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CONTENT/SADRŽAJ

A Message from the Editor-in-Chief

Serbian Journal of Engineering Management is a new scientific journal, published by School of Engineering Management and Society of Engineering Management of Serbia. This international journal is dedicated to the wide scope of themes in engineering management and industrial engineering and is published semiannualy. The papers are presented in English, Serbian and other former Yugoslavian languages.

Themes included in the journal are: Engineering management, Industrial engineering, Project management, Strategic Management, Logistics, Operations management, Production systems management, Quality control, Quality management, Entrepreneurship, Risk management, Human resources management, Financial management, Information systems, High technologies management, Environmental management, Maintenance management, Creative industries management, Security management, and Marketing.

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Information on the journal in English and Serbian can be found at the journal web page: http://fim.edu.rs/en/serbian-journal-of-engineering-management/.

Prof. Dr. Vladimir Tomašević, FRSA

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Serbian Journal of Engineering Management je nov naučno-stručni časopis, koji izdaje Fakultet za inženjerski menadžment i Društvo inženjerskog menadžmenta Srbije. Ovaj međunarodni časopis je posvećen temama inženjerskog menadžmenta i industrijskog inženjerstva i izlazi dva puta godišnje (u januaru i julu). Zastupljeni jezici su engleski, srpski, kao i jezici država bivše SFRJ.

Teme zastupljene u časopisu su: inženjerski menadžment, industrijsko inženjerstvo, upravljanje projektima, strategijski menadžment, logistika, menadžment operacija, menadžment proizvodnih sistema, kontrola kvaliteta, upravljanje kvalitetom, preduzetništvo, upravljanje rizikom, upravljanje ljudskim resursima, finansijski menadžment, informacioni sistemi, menadžment u visokotehnološkim industrijama, menadžment životne sredine, menadžment održavanja, menadžment kreativnih industrija, bezbednosni menadžment i marketing.

Uredništvo časopisa čine istaknuti naučnici iz različitih zemalja sveta koji su posvećeni postavljanju visokog akademskog standarda i promocije principa inženjerskog menadžmenta u Srbiji.

Informacije o časopisu i poziv za autore, na srpskom i engleskom jeziku, nalaze se na web stranici časopisa: http://fim.edu.rs/en/serbian-journal-of-engineering-management/.

Prof. dr Vladimir Tomašević, FRSA

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Nova paradigma u recikliranju - inovativni pristup recikliranju plastičnog otpada u Srbiji

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Apstrakt: Ključni problemi recikliranja plastičnog otpada u Srbiji su neadekvatna zakonska regulativa i niska otkupna cena otpadne plastike koja ne predstavlja podsticaj za njeno sakupljanje u većoj meri. Ovaj rad predlaže metod za recikliranje plastike koji se bazira na pirolitičkoj konverziji plastičnog otpada u supstitute goriva kao primarni način reciklaže. Metod se ogleda u više različitih smernica za njegovu primenu. One su detaljno objašnjene i prikazane u ovom radu. Ukoliko bi zakonodavac prepoznao ovaj metod recikliranja kao društveno odgovorno poslovanje i uneo određene izmene u zakonskoj regulativi, i ukoliko bi navedene smernice bile ispoštovane, implementacijom ovog metoda mogao bi se stvoriti prostor za veću otkupnu cenu plastičnog otpada. Ekonomski posmatrano, viša cena otkupa povećala bi ponudu, odnosno podstakla sakupljanje plastičnog otpada u većoj meri što bi imalo pozitivan ekološki efekat uz ekonomsku opravdanost.

Ključne reči: Recikliranje plastike, piroliza, zamena za dizel, ekološki.

A New Recycling Paradigm - an Innovative Approach to the Plastic Waste Recycling in Serbia

Abstract: The key problems of plastic recycling in Serbia are inadequate legislation and low purchase price of plastic waste, which is a poor incentive for plastic waste collecting. This paper suggests the method for plastic waste handling in Serbia by means of pyrolytic conversion into fuel substitutes as primary recycling method. It is reflected in several guidelines for its application, which are explained in detail, proved and given in this paper. If the state recognized this method as a socially responsible business by introducing certain legal regulation changes and if the above guidelines were followed, the implementation model could make a room for a higher purchase price of plastic waste. In economic terms, higher price would increase supply by encouraging the collection of plastic waste to greater extent, which would have a stronger environmental impact with economic justification.

Keywords: Plastic recycling, pyrolysis, diesel supstitute, ecological.

1. Introduction

Assessment of plastic flows and stocks in Serbia using material flow analysis revealed that approximately 269,000 tons of plastic materials *per annum* were directly disposed in uncontrolled landfills on its territory without any pretreatment (Vujic, Jovicic, Babic *et al*., 2010). Prokic and Mihajlov (2012) also concluded that the waste management in Serbia is inadequate. Environmental and health concerns are integral part of this problem. The national goal in the management of packaging waste, set by the regulation on the establishment of the packaging reduction plan for the period from 2015 to 2019 ("*Uredba o planu smanjenja ambalažnog otpada za period od 2015. do 2019. godine",* "*Sl. glasnik RS"* no. 144/2014), amount 22.5% of recycled plastics waste (PW) per year. The Association of Recyclers of Serbia has repeatedly expressed concern, through public media, about the low level of plastic waste recycling. They repeatedly appealed to the state to introduce some changes towards recycling regulations and stated that they use only 30% of their recycling capacity. There are multiple reasons for this. The main reason lies in the plastic recycling method itself. Plastics waste management can be subdivided into three following hierarchical sequence (Buekens and Schoeters, 1998):

1. mechanical or materials recycling, preserving the macromolecular structure of plastics polymers;

2. chemical or feedstock recycling, converting plastics into monomers or petrochemical feedstock, and
3. energy recycling, such as in the incineration with heat recovery of plastics contained in municipal solid waste.

The first one, which is most commonly used method in Serbia, consists of the following steps: collecting, sorting, grinding/shredding, floating, contaminant separation, milling, washing and drying, chemical washing, melting and pelletizing plastic materials. It is obvious that a serious approach to the preparation and processing of PW is necessary since the final recycling product must be consisted of exactly one type of plastic with no impurities because it is later used for the further manufacture of plastic products. In addition, the obtained product has a lower quality than the starting material and can't be used to produce all range of plastic products. The initial investment, complexity of the process and a relatively low price of non-recycled, new plastic dictate the low purchase price of PW in order for the recycling plant to profit. Furthermore, waste disposal system in Serbia, in the greatest extent, does not include sorting of waste. All municipal waste goes to common dumpsters and is disposed on same landfills. This means that recycling companies are forced to buy much of their raw material from groups and individuals who earn their living by collecting and sorting waste (SECOL). This is obviously a huge drawback of the recycling process since those individuals stated that they have been rather choosing to collect paper and metal instead of plastics due to the low PW purchase price. Through market research, which consisted of contacting 25 recycling companies and numerous individuals from branch, it was established that the maximum price that could be obtained by SECOL for kilogram of well-prepared PW in Serbia amounts approximately € 0.25. The goal of this manuscript is to review and suggest a new approach to PW recycling in Serbia that would allow for a higher purchase price of PW and thus encouraged collection of PW in greater extent.

The method proposed by this paper is pyrolytic conversion of PW into fuel substitutes. It is regarded as a primary recycling process rather than plastic granules production. The definition of thermal pyrolysis given by Stauffer (2003), says that it is a process, by which a solid (or a liquid) undergoes degradation of its chemicals into smaller volatile molecules by means of temperature, usually between 350°C and 900°C, without interaction with oxygen or any other oxidants, that is necessary for almost all solids (or liquids) to burn. PW pyrolysis process consists of steps shown in the following scheme (Fig. 1):

Fig. 1 - Simplified scheme of the plastic and tire waste pyrolysis process

The process results in different products: liquid oil, gases, char, wax and additional residues that depended on what has been fed into the reactor (Miandad, Barakat, Aburiazaiza *et al.*, 2016; Owusu *et al.*, 2018; Xingzhong, 2006; Soganciogl u, Ahmetli and Yel 2017; Demirbas, 2004). The liquid products from PW could be considered as a mixture of heavy naphtha, gasoline and light gas oil fractions (Dembiras, 2004; Owusu et al., 2018). A large number of studies have been conducted on this subject and all indicated the use value of the products obtained by this route. The literary data supporting the goal will be presented. The review will consider which type of plastic waste is suitable for the pyrolysis, which process yield favorable results – continuous or batch, and where the potential application of the described method could be found.

Table 1. The list of acronyms and abbreviations

HDPE	High-density polyethylene	**PS**	Polystyrene
LDPE	Low-density polyethylene	**PVC**	Polyvinyl chloride
PE	Polyethylene	**PW**	Plastic waste
PET	Polyethylene terephthalate	**SECOL**	Secondary raw material collectors
PO	Plastic waste pyrolysis oil	**WTPO**	Waste tire pyrolysis oil
PP	Polypropylene		

2. Methods of collecting data and experimental set up

The data used in this study belong to the primary and secondary collection of data. For the purpose of an economic and feasibility analysis the current prices of energy products, raw materials, PW and equipment were needed. The market research was conducted based on direct contact with recycling companies, equipment manufacturers and individuals from the branch. Considering the presented paper, which aims to investigate and suggest an implementation model, the data relating to techno-economical aspects were obtained from the first-hand experience through the construction of pilot pyrolysis batch reactor (Fig. 2) that was carried out with the courtesy and efforts of Filip Dimov[1]. The material used for the key elements of the reactor consisted of a: 220l tin barrel for the outer shell; a 50l liquid petrol gas tank used as a reactor; two large flanges allowing feeding of the reactor; 6kW iron-chromium-aluminum (FeCrAl) wire heaters – which were submerged into chamotte and wrapped around the reactor; an 0-800°C adjustable thermostat; ≈150 kg of chamotte powder; stone mineral woo; plastic and metal pipes and a mild vacuum pump.

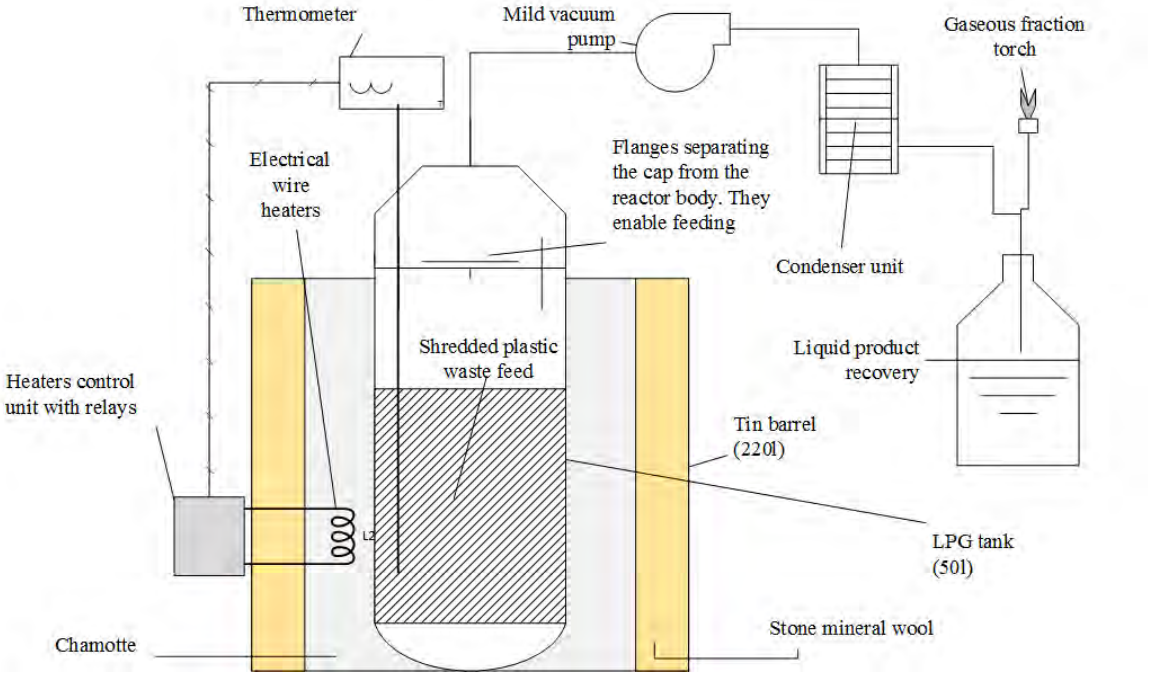

Fig. 2 – Scheme of the constructed setup and pyrolysis batch reactor

The presented literature data was chosen referring to the goals of this manuscript, based on the process of pyrolytic transformation of plastic waste into fuel substitutes, rather than plastic granules production. They will be presented here as a primary recycling process that could supplement the existing recycling methods in Serbia. The review will consider what type of plastic waste is suitable for pyrolysis, which process gives better results - continuous or batch one and where the potential application of the product of pyrolysis, liquid pyrolysis oil, can be found.

3. Conversion of plastic waste into fuel substitutes by means of pyrolysis

3.1 Potential application of liquid pyrolysis oil

Mani, Subash and Nagarajan (2009) analyzed and compared properties of the oil derived from waste plastics with the petroleum products and found that it had properties similar to that of diesel. Some of their conclusions were that engine was able to run with 100% PO; ignition delay was longer by about

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2.5 CA in the case of PO compared to diesel; smoke was reduced by 40% at rated power in PO compared to diesel operation and that engine fueled with PO exhibited higher thermal efficiency up to 75% of the rated power. According to Owusu *et al.* (2018), the results of density, kinematic viscosity, dynamic viscosity, distillation range and calculated cetane index of PO were comparable with conventional transportation fuel. Miandad *et al.* (2016) also found that PO were similar to conventional diesel, thus had potential to be used as alternative energy source for electricity generation. However, presence of high aromatic compounds in liquid oil made it unsuitable as a transport fuel until it was upgraded using different post-treatment methods such as distillation, refining or blending with conventional diesel. The use of pyrolysis liquid oil as transport fuel has been successfully tested after blending with conventional diesel at different ratios (Demirbas, 2004; Islam *et al*., 2010; Lee *et al.,* 2015) blended 20 and 40% of pyrolysis liquid oil with conventional diesel and concluded that at 20%, a successful engine running was achieved. Kaimal and Vijayabalan (2015) concluded that a 25% plastic oil–diesel blend could be considered as an effective replacement for diesel in compression ignition engines without any modifications. Furthermore, disposal of waste automotive tires, one of the most important problems hand in hand with plastic, could be solved by means of pyrolysis in the same manner as it was described for plastc waste (Islam *et al*., 2010; Hürdoğan et al., 2017; Vorkapic et al., 2010). Hurdogan, Ozalp, Kara and Ozcanli (2016) found that the blends of waste tire pyrolysis oil (WTPO) could also be efficiently used in diesel engines without any engine modifications and that blend with 10% of WTPO in diesel could be the best alternative fuel blend for diesel engines, not only for its performance characteristics but also for the environmental aspects.

3.2 Plastic waste suitable for pyrolysis

Contrary to common plastic recycling, pyrolytic method has advantages in different areas (John Schiers, 2006):

- it does not require detailed sorting and costly and complex process of PW preparation (drying and milling of plastic is performed with the aim of maximizing the reactor yield);
- it allows the recycling of waste mixed plastics that cannot be efficiently recycled by common method;
- it permits the recycling of unwashed and soiled plastics (e.g. agricultural plastics, mulch/silage/greenhouse films and dripper/irrigation tube); and
- enables recycling of plastic laminates, co-extrusions and multilayer packaging films, particularly those with aluminum foil layers that are difficult to recycle using traditional reprocessing technologies.

Considering the manner of processing and the insensitivity of the system to possible minor impurities, pyrolysis method opens a possibility of gathering diverse types of PW suitable for the conversion: plastic cups, clothes hangers, park benches, flower pots, toys, tables, roadside curbs, benches, plastic bags, bottles, plugs, car bumpers etc. These are all products made from few common types of plastic given in the bar chart in the Fig. 3 (Sogancioglu, Ahmetli and Yel, 2017). The figure shows the liquid yield of several plastic materials depending on the temperature of the pyrolytic reaction. Samples fed to the reactor were not pre-washed. In the research, conducted by Owusu *et al.* (2018), it was shown that a degradation temperature of thermal pyrolysis from 300 °C to 450 °C, in a batch reactor resulted in the highest yield of liquid fractions. Before them, Muhammad, Onwudili Williams, P. T. (2015) also got similar experimental results with same conclusions. However, there are plastic materials that are not adequate for pyrolysis. Marco, Caballero, Torres *et al.* (2002) showed that PET pyrolysis is rather problematic as no liquids were obtained in the outlets of the autoclave[1]. Only obtained product was yellowy powder, which stuck to the walls of the pipelines, making it impossible to collect and quantify the pyrolysis products. Such a product caused, in some cases, the obstruction of the installation, forcing the experiment to be stopped. It seemed that PET decomposed in pyrolysis generating terephthallic acid and/or similar products which sublime and condense to a solid when cooled. The research conducted by Sogancioglu, Ahmetli and Yel (2017) also showed that product obtained from PET was not a fluid. Instead, it was collected as soft, ductile form and therefore, there is no economic or other justification for pyrolysis of PET. Since the PET packaging is commonly recycled in Serbia to the greatest extent compared to other types of plastics, this shortage does not have to be seen as a disadvantage. It could be viewed as a point of conflict reduction between the usual recycling.

[1]An *autoclave* is a pressure chamber used to carry out industrial processes requiring elevated temperature and pressure different from ambient air pressure.

Furthermore, PVC which is one of the most thermally unstable polymers, of which 58.5 wt % is chlorine (Menges and Berndtsen, 1977) generates different problems in the process of pyrolysis. It's been shown that hydrogen chloride (HCl) was generated in pyrolysis, when PVC was heated to about 300°C (Williams and Williams, 1997; Keane, 2007). Keane concluded that it is essential to remove Cl component from PVC-derived oil and that use of Cl-containing fuel oil would result in severe unit corrosion and the release of environmental toxins – conversion of waste PVC into fuel oil necessitates some form of dechlorination steps. That procedure would increase the cost of required equipment and the production of pyrolysis oil. Blazsó (2006) and Lin, Huang, Luo *et al.* (2010) also showed that pyrolysis of mixed PW containing PVC released hydrogen chloride which caused not only corrosion of the equipment, but also the formation of organochloride compounds in hydrocarbons. Wu *et al.* (2014) showed that the pyrolysis of PVC leads to the production of dioxins which are highly toxic environmental persistent organic pollutants (Berg *et al.,* 2006). Because the HCl may corrode equipment, deactivate catalysts and deteriorate the quality of products this manuscript recommends that PVC is removed from the pyrolysis mixture.

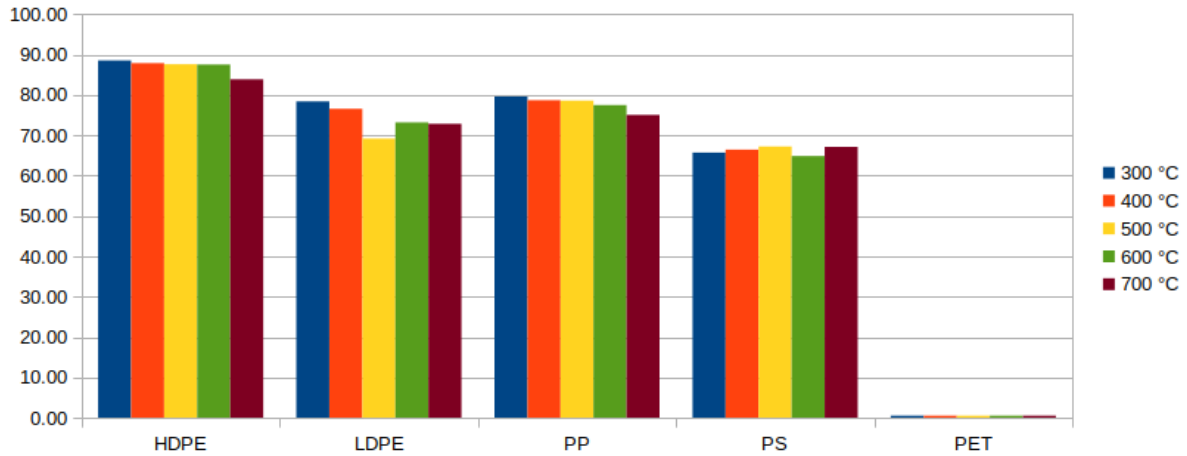

Fig. 3 – Pyrolysis liquid product yield in % depending on reaction temperature and type of plastic. The chart is based on experimental data obtained in the research conducted by Sogancioglu, Ahmetli and Yel (2017).

3.3 Continuous versus batch procedure

Continuous procedure implies uninterrupted flow of materials in production. Materials, which can be fluids or dry bulk, undergo chemical reactions or heat/mechanical treatment in continuous flow process contrary to the discontinuous batch process. In techno-economic analysis conducted in England (Fivga, Dimitriou, 2018), plant that uses continuous pyrolytic process with a capacity of 100 kg/h of plastic waste was modeled. Results showed that for the 1,000 kg/h case, the facility needed to operate approximately four years to recover the capital investment of nearly one million euro. Vorkapic, Ocic and Kurcubic (2006) proposed facility based on continuous procedure with initial investment estimated on €400,000. These were major investments which, in order to profit, implied constant PW supply required for maintaining the business continuity and thus large quantities of obtained product offered in the fuel market. This creates additional problems. To sell fuel, high excise taxes are obliged to be paid per liter of the PO as well as more complex preparation and strict quality management is necessary. The excise taxes on gas oil, liquid petroleum gas and bio-fuels in Serbia amounts ≈€0.48/l, ≈€0.36/l and ≈€0.47/l respectively (*"Sl. glasnik RS"* no. 18/2018). All this raises the final product price and reduces the profit area which brings us to the same stalemate position as in the case of conventional plastic recycling. On the other side, batch procedure had yields of oil fractions significantly higher than the continuous and at a lower pyrolysis temperature (Owusu *et al*. 2018). Other advantages are: smaller initial investments required compared to continuous procedure; conversion could be done *ad hoc,* when PW is available, without financial losses when that is not the case; conversion could be done *in situ* where PW is available in larger quantities; depending on the reactor type and configuration, one trained operator is sufficient for operating the reactor. Disadvantage of batch procedure would be small and finite capacity of PW processed per unit of time, compared to continuous reactor.

3.4 Equipment

3.4.1 Plastic grinders

Regarding the grinding/milling of PW prior to pyrolysis, twenty five grinders offered on the market were taken into account. Price of the adequate plastic grinder with the capacity of 200 kg of PW per hour was €1500.

3.4.2 Pyrolysis reactor

The market offers different varieties of equipment needed for PW pyrolysis. Prices of small, 50l batch reactors ranges from €3500 up to tens of thousands of euro. The price varies depending on capacity, heating type, material, technology, quality *etc*. Fig. 4 shows the experimental set up at Makerere University Agricultural Research Institute in Kabanyolo, Uganda that was used in the research conducted by Owusu *et al*. (2018). Thy pyrolysis was conducted in the batch reactor heated on burning wood. The purpose of this figure was to demonstrate that no hi-tech nor a large technologically demanding facility is needed for plastic pyrolysis to be carried out. It also showes that the process, depending on the settings, could be carried out *in situ* where PW would be available in larger quantities. The price of the reactor constructed as a part of this study (Fig. 1), which is described in the section 2, was approximately €580. Price of human labor, transport and welding materials were omitted because they vary greatly depending on the operational performance and production process design. Of course, if such reactor were offered on the market, its final price would be higher. However, its construction for the purpose of this paper has shown that a complete apparatus for the successful execution of the pyrolytic reaction can be produced with relatively small initial capital investment.

Fig. 4 – Batch reactor heated on burning wood (Owusu et al., 2018)

3.6 Analysis of the pyrolysis oil production price

For the implementation of this process it would be necessary to know the production price of pyrolysis oil (PO). Taking into account the actual price of electricity and labor (*"Sl. glasnik RS"* no. 79/2017 and 88/2017 respectively), technical characteristics of the reactor and grinder as well as yields and time needed for the reaction, as well as other possible costs, the estimation of the PO production price was made possible through the following formulas. They were set for the purpose of paper:

$$ProdPrice = PyrPri + GrnPri + LbrPri + Other; \quad (1.1)$$

$$PyrPri = \frac{P_{price} \times t \times P \times H}{M}; \quad (1.2)$$

$$GrnPri = \frac{P_g}{C_g} \times P_{price}. \quad (1.3)$$

Table 2 - List of symbols used in the formulas

C_g – Grinder capacity $\left(\frac{kg}{h}\right)$	M – Amount of plastic fed into reactor (kg)
$GrnPri$ – Grinding price $\left(\frac{}{kg}\right)$	P – Heating power of the reactor (kW)
H – Liquid fraction yield ( )	P_g – Grinder power (kW)
h – Hour	P_{price} – Electricity price $\left(\frac{}{kWh}\right)$
kg– Kilogram	$ProdPrice$ – Production price $\left(\frac{}{kg}\right)$
kW – Kilowatt	$PyrPri$ – Pyrolysis price $\left(\frac{}{kg}\right)$
$LbrPri$ – Labor price $\left(\frac{}{kg}\right)$	t – Time needed for the conversion (h)

Table 2. is shown here for easier formula tracking. The cost of PO production in the aforementioned reactor was taken as an example. The values used for calculation are explained as follows:

a) Electricity price - "Higher daily tariff - red zone" price was used in calculation of the highest possible price of electrical energy in Serbia which amounts RSD 17.887 or ≈€0.1516.
b) Time - The literature available on this topic did not provide enough data that could be used for prediction of time needed for carrying out the pyrolytic transformation process to the end. Required time for the reaction depends on many factors, starting with temperature, quantity and type of plastics, reactor insulation, power of the heaters, adjustments *etc*. Papuga, Gvero and Vukic (2016) proposed a value of 90 minutes under temperature of 500°C for HDPE. However, due to a greater temperature they had a greater gaseous fraction yield which is not desirable in this case. In practice, it turned out that PE especially HDPE, in the first run came out as mostly paraffin like liquid that solidified at temperatures below 20°C. The resulting substance had to pass through the process one more time in order to reduce the thickening point and thereby acquire properties similar to the fuel. Based on all of the above, as well as the difficulty of accurately predicting the ratio of plastic masses in the material to be converted, the conclusion was made that the empirical practical experience in this case was to be relevant for the estimation of the required time. Based on the results obtained using the constructed reactor as well as the experience of different individuals involved in this process, four (4h) hour time was indicated as upper time limit for the completion of PW conversion, for reactors of a similar ratio of capacity and power, regardless the type of plastic fed into reactor and its occupancy rate.
c) Heating power of the reactor - Constructed reactor had heating power of 6 kW. This means that when all the heaters are constantly switched on, 6 kW of electricity is consumed per hour. However, the automated thermostat switched off and again switched on the heaters at certain times, in order to maintain a constant temperature in the reactor. Nevertheless, the calculation used the value as if the heaters had worked all the time, because the upper limit of the price was calculated.
d) Liquid fraction yield of the reactor – Oil yield depends on the mass ratio of the plastic types fed into the reactor. Data on percentage of plastic types produced (Plastic Europe, 2017), was used for estimation and approximation of the mass ratio of plastic types in the PW. The most common types of plastic were taken into account. The values of liquid yields are derived from experiments carried out by Sogancioglu, Ahmetli, and Yel (2017) in the batch reactor setting at low temperatures of 300-450°C. The average reactor liquid yield was estimated on 79.92%. The Table 3. and the formula 2.1 show how the estimation was made.

Table 3. Working table for calculation of average liquid yield

i	Type of plastic	x – Plastic type share (%)	f – Liquid yield by plastic type (%)	$x \cdot f$
1	PP	36,81	79,62	2930,81
2	LDPE	27,76	78,39	2176,11
3	HDPE	24,4	88,54	2160,38
4	PS	11,03	65,71	724,78
		n=Σx=100		Σ=7992.08

$$Average\ liquid\ fraction\ yield\ = \frac{1}{n}\sum_{i=1}^{4} x \cdot f \approx 79.92 \quad (2.1)$$

e) Amount of plastic fed into the reactor: Grinded plastic is relatively loose so it is impossible to fill the reactor up to 100% of its capacity. The plastic used for testing purposes was manually shredded and grinded. Approximately 28 kg of plastic material was fed into reactor. If the machine had been used for the grinding, plastic material would have been more compact and more of it would have been fed into the reactor. Therefore, this number of 28kg could be safely used for the calculation of the upper price limit.

f) Grinder power: The values used for the calculation referred to a grinder with power of 7.5 kW that could be found on the market. The chosen grinder has capacity of 200 kg plastic per hour, which corresponds to figure g). In other words, 200 kg of plastic could be grinded with 7.5 kW of electricity consumed.

When these values were put into the formulas, the final estimation of pyrolysis, grinding and pyrolysis oil production price was made. The values are shown below in the Table 4:

Table 4 – Eestimated values of pyrolysis, grinding and pyrolysis oil production price

Pyrolysis price	$0.104\ \frac{}{kg}$
Grinding price	$0.0057\ \frac{}{kg}$
Pyrolysis oil production price	$0.11\frac{}{kg}$ + (labor and other costs)

The pyrolysis and grinding costs for one kilogram of PO were estimated on 0.11€. The price of labor and other costs would increase this value but were deliberately omitted from the calculation and placed as separate factors because they vary greatly depending on the operational performance and production process design. In some cases, the price of labor could be reduced to almost zero. It is left to be estimated by the parties interested in the implementation of the proposed model of plastic waste recycling.

Further costs reduction could be achieved if the process was conducted by night, during the cheap tariff time or by using diesel aggregates running on the resulting oil for making electricity. In addition, if the reactor was designed to be heated by a burner, the gas fraction obtained in the pyrolysis process as well as the part of the liquid fraction could be used. It would be possible to reduce or completely eliminate dependence on electricity. This would reduce the yield of the end product, but at the same time it would reduce the cost of production and enable *in situ* conversion of PW into fuel substitutes in areas where no electrical energy is available.

4. Discussion

It was shown that the PW pyrolysis process, when conducted in the described manner, in a small batch reactor setup, required low initial capital investment and could be implemented anywhere across a wide territory. This means that more companies, entrepreneurs and individuals would be able to enter this business. Fuel substitutes obtained through the process could be mixed with automotive fuel or used as a fuel for heating objects as well as for other purposes, which together makes a great use value. If obtained PO were not offered on the fuel market, but instead, used as fuel supplementation by its manufacturers, excise taxes could be avoided as well as the complex and strict product quality management, which would otherwise be necessary if obtained product was to be offered on the fuel

market. The assumption is that the ideal users of the proposed method would be transportation companies, bus carriers, farm households, taxi associations, facilities and buildings that are heated on oil *etc.* It assumed that they would have the capabilities to procure the equipment and start implementing the process as an additional activity. In the same time, they would have sufficient fuel demand. If that was the case, savings in fuel purchases generated as a result of the differences in the price of diesel fuel and the PO that they produced should be regarded as a profit. PW used in the process is to be purchased and obtained from SECOL or directly from citizens. If the PW procurement were to grow, producers could continue to work on their capabilities regarding the process and increasing their capacity. The lowest end price of any diesel fuel on the Serbian market is 1.2€/l and the average price of diesel fuel used by automobiles is 1.37€/l. The high price of diesel fuel that PO substitutes and the relatively low production price of PO, estimated on 0.11€/kg provide a far greater financial space that is to be divided on saving and a larger purchase price of PW (Fig. 5). In economic terms, larger purchase price of PW would act as an incentive for numerous stakeholders. SECOL would be expected to start collecting PW to a greater extent. Citizens would also be expected to start sorting and selling their PW voluntarily, instead of just dumping it. Generally, far more entities would be expected to get involved in this activity and therefore, it could be potentially a milestone in solving the PW problem in Serbia.

