they enable development of innovations. K. Mulder *et al.* (2011) note that technological change will create social change by offering new options, social change will trigger new needs and new conditions for technology. Z. A. Frmanzah (2015) argues that in practice, management should realize that technology adoption is not a static process. It is not only about relationship between some resources both inside and outside organization but also the ability of the organization to recognize the values of novelty in the external form then assimilate and apply it for commercial purposes. Company like Walmart has proven success in adopting technology for boosting

the company's performance based on proactive involvement of their supply chain manufacturers or vendors to end-user customers. As well as Dell's success with their logistics and supply chain technology adoption.

Sustainability is an issue that goes to the heart of the structure and conduct of business. According to P.Wells (2014) new product technologies do more than just change the character of the product itself, they enable innovative business models and new structural relationships.

R. Botsman, R. Rogers (2010) agrees that every aspect of the growing/sharing economy business models has been affected by the growing technology importance and is the most impactful feature driving the sharing economy. In conclusion research confirms technological aspect demand in the model of enterprise sustainable development.

Based on the information gathered in this research and identified limitations of current models the author propose an improved model based on four aspects of sustainability and Plan – Do –Check – Act cycle (Figure 10).

The core activity areas of enterprise are shown in the middle of the circle. This is Production, Sale, Human Resource Management, Financial Management and Accounting. Deming cycle is chosen as an effective way of demonstrating organisational activities in the enterprise. The circle demonstrates four aspects of Sustainable Development: Economic, Social, Environmental and Technological. Each chapter consist of elements of particular Sustainable Development aspect. For instant, Environmental Sustainability content consist of Environmental Management, Product Stewardship, Use of Resources, Pollution, Dangerousness, Biodiversity. In order to identify measurable indicators and assess relative weights further mathematical calculations must be performed. This would help to calculate the Index of Sustainable Development. The index shows whether strong or weak sustainability is achieved. To achieve reliability of the results a few indicators are needed.The sustainability measurements have to take into account all sustainability aspects (environmental (En), economic (E), social (S) and technological (T)). I. H. Garbie (2014) suggests the index to be calculated as a function of each sustainability aspectusing the equation below:

$$S = \begin{Bmatrix} En \\ E \\ S \\ T \end{Bmatrix} = f(En, E, S, T) \qquad (1)$$

where S- sustainability, En, E, S, T – aspects of sustainable development.

To estimate general Index of sustainable development equation (2) is needed:

$$I_{SD} = w_{En}(I_{En}) + w_E(I_E) + w_S(I_S) + w_T(I_T) \quad (2)$$

where w_{En}, w_E, w_S, w_T – relative weight aspects of sustainable development, I_{En}, I_E, I_S, I_T – indexes of each sustainable development aspects, I_{SD} – Sustainable Development Index.

Conclusions

The way businesses operate needs to change considerably to address systemic challenges needed to deliver sustainability. Sustainable business is a holistic approach of thinking of business which seeks to integrate consideration of the three aspects of sustainability – social, environmental and economic – in a manner that balances value created for all stakeholders including the environment and society at all levels and through all activities of the business.

Literature review provides analysis of how different models work. 9 models (Triple Bottom line, Heart – Head – Hands, Sigma Management, Compass, Rainbow Score, Molecule, Global Compact Performance, Sustainable activity, Shared value) have been analyzed.

Models were categorized into five groups (based on three aspects of sustainability, on Deming cycle, on Balanced Score, integrated and Sustainable value creation models).

According to literature review technological aspect needs to be included in sustainable business model. Since proper technology of processes is essential for successful development of every company and technological change, it will create social change and vice versa.

Composed sustainable development model provides further actions to effective implementation of the manufacturing and service companies. Calculated index value shows to interested parties whether strong or weak sustainability is achieved as it strategically important to company's growth.

References

Bilge, P.; Badurdeen, F.; Seliger, G.; Jawahir, I. S. 2014. Model-based Approach for Assessing A Value Creation to Enhance Sustainability in Manufacturing. *Procedia CIRP* 17: 106 – 111. Available from the Internet: www.sciencedirect.com.

Bocken, N. M.; Rana, P.; Short, S. 2015.Value Mapping for Sustainable Business Thinking. *Journal of Industrial and Production Engineering*, 32: 67-81.

Bocken, S. W.; Short, P.; S.; Evans, R. S. 2014. A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production* 65: 42-56.

Botsman, R., Rogers, R. 2010. Beyond zipcar: Collaborative Consumption. Harvard Business Review, 88, 30.

Brazdauskaite, G. 2010. Integrated Framework for Corporate Social Responsibility: Organisational Capability Approach. Doctoral Dissertation, Mykolas Romeris University, Vilnius, p.158.

Ciemleja, G 2010. The Sustainable Performance of Small and Medium-Sized Enterprises. Problems and Solutions. Doctoral Dissertation, Riga Technical University, Riga, p.194.

Dagilienė, L. 2014. Socialinė apskaita: teorinė argumentacija ir vertinimas. KTU.Technologija. p. 235.

Elkington, J. 1997. Cannibals with Forks**.** The Triple Bottom Line of 21st Century Business Capston, Publishing Ltd, Oxford.

Freeman, M. 1984. *Strategic Management: A Stakeholder Approach*, Cambridge University Press, New York.

Frmanzah, Z. A. 2015. The Effect of Dynamic Capability to Technology Adoption and its Determinant Factors for Improving Firm's Performance; Toward a Conceptual Model. 11th International Strategic Management Conference. Procedia - *Social and Behavioral Sciences* 207: 786 – 796.

Fussler, C.; Cramer, A.; Vegt, S. 2004. Raising the Bar, Creating Value with the United Nations Global Compact, Sheffield: Greenleaf Publishing.

Yunus, M.; Dalsace, F.; Menasce, D.; Tavignot, B. F. 2015. Reaching the Rich World's Poorest Consumers. Harvard Business Review. 3: 46–53.

Jonker, J.; Witte, M. 2006. Management Models for Corporate Social Responsibility, Springer Berlin Heidelberg, New York.

Garbie, I. H. 2014. An Analytical Technique to Model and Assess Sustainable Development Index in Manufacturing Enterprises. *International Journal of Production Research* 16: 4876–4915. Available from the Internet: http://www.tandfonline.com/doi/abs/10.1080/00207543.2014.893066.

Global Compact Network. 2017. Available from the Internet: https://www.unglobalcompact.org/what-is-gc

Kuhndt, M. ; Liedtke, S. 1999. Die COMPASS-Methodik, COMPAnies and Sectors path to Sustainability. *Wuppertal Papers* Nr. 97, Wuppertal Institut.

Michelini, L. 2012. Social Innovation and New Business Models Creating Shared Value in Low-Income Markets.

McPhee, W. 2014. A New Sustainability Model: Engaging the Entire firm. *Journal of Business Strategy*, 2: 4 – 12.

Mulder, K.; Ferrer, D.; Lente, van H. 2011. What is Sustainable Technology? Perceptions, Paradoxes and Possibilities.

Porter, M.; Kramer, M. 2011. Creating Shared Value. Harvard Business Review. 1: 62–77.

Schaltegger, S.; Hansen, E.; Ludeke-Freund, F. 2016. Business Models for Sustainability. *Organization and environment*. 1: 3-10.

Schmitt, J. 2013. Social Innovation for Business Success Shared Value in the Apparel Industry. Springer Gabler. p. 91.

Slaper, T. F.; Hall, T. J. 2011. The Triple Bottom Line: What Is It and How Does It Work? Indiana Business Review, Spring. 4-8.

The SIGMA principles. 2015. Available from the Internet: http://www.projectsigma.co.uk/.

Wells, P. 2004. Creating Sustainable Business Models: The Case of the Automotive Industry. Green Management. IIMB Management Review. 12: 15-24.

Wilson, M. 2003. Corporate Sustainability: What is it and where does it come from?, *Ivey Business Journal*, March/April. p. 1-5.

World Commission on Environment and Development (WCED). 1987. Our common future. Oxford, Oxford University Press, 470 p.