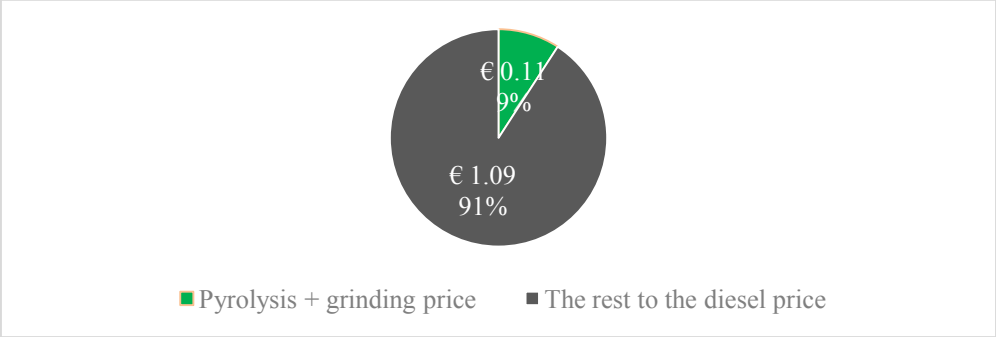

Fig. 5 - pyrolysis + grinding compared to diesel fuel price

However, the major concerns regarding the recommended PW handling method are of a legal nature. In the year 2017, the state started to apply the decree on the marking of oil derivatives (*"Uredba o obeležavanju (markiranju) derivate nafte", "Sl. glasnik RS"* no. 51/2015 and 5/2017). This allowed the market inspection to check the levels of markers in fuel that was taken from vehicles or agricultural machinery tanks. If low levels of markers were found, huge fines were imposed. The reason behind this was the state effort to control the black market and the gray economy. At the same time, problems emerged in the use of bio-fuels. This had a particular negative impact on farmers who have had the opportunity to produce bio fuels for their own needs, by which, they could have strengthen their own business while preserving the environment. Because of the excise tax on fuel, the state prevented different forms of socially responsible business that were in line with the global trend and efforts to encourage sustainable and ecological business. This could be changed if the state recognized these fuel production methods as a form of ecological end socially responsible business. A potential solution to the problem could be a model that would allow the marking of eco-fuels produced in the mentioned ways, by the authorized institutions. This would differentiate the produced eco-fuel from the contraband fuel. At the same time, it would allow control and insight into the quantities of produced eco-fuels. It would be highly recommendable if Serbia, as a legislator, supported and encouraged PW or bio-fuel production because it is in line with the national strategy and aspirations to preserve the environment and enable a better living standards.

5. Conclusion and recommendations

In order to avoid detrimental environmental consequences, a different approach to plastic recycling is obviously indispensable. Common PW recycling in Serbia did not show expected results and changes are necessary. This paper examined and reviewed different approaches of PW handling and proposed an innovative one, applicable in Serbia. It is reflected in the following guidelines:

- The conversion process is to be carried out by small producers as an additional activity and as a form of socially responsible business. Their primary business should

include the consumption of diesel fuel (transportation companies, bus carriers, farm households, facilities heating on diesel, taxi associations etc.).

- Pyrolysis is to be conducted in small batch reactors instead of a continuous one at the industrial level; small initial capital investment means that more entities would be able to get involved in the process.
- The obtained pyrolysis oil is not to be offered on the fuel market - instead, it is to be used as a fuel supplementation by its manufactures. This could eliminate the excise tax and he necessity for detailed PO quality management, and thus could make a room for a higher PW purchase price.
- It would be necessary that the legislator (the state) recognize this method as a socially responsible business and introduce certain changes to existing regulations.

Estimations of equipment and production prices were made to help in creation of implementation model. If the model adhered to these guidelines and state recognized it, it would have the potential to become a game changer in PW handling in Serbia. In the forthcoming period, a statistical survey on PW purchase price should be carried out. The survey should serve to determine which PW purchase price would satisfy SECOL. This manuscript sees their motivation as the key to the PW recycling success because they make the largest part of the scrap plastic supply chain. Therefore, the price is of a great importance as it represents the pivot point between the success and failure in further application of these methods.

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Transformacija lingvističkih vrijednosti u numeričke vrijednosti primjenom fuzzy logike

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Apstrakt: Prilikom realizacije primarnih istraživanja u društvenim naukama najviše se koriste anketni upitnici. Unutar anketnih upitnika moguće je konstruirati pitanja na različite načine. Međutim, kod mjerenja kvantitativnih obilježja najviše se koristi intervalna skala od koja je najpoznatija Likertova skala. Kod ove skale odgovori na postavljene tvrdnje se konstruišu u vidu lingvističkih vrijednosti. Da bi se provela statistička analiza dobivenih rezultata predstavljenih u vidu lingvističke vrijednosti potrebno ih je transformisati u numeričke vrijednosti. Cilj ovoga rada je prikazati kako se pomoću fuzzy logike i odgovarajućih metoda mogu transformisati lingvističke vrijednosti u numeričke vrijednosti. Predmet rada je ponuditi inovativnu metodologiju za transformaciju lingvističkih vrijednosti u numeričke da bi se iste mogli statistički obraditi.

Transformacija se obično vrši tako što se određenoj izjavi dodjeljuje numerička vrijednost. Ukoliko se primjenjuje skala od 7 tvrdnji onda se vrši transformacije u numeričke vrijednosti od 1 do 7. Ljudskom razmišljanju je lakše da koristi lingvističke vrijednosti kod odgovora jer na neka pitanja se ne mogu dati precizni odgovori. Zbog toga u ovom radu prezentovati će se metodologija na koji način se lingvističke vrijednosti mogu transformisati u numeričke vrijednosti korištenjem fuzzy logike. Postupak transformacije biti će objašnjen na primjeru varijable praksa lanca snabdijevanja.

Ključne riječi: Lingvističke vrijednosti, fuzzy logika, numerička vrijednost, praksa lanca snabdijevanja.

Transformation of Linguistic Values in Numerical Values Using Fuzzy Logic

Abstract: Primary research in social sciences is mostly used in survey questionnaires. Within the questionnaire, it is possible to elaborate questions in different ways. However, when measuring the quantitative properties, the most frequently used scale is Likert scale. Responses to statements are constructed in for of language values. In order to show the statistical analysis of the obtained results in the form of language values, it is necessary to convert them into numerical values. The aim of this paper is to show that we can transform linguistic values into numerical values using fuzzy logic and the corresponding methods. The subject of the paper is to offer an innovative methodology for the transformation of linguistic values into numerical ones so that they can be statistically processed.
Converting is usually done by assigning a numerical value to a particular statement. If a 7-scale is applied, then transformations into numeric values are made from 1 to 7. For human way of thinking it is easier to use the linguistic value of the answer because it is not possible to give precise answers to some questions. Therefore, this paper presents a methodology in which linguistic values can be converted into numerical values using fuzzy logic. The transformation process is explained by an example variable of supply chain practice.

Key words: Linguistic values, fuzzy logic, numerical value, supply chain practice.

1. Uvod

Provođenje primarnih istraživanja u društvenim naukama se najvećim dijelom bazira na anketnom upitniku. Istraživač u anketnom upitniku može da kreira različita pitanja koja mogu biti otvorena i zatvorena pitanja. Kod otvorenih pitanja ne nude se ispitaniku ponuđeni odgovori već mu je ostavljena mogućnost da slobodno kreira svoj odgovor. Nedostatak ovakvih odgovora jeste da nije moguća se raditi ozbiljnija statistička analiza pošto se ne mogu vrednovati odgovori u određene numeričke vrijednosti. Zatvorena pitanja ispitaniku ne dopušta slobodu u odgovoru već on odabira neki od ponuđenih odgovora. Prednost ovakvih odgovora je ta što je moguće raditi raznu statisičku analizu sa prikupljenim odgovorima.

Ponekada nije moguće dobiti tačne odgovore od ispitanika pogotovo kada se posmatraju kvalitativne varijable. Ljudsko razmišljanju su primjerenije neprecizne tvrdnje kao što je: malo, veliko, dobro, loše itd. Zbog toga se kod kvalitativnih varijabli najviše koriste pitanja u obliku skale. Najpoznatija skala koja se koristi u anketnim upitnicima je Likertova skala. Ova skala može biti sa pet, sedam, devet i sl. nivoa slaganja odnosno neslaganja sa postavljenim pitanjima. Da bi se ovi odgovori koji su u vidu lingvističke vrijednosti kodirali u praksi se koristi najjednostavniji način a to je da se odgovarajućim tvrdnjama dodijele pripadajuće numeričke vrijednosti. Tako ukoliko se koristi skala sa pet nivoa pripadnosti ovim tvrdnjama se dodjeljuju numeričke vrijednosti od jedan do pet. Tom prilikom se ne vodi računa o razlici između tvrdnje npr. „u potpunosti se slažem“ i „slažem se“, kolika je ta razlika. Veoma teško je upotpunosti reći šta se slaže ispitanika a šta se u potpunosti slaže jer obje tvrdnje su vezane za slaganje sa postavljenom tvrdnjom.

Da bi se koristili neprecizni podaci koje su bliži ljudskom razmišljanju 1965. godine je Zadah uveo pojam fuzzy logike. Ona dopušta nijansiranje nepreciznih tvrdnji koje se pomoću odgovarajućih metoda mogu transformisati u numeričke vrijednosti. Dobivene numeričke vrijednosti potom se mogu koristiti pri primjeni različitih analiza putem statističkih metoda.

2. Teorijske osnove fuzzy logike

Počeci primjene fuzzy logike datiraju iz 1965. godine. U radu Fuzzy skupovi objavljenom u časopisu Informacione nauke prof. Zadeha sa Univerziteta u Berkliju postavio je osnove fuzzy logike. U svom radu je rekao: da bi se izborili sa veoma složenim problemima, ne moramo da se krećemo ka rigoroznosti, što većoj preciznosti opisa i razmišljanju o pojavama, već možemo da krenemo u suprotnom smjeru i dozvolimo da opisi budu neprecizni u duhu prirodnog jezika (Zadeh, 1965). Prema njegovom objašnjenju fuzzy skupovi imaju dva različita značenja i to uži pristup pri kojem je fuzzy logika proširenje klasične logike i širi pristup gdje se fuzzy logika koristi u skupovima koji nemaju jasne granice. Fuzzy logikom se dopušta nijansiranje stepena pripadnosti elementa određenom skupu, tj. svakom elementu pridružujemo realan broj kao dimenzija stepena pripadnosti toga elementa skupu (Pavkov, Japundžić, 2012). Fuzzy pristup je bliži ljudskom razmišljanju jer su u realnom svijetu prisutne situacije koje nisu definisane i teško je odrediti granicu skupa.

Kod korištenja fuzzy logike potrebno je odrediti funkciju pripadnosti. Ona pokazuje koliko pojedinačni element ispunjava uslov pripadnosti skupu A. Primjenom klasične teorije funkcija pripadnosti može primiti samo dvije vrijednosti jedan i nula. Kod fuzzy teorije funkcija pripadnosti može poprimiti bilo koju vrijednost u intervalu od nula do jedan. Ukoliko tvrdnja ima „više istine“ ona će u većem stepenu ispuniti uslove pripadnosti skupu A odnosno važi $0 \leq \leq 1$ za svaki elemenat iz skupa A.

Prilikom definisanja fuzzy skupova koristit će se sljedeća pretpostavka: neka je skup X univerzalni skup, a fuzzy skup podskup skupa X. Na osnovu toga prilikom definisanja fuzzy logike vrijede sljedeće definicije:

Definicija 1. Fuzzy skup http://fim.edu.rs/en/serbian-journal-of-engineering-management/ iz skupa X definisan je funkcijom pripadnosti koja povezuje svaki elemenat x u skup X realnih brojeva iz intervala [0,1]. Funkcija pripadnosti se naziva stepen pripadnosti elementa x fuzzy skupu (Zadeh, 1965).

Definicija 2. Dva *fuzzy* skupa $\widetilde{A}$ i $\widetilde{B}$ su jednaka ako je (Škrbić, 2008)**:**

$$\forall x_i \in X, \mu_{\widetilde{A}}(x) = \mu_{\widetilde{B}}(x) \quad (1)$$

Definicija 3 Za *fuzzy* skup $\widetilde{A}$ kažemo da je podskup *fuzzy* skupa $\widetilde{B}$ ako i samo ako važi (Panić, 2013):

$$\forall x_i \in X, \mu_{\widetilde{A}}(x) \leq \mu_{\widetilde{B}}(x) \quad (2)$$

Definicija 4. *Fuzzy* skup $\widetilde{A}$ je normalan u univerzalnom skupu *X* ako je:

$$\exists x_i \in X\ ,\ \mu_{\widetilde{A}}(x_i) = 1 \quad (3)$$

Definicija 5. Najveća vrijednost *fuzzy* broja u *fuzzy* skupu $\widetilde{A}$ podskupu skupa *X* kada se normalizuje poprima vrijednost jedan.

Definicija 6. Uzmimo dva pozitivna *fuzzy* skupa $\widetilde{m}, \widetilde{n}$ podskup skupa *X* i pozitivan realni broj *r*, gdje je α ugao dva *fuzzy* broja $\widetilde{m}^{\alpha} = \left[m_a^{\alpha}, m_b^{\alpha}\right]$ i $\widetilde{n}^{\alpha} = \left[n_a^{\alpha}, n_b^{\alpha}\right]$ $\alpha \in [0,1]$ respektivno. Prema intervalu pouzdanosti za moguće skupove $\widetilde{m}, \widetilde{n}$ izvode se sljedeće operacije (Chen, 2000):

$$\left(\widetilde{m}(+)\widetilde{n}\right)^{\alpha} = \left[m_a^{\alpha} + n_a^{\alpha}, m_b^{\alpha} + n_b^{\alpha}\right] \quad (4)$$

$$\left(\widetilde{m}(-)\widetilde{n}\right)^{\alpha} = \left[m_a^{\alpha} - n_a^{\alpha}, m_b^{\alpha} - n_b^{\alpha}\right] \quad (5)$$

$$\left(\widetilde{m}(\cdot)\widetilde{n}\right)^{\alpha} = \left[m_a^{\alpha} \cdot n_a^{\alpha}, m_b^{\alpha} \cdot n_b^{\alpha}\right] \quad (6)$$

$$\left(\widetilde{m}(\div)\widetilde{n}\right)^{\alpha} = \left[m_a^{\alpha} \div n_a^{\alpha}, m_b^{\alpha} \div n_b^{\alpha}\right] \quad (7)$$

$$\left(\widetilde{m}^{\alpha}\right)^{-1} = \left[\frac{1}{m_b^{\alpha}}, \frac{1}{m_a^{\alpha}}\right] \quad (8)$$

$$\left(\widetilde{m}(\cdot)r\right)^{\alpha} = \left[m_a^{\alpha} \cdot r, m_b^{\alpha} \cdot r\right] \quad (9)$$

$$\left(\widetilde{m}(\div)r\right)^{\alpha} = \left[m_a^{\alpha} \div r, m_b^{\alpha} \div r\right] \quad (10)$$

Definicija 7. Neka je $\widetilde{m} = (m_1, m_2, m_3)$ i $\widetilde{n} = (n_1, n_2, n_3)$ dva trouglasta *fuzzy* broja *fuzzy* skupa $\widetilde{A}$ podskupa skupa *X* ako je $\widetilde{m} = \widetilde{n}$ tada za sve elemente važi $m_1 = n_1, m_2 = n_2$ i $m_3 = n_3$.

Definicija 8. Vrijednosti izražene u jezičkim terminima nazivaju se lingvističke vrijednosti (Zimmermann, 1991).

Za potrebe ovoga rada je definisana funkcija pripadnosti koja je predstavljena na tabeli 1. Tabela 1 predstavlja transformaciju lingvističkih vrijednosti pomoću funkcije pripadnosti u odgovarajuće *fuzzy* brojeve.

Tabela 1. Transformacija lingvističkih vrijednosti u *fuzzy* brojeve

Lingvistička varijabla	***Fuzzy* broj**
U potpunosti se ne slažem (PN)	(1, 1, 2)
Ne slažem se (NS)	(2, 3, 4)
Neutralno (NO)	(4, 5, 6)
Slažem se (SS)	(6, 7, 8)
U potpunosti se slažem (PS)	(8, 9, 9)

Lingvističke vrijednosti potrebno je transformisati u odgovarajuće *fuzzy* brojeve koristeći funkciju pripadnosti. Primjenom lingvističkih vrijednosti dobivaju se kvalitativne vrijednosti na kojima nije moguće primjena statističkih analiza. Zbog toga je potrebno lingvističke vrijednosti transformisati u kvalitativne vrijednosti. Primjena *fuzzy* logike omogućava da se lingvističke vrijednosti pomoću fuzzy brojeva transformišu u kvalitativne vrijednostima na kojima je moguće primjenjivati statističke analize. Zbog toga je potrebno koristiti određene fuzzy metode. U ovom radu primjeniti će se Fuzzy TOPSIS metoda.

3. *Fuzzy* TOPSIS (FTOPSIS) metoda

Metoda za višekriterijsku analizu TOPSIS je razvijena od autora Hwang i Yoon 1981. godine. Zasniva se na konceptu da alternativa treba imati najmanju udaljenost od pozitivnog idealnog rješenja i najveću udaljenost od negativnog idealnog rješenja. (Lu, et al, 2007). Osnovna logika TOPSIS metode je da se najprije definiše idealno pozitivno rješenje i idealno negativno rješenje. Optimalna alternativa je ona koja je u geometrijskom smislu najbliža idealnom pozitivnom rješenju, odnosno najudaljenija od idealnog negativnog rješenja (Puška, 2014).

Primjenom *fuzzy* logike izvršena je transformacija metode TOPSIS u FTOPSIS metodu. Chen i Hwang (1992) su prvi transformisali TOPSIS metodu u FTOPSIS metodu. Kod FTOPSIS metode vrijednosti alternativa i težina kriterija izražene su putem lingvističkih vrijednosti. Osnovna smisao primjene FTOPSIS metode je da se mogu upotrebljavati lingvističke vrijednosti. Farzami i Vafaei (2013) kažu da je ljudsko razmišljanje neodređeno i utječe na donošenje odluka, pa je tada bolje koristiti FTOPSIS metodu u odnosu na klasične MCDM metode.

Koraci u provođenju FTOPSIS metode su sljedeći:

Korak 1. Formiranje početne matrice odlučivanja i utvrđivanje vrijednosti alternativa i težina kriterija. Prilikom formiranja početne matrice odlučivanja na raspolaganju je „*m*“ alternativa $A_i (i = 1,2,3...m)$ koja se ocjenjuje sa „*n*“ kriterija $C_j (j = 1,2,3...n)$. Na osnovu toga formiraju se elementi matrice odlučivanja X = $\{x_{ij}, i = 1,2,...,m; j = 1,2,...,n\}$ pri čemu se svaki pojedinačni elemenat x_{ij} formira pomoću lingvističkih vrijednosti $x_{ij} = (a_{ij}, b_{ij}, c_{ij})$. Potrebno je odrediti važnost pojedinih kriterija pomoću težina kriterija. One se mogu odrediti na subjektivan i objektivan način. Subjektivno određivanje težina kriterija vrši se na osnovu suda donosioca odluka o određenim kriterijima. Objektivno određivanje težina kriterija vrši se korištenjem različitih objektivnih metodama. Težine kriterija se određuju za svaki kriterij $W(w_1, w_2, ..., w_j)$. Kod primjene FTOPSIS metode težine se formiranju na bazi *fuzzy* brojeva tako da je $w_j = (w_{j1}, w_{j2}, w_{j3})$. Na osnovu svega navedenog formira se početna matrica odlučivanja koja je predstavljena sljedećim izrazom:

$$D = \begin{array}{c} \\ w \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{bmatrix} w_1 & w_2 & \cdots & w_n \\ x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \end{array} \quad (11)$$

Korak 2. Normalizacija matrice odlučivanja.

Pošto su elementi matrice različiti potrebno je izvršiti normalizaciju podataka kako bi se dobila matrica u kojoj svi elementi imaju iste dimenzije. U praksi se najčešće koriste sljedeće normalizacije: vektorska normalizacija, linearna normalizacija tipa 1 (prosta linearna normalizacija), linearna normalizacija tipa 2 (složena linearna normalizacija), linearna normalizacija tipa 3 (postotna normalizacija) i vektorska normalizacija (Eftekhary, et al, 2012). U ovom radu koristit će se linearna normalizacija tipa 1. Kod primjene ove vrste normalizacije formiraju se sljedeće relacije za maksimiziranje:

$$r_{ij} = \left(\frac{a_{ij}}{c_j^+}, \frac{b_{ij}}{c_j^+}, \frac{c_{ij}}{c_j^+} \right), \text{ gdje je } c_j^+ \text{ maksimalna vrijednost } \textit{fuzzy} \text{ broja} \tag{12}$$

odnosno relacije kada je potrebno minimizirati kriterije:

$$r_{ij} = \left(\frac{a_j^+}{c_{ij}}, \frac{a_j^+}{b_{ij}}, \frac{a_j^+}{a_{ij}} \right), \text{ gdje je } \mathrm{a}_j^+ \text{ minimalna vrijednost fuzzy broja} \tag{13}$$

Korak 3. Množenje elemenata normalizovane matrice odlučivanja sa odgovorajućim težinama.
U ovom koraku vrši se množenje svakoga elementa sa odgovarajućom težinom kriterija.

$$V = [r_{ij}]mn, i = 1,2,...,m; j = 1,2,...,n, \text{ gdje je } r_{ij} = x_{ij} \cdot w_j \tag{14}$$

Na ovaj način formira se nova otežana matrica odlučivanja i dobivaju se novi elementi te matrice $r_{ij} = (l_{ij}, m_{ij}, u_{ij})$.

Korak 4. Određivanje idealnog pozitivnog i idealnog negativnog rješenja.

U ovom koraku izračunavaju se n–dimenziona Euklidska rastojanja svih alternativa od idealnog pozitivnog i idealnog negativnog rješenja.

$$A^+ = (v_1^+, v_2^+, ..., v_n^+) \text{ gdje je } : v_j^+ = (\max_i v_{ij}) \tag{15}$$

$$A^- = (v_1^-, v_2^-, ..., v_n^-) \text{ gdje je } : v_j^- = (\min_i v_{ij}) \tag{16}$$

Udaljenost od svake alternative A^* i A^- može se izračunati kao:

$$d_i^+ = \sum_{j=1}^{n} d_v(\tilde{v}_{ij}, \tilde{v}_j^+), \ i = 1, 2, ..., m \tag{17}$$

$$d_i^- = \sum_{j=1}^{n} d_v(\tilde{v}_{ij}, \tilde{v}_j^-), \ i = 1, 2, ..., m \tag{18}$$

gdje je d_i^+ idealno pozitivno rješenje, d_i^- idealno negativno rješenje. Udaljenost (distanca) od idealnog pozitivnog i negativnog rješenja izračunava se pomoću $d_v(\tilde{v}_{ij}, \tilde{v}_j^-)$ koji mjeri udaljenosti između dva fuzzy broja:

$$d_v(\tilde{x}, \tilde{y}) = \sqrt{\frac{1}{3}\left[(x_1 - y_1)^2 + (x_2 - y_2)^2 + (x_3 - y_3)^2 \right]} \tag{19}$$

Korak 5. Određivanje relativne blizine alternativa idealnom rješenju.

Za svaku alternativu određuje se relativno rastojanje na osnovu sljedeće formule:

$$Q_i = \frac{d_i^-}{d_i^* + d_i^-},\ i = 1, 2, ..., m \tag{20}$$

Ova vrijednost (Q_i) predstavlja rezultat FTOPSIS metode i nalazi se u intervalu: $0 \leq Q_i \leq 1$. Što je alternativa A_i bliža idealnom rješenju to je vrijednost Q_i bliža jedan. Alternativa A_i će poprimiti vrijednost jedan ako su njene vrijednosti identične sa pozitivnim idealnim rješenjem, a vrijednost nula ako su vrijednosti ove alternative identične sa negativnim idealnim rješenjem (Puška, 2014).

3. Metodologija istraživanja

U ovom radu pokazati će se metodologija transformacije lingvističkih vrijednosti u numeričke primjenom fuzzy logike. Metodom entropije biti će izvršeno izračunavanje težina pojedinih tvrdnji, dok će primjenom FTOPSIS metode biti izvršeno izračunavanje vrijednosti dimenzija istraživanja. Na taj način se izvršilo transformacija lingvističkih vrijednosti u numeričke.

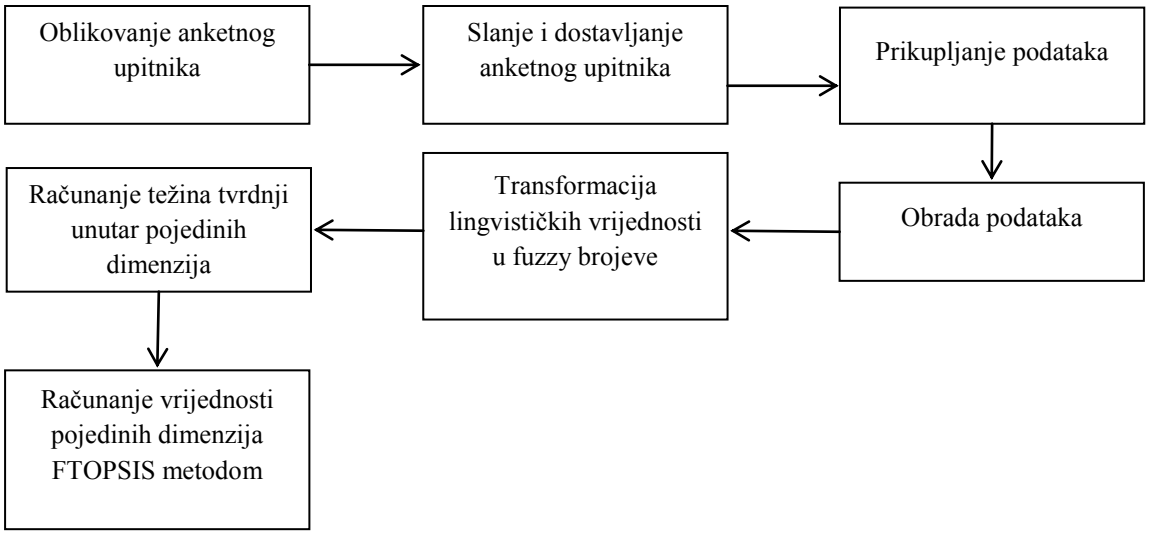
Istraživanje koje je primjenjeno u ovom radu je provedeno je na teritoriji BiH. Osnovni skup čine preduzeća iz oblasti prehrambene industrije u BiH. Prema podacima Statističkog poslovnog registra od 30. 06. 2015. ukupan broj preduzeća iz oblasti prehrambene industrije je 788. Njihov popis formiran je na osnovu baza podataka sljedećih institucija: Registar Uprave za indirektno oporezivanje, Registar poslovnih subjekata Pravosuđa BiH, Agencija za finansijske, informatičke i posredničke usluge Federacije BiH, Agencija za finansijske, informatičke i posredničke usluge Republike Srpske i Registar projekta Podrška razvoju brzorastućih malih i srednjih poduzeća (FGSMEs) i lokalnog poslovnog okruženja.

Nakon što je formiran osnovni skup sa imenima preduzeća ista su poredana abecednim redom. Na osnovu spiska preduzeća formiran je uzorak koji čini polovina preduzeća (394 preduzeća). Uzorak je formiran slučajnim sistemskim uzorkom tako što je svako neparno preduzeće uzeto u razmatranje. Ukoliko nekom od preduzeća nije bilo moguće ustanoviti da li ono zaista i posluje i obavlja djelatnost uzeto je prvo naredno preduzeće odnosno prvo parno preduzeće ispod. Na taj način je formirana baza podataka o uzorku preduzeća. Da bi se povećao broj prikupljenih odgovora koristila se kombinacija različitih metoda prikupljanja primarnih podataka i to: e-mail, telefonski kontakt, lični kontakt itd. Na kraju provedenog istraživanja ukupan broj pristupanja online anketi je bio 427 (neka preduzeća su pristupili više od jednom što se može vidjeti na osnovu IP adresa, pa je zbog toga ovoliki broj pristupa anketi), dok je ukupan broj popunjenih anketnih upitnika bio 135. Od formiranog uzorka od 394 preduzeća prikupljeno je 135 popunjenih anketnih upitnika što iznosi 34,26 odnosno 17,13 preduzeća iz osnovnog skupa.

Prilikom mjerenja varijabli istraživanja koristio se anketni upitnik sa lingvističkim vrijednostima. Popunjavanjem ovih tvrdnji dobili su se rezultati u vidu lingvističkih vrijednosti koje je neophodno transformirati u numeričke vrijednosti. Svaka varijabla istraživanja se sastojala od dimenzija koje su se sastojale od određenog broja tvrdnji predstavljenih lingvističkim vrijednostima. Da bi se izračunala vrijednost dimenzija potrebno je odrediti važnost svake tvrdnje unutar određene dimenzije. Za tu potrebu koristila se metoda *fuzzy* entropija koja služe za objektivno vrednovanje težina svake tvrdnje. Pomoću definisanih koraka metode FTOPSIS i pomoću objektivnih težina tvrdnji izračunate su vrijednosti pojedinih dimenzija. Na taj način se pomoću *fuzzy* pristupa izvršila redukcija jer će se koristiti kod primjene multivarijacione analize vrijednost dimenzija a ne i tvrdnji. Tvrdnje u ovom slučaju služe da bi se dobila realna vrijednost pojedinih dimenzija varijabli istraživanja.

Prednost ovakvog pristupa je da su rezultati *fuzzy* metoda pojedinačnih dimenzija varijabli istraživanja (praksa lanca snabdijevanja, performanse lanca snabdijevanja i konkurentnost preduzeća) u intervalu od nule do jedan. Što je vrijednost bliža jedan to su bolje performanse određene dimenzije istraživanja i obrnuto što je vrijednost bliža nuli to su lošije performanse te dimenzije.

Slika 1. Metodologija istraživanja



Kod transformacije lingvističkih vrijednosti u *fuzzy* brojeve koristile su se funkcije pripadnosti. Ove funkcije pokazuju koliko jedna lingvistička vrijednost pripada određenom skupu. Prilikom određivanja funkcije pripadnosti moguće je koristiti različite pristupe. U ovom istraživanju se koristila transformacija lingvističkih vrijednosti u trouglaste *fuzzy* brojeve. Karakteristika ovih brojeva je da jednu lingvističku vrijednost transformiraju u *fuzzy* broj sa tri vrijednosti. Vrijednosti *fuzzy* brojeva se određuju putem lingvističkih funkcija pripadnosti.

Definisanje lingvističkih funkcija pripadnosti daje prostora za procjenu važnosti pojedinih dimenzija istraživanja. Na osnovu dobivenih rezultata istraživanja moguće je definisati pripadnost lingvističkih funkcija tako da se može povećati odnosno smanjiti razlika između pojedinih lingvističkih vrijednosti. Na taj način se ostavlja sloboda istraživaču da procijeni koji oblik funkcije pripadnosti najbolje odgovara određenom istraživanju, čime se otvara više mogućnosti kod transformisanja lingvističkih vrijednosti, jer istraživač na osnovu iskustava i subjektivnog stava bira vrijednosti funkcije pripadnosti. Za potrebe ovoga rada uzeti će se nezavisna varijabla praksa lanca snabdijevanja. U ovom radu koristiti će se četiri dimenzije i to: partnerski odnosi sa dobavljačima, odnosi sa kupcima, interne integracije te dijeljenje i kvalitet informacija.

Dimenzija partnerski odnosi sa dobavljačima treba da pokaže način na koji preduzeća iz oblasti prehrambene industrije u BiH uspostavljaju partnerske odnose sa dobavljačima. Dobavljači, zajedno sa kupcima, su osnova za uspostavljanje partnerskih odnosa jer od dobavljača se nabavljaju materijali, sirovine, oprema, mašine i sl. Ukoliko sirovine i materijal nisu odgovarajućeg kvaliteta i ako su mašine i oprema zastarjeli preduzeće neće moću da proizvede kvalitetan proizvod i da iskoristi prednosti u funkcionisanju lanca snabdijevanja. Zbog toga su dobavljači ključni za uspostavljanje dobrih praksi lanca snabdijevanja. Da bi se utvrdilo na koji način se koriste partnerski odnosi sa dobavljačima formirane su prilagođene tvrdnje na osnovu sljedećih istraživanja: Li, et al. (2006) i Chavez, et al. (2014) koje glase:

- (POD01) Koristimo pomoć dobavljača pri rješavanju problema u preduzeću,
- (POD02) Poboljšavamo kvalitet naših proizvoda uz pomoć dobavljača,
- (POD03) Uključujemo dobavljače pri razvoju novih proizvoda i poslovnih procesa u preduzeću i
- (POD04) Zajedno sa dobavljačima radimo na poboljšanju poslovanja preduzeća.

Dimenzija odnosi sa kupcima služi da bi se utvrdio na koji se način kod prakse lanca snabdijevanja koriste odnosi sa kupcima. Kupci su, pored dobavljača, ključni učesnici u funkcionisanju lanca snabdijevanja. Da bi se poboljšale prakse lanca snabdijevanja potrebno je uključiti kupce u poslovanje preduzeća kroz pružanje informacija o njihovim zahtjevima o proizvodima i njihovom zadovoljstvu sa proizvodima. Za ispitivanje ove dimenzije prilagođene su tvrdnje iz sljedećih istraživanja: Li, et al. (2006) i Chavez, et al. (2014) i one glase:

- (OSK01) U interakciji sa kupcima pokušavamo da poboljšamo pouzdanost i odgovornost u poslovanju,
- (OSK02) Sa kupcima smo izgradili odnos zasnovan na uzajamnom povjerenju,
- (OSK03) Često mjerimo stepen zadovoljstva naših kupaca i
- (OSK04) Pokušavamo da odredimo buduća očekivanja kod kupaca.

Dimenzija interne integracije unutar prakse lanca snabdijevanja pomaže u istraživanju povezanosti unutar preduzeća koja je osnova za uspostavljanje eksterne povezanosti sa ključnim učesnicima u lancu snabdijevanja. Potrebno je najprije izgraditi internu povezanost koja će dobro funkcionisati u preduzeću i pomoći preduzeću da unaprijedi prakse lanca snabdijevanja. Tek kada je uređen sistem internih integracija u preduzeću uspostavljaju se odnosi sa kupcima i dobavljačima. Da bi se izmjerila primjena internih integracija u ovom istraživanju su korištene prilagođene tvrdnje iz sljedećih istraživanja: Braunscheidela i Suresh (2009) i Danese, et al. (2013) i te tvrdnje glase:

- (IIP01) Pri funkcionisanju lanca snabdijevanja koristimo informacione sisteme,
- (IIP02) Od zaposlenih se traži otvorenost i timski rad te se podstiče međusobna komunikacija,
- (IIP03) Različiti dijelovi funkcionalne organizacije međusobno rade na unapređenju lanca snabdijevanja i
- (IIP04) Kod svih postrojenja se vrši koordinacija aktivnosti kako bi se minimizirali nepotrebni troškovi.

Posljednja dimenzija koja se koristi u ovom istraživanju za mjerenje prakse lanaca snabdijevanja je dijeljenje i kvalitet informacija. Nivo dijeljenja informacija je ključan kod provođenja partnerskih odnosa sa kupcima i dobavljačima. Pošto se ovi odnosi trebaju da zasnivaju na međusobnom povjerenju potrebno je da se i informacije dijele u potrebnom nivou. Što znači da preduzeće treba ustupiti sve informacije koje će unaprijediti saradnju, a isto tako se od kupaca i dobavljača to očekuje. Zbog toga su pri mjerenju ove dimenzije prakse lanca snabdijevanja korištene prilagođene tvrdnje iz istraživanja Li, et al. (2006), Liao i Kuo (2014) i Yang (2014), koje glase:

- (DKI01) Partneri dijele sa nama informacije potrebne za unapređenje međusobne saradnje,
- (DKI02) Partneri dijele sa nama ključna znanja o razvoju naših poslovnih procesa i proizvoda,
- (DKI03) Zajedno sa partnerima razmjenjujemo informacije koje pomažu pri planiranju budućih aktivnosti i
- (DKI04) Komunikacija sa našim partnerima je pravovremena, precizna, potpuna, adekvatna i pouzdana.

4. Rezultati istraživanja

Anketni upitnik je popunilo 139 preduzeća iz oblasti prehrambene industrije. Međutim, 4 popunjena anketna upitnika nisu bila prikladna za dalju analizu jer nisu popunjena preko 80 posto, odnosno greškom su dva preduzeća dva puta popunila anketni upitnik. Na Tabeli 2. predstavljene su osnovne karakteristike preduzeća obuhvaćenim istraživanjem.

Tabela 2. Zbirni podaci o osnovnim karakteristikama preduzeća

Obilježje preduzeća			Frekvencija	Izraženo u %
Veličina preduzeća	1.	mikro	18	13,3
	2.	malo	60	44,4
	3.	srednje	40	29,6
	4.	veliko	17	12,6
Broj zaposlenih	1.	1-9	40	29,6
	2.	10-49	48	35,6
	3.	50-99	17	12,6
	4.	100-199	16	11,9
	5.	200 i više	14	10,4
Starost preduzeća, godina osnivanja	1.	do 1970	15	11,1
	2.	1970-1989	13	9,6
	3.	1990-2010	89	65,9
	4.	poslije 2010	18	13,3
Vlasništvo preduzeća	1.	privatno vlasništvo	129	97,0
	2.	državno vlasništvo	0	0,0
	3.	mješovito vlasništvo	4	3,0
Prihodi od prodaje u 2015 (KM)	1.	do 4 miliona	79	59,8
	2.	4-19 miliona	29	22,0
	3.	20-99 miliona	20	15,2
	4.	preko 100 miliona	4	3,0
Posjedovanje certifikata kvaliteta	1.	jedan od navedenih	94	69,6
		ISO 9001	63	67,0
		ISO 14001	16	17,0
		HACCP	74	78,7
		Halal certifikat	32	34,0
		Košer certifikat	2	2,1
		Neki drugi	15	16,0
	2.	nijedan	41	30,4
Primarna djelatnost preduzeća	1.	Mlinarska industrija	19	14,2
	2.	Industrija mlijeka	9	6,7
	3.	Industrija mesa	20	14,9
	4.	Prerada voća i povrća	16	11,9
	5.	Proizvodnja kanditorskih proizvoda	11	8,2
	6.	Proizvodnja alkoholnih pića	5	3,7
	7.	Proizvodnja vode i bezalkoholnih pića	10	7,5
	8.	Ostala proizvodnja	44	32,8

U ovom radu na osnovu provedenog istraživanja predstaviti će se na koji način se može vršiti transformacija lingvističkih vrijednosti u numeričke vrijednosti pomoću fuzzy logike. Na primjeru dimenzije partnerski odnosi sa dobavljačem predstaviti će se navedena metodologija istraživanja. Zbog specifičnosti transformacije lingvističkih vrijednosti u numeričke vrijednosti potrebno je najprije uspostaviti početnu matricu sa lingvističkim vrijednostima. Ova matrica se formira od prikupljenih i obrađenih podataka. Početna matrica podataka dimenzije partnerski odnosi sa dobavljačima je predstavljena na Tabeli 3.

Tabela 3. Početna matrica podataka

Preduzeće	POD01	POD02	POD03	POD04
1	NS	SS	NS	NO
2	SS	SS	SS	SS
3	NO	SS	SS	SS
4	NS	NS	PS	SS
5	SS	PS	PS	PS
6	NS	SS	NS	NO
7	NS	NO	NS	NS
8	SS	PS	SS	PS
9	NO	SS	NO	NO
10	NS	NO	NO	NO
⋮	⋮	⋮	⋮	⋮
131	PS	PS	PS	SS
132	SS	SS	SS	SS
133	NS	SS	NS	NS
134	NS	SS	NS	NS
135	NO	SS	NO	SS

Prilikom uspostavljanja matrice odlučivanja korištene su skraćenice predstavljene u Tabeli 1. Tabele kod objašnjavanja procedure predstavit će se u skraćenim verzijama sa odgovorima prvih deset i zadnjih pet preduzeća. Tabela 3. pokazuje da su odgovori preduzeća na tvrdnje za dimenziju partnerski odnosi sa dobavljačima različiti.

Na osnovu lingvističkih vrijednosti potrebno je pomoću funkcije pripadnosti transformisati lingvističke vrijedosti u odgovarajuće *fuzzy* brojeve. Funkcija pripadnosti je određena Tabelom 1. gdje krajnja dva odgovora „u potpunosti se ne slažem“ i „u potpunosti se slažem“ odstupaju od uobičajenog rasporeda. Razlog tome je da ljudi ne mogu u potpunosti razlučiti da li se slažu ili u potpunosti se slažu. Zbog toga je krajnjim odgovorima dat manji interval pripadnosti u odnosu na druge tvrdnje.

Tabela 4. Početna matrica odlučivanja u vidu *fuzzy* brojeva

Preduzeće	POD01	POD02	POD03	POD04
1	(2, 3, 4)	(6, 7, 8)	(2, 3, 4)	(4, 5, 6)
2	(6, 7, 8)	(6, 7, 8)	(6, 7, 8)	(6, 7, 8)
3	(4, 5, 6)	(6, 7, 8)	(6, 7, 8)	(6, 7, 8)
4	(2, 3, 4)	(2, 3, 4)	(8, 9, 9)	(6, 7, 8)
5	(6, 7, 8)	(8, 9, 9)	(8, 9, 9)	(8, 9, 9)
6	(2, 3, 4)	(6, 7, 8)	(2, 3, 4)	(4, 5, 6)
7	(2, 3, 4)	(4, 5, 6)	(2, 3, 4)	(2, 3, 4)
8	(6, 7, 8)	(8, 9, 9)	(6, 7, 8)	(8, 9, 9)
9	(4, 5, 6)	(6, 7, 8)	(4, 5, 6)	(4, 5, 6)
10	(2, 3, 4)	(4, 5, 6)	(4, 5, 6)	(4, 5, 6)
⋮	⋮	⋮	⋮	⋮
131	(8, 9, 9)	(8, 9, 9)	(8, 9, 9)	(6, 7, 8)
132	(6, 7, 8)	(6, 7, 8)	(6, 7, 8)	(6, 7, 8)
133	(2, 3, 4)	(6, 7, 8)	(2, 3, 4)	(2, 3, 4)
134	(2, 3, 4)	(6, 7, 8)	(2, 3, 4)	(2, 3, 4)
135	(4, 5, 6)	(6, 7, 8)	(4, 5, 6)	(6, 7, 8)

Prvi korak kod *fuzzy* metoda predstavlja normalizacija *fuzzy* brojeva. Prilikom provođenja normalizacije koristit će se linearna normalizacija tipa 1 (izraz 12), iako je moguće primjeniti i druge normalizacije. Istraživanje provedeno od autora Puška (2013) je pokazalo da normalizacija igra značajnu ulogu kod vrijednosti TOPSIS metode. Međutim, ovaj segment višekriterijske analize, odnosno utjecaja normalizacije na rezultat FTOPSIS-a neće se obrađivati u ovom radu već će se to ostaviti za buduća istraživanja.

Najveća vrijednost *fuzzy* broja je kod tvrdnje „u potpunosti se slažem“ (8, 9, 9) pa se na osnovu formule za linearnu normalizaciju tipa 1 (izraz 12) svaki element matrice odlučivanje dijeli sa ovom vrijednošću. Na osnovu toga su dobivene vrijednosti koje su predstavljeni na Tabeli 5.

Normalizacija se primjenjuje ukoliko mjerne skale za kriterije nisu iste ili uporedive i izračunava se udaljenost pojedine alternative od idealnog rješenja (Puška, 2013). U ovom slučaju normalizacija se vršila zbog funkcije pripadnosti. Normalizovani podaci se kreću u intervalu od nule do jedan. Pošto su funkcije pripadnosti bile u intervalu od jedan do devet potrebno je te vrijednosti normalizovati da bi se mogle primjenjivati odgovarajuće *fuzzy* metode.

Tabela 5. Normalizovana matrica odlučivanja

Preduzeće	POD01	POD02	POD03	POD04
1	(0,25 0,33 0,44)	(0,75 0,78 0,89)	(0,25 0,33 0,44)	(0,50 0,56 0,67)
2	(0,75 0,78 0,89)	(0,75 0,78 0,89)	(0,75 0,78 0,89)	(0,75 0,78 0,89)
3	(0,50 0,56 0,67)	(0,75 0,78 0,89)	(0,75 0,78 0,89)	(0,75 0,78 0,89)
4	(0,25 0,33 0,44)	(0,25 0,33 0,44)	(1,00 1,00 1,00)	(0,75 0,78 0,89)
5	(0,75 0,78 0,89)	(1,00 1,00 1,00)	(1,00 1,00 1,00)	(1,00 1,00 1,00)
6	(0,25 0,33 0,44)	(0,75 0,78 0,89)	(0,25 0,33 0,44)	(0,50 0,56 0,67)
7	(0,25 0,33 0,44)	(0,50 0,56 0,67)	(0,25 0,33 0,44)	(0,25 0,33 0,44)
8	(0,75 0,78 0,89)	(1,00 1,00 1,00)	(0,75 0,78 0,89)	(1,00 1,00 1,00)
9	(0,50 0,56 0,67)	(0,75 0,78 0,89)	(0,50 0,56 0,67)	(0,50 0,56 0,67)
10	(0,25 0,33 0,44)	(0,50 0,56 0,67)	(0,50 0,56 0,67)	(0,50 0,56 0,67)
⋮	⋮	⋮	⋮	⋮
131	(1,00 1,00 1,00)	(1,00 1,00 1,00)	(1,00 1,00 1,00)	(0,75 0,78 0,89)
132	(0,75 0,78 0,89)	(0,75 0,78 0,89)	(0,75 0,78 0,89)	(0,75 0,78 0,89)
133	(0,25 0,33 0,44)	(0,75 0,78 0,89)	(0,25 0,33 0,44)	(0,25 0,33 0,44)
134	(0,25 0,33 0,44)	(0,75 0,78 0,89)	(0,25 0,33 0,44)	(0,25 0,33 0,44)
135	(0,50 0,56 0,67)	(0,75 0,78 0,89)	(0,50 0,56 0,67)	(0,75 0,78 0,89)

Primjenom normalizovane matrice odlučivanja određuju se vrijednosti entropije e_j. Vrijednost entropije računa se na osnovu sljedećeg obrasca:

$$e_j = -k\sum_{i=1}^{n} r_{ij} \ln r_{ij},\ j = 1,2,...,m. \tag{21}$$

Gdje r_{ij} predstavlja normalizovane vrijednosti, a k konstantu.

Uvođenjem konstante k, koja se računa na osnovu sljedeće formule: $k = 1/\ln n$, obezbijeđeno je da se sve vrijednosti entropije (e_j) nalaze u intervalu od nula do jedan (Agarski, 2014).

Nakon što se izračuna vrijednost entropije računa se stepen divergencije (d_j) u odnosu na prosječnu količinu informacija sadržanih u svakom kriteriju (Wang, Lee, 2009). Ovo se računa pomoću izraza:

$$d_j = 1 - e_j,\ j = 1,2,...,m. \tag{22}$$

Što je veća divergencija početnih kriterijskih vrijednosti za kriterij j, vrijednost stepena divergencije (d_j) je veća, pa se zaključuje da je važnost kriterija (C_j) za problem odlučivanja veći. Ako su sve vrijednosti stepena divergencije slične za određeni kriterij, onda je taj kriterij manje važan za problem odlučivanja (Milićević, Župac, 2012). Pomoću stepena divergencije se izračunava odstupanje pojedinih vrijednosti *fuzzy* brojeva po određenim kriterijima. U ovom slučaju to su tvrdnje za dimenziju partnerski odnosi sa dobavljačem.

Nakon što se izračuna stepen divergencije (d_j) potrebno je dobivene rezultate normalizovati da bi zbir pojedinačnih vrijednosti odgovarajućih *fuzzy* brojeva bio jednak jedan. To se postiže koristeći linearnu normalizaciju tipa 3 ili postotnu, odnosno aditivnu normalizaciju koja se računa pomoću sljedeće formule:

$$w_j = \frac{d_j}{\sum_{j=1}^{m} d_j} \tag{23}$$

gdje w_j predstavlja težinu odgovarajućeg *fuzzy* broja

Nakon što je predstavljen postupak metode entropije na Tabeli 6 će se objasniti njena primjena na dimenziji partnerski odnosi sa dobavljačem.

Tabela 6. Postupak računanja težina pomoću metode *fuzzy* entropije

Formule	POD01	POD02	POD03	POD04
$\sum_{i=1}^{n} r_{ij} \ln r_{ij}$	(-34,7 -33,4 -27,8)	(-29,4 -27,6 -19,8)	(-31,0 -29,7 -24,2)	(-35,7 -34,2 -28,1)
$e_j = -k\sum_{i=1}^{n} r_{ij} \ln r_{ij}$	(25,0 24,1 20,0)	(21,2 19,9 14,3)	(22,4 21,4 17,5)	(25,8 24,6 20,3)
$d_j = 1 - e_j$	(-24,0 -23,1 -19,0)	(-20,2 -18,9 -13,3)	(-21,4 -20,4 -16,5)	(-24,8 -23,6 -19,3)
w_j	(0,266 0,268 0,279)	(0,223 0,220 0,195)	(0,237 0,238 0,242)	(0,274 0,275 0,283)

Prvi korak je provođenje normalizacije podataka koja je predstavljena u Tabeli 5. Provođenjem normalizacije dobivaju se normalizovani elementi matrice odlučivanja (r_{ij}). Najprije je potrebno da se izračuna prirodni logaritam iz svakog elementa normalizovane *fuzzy* matrice odlučivanje $(\ln r_{ij})$.

Potom je potrebno dobivene vrijednosti prirodnog logaritma pomnožiti sa odgovarajućim normalizovanim elementima matrice odlučivanja $(r_{ij} \ln r_{ij})$, a zatim se izračuna zbir kolone $(\sum_{i=1}^{n} r_{ij} \ln r_{ij})$. Te vrijednosti su predstavljene u prvom redu tabele 6. Sljedeći korak je da se dobivene vrijednosti pomnože sa negativnom vrijednosti konstante *k*. Pošto je četiri tvrdnje unutar posmatrane dimenzije za n = 4 vrijednosti konstante *k* je 0,721. Dobivena vrijednost entropije je predstavljena u drugom redu tabele 6. Kada se izračunala vrijednost entropije, potrebno je izračunati stepen divergencije (izraz 22). Dobivene vrijednosti stepena divergencije prikazane su u trećem redu tabele 6. Na kraju metode entropije se izračunavaju težine kriterija, u ovom slučaju tvrdnji dimenzije partnerski odnosi sa dobavljačima. To se radi tako što se pojedinačne vrijednosti dijele sa odgovarajućim zbirom (izraz 23) i dobiva se konačna vrijednost težina koja je predstavljena u četvrtom redu tabele 6. Navedeni postupak je potrebno provesti za sve dimenzije varijabli istraživanja i formirati njihove težine.

Provođenjem postupka za sve tvrdnje unutar posmatranih dimenzija dobivaju se rezultati predstavljeni u Tabeli 7. Kao što se može vidjeti iz dobivenih rezultata, postoji različit značaj pojedinih tvrdnji unutar ovih dimenzija, jer se pojedine tvrdnje trebaju više vrednovati u odnosu na druge zbog odgovora dobivenih od preduzeća. Ukoliko su odgovori raznovrsniji to će važnost te tvrdnje biti veća u odnosu na tvrdnju kod kojih su dobivene slične vrijednosti odgovora.

Tabela 7. Težine tvrdnji za sve dimenzije dobivene primjenom metode *fuzzy* entropija

Dimenzije	Tvrdnja 1	Tvrdnja 2	Tvrdnja 3	Tvrdnja 4
Partnerski odnosi sa dobavljačima	(0,266 0,268 0,279)	(0,223 0,220 0,195)	(0,237 0,238 0,242)	(0,274 0,275 0,283)
Odnosi sa kupcima	(0,231 0,229 0,213)	(0,201 0,199 0,178)	(0,310 0,313 0,340)	(0,258 0,258 0,269)
Interne integracije	(0,326 0,333 0,381)	(0,175 0,172 0,147)	(0,267 0,266 0,262)	(0,232 0,229 0,209)
Nivo i kvalitet dijeljenja informacija	(0,250 0,249 0,239)	(0,277 0,280 0,296)	(0,247 0,246 0,240)	(0,226 0,226 0,225)

Pošto je objašnjeno dobivanje težina za pojedine tvrdnje na primjeru fuzzy entropije metode u nastavku će se objasniti dalji postupak transformisanja lingvističkih varijabli u numeričke vrijednosti.

Nakon što su izračunate težine vrši se otežavanje normalizovane matrice odlučivanja. Otežavanje je postupak množenja pojedinačnih članova *fuzzy* matrice odlučivanja sa odgovarajućom težinom. Vrijednosti dobiveni otežavanjem su predstavljene na Tabeli 8.

Tabela 8. Otežana normalizovana *fuzzy* matrica odlučivanja

Preduzeće	POD01	POD02	POD03	POD04
1	(0,07 0,09 0,12)	(0,17 0,17 0,17)	(0,06 0,08 0,11)	(0,14 0,15 0,19)
2	(0,20 0,21 0,25)	(0,17 0,17 0,17)	(0,18 0,18 0,21)	(0,21 0,21 0,25)
3	(0,13 0,15 0,19)	(0,17 0,17 0,17)	(0,18 0,18 0,21)	(0,21 0,21 0,25)
4	(0,07 0,09 0,12)	(0,06 0,07 0,09)	(0,24 0,24 0,24)	(0,21 0,21 0,25)
5	(0,20 0,21 0,25)	(0,22 0,22 0,20)	(0,24 0,24 0,24)	(0,27 0,27 0,28)
6	(0,07 0,09 0,12)	(0,17 0,17 0,17)	(0,06 0,08 0,11)	(0,14 0,15 0,19)
7	(0,07 0,09 0,12)	(0,11 0,12 0,13)	(0,06 0,08 0,11)	(0,07 0,09 0,13)
8	(0,20 0,21 0,25)	(0,22 0,22 0,20)	(0,18 0,18 0,21)	(0,27 0,27 0,28)
9	(0,13 0,15 0,19)	(0,17 0,17 0,17)	(0,12 0,13 0,16)	(0,14 0,15 0,19)
10	(0,07 0,09 0,12)	(0,17 0,17 0,17)	(0,06 0,08 0,11)	(0,14 0,15 0,19)
⋮	⋮	⋮	⋮	⋮
131	(0,27 0,27 0,28)	(0,22 0,22 0,20)	(0,24 0,24 0,24)	(0,21 0,21 0,25)
132	(0,20 0,21 0,25)	(0,17 0,17 0,17)	(0,18 0,18 0,21)	(0,21 0,21 0,25)
133	(0,07 0,09 0,12)	(0,17 0,17 0,17)	(0,06 0,08 0,11)	(0,07 0,09 0,13)
134	(0,07 0,09 0,12)	(0,17 0,17 0,17)	(0,06 0,08 0,11)	(0,07 0,09 0,13)
135	(0,13 0,15 0,19)	(0,17 0,17 0,17)	(0,12 0,13 0,16)	(0,21 0,21 0,25)

Nakon što se izvršilo otežavanje normalizovane fuzzy matrice odlučivanja potrebno je primjeniti FTOPSIS metodu i odrediti rastojanje alternativa od idealnih rješenja i relativne blizine alternativa idealnom rješenju. Najprije je potrebno pronaći najmanju i najveću vrijednost fuzzy brojeva te izračunati Euklidsko odstupanje. Nakon što se izračuna odstupanje potrebno je odrediti relativnu blizinu alternativa idealnom rješenju. Primjenom izraza 20 dobivamo rezultate predstavljene u Tabeli 9.

Tabela 9 Vrijednosti FTOPSIS metode za dimenziju partnerski odnosi sa dobavljačem

Preduzeće	d_i^-	d_i^*	FTOPSIS
1	(0,184 0,206 0,250)	(0,363 0,330 0,278)	0,3974
2	(0,321 0,335 0,394)	(0,194 0,181 0,137)	0,6718
3	(0,291 0,307 0,363)	(0,231 0,213 0,165)	0,6123
4	(0,278 0,290 0,330)	(0,327 0,298 0,258)	0,5043
5	(0,414 0,417 0,433)	(0,113 0,109 0,103)	0,7954
6	(0,184 0,206 0,250)	(0,363 0,330 0,278)	0,3974
7	(0,105 0,139 0,189)	(0,416 0,377 0,323)	0,2798
8	(0,388 0,394 0,421)	(0,148 0,139 0,117)	0,7485
9	(0,225 0,248 0,300)	(0,291 0,266 0,213)	0,5012
10	(0,169 0,198 0,252)	(0,354 0,322 0,269)	0,3956
⋮	⋮	⋮	⋮
131	(0,412 0,416 0,433)	(0,110 0,106 0,102)	0,7985
132	(0,321 0,335 0,394)	(0,194 0,181 0,137)	0,6718
133	(0,154 0,176 0,216)	(0,396 0,359 0,305)	0,3396
134	(0,154 0,176 0,216)	(0,396 0,359 0,305)	0,3396
135	(0,265 0,284 0,338)	(0,263 0,242 0,193)	0,5595

Na ovaj način je izvšena transformacija lingvističkih varijabli u numeričke vrijednosti koristeći se *fuzzy* logikom. Za ostale dimenzije varijabli primjenjuje se isti postupak računanja.

Pošto su izračunate vrijednosti FTOPSIS metode za sve dimenzije izračunati će se povezanost ovih dimenzija pomoću Pirsonovog koeficijenta korelacije. Rezultati povezanosti su prikazani na slici 10.

Slika 10. Povezanost dimenzija prakse lanca snabdijevanja

	POD	OSK	IIP	DKI
POD				
OSK	0,271**			
IIP	0,402**	0,449**		
DKI	0,386**	0,457**	0,398**	

** Korelacija je značajna na 0.01 nivou.

Rezultati korelacione analize pokazuju da postoji statistički veoma značajna povezanost dimenzija istraživanja. Najveća povezanost posmatranih dimenzija je između dimenzija odnosi sa kupcima i dijeljenje i kvalitet informacija (r = 0,457), dok je najmanja povezanost između partnerskih odnosa sa dobavljačem i odnosa sa kupcima (r = 0,271).

5. Zaključak

U većini primarnih istraživanja koje se provodi u društvenim naukama se koristi anketni upitnik. Uobičajno je da se nalaze najrazličitija pitanja u njemu. Ukoliko se želi ispitati stepen slaganja odnosno neslaganja sa postavljenom tvrdnjom koriste se lingvističke vrijednosti. Da bi se lingvističke vrijednosti mogle statistički obrađivati potrebno je iste transformisati u numeričke vrijednosti. Rezultati korelacione analize su pokazale da su sve dimenzije statistički značajno povezane. Ova metodologija je potpuno nova u naučnom svijetu i kao takva ju je potrebno ispitati i uporediti sa drugim načina da bi sama zaživljela u praksi.

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Primenljiva inženjerska rešenja za smanjenje ugljen dioksida u atmosferi korišćenjem prirodnih i veštačkih skladišta

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Apstrakt: Rukovodeći se Okvirnom Konvencijom Ujedinjenih nacija o klimatskim promenama (UNFCCC) iz 1992. godine, kao i Kjoto protokolom 1997. godine, Ujedinjene nacije su napravile ambiciozan plan da će od 2015. godine glavni ciljevi sveta i svih država članica UN-a, biti put ka klimatski bezbednoj ekonomiji i promovisanju ekonomskog razvoja zemalja trećeg sveta, a koji se u znatnoj meri oslanjaju na usaglašavanje sa ciljevima održivog razvoja i na Pariski sporazum o klimatskim promenama. Tehnologija industrijskog vremena koja koristi fosilna goriva za proizvodnju energije je i dalje uobičajena praksa koju mnogi, čak i visoko razvijene zemlje koriste. Prekomerna upotreba i masovna nekontrolisana eksploatacija prirodnih resursa, među kojima su najčešće uništavanje šuma, uglja, ulja i prirodnog gasa, može dovesti do povećanog i neuravnoteženog emitovanja ugljen-dioksida u atmosferu Zemlje, što može dodatno dovesti do povećanja nivoa Zemljine temperature. U ovom radu ćemo izložiti studiju slučaja projekta Weyburn-Midale ugljen-dioksid, koji se smatra najvećim svetskim projektom za odvajanje i skladištenje ugljenika u veštačkim skladištima, koji se nalazi u Kanadi, u Midaleu, Saskatchewan. Pored toga, kao moguću opciju, predstavićemo podatke o pošumljavanju u regionu Amazona u Latinskoj Americi, kao jedan od najambicioznijih planova za obnovu ekosistema, kao i projekat pošumljavanja u Shandongu, u Kini, koji doprinose i okruženju i ekonomskom razvoju regiona. Sve ove opcije trebaju da pokažu da su dovoljno primenljive u smanjivanju zagađenja ugljen-dioksidom u atmosferi. Obe opcije, veštačka skladišta, kao i prirodni načini smanjenja zagađenja ugljenikom kroz povećanje prirodnih prostora za skladištenje, trebali bi se posmatrati kao dugoročni plan koji može koristiti visoko razvijenim zemljama, i istovremeno biti održiv i pristupačan zemljama sa manjom ekonomskom snagom.

Ključne reči: Veštačka skladišta, Prirodna skladišta, Skladištenje ugljenika, Održivi razvoj, Ekonomski razvoj, Ujedinjenje Nacije.

Feasible Engineering Solutions to Reduce Carbon Dioxide Pollution in the Atmosphere Using Natural and Human Made Sinks

Abstract: Following the United Nations Framework Convention on Climate Change (UNFCCC) back in 1992, as well as the Kyoto Protocol in 1997, the United Nations made an ambitious plan, that from 2015 onwars, the main objectives of the world and all member states of the UN, are to pursue the climate safe economy and to promote the economic development for the third world countries, both of which highly rely on Sustainable Development Goals and the Paris Climate Agreement. The Industrial age technology that uses fossil fuels to produce energy is still the common practice that many, even the highly developed countries, use. The excessive usage and massive uncontrolled exploitation of natural resources, amongst which the most common are deforestation, coal, oil and natural gas extraction, can lead to increased and unbalanced mitigation of carbon dioxide content in the Earth's atmosphere, which can further lead to increased Earth's temperature. In this paper we will discuss the case study of Weyburn-Midale Carbon Dioxide project, viewed as the largest in the world human made carbon capture and storage project, located in Canada, in Midale, Saskatchewan. In addition, as a viable option, we will also present data on reforestation in the Amazon region in Latin America, as one of the most ambitious plans to restore the ecosystem, as well as a project of afforestation in the Shandong, China, which reflects both on environment and economic development of the region. All of these

options should show that they are feasible enough to minimize carbon dioxide pollution of the atmosphere. Both options, human made sinks, as well as the natures path and its own way to reduce carbon pollution by increasing the amount of natural sinks, should be seen as a long-term plan that can benefit highly developed countries and also be sustainable and affordable to the countries with smaller economic power.

Key words: Human Made Sinks, Natural Sinks, Carbon Capture, Sustainable Development, Economic Growth, United Nations.

Introduction

With the increasing temperature of the Earth's atmosphere and the growing threat of global warming that is already upon us, we will analyze the factors behind the global warming and focus our attention on the single most dangerous component, which is Carbon Dioxide (CO2) particles. Experts in the world have formed 17 Sustainable Development Goals or SDGs that focus mainly on three branches that are considered a baseline for sustainable development. Those are Economic Well-being, Social Inclusion and Environmental Sustainability. For this scientific paper, we shall focus on the Environmental Sustainability and the goal number 13, which is Climate Action. We will show examples of case studies that can beneficially contribute and combat carbon dioxide pollution of the atmosphere. Relying on the United Nations and the Sustainable Development Goals, we will present three options that are considered viable and feasible, two examples of natural sinks and one human made sink. We will also discuss the most intriguing question to date, the question of Carbon Budget. Considering the remaining amount of the Carbon Budget (how much carbon dioxide have we put up in the atmosphere), how much time do we have left and how fast should we be doing all of this regarding de-pollution?

UNFCC Conventions, Kyoto Protocol and Paris Agreement on climate change

The international environmental treaty on climate change was opened for signatures during the Earth Summit in Rio de Janeiro in 1992, entered into force from 1994 after a sufficient number of countries had signed it. United Nations Framework on Climate Change was the first international document of high importance whose goal was to stabilize greenhouse gas emissions at the level that would prevent irreversible damage to the climate system. When discussing the greenhouse gases, one must take into account that several of them are proven to be the leading cause of global warming. For example, when coal, as a fossil fuel, is burned, a number of gases are released in process. Greenhouse gases from coal include methane (CH4), released during hard coal production and most important carbon dioxide (CO2), as well as nitrous oxide (N2O), which are emitted when coal is used (Smith, Thambimuthu, 1991). It is highly important for countries to ensure that their emissions stay within limits that may later be negotiated and taken into action towards UNFCCC objective of stabilizing greenhouse gas emissions.

Based on the UNFCCC from 1992, the United Nations followed up on climate change focused convention in 1997, with the Kyoto Protocol. It is an extent on 1992 United Nations Framework on Climate Change that focuses furthermore on reduction of greenhouse gases, its stabilization, but now also adds that climate changes are scientifically proven, that global warming is occurring and that it is connected to the human made CO2 emissions. In article 2 of Kyoto Protocol, it is said that countries should pursue and promote sustainable development and to implement and elaborate policies and measures in accordance with their own national circumstances (UN, 1998).

Further advancements in the field of climate changes led to Paris Climate Agreement, which is to this date the most important document that helps countries unite in their goal of stopping the global warming. The United Nations convention took place in Paris, in 2015, just two months after the United Nations had agreed on 17 different Sustainable Development Goals. What is different from both Kyoto Protocol and United Nations Framework Convention on Climate Change is that Paris Climate Agreement has specified that each country should determine and plan its own contribution in order to stop and mitigate global warming. Following the ratification of the Paris Climate Agreement and all signatories, the world united now has a strong chance to mitigate and to stop global warming.

Raising awareness on negative effects caused by increased temperature

The essence behind the Paris Climate Agreement was to stop the global warming before we go to the point of no return. In order to do just that, we should hold the human activities that generate global warming and increase of the temperature to well below 2 degrees Celsius and to further pursue efforts to limit the increase of the temperature by 1.5 degrees Celsius (UN, 2015). The rise of the global temperature, compared to that of the average pre-industrial age temperature should stay below 2 degrees Celsius and we should aim to keep it well below 1.5 degrees Celsius. Temperature of the pre-industrial age is when we had no human activities to interfere and to warm the planet. The problem for this, however, is that we are already maybe well too late for that. Data that we have from NASA (National Aeronautics and Space Administration) shows that 2016 is the warmest year on the record (NASA, 2017) and we are already at 1.2 degrees Celsius at temperature increase. That means we are already at the halfway on that boundary of 2 degrees Celsius.

The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. Carbon dioxide concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions. The ocean has absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification (IPCC, 2013).

Potential threats behind the temperatures increase include those that can be potentially devastative for both human kind and animal and plant life alike. First and foremost dangerous threat is that of rising sea levels. Ice sheets in Antarctica and also the ice sheets in Greenland could melt and degrade so much that can raise the ocean level by several meters. Many coastline cities and low-lying countries that are at sea level could potentially fully flood. Droughts and floods are yet other global warming connected threats. Along with rising temperatures, new diseases related to temperature can also occur. The prime example behind diseases and storms connected with global warming is the Zika virus that has emerged in South America. El Nino storm created the perfect climate for the virus to emerge (Scientific American, 2016). With the addition of heat waves, loss of human productivity, crop failure due to rising temperature, these are all the risks that have led the entire world to band together, with the common agreement to stop global warming and to keep the temperature well below 2 degrees Celsius, and to pursue efforts to keep it well below 1.5 degrees Celsius.

Some risks of climate change are considerable at 1 or 2°C above preindustrial levels. Global climate change risks are high to very high with global mean temperature increase of 4°C or more above preindustrial levels in all reasons for concern and include severe and widespread impacts on unique and threatened systems, substantial species extinction, large risks to global and regional food security, and the combination of high temperature and humidity compromising normal human activities, including growing food or working outdoors in some areas for parts of the year (IPCC, 2014).

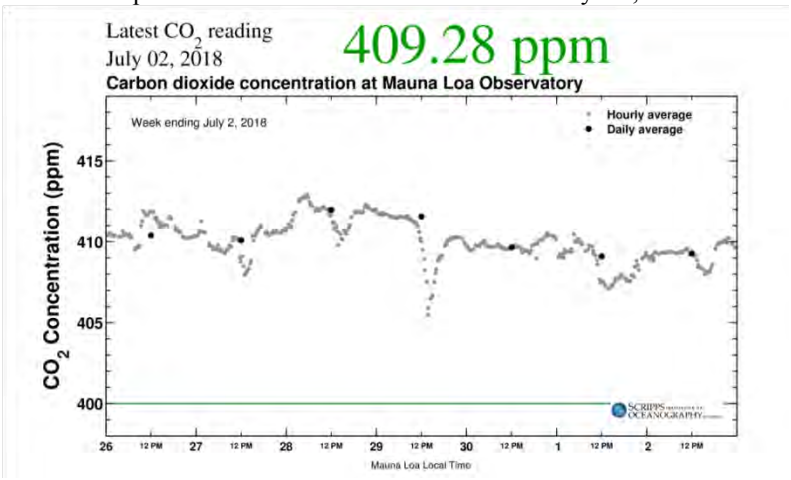
Reducing Carbon dioxide concentration in the atmosphere and Carbon Budget

Carbon dioxide is the most important of all greenhouse gases, simply because it is the main anthropogenic, or human made gas being released, by as much as around 80% due to energy use and industrial purposes, and around 20% from deforestation and land use changes. Carbon-based energy that we get from fossil fuels by combustion, carbon from it is oxidized and combined with O2, or oxygen in the air and it is produced as a carbon dioxide while releasing energy. Other way is releasing carbon and carbon dioxide from biological storage, or when we cut down forests for land use changes, we release carbon dioxide from trees and soils into the atmosphere.

The fate of fossil fuel carbon dioxide released into the atmosphere depends on the exchange rates of carbon between the atmosphere and three major carbon reservoirs, namely, the oceans, shallow-water sediments, and the terrestrial biosphere (Broecker, et al., 1979). Basically, Carbon Budget tells us how much more of carbon dioxide we can emit into the atmosphere and still be safe (limit of 2 degrees Celsius or well below 1.5 degrees Celsius temperature). The atmosphere and the planet itself are capable of cleaning and to removing carbon dioxide particles, but our constant pumping of the carbon dioxide is simply making the planet unable to clean itself up. Some of the carbon dioxide is absorbed by soil, some is being dissolved in the ocean, but at the rate at which we are pumping the carbon dioxide into the atmosphere is just overwhelming the planets capabilities. That means that carbon

dioxide is staying into the air faster than it is being removed by the trees, soil or oceans. The concentration of carbon dioxide in the air is best explained by the Keeling Curve, which shows us the rapid ongoing change in concentration of carbon dioxide in the atmosphere since 1950's when it was first measured.

Graph 1. Carbon dioxide concentration on July 2nd, 2018



Source: https://scripps.ucsd.edu/programs/keelingcurve/

The latest reading shown in Graph 1 is that as of July 2nd, 2018, carbon dioxide concentration is at its maximum since the measure was first taken. The high-accuracy measurements of atmospheric CO_2 concentration, initiated by Charles David Keeling in 1958, constitute the master time series documenting the changing composition of the atmosphere and these data have iconic status in climate change science as evidence of the effect of human activities on the chemical composition of the global atmosphere as they provide a true measure of the global carbon cycle, an effectively continuous record of burning fossil fuel. They also maintain an accuracy and precision that allow scientists to separate fossil fuel emissions from those due to the natural annual cycle of the biosphere, demonstrating a long-term change in the seasonal exchange of CO_2 between the atmosphere, biosphere and ocean (Le Treut, et al., 2007). More carbon dioxide in the atmosphere means that there is more human made warming. It is currently at 409.28ppm (parts per million). It means there are 409.28 molecules of carbon dioxide per million molecules of in the atmosphere as a whole, including all other atmospheric gases. So currently there is a difference of around 100 parts per million molecules of carbon dioxide more than it was back in the 1950s, which shows us that human made warming has been increasing rapidly. When all this is combined, the fact that we have increased the global temperature and that we have increased the level of carbon dioxide particles in the atmosphere, all leads us to the question of how much more carbon dioxide we can still emit before trespassing that limit and boundary. When we look the carbon budget, we can realize that we are already at the limit of breaking it. Looking back from the industrial age and the start of our fossil fuel burning all up until now, our limit of the Carbon Budget is around 3,600 billion tons of carbon dioxide and still be probably below 2 degrees Celsius of temperature increase. But the side note of that is that we have already emitted around 2000 billion tons of carbon dioxide so far. So what that means is that we have around 1,600 billion tons of carbon dioxide left to emit in our budget and still probably be below 2 degrees Celsius, not taking into account the other greenhouse gases that also go into our Carbon Budget because they are also heating up our planet. Which all leaves us with very little budget remaining in our Carbon Budget for carbon dioxide emission. With other gases in account, we would have around 850 billion tons of carbon dioxide remaining to emit. That would leave us with 66% probability to remain below 2 degrees Celsius. So if we limit our future carbon dioxide emissions to 850 billion tones, we would have 66% probability of staying below 2 degrees Celsius. But if it is said that it should be pursued to stay well below 2 degrees Celsius and even well below 1.5 degrees Celsius, 850 billion tones if not enough. On the important note, we are currently emitting around 36 billion tons of carbon dioxide every year, that number divided by the remaining budget leaves us with only 24 years left at the current rate, but that rate is constantly increasing.

Keeling Curve, shows us that we must stabilize our carbon dioxide emissions at the current rate of around 410 parts per million, and pursue efforts to reduce it in the future to around 350 parts per

million by capturing the carbon dioxide that is already in the atmosphere and getting it back into the soils or the forests or capture it by using chemical processes and store it safely into the ground, but also to stop any new emissions.

Energy system transformation - Human made sinks (Carbon capture and storage – CCS)

In order to reach zero emissions in the future, our current carbon-based energy system must be either replaced with alternative energy system that is non-carbon as a primary system or using a specific set of technologies that would still allow the carbon usage, but capturing it before being released into the atmosphere. Our focus will be on those technologies which would allow us to continue to use carbon-based energy, but with no risk to further pollution from carbon dioxide.

Carbon capture and sequestration, or Carbon capture and storage (CCS) is a specific type of technology which enable us to burn down fossil fuels, coal, oil or gas, safely capturing carbon dioxide, using various chemical processes, and storing it underground. Chemical processes used for this type of technology are absorption, adsorption and membrane separation with new concepts such as chemical-looping combustion and hydrate-based separation. Carbon capture and sequestration provide a mid-term solution to mitigate environment impacts and allow continued usage of fossil energy until renewable energy technologies mature (Hongqun, et al., 2008). The way we use technologies, in order to remove and store carbon dioxide underground, can be used as a term of human made carbon sinks. As the world today uses around 80% of the energy from fossil fuels, our future concept should be a switch to renewable sources of energy as a priority. Human made sink would be best described as a pipe that leads from the factory to under the surface, which would allow to burn coal and afterwards an exhaust of carbon dioxide would capture the carbon dioxide and pump it underground into a geological formation where carbon would be safely stored in a mineral formation and be mineralized in time.

As for the carbon capture and storage, we will present our data on Weyburn-Midale Project, taking place in Saskatchewan in Canada. The first phase of the project was to determine whether the site is suitable to sustain large amounts of carbon dioxide. The whole process can be broken down in four different stages, from site characterization, wellbore integrity with the risks of carbon dioxide leakages, to monitoring and verification, and lastly performance assessment. As this system is viable, as pointed out before, as a mid-term solution until better and adequate renewable technologies can be used, carbon capture and sequestration have a lot of weak spots. The site for carbon storage must be able to sustain large quantities of carbon dioxide over a long period of time, without the risk or leakages and without any risk for possibly contaminating the surrounding area. That alone can be the fact for certain countries not being able to safely implement the carbon capture and sequestration technology. For Weyburn-Midale site, looking at the reports, since the beginning of the project back in October 2000, around 30 million tons of carbon dioxide was injected into the ground. Main motivation behind the project was to determine whether this could be a viable option to use for enhanced oil recovery and a research on carbon dioxide. This particular project between the United States and Canada received much media attention and focus when several allegations occurred that there was a leakage of carbon dioxide in January 2011. Claims have soon been dismissed as false allegation, carbon dioxide not leaking because of injection but rather a natural occurring biogenic carbon dioxide from the processes in the soil (MIT, 2011). For the carbon capture and storage project to be a success, one must first complete a series of phases to see if it can be compatible with the land and geographical status of one's country. Not all countries possess viable storage options for the carbon dioxide and not all countries have economies stable enough to use it as a long term plan in reaching their set limits of carbon dioxide pollution.

Land-use system transformation - Natural sinks (Afforestation and Reforestation)

As mentioned before, there is also a natural way to remove particles of carbon dioxide from the atmosphere using biological processes that occur in nature which includes afforestation and reforestation. Previously stated, around 80% of carbon dioxide pollution is generated from energy system and carbon-based energy. The rest of it, around 20% is from land-use. Altogether, what we are putting up must be mitigated by what we are taking out, which means that anthropogenic carbon dioxide generated from either energy system or land-use system must be somehow mitigated and

removed. Carbon dioxide sources must be balanced by the sinks. Within the Kyoto Protocol, the Clean Development Mechanism (CDM) is an instrument intended to reduce greenhouse gas emissions, while assisting developing countries in achieving sustainable development, with the multiple goals of poverty reduction, environmental benefits and cost-effective emission reductions, the CDM allows for a small percentage of emission reduction credits to come from afforestation and reforestation projects (Zomer, et al., 2008).

Afforestation is a term used when a new forest is being created in a place where there was degraded land before. It is human affected natural sink for carbon dioxide absorption. Now the question is, what can be achieved within a global, large scale afforestation program that is economically, politically, and technically feasible. We estimated that, of the areas regarded as suitable for large-scale plantations, only about 345 million ha would actually be available for plantations and agroforestry for the sole purpose of sequestering carbon. The maximum annual rate of carbon fixation (1.48 Gt/yr) would only be achieved 60 years after the establishment of the plantations - 1.14 Gt by above-ground biomass and 0.34 Gt by below-ground biomass. Over the period from 1995 to 2095, a total of 104 Gt of carbon would be sequestered. This is substantially lower than the amount of carbon required offsetting current carbon emissions (3.8 Gt/yr) in order to stabilize the carbon content of the atmosphere (Nilsson, Schopfhauser, 1995). With the analysis provided, it is seen that afforestation can be used to capture the carbon dioxide from the atmosphere, but not by the amount needed to reach the zero emissions.

One of the largest projects regarding afforestation is placed in the Shandong region of China. China has a standing problem with soil erosion and desertification (Cao, et al., 2011). As for the Shandong region in China, the World Bank reports that outcomes were highly satisfactory, the risk to development outcome was low, the Bank performance was satisfactory, and Borrower performance was highly satisfactory. Projects designed around coherent national policy frameworks and local development strategies enjoy strong political support which, in turn, greatly enhances their chances of success. Integrated afforestation approaches which include mixed species planting, the retention of ground cover, the inclusion of economic activities, and the promotion of natural regeneration are ecologically sustainable, financially viable, and more resilient to pests and diseases (Worldbank, 2017). Positive outcome on Shandong, China, shows us that afforestation is a good way to mitigate and capture the carbon dioxide from the atmosphere while also reaping the benefits of developing the local communities, promoting ecosystem and overall economic activity, while staying sustainable and financially viable.

Next to the afforestation is reforestation, or replanting the forests where they used to be. Connected to the poor land-use management and deforestation, reforestation aims to replant the forest and bring balance to the ecosystem where it once was. Reforestation of these abandoned lands, both natural and managed, has been proposed as a means to help offset increasing carbon emissions to the atmosphere (Silver, et al., 2011). Widely considered as the “lungs of the planet”, Amazon rainforest in South America is known for its effect on cleaning the Earth’s atmosphere from carbon-based pollution and negating the effects of global warming. In recent years, Amazon rainforest has been widely damaged, and massive deforestation took effect when removing the trees in order to make room for farmlands, crop plantations and pastures. On the other hand, with deforestation, the biodiversity of the region is also suffering from deforestation, and many species of mammals, reptiles and birds are losing their natural habitat. Reports say that if these rates of deforestation continue, there likely won’t be any rainforests left in the next 100 years (Onegreenplanet, 2017).

Brazil has about two thirds of the Amazon rainforest and is the country with the richest biodiversity in the world. Its main nationally determined goal is to reach zero deforestation, to improve satellite monitoring of the Amazon rainforest, to protect certain areas with implementing penalties and fines and the restriction of credits. Regarding the reforestation and land-use management, Brazil plans to restore 15Mha of degraded pasture lands and to promote additional 5Mha of integrated cropland, livestock and forestry. Brazil further plans to eliminate illegal deforestation in the Amazon region by 2030 and also to restore over 12Mha of forests in all biomes in order to enhance sustainable forest management. As for the rest of the Amazon rainforest biome, tropical rainforests are often considered to be the “cradles of biodiversity”. Though they cover only about 6 of the Earth’s land surface, they are home to over 50% of global biodiversity. Rain forests also take in massive amounts of carbon dioxide and release oxygen through photosynthesis. They also store very large amounts of carbon, and so cutting and burning their biomass contributes to global climate change (PSU, 2017). Benefits of reforestation are

closely connected to the sustainable development and also growth in economy and by promoting healthy reforestation, specifically in the Amazon rainforest region, where the current scale of deforestation in tropical regions and the large areas of degraded lands now present underscore the urgent need for interventions to restore biodiversity, ecological functioning, and the supply of goods and ecological services previously used by poor rural communities (Lamb, et al., 2005).

Conclusion

All member states of the United Nations agreed on to limit and to control human made global warming, to pursue climate safety, in the context of sustainable development. Greenhouse gases are one of main reasons behind global warming, and when you add to that deforestation and cutting down the forests, ocean acidification connected to carbon dioxide generated while burning down fossil fuels, and along with it the ecosystems general pollution and the depletion of fresh water. When it is talked about putting the greenhouse gases in the atmosphere, that is causing the global warming, especially carbon dioxide, nitrous oxide, methane and other industrial chemicals, those chemicals that remain in the Earth's atmosphere, when the solar radiation generated from the Sun hits Earth and is reflected back, it is captured by those greenhouse gases warming the planet.

Since 2015 and the Paris Climate Agreement, we have realized that our goal and main objectives are to pursue climate safe economy, to stabilize and to reduce the greenhouse gas emissions from carbon-based energy from fossil fuels, mainly carbon dioxide as the biggest anthropogenic or human made pollutant, from the atmosphere so that we have a chance to stay below 2 degrees Celsius or even well below 1.5 degrees Celsius, all in accordance with the goals set by the Paris Climate Agreement. We must turn our focus to staying within our Carbon Budget, and also to turn our emissions down. All of that can be achieved in either short term plan, where each country or member state of the United Nations should communicate with other countries, prepare and maintain its own Nationally Determined Contributions that it attends to achieve. On the long term plan, all countries should contribute by formulating and communicating low greenhouse emission development strategies. What can be done in the way to promote less emission is to work on energy system transformation and also on land- use system transformation as shown in cases regarding Canada, China and Amazon.

As a negative thing that increases carbon pollution, we should aim to stop deforestation, and turn our attention to afforestation and to create new forests through land management. But, if we change our habits, and add with the afforestation other means to capture the carbon dioxide, and also replace and reduce our current usage of carbon-based energy and fossil fuels with human made sinks and carbon capture and sequestration technology, while also promoting renewables as a mean to produce energy, our carbon pollution in the atmosphere would be lowered substantially.

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Predlog marketinškog plana za ulazak novog brenda prehrambenih dodataka na tržište

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Apstrakt: Snabdevanje sigurne hrane, koja ne ugrožava zdravlje potrošača putem hemijskih, bioloških ili drugih vrsta zagađivača, je osnova zdrave ishrane i važan faktor zaštite zdravlja kao javnog interesa. Prevencija bolesti koja se prenosi hranom i zaštita interesa potrošača su stoga dva glavna elementa zakonodavstva o prehrambenim proizvodima. Zakon o prehrambenim proizvodima propisuje opšte uslove, biološku i hemijsku sigurnost hrane i utvrđuje zahteve za nosioce poslovanja u vezi sa označavanjem, prezentacijom i reklamiranjem hrane, uključujući zdravstvene i prehrambene zahteve za hranu. Zahvaljujući posebnom proizvodnom procesu, načinu delovanja i sastavu, dodaci hrane Gematria su jedinstveni brend proizvoda. Oni su klasifikovani kao proizvodi visokog kvaliteta i cene. Pored pitanja cena, postoji i izazov da se proizvodi proizvode u SAD, gde se primenjuje različito zakonodavstvo o prehrambenim proizvodima. Naša studija istražila je da li postoje realne mogućnosti uvoza ovih proizvoda u Evropu, da li slovenačko tržište ima prostor i interes za takve proizvode, a na osnovu analize rezultata kvantitativne studije, pripremi marketinški plan za ulazak novog brenda na slovenačko tržište. Rezultati studije nam omogućavaju da zaključimo da je slovenačko tržište spremno za unos novih i prethodno nepoznatih brendova za dodatak prehrani, koji nude visokokvalitetne proizvode od visokokvalitetnih sastojaka i u skladu sa dobrim proizvodnim praksama.

Ključne reči: Prehrambeni dodatak, brend, pozicioniranje, zakon o prehrambenim proizvodima, marketinški plan

Marketing Plan Proposal for the Entry of a Food Supplement Brand into the Market

Abstract: The supply of safe food, which does not endanger the health of consumers through chemical, biological or other types of pollutants, is the foundation of a healthy diet and an important factor of the protection of health as a public interest. The prevention of food-borne diseases and the protection of consumers' interests are therefore two main elements of food legislation. Food legislation stipulates the general requirements, biological and chemical safety of foods, and establishes the requirements for food business operators as regards the labelling, presentation, and advertising of foods, including health and nutrition claims on foods. Due to the special manufacturing process, mode of action, and composition, Gematria food supplements are a unique brand of products. They are classified as products of a high quality and price. In addition to the price issue, there is the challenge that the products are manufactured in the USA, where a different food legislation applies. Our study investigated whether there are realistic possibilities of importing these products into Europe, whether the Slovene market has the space and interest in such products, and, based on an analysis of the results of a quantitative study, prepare a marketing plan for the entry of a new brand into the Slovene market. The study results allow us to conclude that the Slovene market is ready for the entry of new and previously unknown food supplement brands, which offer high-quality products made of high-quality ingredients and in accordance with Good Manufacturing Practices.

Keywords: Food supplements, brand, positioning, food legislation, marketing plan

1. Introduction

The supply of safe food, which does not endanger the health of consumers through chemical, biological or other types of pollutants, is the foundation of a healthy diet and an important factor of the protection of health as a public interest. The prevention of food-borne diseases and the protection of consumers' interests are therefore two main elements of food legislation. Food legislation stipulates the general requirements, biological and chemical safety of foods, and establishes the requirements for food business operators as regards the labelling, presentation, and advertising of foods, including health and nutrition claims on foods.

Food supplements are considered foods and from the viewpoint of quality and safe use, the safety of food supplements therefore falls under the authority of various offices of the Ministry of Health. Each entity entering the Slovene market with a foodstuff (food supplement) has to register a food establishment with the Administration of the Republic of Slovenia for Food Safety, Veterinary Sector and Plant Protection. After the registration of its activity, control over the entity is taken over by the Health Inspectorate, which performs inspection visits so as to establish appropriate operations and compliance with legislation at the time of the entry of the product into the market and at least once a year. During the inspection visits, the inspectors make sure that business operators comply with legislative requirements concerning the composition and labelling of food supplements and foods for special purposes. Appropriate presentation and advertising are checked by monitoring various media, with an emphasis on the Internet. As regards manufacturing and storage, the inspectors check if the facility meets the hygiene requirements and whether procedures which are based on HACCP principles have been set up. Wholesomeness of foods is checked with laboratory analyses of taken samples (Health Inspectorate, 2017).

Food supplements are foods whose purpose is to supplement the normal diet. They are concentrated sources of individual or combined nutrients, or other substances with a nutritional or physiological effect and are marketed in the form of capsules, pastilles, tablets and other similar forms, sachets of powder, ampoules of liquids, drop dispensing bottles, and other similar forms of liquids and powders designed to be taken in measured small unit quantities (Rules on Food Supplements, 2013). For different conditions, a different nutrient content is required to achieve a physiological effect (e.g. a healthy individual has a lower requirement for additional nutrients than patients, pregnant women, people with a compromised immune system).

Despite claims made by nutritionists that we receive all the required nutrients with a healthy diet, consumers are aware that the path from the garden to the plate is getting longer and the food is consequently losing its nutritional value. The modern lifestyle, environmental, psychological and physical stress increase the need to add nutrients. There are a number of food supplements in the Slovene market; however consumers are mostly not sufficiently informed to be able to choose products of the highest quality. They mostly settle for the opinion of the sellers, who usually offer a product of their choice (which depends on a number of factors). The fact is that different chemical forms of nutrients have a different bioavailability and the uptake can be substantially different.

The European Union wishes to unify the legislation of member states; however there are still major differences in regulations which hinder individual products from entering the market. So as to balance this obstacle and facilitate the exchange of goods within EU borders, the Contract on the free movement of goods and services was concluded stipulating that the competent authority has to prove the effect on public health if it prohibits the sale of a specific product in the territory of a member state and Regulation (EC) no 764/2008 on mutual recognition was adopted. The main objective of this Regulation is to lay down the rights and obligations of national authorities and enterprises when these authorities intend to reject mutual recognition and access to the market to a product which is legally marketed in another member state. The Regulation stipulates that the burden of proof lies with national authorities which plan to reject the product access to the market (Free movement of goods, 2010).

Gematria food supplements are a unique product. The owner of Gematria Products Inc, a company based in Carlsbad, the USA, Dr Todd Ovokyatis, is an inventor and expert with excellent knowledge of the human body. Dr Ovokyatis participated in numerous studies on the workings of the immune system, which led him to persons afflicted with HIV infection. To help with conventional treatment, Dr Ovokyatis developed a line of food supplements which help strengthen the immune system. He also

developed a special laser which enhances the energy of bonds in crystals, thus enabling better absorption of nutrients in the body. This laser optical technology has been patented worldwide. This invention is now being used in the potentiation of nutrients and for directing substances to a specific place in the body. Gematria food supplements are manufactured in accordance with pharmaceutical GMP (good manufacturing practices) standards (Gematria, 2017).

The strict food legislation is the main reason why Gematria has left the EU market, as of all the available products (approximately 40), only 5 or 6 (depending on the member state in question) meet the requirements of the EU legislation. Individual EU member states, which are more inclined towards the United States (Great Britain and Ireland), still allow the import of food supplements from the United States despite the incompatibility of products with the applicable legislation. Europe is a market with 500 million consumers and a high purchasing power and as such interesting for manufacturers from across the globe. As the market of self-treatment and prevention of diseases is constantly growing (including wellness, alternative medicine, etc.), there are realistic possibilities for Gematria to re-enter the Slovene and later the entire European market.

We wish to use the study results to prepare a marketing plan proposal for the entry of this high-priced food supplement brand into the Slovene market. We studied whether, in light of the applicable legislation, there is a legal option for these products to be present in the market and whether the Slovene market has the space and interest in such products. One of the objectives was to explore the market's attitude towards food supplements which are made predominantly from natural plant ingredients.

2. Purpose, Methodology and Study Sample

2.1 Purpose of the Study

The purpose of the study was to search for answers to the posed hypotheses and establish whether consumers are interested in natural plant-based food supplements and whether consumers, who are already taking food supplements, are willing to accept a high-priced brand and what would convince them to do so.

2.2 Methodology and Study Sample

The quantitative research method and the technique of online surveying were used. A survey was implemented among consumers of food supplements. The respondents were asked to participate in the survey by an e-invitation. The invitation/access to the survey was sent to our contacts, who were asked to fill it in and send it to their contacts – this way, snowball sampling was used for the survey. The survey was filled in by 80 respondents. The survey was active from 29 July 2017 to 29 August 2017. The sample is not representative and the study results cannot be generalised to the whole population. The obtained data have been analysed and are presented in the results of the analysis. Based on the obtained results, the research hypotheses were tested.

2.3 Research Hypotheses

The hypotheses which were tested during the study:

H1 There are realistic market opportunities in the EU for importing food supplements from the USA.
H2 Consumers of food supplements are more inclined towards products which also contain plant ingredients.
H3 Consumers of food supplements are aware of the chemical forms of food supplements that the body more easily absorbs.
H4 Price is important for the purchase decision.
H5 The brand of the food supplement is a decisive factor for the purchase of the product.

3. Survey Results

3.1. Respondents' Demographic Characteristics

The survey was filled in by 80 respondents, i.e. 49 women (61%) and 31 men (39%). The majority of the respondents were 40 to 49 years old, i.e. 38% (n=30), followed by respondents in the 30 to 39 age group, i.e. 28% (n=22), respondents in the 50 to 59 age group, i.e. 20% (n=16), 11% (n=9) were in the 20 to 29 age group, and the lowest number of respondents belonged to the 60 to 65 age group, i.e. only 4% (n=3).

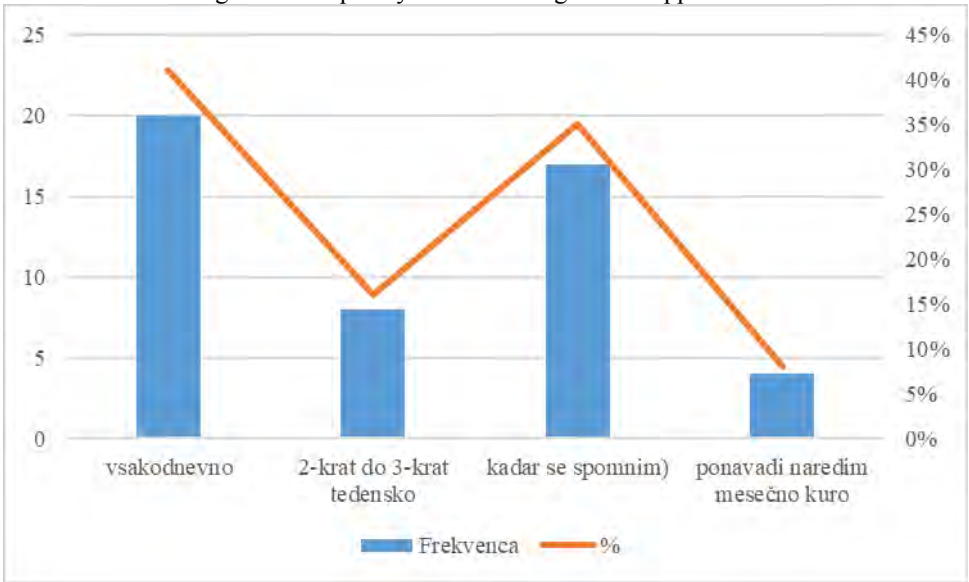
95% of the respondents (n=76) are employed, 2.5% (n=2) are still in school, 1.25% (n=1) are retired, and the same percentage, i.e. 1.25% (n=1), are unemployed.

The educational attainment of respondents is relatively high, as 49% (n=39) of respondents hold a university degree/2nd cycle Bologna degree, 24% (n=19) have a college diploma, and the remaining percentage have completed secondary school (10%, n=8), hold a master of science or PhD (9%, n=7), have completed a vocational school (5%, n=4), short-cycle college (3%, n=2), and 1 responded completed primary school.

3.2 Analysis of Purchasing Habits of Consumers of Food Supplements

We were first interested in the percentage of respondents who regularly or occasionally consume food supplements. The answer was interesting, as from the 80 respondents, 61% (n=49) said yes and 39% (n=31) said no. The 49 respondents who provided an affirmative answer participated in the continuation of the survey. From the 49 respondents who said that they consume food supplements, 25% (n=20) consume them daily, 21% (n=17) when they remember, 10% (n=8) twice to three times a week, and only 5% (n=4) usually make a monthly treatment using an individual food supplement (Figure 1).

Figure 1: Frequency of Consuming Food Supplements



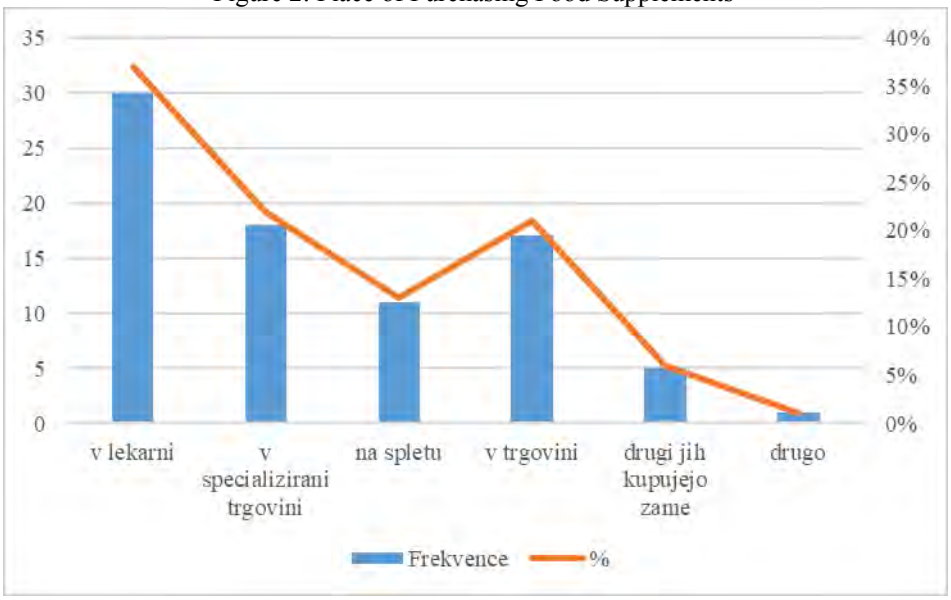
On average, the respondents consume 2.8 (standard deviation=1.8) different food supplements.

Asked which food supplements they consume, the respondents reported the use of different vitamins (multivitamins: n=11, vitamins B: n=6, vitamin C: n=5, vitamin D: n=4, vitamin E: n=1), minerals (calcium: n=2, magnesium: n=16), omega-3 fatty acids (n=6), Bilobil (n=2), maca (n=1), MSM (n=3), hemp protein (n= 1), algae (n=2), probiotics (n=1), and coenzyme Q10 (n=2).

Asked where they buy food supplements (several different answers were possible), the majority of the respondents, i.e. 37% (n=30) answered that they buy them in the pharmacy, 22% (n=18) buy them in

specialised stores, 21% (n=17) buy them in shops, 13% (n=11) online, 6% (n=5) said that other people buy the food supplements for them, and 1% (n=1) buy them in sports nutrition stores (Figure 2).

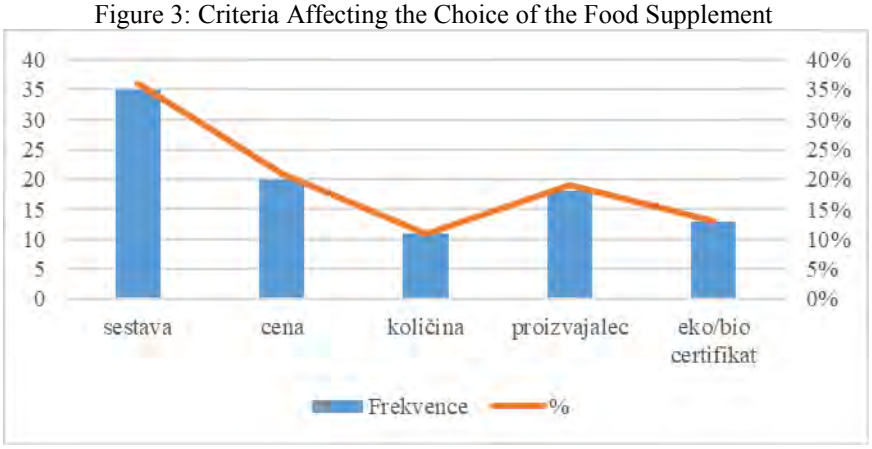
Figure 2: Place of Purchasing Food Supplements



Slightly less than one half (49%, n=24) have more faith in food supplements of known brands, 33% (n=16) believe that brand is not important, 14 (n=7) said "I don't know", and 4 (n=2) said that sometimes yes and sometimes no and that they have their own selection of good products.

When choosing the food supplement (several answers were possible), the respondents mainly focus on the composition (36%, n=35), price (21%, n=20), 19% (n=18) of respondents find it important who the manufacturer is, for 13% (n=13) it is important whether the product has an organic/biological certification, and the least important criterion for the decision to buy a food supplement is the quantity of the food supplement (11%, n=11) (Figure 3).

Figure 3: Criteria Affecting the Choice of the Food Supplement



We were further interested who they ask for advice on which food supplement is appropriate or which food supplement to choose. The highest share of the respondents, i.e. 21% (n=19), believe that they get the best advice from the people they know, 19% (n=17) of the respondents search for information on the manufacturers' websites, 18 (n=16) study different literature, 16% (n=14) ask the pharmacist for advice, 10% (n=9) seek the information from a nutritionist, 7% (n=6) ask their personal trainer, 6% (n=5) search for information in blogs, only 2% (n=2) consult their doctor, and 1% (n=1) do not ask anyone for advice.

Slightly more than one half (56%, n=27) always check the ingredients prior to purchasing the food supplement, 42% (n=20) check them sometimes, and 2% (n=1) never check the ingredients.

56% (n=27) find it important that food supplements contain plant ingredients, while 44% (n=21) believe that this is not important.

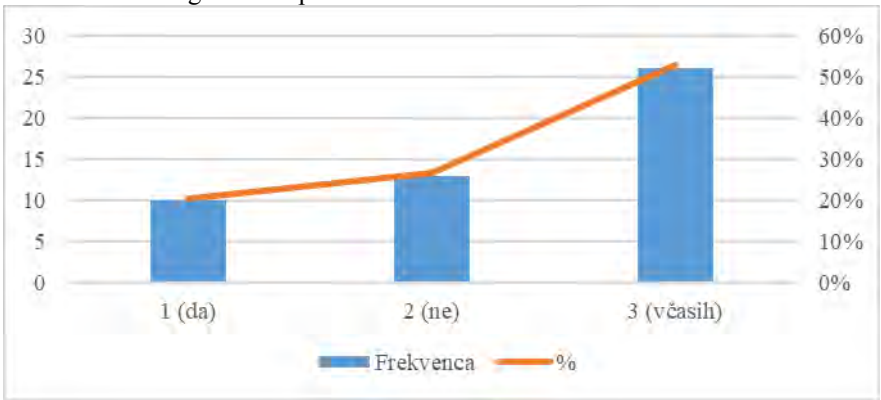
From the 27 respondents who answered in the affirmative as regards plant ingredients, 56% (n=15) believe that it is important that the plants come from organic farming and the remaining 44% (n=12) believe that this is only sometimes important.

In order for the absorption of nutrients to be effective, the chemical forms of vitamins and minerals are important. 57% (n=28) of the respondents never check the chemical form of the product, while 43% (n=21) do so at the time of purchase.

Almost two thirds of the respondents (59%, n=29) occasionally use a combination of natural plant ingredients, vitamins and minerals, 27% (n=13) always use such a combination, while 14% (n=7) do not use such combinations.

The price as a decisive purchasing factor is occasionally important for slightly more than one half of the respondents (53%, n=26), it is always important for 20% (n=10) of the respondents, and not important for 27% (n=13) of the respondents (Figure 4).

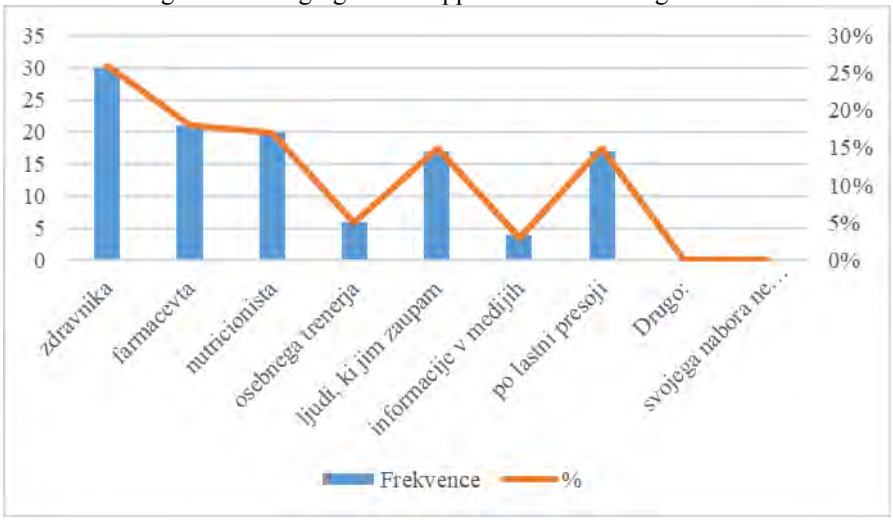
Figure 4: Importance of Price as a Choice Criterion



The respondents spend an average of €28.90 (standard deviation=19.99, min.=2, max.=85) monthly on food supplements and they would be prepared to spend an average of no more than €53.40 (standard deviation=50, min.=5, max.=250).

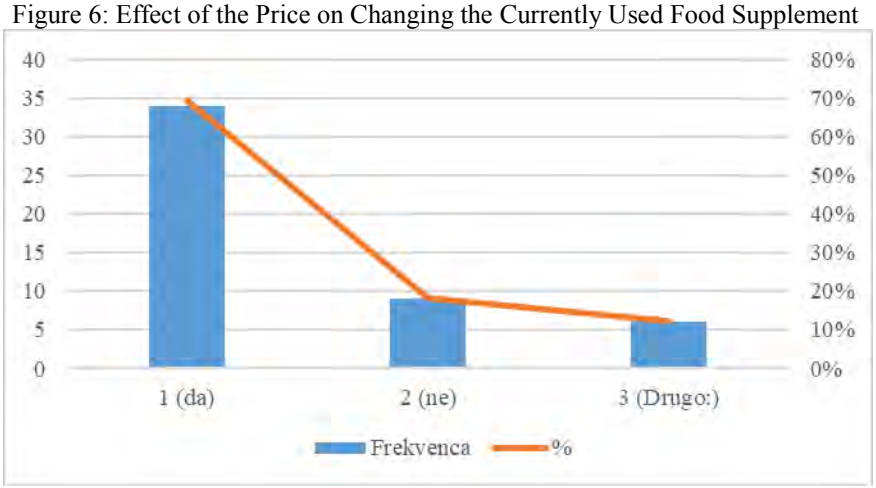
26% (n=30) of the respondents would make the decision to change the currently used food supplements if advised to do so by a doctor, 18% (n=21) if it was recommended by a pharmacist, 17% (n=20) if recommended by a nutritionist, 15% (n=17) if recommended by people they trust, and the same percentage also by their own choice, 5% (n=6) would do so if this was recommended by their personal trainer, and only 3% (n=4) would be convinced to change the food supplements on the basis of information from the media (Figure 5).

Figure 5: Changing Food Supplements Following Advice



69% (n=34) of the respondents would decide for the change despitea higher price, 18% (n=9) would not decide for the change because of a higher price, and 12% (n=6) believe that they would decide for the change in specific cases, depending on the difference in the price, the quality of the other product, and the person who recommended the change (Figure 6).

Figure 6: Effect of the Price on Changing the Currently Used Food Supplement



3.3 Hypotheses Testing

H1 There are realistic market opportunities in the EU for importing food supplements from the USA.

This hypothesis can be confirmed. Reviewing the literature and the study results, we came to the conclusion that market opportunities do exist, i.e.

- If labelling of Gematria food supplements is adapted to the EU legislation, as the recommended daily allowances are lower than in the USA. New calculations need to be made, the RDA percentage calculated, and daily allowances adapted to the EU legislation (e.g. instead of two capsules, which are allowed in the USA, only one capsule a day).
- Within the EU territory, different member states have a different national legislation regarding the amount of nutrients in food supplements. In consideration of the Treaty relating to the free movement of goods, we decided to make Ireland the entry point to the EU, as it does not stipulate limitations on the import of products from the USA. From Ireland, the products can freely move to other EU member states.

H2 Consumers of food supplements are more inclined towards products which also contain plant ingredients.

Plant ingredients are important to almost two thirds of consumers, while the remaining percentage see this as an unimportant fact. The hypothesis can be confirmed, as this is important to the majority of the consumers.

H3 Consumers of food supplements are aware of the chemical forms of food supplements that the body more easily absorbs.

Only slightly more than one third of consumers of food supplements are aware of the chemical forms of vitamins and minerals, which means that this can be a sales leverage for the sellers/distributors for the products already present in the market and for those they wish to launch to the market. The hypothesis is refused.

H4 Price is important for the purchase decision.

The study results show that the price is not a decisive factor for the purchase of a food supplement, as it ranked second in terms of a purchasing criterion. Composition is more important, however the hypothesis is nevertheless confirmed, as consumers rank it among the most important factors influencing their purchase decision.

H5 A renowned brand of the food supplement is a decisive factor for the purchase of the product.

Less than one third of consumers believe that a renowned brand is important when choosing the product. We therefore believe that yet unknown (but high-quality) brands have the possibility to successfully enter the market and therefore refuse the hypothesis.

4. Marketing Plan Proposal for the Entry of the Gematria Brand into the SLOVENE Market

4.1 Market Analysis

According to 2015 data, the food supplements market in Slovenia is growing, i.e. an average 2% under current retail conditions. Consumers' interest in the purchase of food supplements is increasing due to the need for self-treatment, the growing trend of a healthy lifestyle, and due to encouragements from the professional public (Euromonitor, 2015).

The following competitive enterprises have been identified in the Slovene market:

- **Sensilab**: a very recognisable Slovene food supplements manufacturer with its own chain of stores and a broad range of products. The company is very active at fairs, offers expert measurements, counselling, prepares nutrition plans, offers assistance in choosing the right solution for an individual problems, offers free advice and information on healthy living online and in magazines, has online applications helping consumers, etc. It is possible to order their products online and buy them in pharmacies and in specialised stores (www.sensilab.si, 2017).
- **Medex**: one of the leading European manufacturers of food supplements based on bee products and other natural products and cosmetics. Production has been upgraded with high production standards and tested quality ingredients. An advantage is the Slovene origin of products. The company markets its products via the online shop, is a very active advertiser, has an own store in Ljubljana, and Medex products can be found in almost all stores across Slovenia and in individual filling stations. (www.medex.si, 2017).
- **Jamieson:** is a Canadian food supplements brand. They are characterised by a broad spectrum of different combinations of vitamins and minerals in doses which mainly exceed the highest allowed doses in the EU. Their products are available in pharmacies, specialised stores and in the online shop. In terms of price, they come closest to Gematria from all the compared

brands, and the same applies to the composition and quality of the ingredients (www.jamiesonvitamins.com/, 2017).

The strengths and weaknesses of individual brands have been assessed with regard to different factors (Table 1). A downwards arrow means that Gematria is better than the competition and an upwards arrow means that it is worse.

Table 1: Strengths and Weaknesses of Gematria Compared to its Competition

Factor	Competitive brand		
	Sensilab	Medex	Jamieson
Product price	▼	▼	▼
Brand recognisability	▲	▲	▲
Ingredient quality	▼	▼	the same
Sales channel accessibility	▲	▲	▲
Number of sales channels	▲	▲	▲
Marketing activities	▲	▲	▲
Negotiating power with suppliers	▲	▲	▲

Source: own

4.2. SWOT Analysis

The SWOT analysis was chosen to analyse the threats and opportunities, as it appropriately shows the main strengths and advantages of Gematria compared to the competition and sheds light on the weaknesses and potential threats which might endanger the successful entry into the Slovene market (Table 2).

Table 2: SWOT Analysis for Gematria

Strengths	Opportunities
• The only laser enhanced food supplements in the world; • Carefully chosen ingredients and continuous quality control; • Sophisticated composition of products for the best possible effect; • Manufacturing in accordance with GMP standards.	• Excellent supportive treatment of complex chronic and acute diseases; • Relocation of production to the EU; • Adapting formulas so that they comply with EU legislation; • Setting up an educational network for buyers/therapists.
Weaknesses	**Threats**
• Expensive ingredients; • Complex production process; • Manufactured in the USA, raising the price of the product; • Recommended doses in the USA substantially exceed those in the EU; • Use of plant ingredients which are not allowed in Slovenia or which are registered as medicine;	• Complex positioning of products compared to the competition; • High costs of setting up production and a network in the EU; • High price of the products; • Rigid European legislation; • High wholesale and retail margins which substantially increase the price of the product (up to 40%).

Source: own

4.3 Segmentation of Target Groups

Table 3: Segmentation of Target Groups

Demographic characteristics	Youth: preventive and curative care, fast treatment of diseases. Elderly: curative care, better buyers due to the increase of modern-day diseases and the desire for a long and healthy life. Households with above-average income and a higher level of educational attainment.
Geographic characteristics	Consumers who live in the urban environment and have a higher income and better access to information and products.
Psychographic characteristics	Primary target group: patients with a weak immune system, active individuals, athletes, business people, frequent travellers, people with a hectic lifestyle and a lack of time for traditional meals, which increases the need for food supplements, individuals with a higher income. Secondary target group: conscious buyers who take active care of their health and the health of their family.
Behavioural characteristics	Consumers who are highly conscious of the preservation of health. Loyal consumers who regularly consume the products of their chosen brand. Consumers who are willing to learn and are strongly motivated to preserve a healthy lifestyle.

Source: own

4.4. Setting Marketing Objectives

After the SWOT and market analysis for food supplements, short-term marketing objectives for a three-year period were set:

- The visual identity of the brand has to be refreshed prior to entering the market, making it more agreeable to the European market,
- An online educational portal and smartphone application for the professional public and consumers have to be set up.
- Certified consultants have to be trained to become the operators of the educational platform,
- A network of nutritionists/doctors/pharmacists, who will recommend our products, has to be established,
- Active field promotion, workshops, training seminars, counselling offices,
- Media and online advertising.

4.5. Designing the Marketing Strategy

Currently, marketing in Gematria is not developed, the products are being sold by inertia selling, and there is no marketing plan which would foresee future actions and appropriate positioning of the products in the market. The introduction of a brand which does not have a clear strategy and appropriate marketing support from the manufacturer is a major challenge. These products are unique and it is therefore sensible to use resources to successfully launch them into the Slovene market. The company's owner is a scientist with an exceptional sense and knowledge for creating products, however due to too great a need for control is also hurting the business. The marketing strategy for Gematria with the aim of achieving the marketing objectives has been designed with the help of marketing mix elements (4Ps), which are aimed at realising the marketing objectives in the chosen market.

4.5.1. Product

In light of the benefits of Gematria products for individual target groups and with specific medical conditions, we decided to position Gematria products as a high-quality brand of high-priced food supplements, which are unique in the market in terms of composition and mode of action. The sophisticated composition, special processing, and exceptional effectiveness of the products support the treatment of acute modern-day diseases (HIV infection, AIDS, cardiovascular diseases, cancer, etc.).

The message for the buyers is "The perfect choice for maintaining everyday health and an excellent support for treating health conditions."

4.5.2. Price

As regards pricing of Gematria products at the time of entering the market, the price skimming strategy will be employed in accordance with the set marketing objectives, market segmentation, and product positioning. Price adaptation for individual products will further be used for rewarding and encouraging consumers. Discounts will be offered for the purchase of a larger quantity of the same products (e.g. buy two equal products and get a 20% discount), a 10% discount will be offered for payment against a pro forma invoice, promotional prices will be available for the first purchase, i.e. prices equalling our cost of purchase including costs, consumers who will order regular monthly packages of products will receive additional discounts and benefits.

This way, consumers will be encouraged to regularly consume the products, we will create a pool of loyal consumers whose brand loyalty will spread a positive opinion on the products and whose regular purchases will enable the organisation to develop and expand its operations.

4.5.3. Place

Gematria buyers will be able to buy the products in pharmacies/specialised stores and/or online. In the event of online purchases, consumers will receive a special benefits package (lower prices, discounts, promotions), which we cannot provide in pharmacies or specialised stores as the distributor. We hope that this way online purchase will become attractive to consumers who are not used of buying such products online.

4.5.4. Promotion

When planning promotional activities for Gematria, all tools of the marketing mix will be used. The majority of the activities will pertain to sales promotion, direct/electronic marketing, and viral marketing. Advertising, personal selling, and public relations will be used to support the main tools. The following activities are planned for individual tools:

4.5.4.1. Advertising

Advertising will inform potential buyers of the arrival of a new brand to the market. Gematria products will be advertised in various media: magazines focusing of health-related topics, journals for pharmacists and doctors, magazines focusing on specific groups of patients, magazines read by business people, using Google AddWords the products will be presented online with banners, the majority of advertising will take place via social networks (mainly Facebook), as this way we can reach a large number of potential consumers in a more individual and sentimental way. In order to reach the target population, all functionalities offered by Facebook will be used.

4.5.4.2. Sales promotion

In sales, direct and indirect sales promotion will be employed in wholesale, retail, and with final users. Wholesalers will be motivated with promotional quantity discounts, retail with free products, which they can either sell or use themselves, while a detailed system of discounts, promotional prices, and quantity discounts will be prepared for final users in accordance with the brand's pricing strategy.

4.5.4.3. Personal selling

Gematria is a unique brand due to its composition and it is important for consumers (direct and indirect) to be aware of all the advantages and benefits. This will be achieved with regular sales presentations for smaller groups, participation at fairs, and free samples. The foundation of marketing is in consulting consumers over the educational platform. Buyers will also be able to use the forum on the website where employees will provide assistance and advice when choosing the right product.

4.5.4.4. Public relations

So as to create a positive public image, press conferences for journals intended for the professional public are planned. This group mostly focuses on pharmacists and doctors who advise consumers to use Gematria products.

4.5.4.5. Direct marketing and/or electronic marketing

Direct marketing will be implemented with text messages and emails. Consumers will be informed of current events, novelties, various health conditions (e.g. obesity, fatty liver, weakened immune system, etc.) and how to address those using Gematria products, they will be advised to use Gematria products to help them alleviate their problems. Each message will also contain a link for fast orders. We expect that this way a larger number of consumers will more quickly decide for the purchase of the products.

4.5.4.6. Viral marketing

Using YouTube, Snapchat, Instagram, and Facebook, the public will be provided with short, interesting, humours, and ingenious messages, which they will want to share with their friends and acquaintances. This way, a large number of potential buyers will be reached in the shortest possible time and with a minimum investment.

4.6. Control of Marketing Activities

So as to control the implementation of marketing and business activities, an appropriate business structure needs to be set up. In addition to the general manager, the company will also employ the head of sales and marketing. As the company will mostly focus on marketing and indirectly on sales, while direct sales or distribution/logistics will be implemented by an external partner, we decided that for internal and external needs, standard operational procedures for the following business processes will be prepared:

- Ordering products from the USA,
- Customs clearance and transport to the central warehouse,
- Storage, distribution,
- Sales,
- Quality management (product recall and monitoring of unwanted events).

All employees and external partners will receive training on procedures affecting their work in the company's business structure.

The head of marketing and sales will be responsible for:

- Preparation of product labelling (in accordance with the legislation),
- Preparation of marketing material,
- Setting up and maintenance of the website and social networks,
- Maintenance of the website and social networks content,
- Training and control of partners as regards the use of promotional materials.

The company's general manager will be responsible for concluding contracts, supervising partners and employees, and for the appropriateness of procedures and products.

5. Conclusion and Discussion

The purpose of the study was to employ an analytical approach to establish the situation and factors in the Slovene market which encourage and/or impede the entry of a new food supplements brand into the Slovene market. Due to the nature of food supplements, which are considered foods however due to their shape and composition the lay public often attributes the characteristics of medical treatment to them, the entry into the market represents a challenge already from the legislative aspect. The European Union has recognised the problem of the lacking regulation of food supplements and began regulating the legislation slightly more than 10 years ago. As fast change can cause economic damage, EU experts, together with the economy, have been shaping the legislation since 2006. This way, enterprises

had sufficient time to implement all changes in their manufacturing and marketing processes. Health claims for food supplements and conditions when these can be attributed to food supplements and for which groups of consumers have been specified since 2012. In 2013, the labelling of allergens changed and in 2014 legislation on additives entered into force. We can now claim that on the global scale, the EU has the most regulated legislation in the field of foodstuffs and consequently food supplements. The USA followed the EU with similar measures, however due to strong lobbies the United States were unable to regulate its legislation in a similar manner. So far, food supplements can still be attributed the characteristics of medical treatment by adding that such a statement has not been evaluated by the FDA. With a good knowledge of the legislation, Gematria products can nevertheless enter the Slovene (EU) market despite legislative reservations.

The next challenge for entering the market is the price of Gematria products, which ranges from €30 to €120 monthly for one product. In the survey, the respondents said that the (average) highest monthly amount that they would be willing to pay for all the food supplements that they consume (which in light of the survey results is an average of 2.5 products) is no more than €53.40. This means that the majority of the respondents would be willing to buy only one Gematria product a month. There is a realistic possibility, which has shown itself in the respondents' answers, that they would be willing to pay more for the food supplements if the recommendation to change their current choice came from the doctor/pharmacist. This means that active promotion among the professional public needs to be implemented, which is foreseen by the marketing plan. A deficiency noted through the answers is the fact that Gematria is still an unknown brand, since the majority of respondents prefer to buy products of known brands. This means that initial activities will have to focus on building brand image more than they will focus on product presentation.

We believe that the unique nature of Gematria products represents an excellent starting point for successfully positioning the brand in the Slovene market. It is necessary to shape clear messages which will present all benefits of the products for the buyer. We are convinced that financial incentives when introducing a product to the market are sensible; however these products are of such a high quality that excess sales below value are not justifiable. The fact remains that after the recent economic crisis, consumption is growing and people are ready to invest in their health and well-being. More than financial incentives, information needs to be provided to all involved parties (professional public, consumers, and distributors). An advantage in the marketing of food supplements (with the assumption that we comply with the legislation) is that we can use the marketing mix to influence the final users and the professional public.

The study results allow us to conclude that the Slovene market is ready for the entry of new and previously unknown food supplement brands, which offer high-quality products made of high-quality ingredients and in accordance with Good Manufacturing Practices. The higher price is not an obstacle to succeeding in the market; however the right distribution channels have to be chosen which, in light of the survey results, are pharmacies and specialised stores. An appropriate market approach has to be prepared, which would be based on raising the awareness of the professional public (doctors and pharmacists) and the use of social networks, as consumers usually ask advice from people that they know and trust.

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Tehnička analiza investicija u Ripple XRP digitalnu valutu

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Rezime: Predmet istraživanja u ovom radu jeste mogućnost primene tehničke analize investiranja u hartije od vrednosti kompanije Ripple XRP. Ripple XRP predstavlja digitalnu valutu koja se koristi u mreži plaćanja za sve transakcije, smanjujući potrebno vreme, kao i štedeći novac, za prekogranična plaćanja Cilj ovog istraživanja jeste pronalaženje optimalne metode koja će poboljšati efikasnost trgovanja na osnovu testiranih konkretnih primera uz mogućnost unapređenja upravljanja portfolijom sačinjenim od digitalne valute Ripple XRP, sa posebnim osvrtom na optimalan izbor metoda tehničke analize. Period analize je trajao jednu godinu opservacija, od aprila 2017. do marta 2018. godine sa posebnim fokusom na poslednjih šest meseci, od oktobra 2017. do marta 2018. godine. Rezultati istraživanja biće korisni kako za akademsku zajednicu za dalje istraživanje u oblasti tehničke analize digitalnih valuta, tako i za institucionalne i individualne investiture u funkciji stvaranja određenih instrumenata koji su usredsređeni na efikasno trgovanje ovom ili sličnim digitalnim valutama.

Ključne reči: Finansijska tržišta, Tehnička analiza, Trgovina, Ripple XRP, Digitalne valute

Technical Analysis Investment in Ripple XRP Digital Currency

Abstract: The subject of the research in this paper is empirical testing of the possibility of applying the technical analysis of investments in securities on the example of Ripple company. Ripple XRP is the currency used in the payment network for all transactions, reducing the time needed, as well as the money for cross-border payments. The aim of this research is to find an optimal method that will improve the trading efficiency through tested specific examples with possibilities of improving the portfolio management made of Ripple XRP digital currency, with a special focus on the optimal choice of methods of technical analysis. The analysis period was one year of observations, from April 2017 to March 2018, with a special focus on the last six months, from October 2017 to March 2018. The results of the research will be useful to the academic community for further research in the field of technical analysis of digital currencies, as well as institutional and individual investors in the function of creating certain instruments that are focused on effective trading with this or similar digital currency.

Keywords: Financial Market, Technical Analysis, Trading, Ripple XRP, Digital Currencies

1. Introduction

When monitoring price movement of financial instruments, the identification of factors is very important in explaining the current prices. The technical analysts agree with the general nature of the importance of the factors in explaining the movement of the value of financial instruments, and the identification of the specific values of the relevant variables is the central point of the discussion (Beatman et al., 2009). The ability and role of a technical analysis is to anticipate price movements, using historical data, as well as tracking the historical movement of the prices of the observed instruments. One of the biggest differences between academic finance and financial practice is the separation between technical analysts and their academic critics. Unlike the fundamental analysis, which was quickly adopted by scientists of contemporary quantitative finance, the technical analysis was unacceptable and scientifically unfounded from the very beginning. However, a number of studies

such as (Lo et al., 2000) tell us that technical analysis can be quite effective. Regarding this, the subject of research in the paper is to analyze the optimal methods of technical analysis in the function of efficient management and trading digital currency Ripple XRP. Due to the large number of data, we will focus on the main price drivers as the basis of the Ripple XRP value, as well as the combination of the technical analysis methods. Stock exchanges and trading platforms traded in financial instruments, depending on the focus of dealing with specific issues, can be analyzed from different aspects. Changes in the conditions of the market environment pose a challenge for the creators of increasing demands in analyzing, examining and testing modern aspects of stock exchange trading in order to effectively respond to changing environmental conditions (Anđelić et al., 2016). Most trading systems can be divided into two categories, the first by trend. That is, technical indicators are trying to discover an important trend and inform investors that they can profit from the trend. Other category is an analysis of technical indicators using oscillators through which the trend change can be quantified. In accordance with the above, the main objective of this research is to provide to readers the information on one of the market's best-quality digital currencies - Ripple XRP, as well as providing up-to-date information on the possibilities and directions for improving efficient management and trading it. The basic hypothesis of this research is that the optimal choice of technical analysis methods is in the function of efficient portfolio management and trading this digital currency.

2. Technical Analysis Indicators

The very basis of the technical analysis lies in the Dow Theory[4]. The Theory is actually a form of technical analysis that relies on detecting trends in the stock market to determine an investment strategy (Schannep, 2013). In practice, technical analysts do not dispute the validity of fundamental analysis, but on the other hand believe that prices have already been incorporated into the value of the financial instruments. For instance, one of the best documented behavioral tendencies is the effect of dispositions, which relates to the tendency of investors to keep the instrument to a loss of investment. As Grinblatt and Bing concluded (Grinblatt and Bing, 2005), according to the effect of the dispositions, investors are willing to understand the losses. This effect can lead to shifts in the prices of financial instruments, even if the fundamental values follow a random walk. Technical analysis uses a large number of data, including historical price, which allows direct trading strategies. Bigger or smaller price changes will follow the main trend of movement, creating opportunities for their exploitation (Bodie et al., 2013).

There were defined three aspects that include psychology, methods and risk management (Elder, 2002). The influence of psychology refers to the study of the emotional characteristics of investors such as greed, fear, courage, or some other emotion. Risk management defines investment decisions based on signals and factors by defining the choice between risk and return. Also, various types of charts are used in assessing the trend in technical analysis. In financial theory and practice, there are three types of charts. The candlestick charts[5] are most often used and provide the most information, then the line charts that are the most basic ones, and finally column charts which shows more detail than line charts but are not as precise as candlesticks.

[4]Dow Theory is the name given to the ideas that derive from Charles Dow, the first editor of the Wall Street Journal and inventor of the stock market average, known today as the Dow Jones Average. The Dow Theory is made up of six tenets, and all traders who decide to use technical analysis should know these 6 principles, as they will help them to better understand how the markets work. More about the Dow Theory and the Technical Analysis see:
https://www.ifcmarkets.com/pdf_files/tradingbooks/en/the-dow-theory-in-technicalanalysis.pdf

[5] Each candle represents a single trading period. The candle consists of a body and two shadows/wicks, one of which is on the upper and the other at the lower end of the body of the candle. The wick of the candle at the upper end of the body represents the highest level, while the shadow on the lower part represents the lowest level of the price of a particular instrument in a certain period. The body of the candle represents the prices at the opening and closing. In practice, if the body was painted, there was a price increase compared to the previous period. If it is "empty", prices have fallen in relation to the previous period. In the continuation of the work, and for the purpose of explaining the practical example of trading, IQ trade platform was used in which the candles are painted green and red

2.1 Technical analysis main tools

Further in this paper, the basic tools used in the technical analysis will be explained, and then will be shown how these tools will be applied during the trade. The first tool is the moving average (MA) that represents the arithmetic mean. The difference is that the arithmetic mean is the average value of all available data, and the moving average - only one part of this data. If the price information is available for a period of 260 days (52 weeks x 5 business days), then, for example, a moving average of 30 days is equal to the average price for the first twenty days. The next average value is the average value of the price from 2 to 31 days, then from 3 to 32 days, and so on. Basically, for the analysis of short-term trends, movable averages are used with fewer periods (usually 5, 8 or 14), while in long-term trends the averages with longer periods (20, 50 or 100) are used. Within the moving average, there are several subspecies of moving averages, which will be explained below. The first in the series is an ordinary moving average-SMA and all of the above refers to a regular moving average. The formula for calculating the moving average is:

$$PP = \frac{\sum_{i=1}^{n} Ci}{n} \quad (1)$$

Where (ΣCi) represents the prices sum set for n period; n = number of periods for which the moving average is calculated. The simplicity of calculating this average (1) contributed to its popularity and wide application. However, precisely because of the method of calculation, all types of moving averages are "late" for the current price and therefore belong to the group so-called. Indicators that follow the trend (trend following indicators). The next moving average is a weighted moving average-WMA, which differs from SMA in that it gives a certain weight to each price in the observed interval, which is the greater the data is closer to the present moment. In this way, newer data is given more importance than those from previous periods. The formula for calculating the weighted moving average is:

$$PPP = \frac{\sum Ci\ Wi}{\sum Wi} \quad (2)$$

Where Wi = is the weight of the i-th price. In the case of linear weighting W = i. In addition to the weighted, it is necessary to mention the exponential movements of the average-EMA. This is a weighted moving average in which, as in the previous case, a greater significance is given to newer data. The difference from the previous one consists in calculating the exponential moving average taking into account all the available data, and not only those for which the average is calculated (in the previous case, 30 days). The formula for calculating this average is:

$$EMAt = EMAt\ -1+(k*(Ct - EMAt - 1)) \quad (3)$$

Where t represents today's date; t-1 represents the previous day; k = 2 / (n + 1).

It follows the MACD, ie the convergence / divergence index of moving averages. This index is a two-component indicator based on two exponentially weighted moving and medium-term moving average. The first component of this indicator is the line that represents the difference between the two moving averages, calculated for a different period of time. This component is called the Price Phase Line. The second component, called the Signal Line, is the exponentially weighted moving average of the first component. These two lines are graphically represented on the same X-axis timeline. The price phase line is above the Signal line, in a period of rising trend, that is, in the event of a downward trend, this line is below. Signals for buying or selling are generated at the moment when these lines are crossed. The purchase signal is when the price line in its movement from below upwards exceeds the Signal line, while the sales signal appears at the moment when the price line line, in its movement from above, crosses the Signal line from below. Due to its weighted nature, this indicator is useful in highly volatile markets, such as the digital currency market but it also gives very precise forecasts when it comes to the digital currency that is analyzed in its work. The time period used to calculate the short-term moving average is usually 12 periods, and for the long-term 26, and for the signal line 9 periods. In addition to moving averages as an indicator of technical analysis, in practice can be found Oscillators. The use of an oscillator is one of the easiest and most reliable methods of forecasting the future movement of the prices of financial instruments. In contrast to moving averages, oscillators give the best results in the analysis of the period without apparent trends, or with the so-called side trend. At the

core of the oscillator application lies the concept of overbought and oversold in the financial market. It is considered that the market is in the stage of over-purchasing, when the price is around its upper limit for a certain period and when there is a serious resistance to its further growth. In the stage of over-sales, the market is when the price is at such a low level that its further decline is not expected due to strong support. When the price is so low, that its further decline is not expected due to strong support the market is in the phase of over-sale. To recognize these situations, the upper and lower limits are defined for each oscillator. When the value of the oscillator reaches these limits, it is a signal of a trend change - buying or selling signal. Another important type of oscillator is divergence between the direction of the price movement and the oscillator line. The dissolution is the announcement of a potent trend change. Below it can be found the two most famous and commonly used oscillators. Relative Strength Index (RSI) which shows the relative relationship between positive and negative price changes over a specific period. RSI is a range-bound oscillator, meaning that it fluctuates between 0 and 100 depending on the underlying security performance, and is calculated based on prior sessions' average gains versus losses. As the number of sessions used in the calculation increases, the measurement becomes more accurate (Boyte-White, 2018). The recommended number of the period is 14. The formula for calculating the relative strength index is: RSI = 100 - 100 / (1 + RS); RS = AG/AL; AG represents the average positive change in the price from period to period (for example 16 periods); AL represents negative price change from period to period (for example 16 periods). The purchase signal is generated when the value of the RSI drops below 30 (oversold), while the ability to sell when it is above 70 (overbought). In addition to the RSI, there is also a Stochastic oscilator, which puts the difference between the maximum price in the previous period and the prices of the current day, and the maximum price and minimum prices in the previous period. George Lane[6], the author of this indicator, proposes 21 periods for calculating the price range. The significance of indicators is based on the observed rule that the current price is almost always closer to the upper limit in growth periods, that is, closer to its lower value - in periods of decline. The formula for calculating a stochastic indicator, often marked with % K, is:

$$\%K = 1 + \frac{Cmax - Ct}{Cmax - Cmin} \tag{4}$$

where Cmax = maximum price reached during the previous period; Ct = current price of the instrument Cmin = minimum price during the previous period. The indicator is expressed in values on the scale from 0 to 100. The control lines are at 80 and 20. The value of the indicator above 80 indicates the reached maximum price (overbought), and generates a signal for sale, before the expected drop occurs. Analogously, when the indicator has the value below 20 has reached the bottom (minimum), and no further decline is expected, but the price increase, which gives a buying signal.

3. Ripple XRP – Technology for improving the function of Financial Institutions

Ripple is a network created by the company with the same name in order to facilitate transactions between financial institutions. On this network, the XRP Token, which is traded on the financial market, appeared in response to the ever more frequent trading in digital currencies. At the beginning of its work, the goal of this company was to allow the transfer of money from any currency into any currency within a few seconds, where Ripple would serve as a universal currency that reduces transaction costs, a similar role nowadays to SWIFT code or even PayPal. This network and token have not been created with the intention to be a method of paying for goods and services, but the essence is that Ripple offered financial institutions a way to bypass the currently complicated, unnecessary expensive and slow cross-border payment procedure, and to this day, many banks accepted Ripple as a network that provides far less transaction fees.[7] Also, this network is safer, since it allows sending, receiving and retaining currencies in the decentralized system. To make this clearer, the purpose of

[6] According to an interview with Lane, the Stochastic Oscillator doesn't follow price, nor volume or anything like that. It follows the speed or the momentum of price. As a rule, the momentum changes direction before price. For more information about George Lane's Stochastic visit http://forexstarmoon.com/files/ebook/Part0/Lane-Stochastics.pdf

[7] The license to use Ripple blockchain technology currently has more than 100 banks such as UniCredit, Sanntander, UBS, American Express, BBVA and others.

Ripple is to create a streamlined, decentralized payments system using technology inspired by the blockchain[8].

For instance, the token may be used as a bridge currency - Serbian Dinar in Belgrade could become XRP, which could then be turned into Brazilian Real in Rio de Janeiro. Having a lingua franca of payment could help banks avoid the hassle and expense of tying up money in different currencies at other bank accounts. It can be noted that the most valuable feature of Ripple is liquidity. In other words, unlike some other digital currencies such as Bitcoin, which is the pioneer in the world of financial instrument trading of this type, and who need four hours to execute the transaction, the XRP, a token within the Ripple network, requires 3.6 seconds. The less time consumed means lower transaction costs, which is fully enough for the banks to fully start switching to a new cross-border payment system. On the other hand, there is also a fear of losing privacy, as well as a lack of transparency in what is the essence of the blockchain technology. The present fear is in a way justified by the fact that in the case of Ripple there is an instance that oversees all transactions. The centralized currency in the world in which the talk of decentralization has led to the fact that, on the one hand, Web sites like CoinMarketCap[9] classified it as a digital currency, and on the other, certain users do not regard it as one at all. However, Ripple XRP is very popular, and one of the strongest factors in increasing popularity is that Ripple is perceived as a safer option by investors because it is used by banks. Many investors have the view that the most popular digital currencies has experienced its peak, so they are looking for an alternative that will pay off in the long run to the XRP. In matter of fact, today Ripple is perhaps most likely the most attractive among the digital currencies, with the best performance in the end of 2017, recording a profit of 36.018% during the last year. As Ripple's price was more affordable at the beginning of December 2017 (it will be shown below) than it was with other digital currencies, a "bubble" was formed around the XRP, and in a short time it climbed to a scale of values. In pictures bellow it will be shown movement of the Ripple XRP value in both the December 2017 and the period from June 2017 to March 2018.

Picture1. Ripple XRP value in December 2017

Source: (Daily price information taken on December 2017 from IQ Option trading platform)

Picture 1 shows that the last signal for buying the XRP token was around 10th December. Also, it can be seen how was the volatility of this currency was moving (showing just the month of December). The impression is that the value of this token has rapidly burst since in December 2017 more than 60 banks

[8] Decentralization is a way of taking power away from big institutions and distributing it to everyone else. It's one of the most exciting things about crypto currencies and a big breakthrough in thinking about how the world can be organized.

[9] Blockchain technology made it possible for digital information to be distributed rather than copied, creating the basis for, as it is increasingly commented on - a new version of the Internet. This technology was created for the needs of the digital currency Bitcoin, but in the meantime its enormous potential has become important in the financial sector. For more information on Coin Market Cap: www.coinmarketcap.com.

from Japan and South Korea formed a coalition to transfer money across the border using Ripple. Also, MoneyGram and Western Union are in terms of XRP adoption in March 2018. While both of these partnerships represent pilot programs, it should be seen within the next several months whether the companies are benefiting from implementing XRP. Assuming XRP increases the efficiency of money transfers and transactions, it only makes sense that more businesses within the financial industry (both banks and financial institutions) have given XRP a try (LeVere, 2018). Below in the picture 2 the movement of the XRP token value is shown in the period from June 2017 to March 2018. The price volatility for this period can be clearly seen as well.

Picture 2. XRP price movement from June 2017 to March 2018

Source: Price movement information taken on March 2018 from IQ Option trading platform

Picture 2 shows the price movement from October 2017 to March 2017 where it can be clearly seen first the bullish trend in December and the bearish one in the beginning of January 2018. For instance, the investor who bought an amount of these tokens in the beginning of October, when the price was around $0.20, and sold the same amount at the end of the same year when the value was around $2.71, could have a 1350% return.

3.1 Ripple XRP management: daily trading Case Study

Ripple XRP has been gathering a great deal of interest in the world of crypto world. Just like number of other digital currencies, Ripple's XRP likewise makes purpose of the blockchain technology. As it was mentioned above, unlike other digital currencies, Ripple XRP is regulated and it helps with fund transactions for banking institutions.

XRP Ripple's native currency soared from under $0.01 to over $0.30 a unit in 2017 and from $3.31 in the beginning of January 2018 to less than $0.54 in March 2018. This spike can be attributed to its adoption by numerous banks and the global growing interest. These price fluctuations provide precisely the environment needed to bolster profits. The first trade was in December 2017, precisely December 27th to December 30th 2017. Observing the previous trading day and noting that both lines of moving average (SMA) and (WMA) crossed, as well as by interpreting the MACD indicator, it could be clearly conclude that a trend change will occur, ie the trend will be rising. At the first day of trade the price was $1.12, and just during that day Ripple XRP jumped to $1.26. On December 28th the highest price was around $1.25 and it kept rising until December 30th, when the selling decision was planned. Price at selling moment was $2.16, just at the moment when moving averages crossed themselves downside, which indicated the decreasing trend. At the selling moment the 72.80% return was made. In the picture below it can be seen the trading period from December 27th to December 30th including the SMA, WMA and MACD indicators.

Picture 3. SMA WMA MACD trading December 27th-30th

Source: (Price movement information taken on December 2018 from IQ Option trading platform)

Next trade was in a range from February 15th to 19th Ripple XRP broke down of this range on February 20th. It has also fallen below EMA (red line on the Graph) and this indicates weakness, which will be shown in Picture 3 below. The stop loss of $0.95 that was suggested has not yet been breached.

Picture 4. EMA trading February 15th -19th

Source: (Price movement information taken on February 2018 from IQ Option trading platform)

The investment in this financial instrument will gain strength only if it breaks out and sustains above $1.24. It was expected the digital currency to remain range bound between $0.86 and $1.2 over the next few days, and fortunately that scenario happened, right before the next plummet.

Last trade, but for sure not the least one was in March 2017, precisely March 4th to March 8th 2017. Observing the previous trading day and noting that price on March 4th was $0.91 when the purchase was done, the next day the price jumped and then everything indicated that the trend would come to an end, however, the short-term estimate was wrong, and with the help of the oscillators that pointed to the

future decline in the trend came to the sale of the instrument the day before, or March 7. The picture below shows the RSI oscillator set to 14 periods, Stochastic oscillator, as well as moving averages EMA and SMA. In the figure of the graph, on the trading simulation below, it is clear that the oscillators were given the prognosis, on the basis of which the original plan for the sale of this currency has been changed and moved for the day before. The conducted research and simulation of the above organized trading confirmed the basic hypothesis of this research, which is that the optimal choice of technical analysis methods including the basic Oscillators prediction is in the function of efficient portfolio management and trading Ripple XRP digital currency.

Picture 5. RSI Stochastic and EMA SMA trading March 4th-8th

Source: (Price movement information taken on March 2018 from IQ Option trading platform)

4. Conclusion

Technical analysis enables the minimum necessary information for decision making in a quick and easy way, and the long-term use gets a very significant experience for a quick reaction to the newly emerging market changes. Despite all the disputes due to the lack of a scientific basis, technical analysis has kept and will keep its popularity and purposefulness among investors. In the world where money exists in the digital ledger of banks, digital currencies like Ripple is, have a special place as they are not anti-bank in way like many other ones are. Instead, they are developed to let the banks utilize the evolving blockchain technology. It's not easy to say how quickly Ripple will have the ability to take SWIFT down or not. At least, there is no doubt that it can certainly break the monopoly of it over international bank transfers. By analyzing Ripple XRP for last 11 months, with the special focus on the period from October 2017 to march 2018, and implementing Technical analysis tools for trading with Ripple XRP digital currency, quite few conclusions can be made. Ripple, much like the other big players in the digital currencies world is hugely volatile. With that unpredictability comes the potential for significant profit, especially for short-term traders. Only one news announcement can create a bubble and send prices soaring, or plummeting. Also, investing in Ripple XRP as a long-term investment that would like to hold for years to come, Ripple indeed seems to be a promising investment. Investment in XRP for quick gains within a few months up to a year seems quite promising. In 2018, after three months of plummet, it is expected to be seen the same situation for not more than one month, and after a sharp upsurge in prices is expected. It is projected to cross the $1 value at the very least. In the other hand, if you are a day trader, XRP's trading volume should grow as well. With increased trading activity, fluctuation in prices will also be seen. Investing in XRP as an extended investment with intention to keep it for many years to come appears to be a promising investment. A paradigm transformation is taking place indeed, and we are witnesses of moving to the digitization of all money. With more investors becoming aware of XRP and a growing awareness towards its technology, XRP's prices are expected to rise in 2018. In the first half of 2017, XRP's price surged up to 4000%, and in the observed period in this paper up to 1350%. A general conclusion can be made that whilst other digital currencies elude banks, Ripple is embracing them, and this is

doubtless good for traders. It means Ripple's value will continue to increase, along with many trading opportunities.

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Утицај Cloud Computing-а на савремено пословање

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Сажетак: Рачунарство у облаку представља огромни потенцијал за стварање нових пословних вредности за све оне који су спремни и у могућности су да спроведу техничку, културну и организациону промену која је потребна за усвајање новог концепта. Аргумент редукције трошкова у пословању не наводи крајње кориснике на приступ клауду, већ аргумент флексибилног коришћења IT извора. У данашњој пракси клауд се примењује за апликације, као нпр. за тест и за развојне системе, у виду основе за обуке запослених или резерве за инфраструктуру тј. услед повећане потребе за складиштењем података, мада се и друге клауд апликације (као нпр. CRM или колаборативне апликације) у све већој мери примењују, притом заобилазећи IT сектор. Предузећа би требала да предухитре овакав тренд из безбедносних и законских разлога тако што би проактивно овај концепт увели у своје стратегијско планирање. Финансијска рачуница и исплативост клауда се израчунава за сваки случај понаособ и зависи од постојећих услова и пословних захтева предузећа.

Кључне речи: информационе технологије, интернет ствари, магични квадрант, пословни системи, рачунарство у облаку

Cloud Computing Influence on Modern Business

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Abstract: Cloud computing represents a huge potential for creating new business value for all those who are willing and able to implement the technical, cultural and organizational change needed to adopt a new concept. The cost reduction argument in business does not list the end users for access to cloud, but the argument for the flexible use of IT resources. In today's practice, cloud is applied to applications, for example, for testing and development systems, in the form of a training for employees or an infrastructure reserve, i.e. due to the increased need for data storage, although other cloud applications (such as CRM or collaborative applications) are increasingly being applied, while bypassing the IT sector. Enterprises should advance this trend for security and legal reasons by introducing proactively CC into their strategic planning. The financial calculation and profitability of cloud computing is calculated for each case individually and depends on the existing conditions and business requirements of the company.

Key words: Business Systems, Cloud Computing, Information Technologies, Internet of Things, Magic Quadrant

1. Introduction

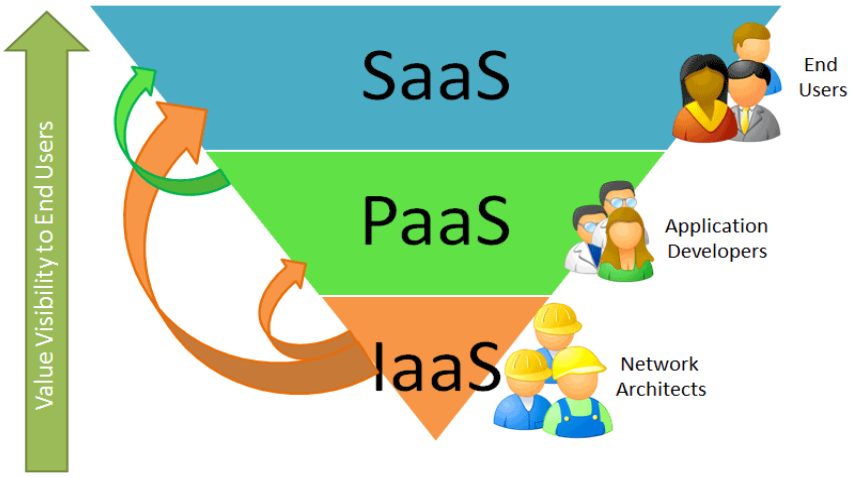
Cloud computing (CC) services are particularly attractive for small or startup companies that can not afford large initial investments in IT equipment. Large firms have a problem of not being so agile and flexible, in other words, they can not react quickly to changes or adapt to them. New hardware procurement, maintenance of the existing one, software and operating systems purchase and upgrade take a lot of time and resources. However, it is unlikely that larger organizations will completely abandon the information technology (IT) model on the spot or replace the IT services that play a central role in their market competitiveness. Many companies will still require a level of security, performance, or specialization of applications that can not be reached by using CC public services. They may form their own private CC architecture, hidden behind corporate firewalls, due to taking advantage of their efficiency, but with larger security and control.

In short, cloud computing does not represent a passing mode, nor a revolution in electronic commerce. Instead, most companies are likely to use a combined IT environment where applications, infrastructure, and business processes will be implemented through public and private CCs, and possibly using a hybrid cloud model. In any case, the undeniable fact is that CC changes existing business models.

2. Cloud Computing – challenge for management and IT

As shown in figure 1, Cloud computing models are broadly divided into three categories (SPI model): Software-as-a Service (SaaS), Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (IaaS).

Figure 1: Pyramid of SPI Models



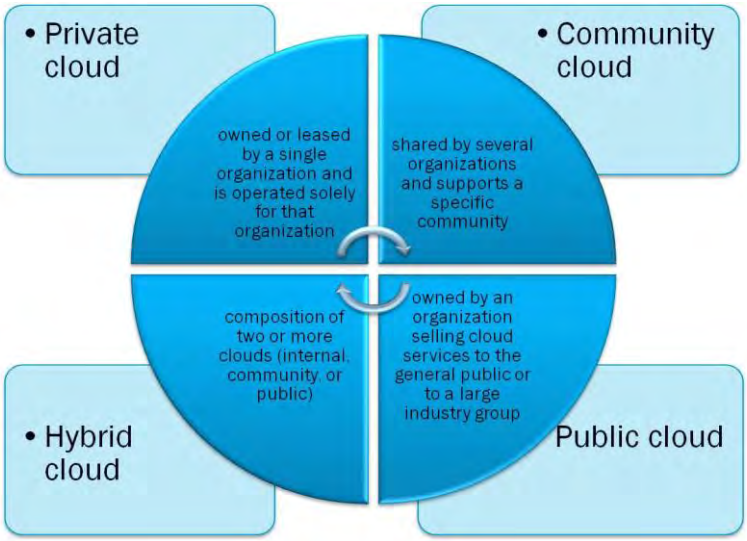
Source: Techtarget (n.d.)

Cloud computing has seamlessly established itself in the market as a new IT model (Langović, Pažun, and L.Milićević, 2011). Many great names such as Facebook, Google or Amazon use this production method to meet dynamic resource requirements and different levels of load. These services are mostly free and as in the Amazon case, easy to understand as they are integrated into the business process. This kind of use of IT represents a revolution for companies. Previously, it was common for the IT business focus primarily on the highest estimated IT system load and accordingly invests in IT systems. Various studies have shown that such classical systems have an average system load of between 10% and 50%. In other words, the other 50% were invested in some of the maximum system loads. CC offers a completely new solution to this model. Consequently, in small and medium-sized enterprises, the risk of investment is reduced, whereby CC offers absolute transparency of costs incurred. The provider takes over the entire management of the service, opening up the possibility to try out new business models promptly, entering the market and, in case of failure, promptly retreat from the market with minimal costs.

2.1 Cloud Implementation Types

Although cloud computing has emerged mainly from the view of public utilities, other deployment models, with variation in physical location and distribution, have been adopted. In this sense, the cloud deployment models can be classified as private, public, community and hybrid as shown in Figure 2:

Figure 2: Cloud Deployment Models



Source: Sujana, 2014

Comparison between deployment models is given in the following Table 1:

Table 1: Comparison of Deployment Models

Cloud	Advantages	Disadvantages
Public	-Efficient of use of hardware -No need to buy hardware	-Data is stored outside premise
Private	-High cost -Control over hardware -Control over data	-Hardware has to be bought or leased -Hardware for peak load
Hybrid	-Maximization of Cost-efficiency -Business critical information can stay in-house	-Less efficiency than a public solution.
Community	-More efficient use of hardware	-Less efficient than a public cloud

Source: Eamonn, 2013

3. Financial benefit of Cloud implementation

With CC enterprises have the chance to reduce the level of investment in the IT sector and thus create free capital that can be allocated to other IT innovative projects. Consumption-based billing is in direct relation with business requirements, which means that IT services are purchased on the basis of operating demand. With this fact over-sized hardware purchases and unused capacities can be avoided.

The cost-effectiveness of the CC introduction and use depends on a case-by-case, i.e. from the given preconditions and requirements that the given company has. There are no general recommendations, but certain regularities related to the financial viability of introducing CC can be defined.

Overall factors affecting the financial cost of CC are shown in the Table 2:

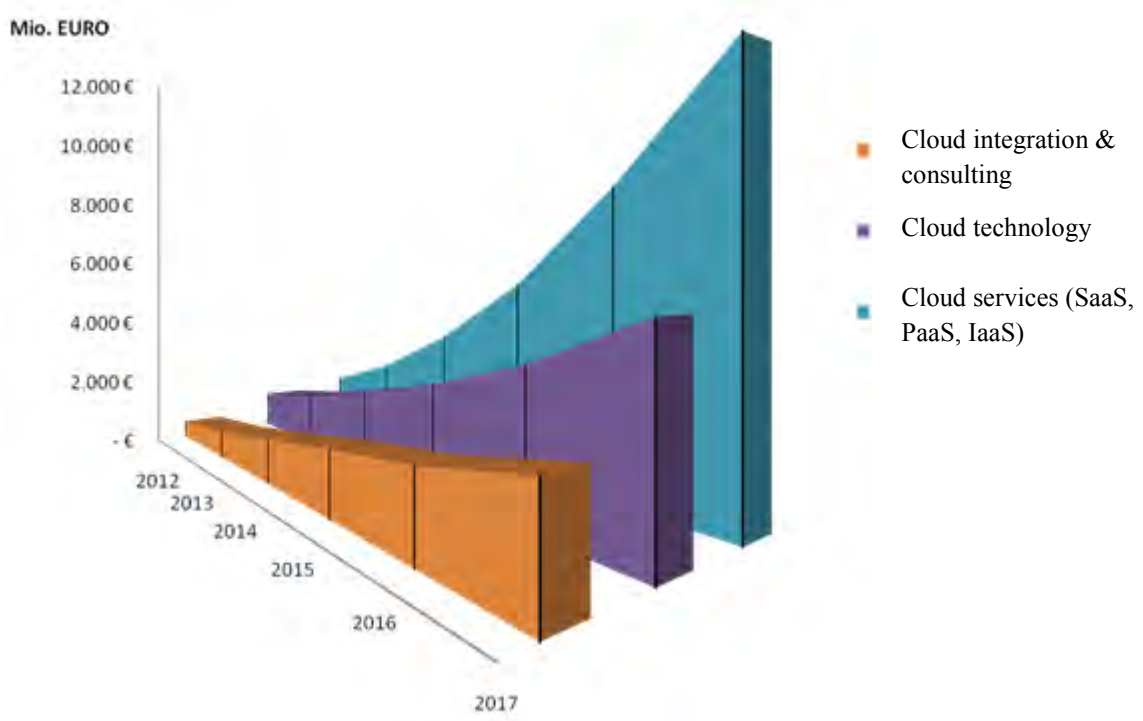
Table 2: Overall factors affecting the financial cost of cloud computing

Expenses that can be monetarily expressed	Small or no investment costs for hardware, software and computing centers
	There is no investment in the pre-dimensional capacities, based on the "peak demands"
	There is no cost of replacing existing investments (hardware, software ..)
	Reduction of existing personal and running costs
	The provider performs software upgrades and takes care of new releases
	The provider maintains IT systems and bears all the costs
	There is no "waiting" through a self-service service
	Energy costs reduction
	High level of standardization
	Small costs of introducing new applications
	Low staff training costs
	Price model "Pay per Use"
	Increased transparency of costs
	Improved IT security through professional Security-Management
	Flexible availability of additional resources
	High technical flexibility
	Using the installed Backup/ Restore process of the service provider
Costs that can not be monetized	Enterprise concentration on primary activity
	Further sourcing options
	Development of new business models
	Reducing the IT management process complexity
	IT processes simplification
	Potentially higher consumer satisfaction (external and internal)
	Potential faster market access (Time-to-Market)
	A significantly shorter time to make additional IT resources available
	Accelerate business processes through IT

On the one hand, a company can determine the rate of using CC's virtual servers, while on the other it has to estimate the cost of purchasing a given server. After a certain number of months it can become more convenient for a company to own and maintain a server in the enterprise itself. Therefore, if it is expected that the server or software will be in circulation for a number of months or years, then in any case it is suggested that the server be purchased and maintained in the company itself. According to Hugos and Hulitzky, hardware costs are for short-term projects up to two years lower using CC, rather than buying their own. For a system that needs to operate for more than two years, it's better to buy it and maintain it in the company itself. If there is a need for the existing hardware to upgrad after three years, there is no savings or advantage in owning it. In this case it's easier to use cloud services. If an IT manager spends most of his time on a personal policy of maintaining hardware operability, building a computer center and database, it would be costly and time-consuming, so it is better to invest in new technology to achieve better product sales or reduce current costs (Hugos and Hulitzky, 2010).

Although some years ago there was a controversy about whether the cloud computing concept was without any practical significance and usable value for the company, today there is already a differentiated view of the CC subject. The share of cloud in world IT traffic is constantly growing. For example, only in Germany there was an investment of about 7 billion euros in the cloud business in 2014. Three years later, the amount increased to 18.5 billion euros, which is an increase of 167% (Pauly et al, 2015; Bitkom, 2017).

Graph 1: Investments and Expenses in Cloud Computing in Germany 2012-2017



Source: Pauly et al, 2015

Today, when choosing a cloud service, shades decide. The estimated revenue of the world's largest cloud-based companies, according to Gartner, is shown in the following table (in billions of dollars):

Table 2: Estimated revenue of the world's largest cloud-based companies

Company	Solution	Yearly revenue
Microsoft	Commercial cloud (Azure, Office365, Microsoft365)	21,2
Amazon	AWS	20,4
IBM	/	10,3
Oracle	/	6.1
Google	Google Cloud Platform, G Suite	4,0
Alibaba	/	2,2

Source: Gartner (n.d.)

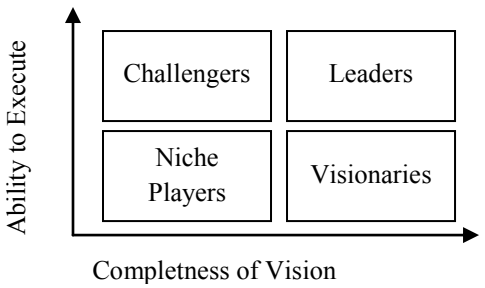
Considering exclusively revenue, IBM and Oracle are corporations that have been running computer world-class for many years now, and have a significant role in the cloud computing world, as well, making comparison over i.e. Google and Chinese Alibaba. However, the question of the maturity of the offered individual solutions and the location of these solutions in the wider context of cloud computing are very different in the offerings of these companies. Some of the service providers (i.e. IBM) have infrastructure and platforms and applications, while others (Amazon) are mainly located in the world of infrastructure. On the other hand, the dominant part of Microsoft's revenue comes from Office365 that does not have a competitor other than Google Suite.

4. Magic Quadrant methodology

Gartner's Magic Quadrant is a methodology and tool for visualizing and evaluating the progress and position of companies in specific technology markets. This methodology is aimed at examining the market from a broader perspective, and analyzing the relative positions of competitors of the internal market, which facilitates understanding of positions, changes and results of efforts in the evolution of markets and solutions.

Gartner chose a two-dimensional matrix display by dividing competitors into four different quadrants based on the Completness of Vision and Ability to Execute parameters. This way, Gartner recognizes the efforts of technology companies to come up with innovative solutions, but also to demonstrate progress in implementing innovation, without which it is not possible to get a competitive advantage.

Graph 2: Magic Quadrant



Source: Gartner (n.d.)

The differences exist in the magic quadrant when it comes to IaaS between 2017 and 2018. In the analysis of 14 companies by Gartner, Google has entered the leaderboard. The effort of this company has been obviously recognized in order to offer competitive solutions, first of all in the areas of artificial intelligence and machine learning.

The cloud computing market is in a big swing. Gartner estimates that with 260 billion US dollars in the previous year, the total value of this segment will jump to over 410 billion by 2020. Microsoft has recently been engaged in a hybrid cloud, or a combination of servers located in customer data centers and those that are under the control of the US company. Oracle is still strong in this domain when it comes to supply, although the big question is whether the hybrid cloud will succeed in future. It seems that most companies, motivated by savings in capital investment, will overtake complete dependence on clouds. There is “a golden fever” in the world of clouds, and those who find the correct measure of topics, such as machine learning, artificial intelligence, serverless architecture and service accuracy, as well, can expect the next year to be in the focus of Gartner research.

The growth of Alibaba's cloud supply is particularly interesting. Morgan Stanley's latest research suggests that Alibaba is worth almost twice as much as before (from $ 39 to $ 68 billion), and predicts that cloud computing will bring this Chinese corporation nearly $ 30 billion by 2024. Alibaba holds almost half (47.5%) in Alibaba's domestic market, with plans other than the internationalization of its offer, especially to Europe and North America, related to the countries of Asia, such as Indonesia, where their latest center has been recently opened data. Alibaba is investing heavily in the IoT sphere, with a focus on smart cities smart homes. The first Alibaba smart city project outside the territory of China, called Smart City Brain, is being implemented in Kuala Lumpur. The core of this project is the artificial intelligence and a large number of different sensors working on the Alibaba infrastructure in the cloud. The aim of the project is to reduce inefficiency in the management of the city ecosystem, primarily in the traffic area (Technode, 2018).

5. Conclusion

Companies need an IT infrastructure that would allow them to operate more efficiently and given data literally follow changes in future business. Companies have come to a point where they have to overcome the previous internal focus on maximizing the use of IT resources and switch to an external focus, i.e. on external support and new product development with cloud technology. Companies become web-oriented using SaaS applications, combining them with internal applications that support collaboration with other companies to achieve economic growth. This is possible because cloud and SaaS providers become tools, which offer reliable computing power and basic operations such as mail, Enterprise Resource Planning (ERP), Customer relationship management (CRM), and a growing number of applications in the industry. Over the years, providers have developed such economies of scale and expertise to offer at much lower prices than any company could offer internally. For this reason, companies in the coming years will increasingly buy basic IT operations in order to reduce

costs. This in turn will allow companies to devote their time and attention to create new value for their products and to stand out in customers' eyes.

Many SaaS providers and CC providers are focused on creating a user-friendly interface, which would be easy to use. They continuously integrate with mobile devices such as Blackberries, iPhones, netbooks, electronic book readers and iPads.

When it comes to providers' point of view, Gartner's methodology seems to be very convenient for a relative comparison of the efforts of the most successful companies in order to fully implement the powerful innovations to which each other is motivated. At the center of the next stage of growth will be the spheres of artificial intelligence and machine learning.

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Rešenja za nadoknadu efekata mobilnosti radne snage u industrijskim preduzećima u Rumuniji

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Apstrakt: Emigracija među mladima ima posledice na ekonomsko okruženje. Unutrašnja mobilnost stvara neravnoteže u potencijalu ljudskih resursa. Međunarodna mobilnost dovodi do smanjenja nacionalnog i regionalnog potencijala rada i naglašavanja deficita u pojedinim oblastima delovanja. Izlazni tokovi ljudskih resursa pokazuju bolji nivo kompetencija u oblastima potrebnim za buduće tržište rada. Pored toga, u poslednjih nekoliko godina došlo je do povećanja međunarodne mobilnosti. Na sve ove izazove koji dolaze iz oblasti ljudskih resursa, rumunska preduzeća treba da pronađu rešenja, kako bi osigurali rast ili, u nekim slučajevima, pad. Perspektive za njihov razvoj zasnovane su na balansiranoj i korelirani upotrebi ljudskog faktora i kapitala. Opšti kontekst, određivanje posledica mobilnosti radne snage na industrijskim preduzećima i identifikacija rešenja koja mogu da preduzmu u različito vreme su predmet istraživanja.

Ključne reči: mobilnost radne snage, posledice, rešenja, industrijska preduzeća

Solutions to Compensate the Effects of Labour Mobility in the Field of Industrial Enterprises in Romania

Abstract: Emigration among young people has consequences on the economic environment. Internal mobility generates imbalances in the potential of human resources. International mobility leads to the reduction of national and regional labour potential and the accentuation of deficits in certain areas of activity. Output flows of human resources show a better level of competence in areas required on the future labour market. In addition, there has been an increase in international mobility in recent years. To all these challenges coming from the human resources area, Romanian businesses need to find solutions, to ensure growth or, in some cases, downfall. The prospects for their development are based on a balanced and correlated use of the human factor and capital. The general context, the determination of the labour mobility consequences on the industrial enterprises and the identification of the solutions they can take, at different times, are the subject of the research.

Keywords: labour mobility, consequences, solutions, industrial enterprises

1. Introduction

The study presents a synthesis of more researches, concerning the impact of mobility of human resources upon the industrial companies of Romania. The researches were broken down investigating private companies and public companies. The identified solutions, depending on their provenance and term of application, were grouped in domestic and external, respectively for short, medium and long term.

In Romania the situation of the persons affected by poverty was improved and the number of the persons having a precarious material state was significantly diminished in the last years. The level of poverty of Romania remains among the highest in the European Union. The results in the fields of education and of health care remain unsatisfying, especially for the categories most affected by poverty. The situation of the labour force continues to improve, presenting at the same time some structural issues (European Commission, 2016). The quota of employment of the labour force increased in the last years, but there are significant differences in comparison with the European Union and the national objectives (European Commission, 2017). Taking into consideration all the mentioned aspects, Romania is still facing a negative demographic evolution determined by the aging population and the emigration. There are major social and economic differences between urban areas and those of the

urban periphery, between urban and rural areas. The differences in those concerning the access to the medical assistance and education, contribute to maintaining these inequities. The migration of labour force, from a sector to another, inside the borders of the state, brings a lot of challenges. As the economy has been transformed, the manual workplaces requiring low level of qualification such as those in agriculture and industry are lost and new labour places are created in the field of services and in public sector. Also, based on a sustained economic rise, it is noticed as re-launching of the civil engineering industry (re-launching of civil engineering industry can be noticed). Also it is expected that the services to create new labour places in the next years (It is also expected that new workplaces emerge in the service industry in the years to come). (Table 1).

The difficulties to face with for recruiting and keeping the employees having a high qualification, in the sectors having a fast growing, represent an issue for the economic growth. There are deficits of competences, especially in the Technology of Information and Communication sector, but also among the professionals in health, education and in the field of services. The professions and trades qualified in industry, trade, transport and distribution are affected by a deficit of labour force. The poor results obtained in the educational system, professional training and lifelong learning, the non-attractive labour conditions and the high level of wages for those working abroad contribute to the deficit of labour force. The domestic mobility of the labour force, which might balance some deficits of competences, remains limited (Manpower Group, 2015).

2. Solutions in the field of industrial enterprises in Romania

2.1. Increasing resource efficiency

The increase of the investments in utilization of the human, material and financial resources can provide the maintenance of the costs of production at a low level, improving like this the competitiveness and the perspectives of economic growth. At national level the energetic efficiency is going to be improved, but the progresses appear slowly. The gradual deregulation of the prices of the natural gas for the natural persons and legal entities was finalized in 2015. Romania is not entirely integrated into the energetic market

Table 1: Distribution of the active population by sectors of activity in 2012-2016 (thousands of persons)

Activity	2012	2013	2014	2015	2016
Agriculture, forestry and fishing	2556,7	2500,8	2441,9	2183,8	1951,9
Industry (except construction)	1789,5	1788,3	1852,0	1792,8	1846,2
Construction	637,7	629,8	639,8	636,3	678,4
Wholesale and retail trade, transport, accommodation and food service activities	1670,9	1688,3	1724,8	1810,3	1854,5
Information and communication	146,5	144,6	147,6	172,8	168,3
Financial and insurance activities	126,9	117,4	112,5	104,8	110,9
Real estate activities	14,7	18,1	20,8	22,0	18,1
Professional, scientific and technical activities; administrative and support service activities	307,6	338,6	377,0	389,6	402,5
Public administration, defense, education, human health and social work activities	1140,1	1102,7	1071,3	1184,6	1170,0
Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies	214,3	220,6	226,1	238,3	248,0
Total	8605,1	8549,1	8613,7	8535,4	8448,8

Source: (European Commission, 2018)

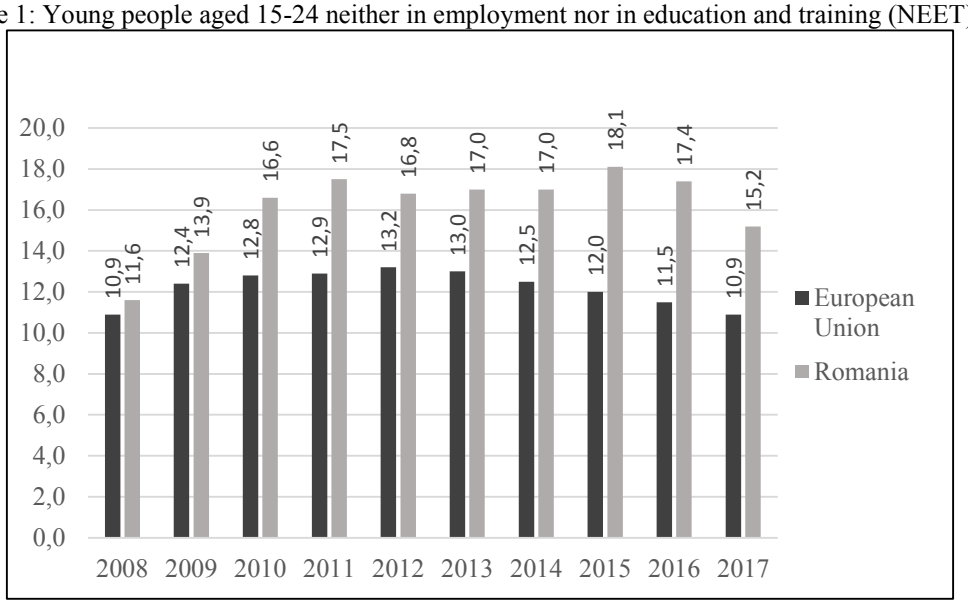
of the European Union. In 2017, the capacity of interconnection for the electric energy was under the objective of 10% established for 2020 (European Commission, 2017). The modernization of the domestic lines and of the old assets of the network is very slow. In order to achieve this objective,

Romania has to implement new projects of common interest and to modernize the domestic lines. The economy is not efficient from the point of view of utilization of resources, being classified well below the average of the European Union, with effects upon the competitiveness and upon the long lasting development. The recycling rate is one of the lowest in the European Union (5%) while the rate of storage of wastes is one of the highest (82% in 2013) (European Commission, 2018). The reform of the system of administration of the waste suffers important delays. There is no efficient legal and economic frame for recycling waste.

2.2. The utilization of the non-exploited labour force

Based on the general context described in introduction, for the stimulation of the economic growth of the industrial companies, it is essential to exploit the unused potential of the labour force. The diminished levels of the unemployment are accompanied by one of the highest rate of inactivity of the population able to work in the European Union. The employment of the labour force and the rates of activity of the women, of the persons having low level of qualification, of the youth, of the handicapped persons are under the average of the European Union. The proportion of the youth which is not framed from professional point of view and does not attend an educational or training program (NEET meaning not in education, employment or training) remain at a high level (Figure 1).

Figure 1: Young people aged 15-24 neither in employment nor in education and training (NEET) (%)



Source: (European Commission, 2018)

This situation was getting worse in the last years, being determined by the increase of the rate of those leaving school early. Two thirds of the youth belonging to NEET remain inactive and among them there is a relatively high percentage of youth and women living in rural areas. Since 2016, all the youth of NEET are the beneficiaries of subventions for obtaining a workplace. Actually the warranty for the youth is partially available to the youth of NEET (European Commission, 2018). The participation of the women in labour market remains at a low level. The rate of employment of women has not improved since 2008 and remains under the average of the European Union. The main causes are: the lack of some structures for childcare, or the facilities for long-term care and childcare after school. In 2016 some measures were adopted to improve active participation on the market of labour force. The financial stimulus was increased to cover displacement and the expenses for the transport, in order to improve domestic mobility of the labour force. New measures to encourage the coming back of the Romanians from abroad were launched with the financial support from the European Union but the results have been very poor.

2.3 Recruiting the labour force in the rural areas

The disparities between the urban areas and the rural ones prevent the economic and social development. Over 45% of the population lives in rural areas, which remain a lot behind the urban ones in those concerning diminishing poverty, the employment of the labour force, education, the access to the services and infrastructure (European Centre for the Development of Vocational Training, 2016).

The differences between the urban and rural area, represent a hindrance for the economic growth and for the convergence of the incomes. A solution for the industrial companies can be recruiting staff from rural areas. In 2016 comprehensible set of measures were adopted for the improvement of the level of being, for the stimulation of the productivity and for the diversification of the economy. Among them there are: modernizing and restructurinsmall farms, setting up of non-agricultural small and mid-sized companies in rural areas, investments in rural infrastructure, including in the social and educational infrastructure. Applying successfully these measures will depend upon the capacity to direct and absorb, in an efficient manner, the available funds of the European Union.

2.4 The correlation with the dynamic of the professional and technical education

The unequal offer of quality education affects the potential of the human capital. The poor results of the basic competences, the increased and growing rate of early school leavers and low rate of graduates do not cover the increased need of qualified persons and the situation is aggravated by the persistent flux of emigration. In Romania the level of public expenses for education is among the lowest in the European Union. If this situation continues, these factors will continue to undermine the potential of the human capital and the economic growth (European Centre for the Development of Vocational Training, 2016).

The access to the quality education is limited in the rural areas. The schools of the rural areas- where almost half of the pupils of the primary and inferior secondary school are learning - have poor results in comparison with those of the urban area. The growing rate of the persons which leave school earlier represents a problem. In 2015 the percentage of the persons which left school earlier was 19.1%, the third highest of the European Union, being at a very high level in rural areas. This trend is determined by poverty and by an insufficient offer of education (Figure 2).

The quality and the relevance of the academic education on the labour market continue to be a challenge. The rate of graduation of the academic education is one of the lowest of the European Union (25.6% in 2015 in comparison with 38.7% in the European Union) and it is less probable to be improved significantly due to the low rate of g seconraduates from secondary school (68.1% in 2016) and to the high level of rate of those leaving school earliy (European commission, 2016).

Figure 2: Graduates in tertiary education, in science, math., computing, engineering, manufacturing, construction per 1000 of population aged 20-29

Source: (European Commission, 2018)

The progresses registered in the field of professional and technical education (VET= Vocational Educational Training) are insufficient to answer all the needs of labour market. Recently methods of education of dual type have been initiated, in order to sustain the reform of the system of professional and technical education by offering fiscal stimulus to private companies which supply courses for pupils training. A strategy has been adopted for the professional and technical education and there has been a reform of the apprenticeship system. In spite of all these, the qualification and the school program of the professional and technical education continue to be insufficiently adjusted to the requirements of the labour market. The participation in life-long education is one of the lowest of the European Union. There is a national strategy for the remediation of the deficiencies of the systems of professional and technical education, of life-long learning, but putting into application is slow.

2.5 The dynamic of the public sector wages

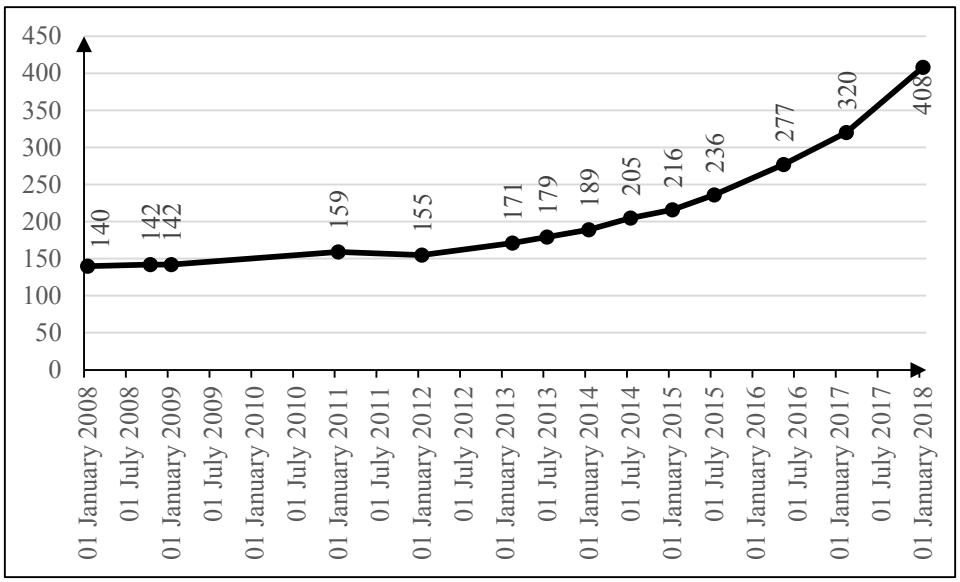
In the last years the increases of the wages of public sector were more volatile in comparison with the private sector. The periods of diminishing and stagnation of the wages paid in the public sector were followed by rapid increases of the wages. Beginning with 2010 the wages of the public sector increased more rapidly, in comparison with those of the private sector. The increasing of the wages was determined also by the important increases of the minimum wage (Figure 3).

The unpredictable changes brought to the policy of wages of the public sector might cause a deviation from the economic fundaments of the evolution of wages at the level of the entire economy. A higher degree of predictability in the process of establishing the wages of the public sector and of the level of the minimum wage, might be useful in order to avoid the negative effects upon the competitiveness. The exports of the industrial companies are strongly affected by the evolution of the costs of labour force and by the dynamic of the rate of change. The increases of the minimum wage continue to be adopted without applying some objective criteria. The ad-hoc increases of the minimum wage increased in a significant manner the percentage of the workers paid with the minimum level of the wage and led to a strong concentration in the lowest part of the distribution of the wages (Government of Romania, 2017). These increases are not grounded on objective criteria.

Although they have an important role in economy, public companies do not have a financial base as solid as that of the private sector. They are dominating the key sectors as energy and railway transport, which are essential for a reliable economic growth. In spite of all these, public companies have a higher degree of indebtedness and a lower return in comparison with the companies of the private sector. The arrears to the state, to some other public companies and to the private suppliers are a generalized problem and represents contingent liabilities.

A legislation concerning the improvement of the corporative governance has been adopted. The law in case and the afferent methodological norms observe the international practice concerning the providing of the transparency of the process of appointing the members of the boards of directors and of the management of the public companies.

Figure 3: Minimum gross wage in economy during 2008-2017 (EUR)



Source: (Government of Romania, 2017)

2.6 The selection of the emplacement of the new industrial companies

In Romania the infrastructure represents one of the main factors which prevent the competitiveness. The precarious state of infrastructure represents one of the main obstacles in the way of developing the economic activity. In spite of the high public expenses, the quality of the infrastructure remains poor. In spite of the fact that overall were registered improvements, Romania is situated on the last place in the European Union in those concerning the perceived quality of the infrastructure. The sector of

transport continues to be dominated by public companies which are running on loss. A better absorption of the funds of the European Union might have an essential role for the improvement of the expenses with the infrastructure. The companies which were relocated from developed companies, might take into consideration the quality of the infrastructure, when they choose the area in which they are placing the activity on Romania's territory.

2.7 The improvement of the business environment

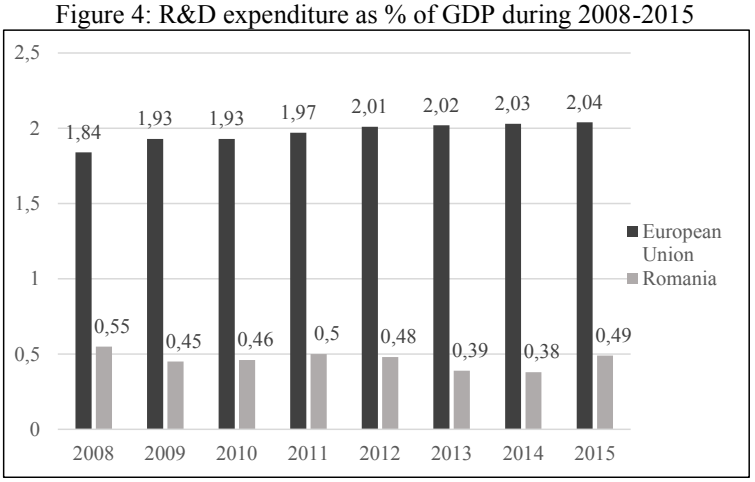
The business environment was improved but some deficiencies still persist. Between 2011 and 2017 the competitiveness of Romania improved in a significant manner, but it is still on the 45th place in the classification of the World Bank concerning the favourable climate of the business for 2017 and fall from the position 62 to the position 68 in the evaluation of the competitiveness at the level of the world (World Bank Group, 2018). The deficiencies are connected to: infrastructure, administrative task, efficiency of the labour force, health and education. The problems connected to the corruption and to the management of the public sector are among the main issues of the private business environment. The procedures of management for the companies are being simplified. The new laws simplify the process of deposing the forms and promote the utilization on a wide scale of the e-mail. In January 2017 new measures were adopted in the favour of the contractors and for simplification as: the increasing of the plafond for the micro-enterprises, the exoneration from the payment of the tax upon profit for the companies of Research and Development (R&D) and the elimination of 102 commissions and taxes. In spite of all these, the potential offered by the modern solutions of e-government remains largely unexploited. In Romania the utilization of the services of e-government is one of the lowest in the European Union (European Commission, 2015). The IT system of the national administration is segmented, this fact increasing the administrative task of the companies.

2.8 Research and innovation

The structural deficiencies limit the contribution of the system of Research and Innovation to the economic growth. The structural challenges that the department of Research & Innovation must face are unchanged: insufficient financing, institutional segmentation, the poor quality of the public scientific base and the poor cooperation between the public sector and the private one (World Economic Forum, 2017). In 2015 the European report concerning the innovation, placed Romania in the category of countries with "poor performances in the field of innovation", with a score well below the average of the European Union. The poor dynamics of Research & Innovation has consequences upon the competitiveness and upon the perspectives of long-term economic growth.

From the total of the structural funds allotted for the period 2014- 2020 only 3.4% were allotted to the R & I sector, well below the average of 10.6% of the European Union of the same period. In order to stimulate the activities of R & I at the level of the enterprises in 2016 an exoneration of the payment of the taxes upon the incomes of the employees of R & I was introduced. In 2017 there was a new measure adopted, which is exoneration of the taxes upon the incomes from the wages which are applied to the employees of the new set up companies of R & I. The intensity of the expenses with R & I was improved but the lack of investments prevent the development of the capacities of R & I. The Research and Development (R&D) is the statistic indicator for the expenses in the system of research and innovation. The intensity is calculated depending on the expenses with Research and Development expressed as percentage of Gross Domestic Product (GDP) as in Figure 4.

Figure 4: R&D expenditure as % of GDP during 2008-2015



Source: (The Ministry of Finance and Economy, 2018)

The small and middle companies have a low level of innovation and the flux of knowledge between the public activities of R & D and the business environment is poor, aspect which is confirmed by the fact that Romania is at the end of the classification at chapter "Cooperation and entrepreneurship spirit" of the report (European commission, 2016)]. The main obstacles which prevent the innovative entrepreneurship spirit, of creation and development of companies in the sector of technology are: bureaucracy, poor developed infrastructure and the low level of entrepreneurship education.

2.9 The improvement of the governance and the diminishing of the fragmentation

Essential measures were adopted for the improvement of the governance and the diminishing of fragmentation. For the issuing and setting into application of some efficient strategies of intelligent specialization it is necessary: to valorise the strong points of the clusters of knowledge and of entrepreneurship resources, to engage all the regional and national factors. In this context the creation of the National Council for the Policy of Science and Technology can be an important step in the sense of improvement of the poor coordination between the national and regional level of the coherent innovative system. Still remains to settle the issue of the high level of fragmentation which characterize the functioning of the public research, in conditions in which over 150 public institution develop activities of R & D and based on the inefficiency of the politics of transfer of technology.

In the frame of "specific support" granted by the European Commission by the mechanism of support for politics of "Horizon 2020" program, in 2016 was initiated the issuing of recommendations concerning the creation of an environment favourable to the development of the new set-up technological enterprises. This includes indicators of performance concerning the Small and Middle Companies which are innovating using internal resources, the innovating Small and Middle Companies which cooperates with other companies and the scientific publications issued in common by the public and private sector.

2.10 Digital economy

The low level of the digitalization of the companies prevents the improvement of the productivity. Taking into consideration the 12 main digital technologies included in the index of digital intensity, Romania is among those three states of the European Union having the lowest proportion of companies having a high degree of digital intensity. Although the percentage of the companies having very high digital intensity is greater than those of the equivalent member states and it is close to the average of the European Union, the digital competences of the labour force are among the lowest of the European Union.

In spite of the existence of a great number of qualified specialists in Technology of Information and Communication, generally speaking to the workers on the labour market are missing the basic digital competences or those over the basic level, while in the European Union this proportion rises to 56%.

3. Conclusion

Labour mobility is a topical issue, not only for industrial enterprises, but for the entire Romanian economy. Although it is one of the most difficult issues in the last decades, urgent solutions are needed in the face of this challenge. Some of these come from within businesses, while others are provided by the outside environment.

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Bezbedonosni izazovi za decu na Internetu

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Apstrakt: Onlajn mreža, nudi potpuno nova otkrića koja mogu da prošire prethodna istraživanja o deci, a danas deca zadobijaju digitalne veštine i socijalnu podršku koja im treba za navigaciju kroz ovaj teren koji se brzo menja. Međutim, onlajn internet mreža takođe može da identifikuje nove izazove sa kojima se deca susreću, a one se prepoznaju kroz moguće štete koje mogu pratiti decu kod rizičnih onlajn susreta. U ovom radu, pažnja je usmerena na roditelje kako da zastite svoju decu od izazova koji prete na globalnoj računarskoj mreži. Sagledavanjem sekundarnih izvora analizirali smo preporuke o postupanju u datim situacijama. Isto tako su dati saveti kako za roditelje, tako za nastavnike i vaspitače koji rade sa decom, koja koriste savremene tehnologije, kako da smanje rizk i uspostve kontakt sa decom i izgrade međusobno poverenje koje je izuzetno važno u procesu obrazovanja i vaspitanja.

Ključne reči: Internet, vršnjačko nasilje, bezbednost, prevencija i sigurnosni izazovi.

Safety Challenges for the Children on the Internet

Abstract: Online networking offers completely new findings that extend previous research; nowadays, children are gaining the digital skills and social support they need to navigate this fast changing terrain. But online networking also identifies the struggles they encounter, pinpointing those for whom harm can come out of risky online encounters. In this paper, the main focus is on the parents and the challenges of child protection from security hazards that threaten global computer networking. By examining the secondary sources, the challenges were analyzed with the result in a form of recommendation of how to overcome such delicate situations. Parents, teachers and educators that work with children who use modern technologies are advised how to reduce the risk and create contacts with children and build mutual trust that is extremely important in the process of education.

Keywords: Internet, bullying, safety, prevention and security challenges.

1. Uvod

Onog momenta kada je Internet postao široko dostupan svi smo dobili beskonačne mogućnosti za komunikaciju, informisanje, poslovanje, učenje i zabavu. Tako da se u poslednje vreme za sve više stvari oslanjamo na Internet. Ukoliko pođemo od maksime da živimo u vremenu nasilja i nasilju vremena (Koković, 2001), a imajući u vidu mnogobrojne karakteristike interneta i kao medija, i kao okruženja, ali i kao lokacije, te populacije interneta, razumljivo je da je Internet i poligon za ispoljavanje raznih oblika nasilja, koje je uglavnom verbalnog karaktera, ali ne treba zapostaviti ni njegove implikacije koje (može da) ima i u stvarnom okruženju. (Matijević i Miladinović, 2016) Mnogi rizici iz fizičke stvarnosti preseljeni su u virtuelno okruženje, pa se deca u okruženju socijalnih mreža mogu susretati sa različitim negativnim aspektima interpersonalne komunikacije sa vršnjacima i odraslima. (Kovačević-Lepojević i Žunić-Pavlović, 2011) Nova generacija "milenijumske dece" raste i sazreva u okruženju Interneta, mobilnih uređaja i brze razmene informacija, kao i raznih tehnoloških igračaka koje njihovi roditelji nisu mogli ni da zamisle u svojoj mladosti. Stoga nije ni čudo da su deca napredniji korisnici interneta i računarskih programa od svojih roditelja. Sa druge strane, u trenutku kada svom detetu dozvolimo pristup online sadržajima poželjno je da znamo kako da dete uputimo i zaštitimo, ali da ih ne ograničimo u sticanju znanja i veština koje će im u današnjem svetu biti neophodne. Internet može biti sjajan i loš u zavisnosti od toga na koji način se koristi. Internet nudi deci i mladima fantastične mogućnosti za otkrivanje, povezivanje i kreiranje. Međutim, prilikom

korišćenja Interneta postoje i rizici, na primer, to je otvoreni prozor u svet koji takođe pripada odraslima i sadrži neodgovarajuće materijale za decu. Aposlutno je neophodno imati ili razvijati svest o pretnjama koje dolaze od interneta, ali treba naglašavati da Internet ne predstavlja opasnost po živote dece. Sam po sebi Internet treba koristiti za sve ono dobro što on pruža svojim korisnicima. (Hoed-Rasmusen, 2010)

Pojava psihološkog zlostavljanja u cyber prostoru posebno je aktuelizovana poslednjih nekoliko godina na svetskoj sceni, ali su u domaćoj naučnoj i stručnoj javnosti, rasprave i istraživanja posvećena psihološkom zlostavljanju u cyber prostoru još uvek u začetku. (Spalević, 2013) Informacije koje su nam dostupne, kada je ova tema u pitanju nisu optimistične i ukazuju da je ovaj vid maltretiranja u stalnom porastu, da se nažalost u velikom broju slučajeva roditeljima ništa ne govori dok stvari baš ne eskaliraju, a neki tinejdžeri u tim situacijama ne mogu da izađu na kraj sa pritiskom kome su izloženi i imaju različitih psiholoških tegoba.

Cilj ovog rada jeste da korišćenjem sekundarnih izvora ukažemo na sam pojam i osnovne karakteristike zlostavljanja i drugih vidova opasnosti u cyber prostoru kao i primenom savremenih tehnologija koje nam to omogućavaju. Kao i na njegove posledice kako za pojedinca, njegovo okruženje i porodicu i da predstavimo neke aspekte na koje treba obratiti pažnju i samim tim doprineti prevenciji, lakšem prepoznavanju i rešavanju istog.

2. Odakle vrebaju opasnosi

Pored svih opasnosti uvek je aktuelno pitanje, da li postoje i koji su rizici pri upotrebi mobilnih uređaja. Postoji mnogo različitih mišljenja zasnovanih na brojnim studijama i istraživanjima. Posmatrano sa nekoliko različitih aspekata (zdravstvenog, etičkog, socijalnog) posebnu opasnost mobilni telefoni predstavljaju za decu predškolskog i školskog uzrasta (Ničković i sar., 2010). Mnoga istraživanja i studije naglašavaju da deca uopšte ne bi smela da koriste mobilni telefon sa aspekta zračanja kao direktnog štetnog uticaja ali i činjenice da im je na taj način uglavnom uvek dostupan Internet bez ikakvog ograničenja i kontrole. Posmatrajući zračenje uređaja kroz zdravstveni aspekt, osnovni razlog tome je što tanke kosti lobanje, koža i potkožno tkivo ne predstavljaju gotovo nikakvu prepreku za prodiranje elektromagnetnog zračenja. (Bašić i Viduka, 2014)

Nove tehnologije sa sobom nose mnogo zdravstvenih izavova kao sto je to problem sa očima (sindrom računarskog oka - CVS) (Viduka i sar., 2017) i kičmom, ali cilj ovog rada nas ograničava samo na izučavanje problema primenom online sadržaja. Prema nekim istraživanjima procenjeno je da više od 350 miliona dece i tinejdžera između 12 i 17 godina imaju pristup internetu. Ta cifra predstavlja oko 40 mladih tog uzrasta u svetu i zbog toga je veoma važno povesti računa o bezbednosti mladih na internetu. Neprikladan sadržaj se može naći i pojaviti skoro svugde na internetu. Recimo u email-u, se može naći link za sajtove sa pornografskim sadržajem, chat-u, forumima, socijalnim mrežama, itd. Pre svega, deca mogu biti izložena neprikladnom sadržaju kao što su pornografija i nasilje. Oni se mogu pojaviti u obliku slike ili teksta. Nažalost, opasnosti su stvarne. U nekoliko slučajeva, koji su privukli nacionalnu pažnju gde su deca upoznala i komunicirala sa nekim online, što je na kraju završilo sa zlostavljanjem. Veoma je važno decu upozoriti na opasnosti koje vrebaju na internetu. To ništa drugačije nije od situacije gde deci ne dozvoljavate da izlaze kasno noću ili sl.

3. Nasilje među vršnjacima

Nasilno ponašanje u današnje vreme prelazi granice fizičkog okruženja i postaje jedan od većih problema u interakcijama dece i mladih na internetu. Tako je i vršnjačko zlostavljanje dobilo svoje novo lice u vidu sajber zlostavljanja. Sajber (internet ili virtuelno) zlostavljanje ili uznemiravanje dešava se kada se mobilni telefoni, društvene mreže ili druga komunikaciona sredstva koriste za pretnje, zastrašivanje, ismejavanje ili bilo koji drugi oblik zlostavljanja. Ovakvi oblici uznemiravanja postaju sve češći iz dana u dan. Ovaj vid maltretiranja može biti od osoba iz neposrednog okruženja žrtve (škole, komšiluka i sl.) koja žrtvu poznaje. Nasilje u školi je najviše istraživano u Srbiji, u odnosu na sve druge kontekste u kojima se ispoljava. Prema nalazima jednog od najobimnijih istraživanja o nasilju u školi koje je sprovedeno u okviru projekta „Škola bez nasilja - ka sigurnom i podsticajnom okruženju za decu" u 2013. godini, 44 učenika je bilo izloženo nasilju u periodu od tri meseca koja su prethodila istraživanju. (UNICEF Srbija, 2017) Međutim, specifičnosti okruženja na internetu, čine ovaj vid zlostavljanja sve rasprostranjenijim i po nekim verovanjima čak i

opasnijim. Sajber zlostavljanje se za razliku od onog "klasičnog" koje se odvija uglavnom u školi ili nekom drugom okruženju. Ovaj vid maltretiranja nema granice i žrtva mu prosto ne može pobeći. Ne treba zanemariti ni sexting, takođe sve izraženiji i kod nas, kada mladi svoje fotografije i video materijal eksplicitnijih sadržaja šalju svojim partnerima, a oni ih dalje distribuiraju pa završavaju na Facebooku ili Youtube, često sa punim imenom i prezimenom osobe koja je na njima. Britanska Agencija za zaštitu dece od eksploatacije na internetu (CEOP) (Ivanović i Marković, 2017) snimila je promotivni video vezan za sexting, o petnaestogodišnjakinji koja pravi grešku šaljući provokativne snimke svom dečku, koji završavaju distribuirani po celoj školi. Budući da je u pitanju nov i nedovoljno proučen tip zlostavljanja, sajber zlostavljanje nije još uvek dovoljno prepoznato kao problem u školama, što zbog nepoznavanja i neprepoznavanja problema od strane nastavnika, školskih psihologa i roditelja što zbog nepostojanja razvijenih mehanizama prevencija i intervencija.

4. Problematika

Danas deca o internetu znaju mnogo više od svojih roditelja i nastavnika i zbog toga je neophodno da se oni obuče i saznaju šta se sve može naći na internetu, šta je to što njihova deca treba, odnosno, ne treba nikad da urade da bi se zaštitila.

Četiri petine dece između 10-18 godina ima profil na društvenim mrežama od čega na Facebook-u koji spada u najzastupljeniju društvenu mrežu, postoje opcije zaštite privatnosti, ali ih korisnici u Srbiji retko koriste. Korišćenje društvene mreže Ask.fm je rizičnije s obzirom na to da ne postoje mehanizmi zaštite privatnosti. Na ovoj društvenoj mreži korisnici mogu da anonimno postavljaju pitanja koja su često uvredljive ili seksualne prirode. Anonimnost objavljivanja ili komuniciranja ne treba smatrati prekršajem, tako da anonimna komunikacija nije štetna i ne povređuje sama po sebi. (Vorhof, 2010)
Deca se slažu da roditelji uglavnom ne umeju da koriste računar i Internet ili bar ne na nivou na kojem ga koriste njihova deca, pa se samim tim oslanjaju samo na informacije koje dobijaju od svoje dece vezano za njihove aktivnosti na računaru, mobilnom telefonu kao i online.

Prema podacima istraživanja koje je sproveo Institut za psihologiju, 62 starijih osnovaca i 84 srednjoškolaca je bilo izloženo riziku u sajber (eng. cyber) prostoru u 2011. godini. Najrasprostranjeniji rizici su sklapanje virtuelnog prijateljstva sa nepoznatom osobom (43% osnovaca, 71% srednjoškolaca), kao i ostavljanje ličnih podataka javno dostupnih svima na profilima (29 osnovaca, 39 srednjoškolaca) i odgovaranje na poruke nepoznatim osobama koje žele da uspostave kontakt sa detetom (27 o snovaca, 47 sre dnjoškolaca).

U toku 2014. i prve polovine 2015. godine Net patrola, online mehanizam za prijavu digitalnog nasilja pri Centru za bezbedan Internet Srbije, primila je 1690 prijava zloupotreba i štetnih sadržaja po decu koje su dalje prosleđene Službi za visokotehnološki kriminal pri Ministarstvu unutrašnjih poslova Republike Srbije i INHOPE, međunarodnom udruženju Internet operatera za dalju istragu i postupanje. (Šapić, 2016)

Po podacima Republičkog zavoda za statistiku za 2016. godinu, dobijenim u anketi o upotrebi IKT u Republici Srbiji, koja je pokazala da 72 domaćinstva pristupa internetu putem personalng računara, 76.5 domaćinstava pristupa koristeći mobilni telefon. U starosnoj grupi 16-24 procenata korišćenja mobilnih telefona je iznad 95%, a u grupi 25-54 još i veći. (Ivanović i Marković, 2017)

U jednom istraživanju koje je provedeno u Nemačkoj, čak 18 dece u dobi od 12 do 14 godina bilo je žrtva nekog od oblika nasilja online. Od dece koja su bila izložena učestalom nasilju na internetu, njih 62 % izjavilo je kako je nasilnik bio njima poznata osoba ili čak kolega iz razreda. Isto istraživanje kaže da su devojčice češće žrtve, ali i češći nasilnici na internetu od dečaka. (Nijaz, 2016)

Istraživanje u SAD-u, koje je uključivalo decu u dobi od 10 do 17 godina koja su redovno koristila Internet, pokazalo je da je 19 njih bilo izloženo seksualno neprimerenim porukama. Od izložene dece, njih 25 pokazivalo je veći stepen stresa nakon toga. Najveći stres bio je prisutan kod mlađe dece (dobi od 10 do 13 godina), kod dece koja su se koristila računarom van svoje kuće, ta deca su dobijala agresivne poruke seksualnog sadržaja, uz veoma često nagovaranje dece na lični susret. (Nijaz, 2016)

5. Saveti i rešenja

Prvo, što mogu roditelji da urade jeste da postave računar na mesto u kući koje je lako dostupno i vidljivo i njima kako bi lakše mogli da nadgledaju šta im deca rade na računaru. Važno je takođe, upoznati decu sa opasnostima sa kojima se mogu susresti na internetu. Roditelji bi trebali da se zainternesuju šta im deca rade na internetu, koje sajtove posećuju, sa kim se dopisuju, od koga dobijaju email-ove. Takođe mogu se koristiti i neki internet filteri, programi kojim je moguće blokirati sadržaje određenog tipa ili određene web sajtove (Tot i Grubor, 2014) i oni se preporučuju roditeljima, jer je sa njima moguće vrlo efikasno blokirati pornografske sadržaje. Internet provajder SBB (Srpski kablovski i internet operater) pridružio se Savetu Evrope u borbi za bolju zaštitu dece na internetu i u skladu sa tim promoviše igru Saveta Evrope "Kroz divlju šumu weba" namenjenu najmađima u Srbiji. Igra "Kroz divlju šumu weba" (Council of Europe, 2018) koristi poznate bajke kako bi vodila decu kroz lavirint opasnosti koje vrebaju na internetu, pokazujući im kako da ga sigurno koriste. Prevedena je na 24 jezika zbog rastuće zabrinutosti gde "online", mališani dolaze u sve veću opasnost od "internet vrbovanja" od strane seksualnih i drugih napasnika. Koristeći ovu igru, deca na zabavan način uče kako da bezbedno koriste Internet. Nadamo se da će i ostale kompanije, ali i škole, nastavnici i roditelji da se pridruže u naporima da internet bude sigurna sredina za decu i mlade ljude. Za više informacija treba pratiti i zvanican web sajt Vlade Srbije koji se bavi problematikom bezbednosti na Internetu pod imenom "Pametno i bezbedno" na adresi www.pametnoibezbedno.gov.rs. Pored ovog web rešenja aktiviran je i broj za prijavu svih vrsta online uznemiravanja i drugog nasilja na broj telefona 19833.

6. Šta preduzeti

Ono na šta bi svaki roditelj trebao da obrati pažnju kada odluči da je vreme da detetu dozvoli korišćenje interneta su sledeće tačke:

1. Ograničiti dnevno vreme provedeno za računarom. Po potrebi podesiti na odgovarajući način profil deteta na računaru, da istom mogu imati pristup samo određen broj sati dnevno. Profile ostalih ukućana zaštitite lozinkom.
2. Pratiti sajtove koje dete posećuje. Pristup sajtovima koji nisu poželjni treba ograničiti korišćenjem kontrolnih programa. Ukoliko se detetu dozvoljava pristup socijalnim-društvenim mrežama (Facebook, Twitter, YouTube i sl.) podesiti privatnost profila i pratiti aktivnosti njih i njihovih prijatelja u okviru profila.
3. Ako je ikako moguće računar nikad ne postavljajti u dečju sobu, već na mesto koje je prometno i gde svi imaju pristup.
4. Starija deca i tinejdžeri u komunikaciji dosta koriste sleng i engleske skraćenice pa često njihova komunikacija i kada ih pratite možu biti nerazumljiva.
5. Upoznati decu sa potencijalno ružnim situacijama koje mogu da se dese na internetu i porazgovarati o najboljem rešenju problema. Objasniti im šta su računarski virusi i kako se od njih štiti. Treba im pokazati na primerima koji su sigurni i provereni sajtovi, a koji nisu. Treba ih naučiti da zaštite svoje lične podatke, i da se i oni sami ponašaju odgovorno kada su na internetu, na isti način na koji se deca uče da ne pričaju sa nepoznatima.
6. Treba ohrabriti dete (i to raditi stalno) da vam prijavi svaku konverzaciju ili kontakt koji im se učini čudan ili se zbog njega ne osećaju dobro. Imajte u vidu da se deca često plaše da ćete im uskratiti korišćenje računara ukoliko se budu požalili i da je to po nekim istraživanjima koja su rađena u USA jedan od najčešćih razloga zašto ne prijavljuju roditeljima uznemiravanje.
7. I na kraju treba se istinski zainteresovati za ono što dete radi online. Potrebno je pronaći vreme da sa njima posetite omiljeni sajt, odigrate neku igricu, porazgovarate o tome. Stvoriti neki zajednički online prostor pa će i deca biti otvorenija i spremnija da sa roditeljima-starateljima podele svoja iskustva. Potrebno je stvoriti atmosferu poverenja u kojoj će dete biti dovoljno opušteno da sa odraslima razgovara o svojim aktivnostima na internetu.

Ako roditelji ranije nisu bili mnogo zainteresovani za sve novine koje nam ulaze u živote, potrebno ih je prihvatiti kao sastavni deo života deteta ili njegove generacije i naći vremena da se sa njima bolje upoznaju tako da mogu pomoći ili zaštititi dete.

7. Zaključak

Deca prvenstveno treba da znaju da se na internetu ne ostavljaju lični podaci, puno ime, adresa, ime škole i ni u kom slučaju ne treba da ostavljaju fotografije, dok bar ne pođu u srednju školu. Ono što roditelji treba da urade da bi zaštiti svoje dete jeste da ga ne puštaju da samostalno koristi Internet do 12 godine. Računar bi trebalo da bude postavljen tako da se vidi šta je na ekranu i šta dete radi, a uporedo sa tim, sa decom treba razgovarati o tome šta je Internet, za šta se koristi, kao i da kod deteta treba stvarati naviku da se Internet koristi za informisanje, učenje, a ne samo za druženje. Kako deca veliki deo dana provode u školi ovaj zadatak imaju i nastavnici koji treba da ih edukuju o sistemima zaštite i o mnogim stvarima koje se mogu iskoristiti i zloupotrebiti u razne svrhe, a deca nisu u stanju da to samostalno sagledaju. I ako odrasli nisu u velikoj meri do sad bili zainteresovani za ove probleme, kroz ovu edukaciju na njih treba da se pozitivno deluje da prihvate nove tehnologije kao sastavni deo života njihovog deteta ili njegove generacije i da nađu vreme da se sa njima bolje upoznaju tako da mogu pomoći deci da ih koriste na ispravan i siguran način. Drugim rečima ovo je slično kao tradicionalno vaspitanje dece sa novim izazovima koje sa sobom nose nove tehnologije i mogućnosti koje one pružaju. Da bi roditelji mogli da svojoj deci pomognu svojim znanjem i iskustvom kao što je to u slučaju klasičnog vaspitanja potrebno je da se roditelji bolje upoznaju sa mogućnostima novih tehnologija i interneta kao i sa sigurnosim izazovima koji mogu proizići iz njihove upotrebe.

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Industrijska konoplja – ekonomske i ekološke prednosti: slučaj Srbije

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Apstrakt: Industrijska konoplja je biljka koja pruža mnogobrojne mogućnosti čovečanstvu već deset milenijuma. Poznata kod starijih generacija kao sredstvo sa lekovitim svojstvima, izradu tekstila, prehrambenih proizvoda itd, ova biljka je znatno izgubila svoju popularnost usled rata protiv narkotika i sve pogrešne stigme koji su se uz njega pojavile. Zbog oštre klimatske promene i velike potražnje ka jeftinim i obnovljivim izvorima koji će imati što manji 'zeleni otisak', pažnja se polako vraća na industrijsku konoplju. Cilj ovog rada je da skrene pažnju na postojeće predrasude i mnogobrojne ekološke i ekonomske prednosti kod kultivacije ove biljke. U radu se koristila opšta metodologija, primenom induktivne i deduktivne metode, kao i metode analize i komparacije. Najveća poteškoća u istraživanju ove teme bila je u nedovoljnim i neadekvatnim objavljenim istraživanjima i činjenicama, prouzrokovanih lošom reputacijom konoplje, zbog svoje bliske (ali nebitne) korelacije sa rekreacionom drogom kanabis (poznatom kao marihuana). Sa jasnom distinkcijom ove dve vreste *Cannabis Sativa L* biljke, vrednost poljoprivrednog tržišta industrijske konoplje je u značajnom porastu, kao i potražnja obrađenih proizvoda.

Ključne reči: industrijska konoplja; ekonomske; ekološke; prednosti; Serbija;

Industrial Hemp – Economic and Ecological Benefits: The Case of Serbia

Abstract: Hemp is a plant that has been cultivated by civilizations for over 10,000 years in terms of agriculture, medicine, source of fiber, etc. Almost a century ago, for various political reasons, the plant has been banned in most regions of the world with rigorous laws and regulations. With today's concerns on overpopulation and global warming, people have started to look for alternative, natural, and economically beneficial sources. Hemp gives a simple solution as a step towards a cleaner future, one that our ancestors knew very well. Though, research on industrial hemp has had two very opposing results, some believe this is due to the misconception that industrial hemp is the same as the recreational drug, commonly known as marijuana[10]. Nevertheless, with the distinction of these two types of cannabis, the industrial hemp market is emerging in a rapid manner.

Keywords: industrial hemp; economical; ecological; benefits; Serbia.

Introduction

Annually, the amount of plastic thrown could circle the Earth four times, around 7.3 million hectares of forest is lost, and greenhouse gases are emitted into the atmosphere. These environmental hazards are a part of a world-wide rising problem that we are facing every day. To begin making a change, one must start locally, and from there work on out. This paper aims to review the effects of one plant on pollution, and to stimulate its growth.

Industrial hemp is what some might call a phenomenon. It can provide more than 20,000 biodegradable products, in almost every major submarket (from agriculture and the textile industry, to automotive,

[10]*Cannabis Sativa L; The difference between industrial hemp and 'marijuana'* Cannabis plants contain unique compounds called cannabinoids; the most well-known is THC (tetrahydrocannabinol) credited with causing the 'marijuana high'. The main difference lies in that industrial hemp has a legal limit, around the world, of up to 0.3 in THC, while marijuana has a minimum dose of 5% that can go as high as 30%. Another key ingredient in the cannabis plant is the cannabidiol, or CBD (shown as a reducer of the THC psychoactive effect). Hemp plants are richer in CBD than in THC, while the opposite goes for marijuana.

and furniture). It has both the ecological as well as economic benefits. These all are qualities that can help aid today's major waste and pollution problems. Although some research has been done regarding mass production of industrial hemp, there is too much social stigma which strongly influences funding and legal interest in the plant. The European Industrial Hemp Association stated that hemp and its compound CBD are being increasingly used in the food supplement industry as well as in the cosmetic industry and "thereby generating new investments and creating employment in the cultivation and processing of hemp and hemp-derived products" (EIHA, 2017, para. 1). In this paper, the difficulties, economic and ecological benefits of growing hemp on a larger scale in Serbia will be revised, while comparing the laws and outcomes of more progressive countries, in hopes of stimulating further research on this topic.

Methodology

In order to collect data, a mix of quality and quantity research techniques and thorough analysis, of said data, has been used for the sole intention of research purposes for this paper. By analyzing over 20 different online sites, published papers, and discussion forums, it was possible to obtain a, somewhat, clear understanding of the main problem facing the unpopularity and restrictions of harvesting industrial hemp, as well as numerous benefits and bright aspects of cultivating it. Though the findings in this research have been split into two different results of the same topic: "what are the benefits of growing industrial hemp?" I have chosen to rely on conclusions not based on the plants prejudice and associations with the drug from the same species, cannabis.

Theoretical questions

There have been numerous researches done on this topic, though they are highly influenced by laws and regulations by the region's political leaders. Heated arguments, from two opposing sides, have been led concerning cannabis and the war on drugs for many decades now. In the US, cannabis is classified as a 'schedule I' drug, alongside heroin, and lysergic (DEA, n.d.). A number of published papers have been called into question due to inaccurate results that contradict newly found results. One of the major problems, when discussing the future of *Cannabis Sativa L* in mass production, is the fear of cannabis as a, recreational drug, being mixed with the industrial sort, causing farming corruption. A simple solution lies in education, and knowing the physical differences between the two brands, as well as mandatory random check-ups.

Laws and regulations

Whereas the laws and regulations in the EU allow for 46 types of *Cannabis Sativa L* to be grown, in Serbia only 2 are permitted, even though it has never been illegal to do so. The amount of THC allowed in hemp in the EU equates to 0.2% (EMCDDA, 2017), in contrast to Serbia, that allows 0.3% (Pravilnik o uslovima za gajenje konoplje, 2013). Both the European Union and the Serbian institutions have a one year limited contract. Requirements for getting the license to grow industrial hemp, if followed precisely, don't present a problem, as the instructions are clear and simple. If one is considering starting a hemp growing business, apart from the license, finding the seeds which have to be approved by the Registry types of agriculture plants (Registar sorti poljoprivrednog bilja), might be of an inconvenience. Luckily, Serbia has its very own hemp organization "Konoplja", which helps its members in all forms, from finding the equipment to teachings about the best way to handle the hemp plant for its maximum output. What one also has to keep in mind are the regular checkups from government officials, who maintain the legality of this expanding business.

China, as the leading industrial hemp provider, has had a long and supportive role from its government. Scientists, funded by the government, have been studying the plants military, medical, and commercial use, while also developing hybrid plants that can sustain themselves and thrive in disdained environments. Even though China is accountable for more than half of the world's hemp production, half a century ago, it had rigorous laws against this plant, going as far as the death penalty if caught with fresh or dried leaves spanning from 5 to 150kg (Chen, 2017). Around the time when the Vietnam War broke, the country needed a fabric to keep its military force clean and dry, and industrial hemp had both the required fiber as well as an antibacterial benefit. From there on out, the officials realized that hemp had much to offer and began heavily investing in its further research.

Yugoslavia was one of the world's major hemp providers, which is worth mentioning when considering reviving this type of agricultural growth. Despite Yugoslavia falling apart, Serbia still has a role in hemp production. The mass production of hemp wouldn't be a novelty in this region for it has been present here for a very long time. (eKapija, 2017) Though, like said beforehand, official research, as well as prejudice, is motivated by the government and its local history. In Serbia's rural and suburban villages, hemp has been a daily part of the community, from medical teas to nutriments.

Economic aspects

The demand for industrial hemp is such that the USA has an annual income of around of $580 million in hemp products, mentioning that all of its raw hemp material is imported (Miller, 2017). China has 3 major hemp processors, Shanxi Greenland Textiles being one of them, on a yearly basis produces 5,000 tons of yarn, 10 million meters of fabrics, 150 thousand finished textile products, all of which are for the most exported to Europe, the US, and neighboring countries (Woodford & Cui, 2016). Forbes estimates that by the year 2020, the hemp market is going to grow by 700%, with the market value of $2.1 billion (Naturally Splendid, n.d., para. 1).

Such is the quality of hemp that selling it either raw or processed will yield substantial profits. One of the major advantages of industrial hemp is that is requires no pesticides, as the plant is a weed itself. Another advantage worth mentioning is that it does not require a lot of room to grow, yielding around 10 tons per hectare. Hemp can be 100% processed, from its roots to its leaves and seeds. More than 20,000 products can be made from hemp. It has potential to replace wood, plastic, and fiber altogether in a much cheaper manner. To cement these already staggering facts, it has to be taken into account that 1 hectare of hemp fiber equates to 4 ha of wood fiber or 2 ha of cotton fiber (Jordan, 2014). To add to that 0.4t (1 acre) of hemp has roughly 3,600kg of seeds, which, when processed can produce around 1,100l of hemp oil or almost 3,000kg of hemp flour (CGBA, 2014).

Recent reports suggest that investing in industrial hemp, in Serbia, could bring profits that are considerably high, compared to the invested finances (taking into consideration, for now, the undeveloped state of hemp culture).(Božović, 2018.) Even though the plant has seen a remarkable growth in its cultivation, Serbia has yet to take advantage of its agricultural potential. When comparing with Serbia's neighbouring countries, Croatia (an EU member) had the same undeveloped status when it came to cannabis, but with the EU regulation system, it has strived and succeeded in harvesting the plant. Serbia would greatly benefit from industrial hemp cultivation, locally and internationally.

Ecological benefits

One thing to know is that hemp can produce well over 20,000 products. Those products can be categorized in nine subcategories or markets, such as agriculture, the textile industry, recycling, automotive, furniture, etc. (Thayer et al., 2017). To name a few key products, we could start off with plastic.

Hemp plastic is already in use as composite bioplastic[11] that has high strength and rigidity. Another thing to note is that bioplastic is used in the construction of cars, boats, and musical instruments. 100% biodegradable shopping bags have been in mass production in more developed countries, which have not yet switched to paper product bags. With global warming being an issue, the toy company Lego has plans to phase out fossil fuel based resin by 2030 and is considering switching to hemp plastic. Despite the advantages, and the fact that this type of plastic needs between 3 and 6 months to degrade in nature, which is practical compared to hundreds of years that is needed for regular plastic, hemp plastic, which is a part of bioplastic, does not resolve the afterlife of plastic. (O'Connelly, 2017) Hemp plastic provides a far more suitable replacement for regular plastic, which has a very diverse function in everyday life. From kitchen supplies and toys, to appliances and big-scale demand, organic plastic has, undoubtedly, a profitable platform to evolve on.

With deforestation being such a widespread problem, some people would consider hemp to be an enormous benefit. This is backed up by the fact that 1 acre of hemp would equal to 4 acres of wood in terms of cellulose fiber production (essentially paper). In terms of paper production, hemp takes

[11] *Composite bioplastic:* plastics made from a combination of hemp and other plant sources.

roughly a hundred days to grow, being an annual plant, while trees take at least 8 years. Another major advantage of hemp is that it is made mostly of cellulose. A staggering 75% of the plant could be used for cellulose, while the other 25% could be used for fertilizing soil. Wood on the other hand is only 30% cellulose and the other 70% is removed with toxins, which pollute the environment and waste the plant. A key difference in recycling is that wood can only be recycled 3 times, whereas hemp has the ability to be recycled 7 to 8 times without losing its rigidity. (Jordan, 2014) Similar to plastic, fiber has also a majorly developed market. When it comes to paper, one of the great categories with paper use lies in publishing. In the US alone, between half-a-million and a million books are published each year, while in Serbia around 1458 titles are published per million inhabitants (Morgan, 2013; Biznis i Finansije, 2017.). Aside from paper, industrial hemp can replace wood in terms of furniture and other goods. Even though not yet dominant, hemp-furniture has been getting increasing recognition from around the world for its durability, design and the effect it has on tree preservation.

Hemp and cotton are both used for clothing production. While hemp has a smaller ecological footprint, cotton makes up for 16% of world's pesticide use. As aforementioned, hemp does not require pesticide use; therefore its effect is not as substantial (this helps significantly reduce air pollution). Likewise, cotton requires 10,000 liters of water per kg of cotton for irrigation, but hemp, on the other hand, requires 300 to 500 liters per kg, which is an invaluable 95% reduction of water usage. Hemp does not wear out, it even softens over time and it has antibacterial properties. (Kentucky Hempsters, 2015) This trait makes it very useful, making the piece of clothing last longer, without losing its quality. The variety of types of clothes that is being made, while preserving fashion statements and exceptional nature, is staggering. One of the most famous multinational companies, Adidas, realised limited hemp sneakers designed by Bait X. Other products vary from workout clothes, to elegant ties and handkerchiefs. Some major online branding companies have organic-cotton (typically 60% hemp and 40% cotton mix). Towels and sheets made from hemp last longer and become more comfortable over time. (Ministry of hemp, 2017.)

In nutrition and even cosmetological production, hemp can play a dominant part. Industrial hemp is rich in plant-based protein, minerals, vitamins, amino and fatty acids. All these compounds make organic products that can be used in daily hygiene, food supplements, remedies, and many more. Milk, vodka, burgers, energy bars, all made from 100% organic hemp. The production of facial creams, shampoos, massage oils, even sunscreams, etc. can substitute chemicals for more natural and healthy replacements. (Felice, 2017)

Hemp can also be used as a building material. There is a special combination where both hemp and concrete are mixed to create a more ecofriendly substance, or hemp and lime which results in a sound-proofing and insulating material that is stronger and lighter than concrete (though it often needs additional support). Some of the most important advantages are isolation, antibacterial use against rodents, and rigidity against earthquakes. A home can be built (exterior and interior) completely out of hemp-derived products, spanning from fiberboards, and bioplastic, to hemp-based textiles and furniture. The prime examples of this construction material being used are the buildings in Europe, which are 10 stories high. (American Lime Technology, n.d.)

Conclusion

With all the above date reviewed, it is concluded that opting for mass industrial hemp production is the next step towards a more sustainable economy and, more importantly, towards saving the planet. Serbia has the adequate soil and climate conditions for hemp agriculture. This region has had a history with cultivating the hemp plant, being used for personal use as well as mass consumption. Even though the upsides to breeding hemp are obvious, there are still very constricting laws and regulations that need to be reformed. The government's role, considering the future of hemp production, is crucial. There should be overall funding as well as for scientific research of this type of plant, modeled on China. Needless to say, this fast growing industry presents a tremendous opportunity for job and economic growth. By encouraging people to grow and sell hemp, the butterfly effect would result in the need for more processing factories which in term presents the opportunity for even more workers. With research, general interest and the support from the government, the agriculture community will flourish.

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Figure 1: Accommodation units according to the structure of hotel capacities in 2011 and 2012, written in the form of percentage

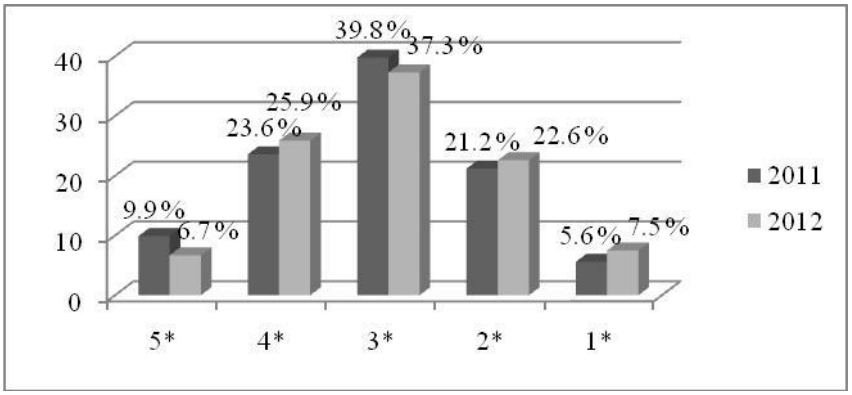

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Table 1: Accommodation units according to the structure of hotel capacities in 2011 and 2012, written in the form of percentage

Category	2011	2012	Number of accommodation units (2011)	Number of accommodation units (2012)
5*	**9,9**	**6,7**	1452	990
4*	**23,6**	**25,9**	3486	3911
3*	**39,8**	**37,3**	5895	5636
2*	**21,2**	**22,6**	3102	3420
1*	**5,6**	**7,5**	1133	1132
total	100	100	15068	15089

Source: (The Ministry of Finance and Economy, 2013)

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Naslov rada na srpskom jeziku

Ime Prezime[12]*, Ime Prezime[2], Ime Prezime[3] [ostavite u ovoj verziji prazno za potrebe recenzije]

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Apstrakt: Ovaj dokument predstavlja obrazac za formatiranje radova tako da izgledaju kao da su već spremni za štampu. Sažetak predstavlja kratak informativni prikaz sadržaja članka koju čitaocu treba da omogući brzu i tačnu ocenu njegove relevantnosti. Autori treba da obrazlože ciljeve istraživanja ili navedu razlog (razloge) zbog koga pišu članak. Zatim, potrebno je da opišu metode korišćene u istraživanju i ukratko opišu rezultate do kojih su došli u istraživanju. Sažetak treba da sadrži od 100 do 250 reči.

Ključne reči: 3-5 ključnih reči za indeksiranje i pretraživanje

Title of Paper in English

Abstract: This document presents a template for preparing the print-ready papers that will be included in the Serbian Journal of Engineering Managment. The abstract briefly summarizes the article and gives the reader the opportunity to assess it's relevancy. The authors should elaborate the goals of the research or state their reason (reasons) for writing the paper. It is additionally required for them to describe the methods used during the research and give a brief description of the results and conclusions of the research. The abstract should be between 100 and 250 words in lenght.

Keywords: 3-5 keywords

1. Uvod

Rad pisati koristeći MS Word za Windows (tastatura za srpsku ćirilicu, latinicu ili engleski jezik - UK). Dužina rada treba da bude najviše 10 strana uključujući tekst, slike, tabele, literaturu i ostale priloge. Format stranice je **A4.** Koristite **2 cm** za donju i gornju marginu, a **2,5 cm** za levu i desnu marginu. Razmak između redova u okviru jednog pasusa je jedan, dok je razmak između paragrafa dvostruki. Za formatiranje teksta preporučuje se korišćenje fonta **Times New Roman.**

2. Struktura rada

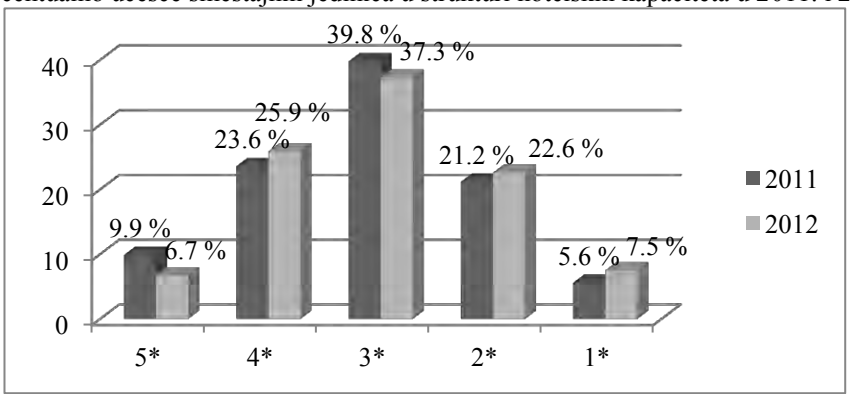
U prvom redu na prvoj strani treba napisati naslov rada na srpskom jeziku (16 pt). Ispod naslova rada treba ostaviti mesto za navođenje ime(na) autora, nazive institucija autora onako kako je naznačeno u ovom Obrascu. Nakon institucije poslednjeg autora, ostaviti jedan prazan red i u sledećem napisati kratak sažetak (10 pt). Nakon sažetka sledi pregled ključnih reči. Nakon prikazanog naslova rada, sažetka i ključnih reči na srpskom jeziku, potrebno je i na engleskom jeziku naznačiti prethodno navedeno.

Numerisane podnaslove prvog nivoa treba formatirati korišćenjem fonta 12 pt boldovano, a podnaslove drugog nivoa 10 pt boldovano. Tekst, kao i spisak literature treba formatirati korišćenjem fonta 10 pt.

3. Grafički i tabelarni prikazi i formule

Sve ilustracije, bez obzira da li su dijagrami, fotografije, grafikoni nazivaju se slike. Naziv i broj slike treba prikazati na sredini reda iznad slike.

Slika 1: Procentualno učešće smeštajnih jedinica u strukturi hotelskih kapaciteta u 2011. i 2012. godini



Izvor: (Ministarstvo finansija i privrede, 2013)

Naziv i broj tabele treba prikazati iznad tabele na sredini reda.

Tabela 1: Procentualno učešće smeštajnih jedinica u strukturi hotelskih kapaciteta u 2011. i 2012. godini

Kategorija	2011.	2012.	Broj smeštajnih jedinica (2011)	Broj smeštajnih jedinica (2012)
5*	**9,9**	**6,7**	1452	990
4*	**23,6**	**25,9**	3486	3911
3*	**39,8**	**37,3**	5895	5636
2*	**21,2**	**22,6**	3102	3420
1*	**5,6**	**7,5**	1133	1132
ukupno	100	100	15068	15089

Izvor: (Ministarstvo finansija i privrede, 2013)

Pošaljite svoj rad, uključujući tabele, slike itd, kao jednu datoteku. Pored toga, treba dostaviti sve slike i tabele (koje se unose u crno-beloj tehnici) kao posebne fajlove u JPF ili TIFF formatu sa najmanje 300dpi rezolucije.

Formule treba centrirati na stranici sa numeracijom, kao u narednom primeru. Preporučuje se formatiranje redova sa formulama u Microsoft Word-u (MathType).

$$\mathrm{PVo} = \frac{\mathrm{FVn}}{(1+\mathrm{i})^{\mathrm{n}}} \qquad (1)$$

4. Zaključak

U zaključku autori treba da sumiraju rezultate do kojih su došli u istraživanju.

Literatura

Prilikom navođenja literature, treba se pridržavati uputstva APA sistema navođenja literature. Za više informacija pogledajte *Publication Manual of the American Psychological Association* (6th ed.).

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Reference treba navesti zajedno na kraju glavnog teksta azbučnim redom po prezimenu autora. U nastavku su prikazani primeri korišćenja APA stila za citiranje u raznim oblicima pojavljivanja (knjiga, rad u časopisu, zbornik, elektronski izvori itd.).

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Knjiga, prevod dela:
Primer: Spic, E. H. (2011). *Umetnost i psiha: studija o psihoanalizi i estetici.* (A. Nikšić, prev.). Beograd: Clio.

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Primer: Čerović, S. (2012). *Savremeni koncepti strategijskog upravljanja turističkom destinacijom.* Naučni skup sa međunarodnim učešćem "Turizam: izazovi i mogućnosti", Trebinje.

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Primer: Harish, R. (2008). Brand Architecture and its Application in Strategic Marketing. *The Icfai University Journal of Brand Management,* 7(2), 39-51.

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Primer: Tew, C. & Barbieri, C. (2012). The perceived benefits of agritourism: The provider’s perspective. *Tourism Management,* 33(6), 215-224. doi:10.1016/j.tourman.2011.02.005

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