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Fakultet za inženjerski menadžment

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## A Message from the Editor-in-Chief

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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.

Editorial board is consisted of distinguished academics from various countries dedicated to establishing the highest academic standards and promoting engineering management principles in Serbia.

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

Prof. Dr. Vladimir Tomašević, FRSA

## Reč urednika

Serbian Journal of Engineering Management je nov naučno-stručni časopis, koji izdaje Fakultet za inženjerski menadžment i Društvo inženjerskog menadžmenta Srbije. Časopis je kategorisan od strane Ministarstva prosvete, nauke i tehnološkog razvoja kao novi naučni časopis. 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.

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

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Prof. dr Vladimir Tomašević, FRSA

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# Analiza aktivnosti prevencije zagađenja plastikom za „zeleni turizam“

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**Apstrakt:** Većina reciklažne plastike se može reciklirati samo po stopi od 20-30%, ostatak odlazi u reke, okeane, deponije, gde su, za materijale bogate ugljenikom, potrebni vekovi da se razlože. Svetske organizacije i stejkholderi u turizmu ulažu napore u inicijative koje bi mogle podići svest javnosti o “belom zagađenju” (zagađenje plastikom). Ovaj rad rezimira poslovne prakse u turizmu u vezi sa održivim razvojem, posebno u ekoturizmu i u hotelskom sektoru. Kao deo cirkularne ekonomije, načelo „ponovna upotreba, smanjenje i recikliranje“ usvojeno je za većinu hotela i odmarališta u svetu. Složenost prevencije zagađenja je motivisala i dovela istraživače do pronalaženja metoda koje bi preusmerile životni ciklus plastičnog otpada sa linearnog na cirkularni.

**Ključne reči:** zagađenje plastikom, cirkularna ekonomija, održivi razvoj, ekoturizam, zeleni turizam

# Analysis of the activities of white pollution prevention for green tourism

**Abstract:** Even the most recyclable plastic can only be recycled at a rate of 20-30%, the rest of goes to rivers, oceans, and landfills, where the carbon-rich materials take centuries to decompose. World organizations and stakeholders in tourism are putting an effort to the initiatives which could raise public awareness on White polition (plastic pollution). This paper summarizes the business practice in tourism concerning future sustainable development specificly in eco tourism and hotel sector. As part of a circular economy, policy “reuse, reduce, and recycle” has been adopted for most hotels and resorts in the world. Complexity of pollution prevention had motivated and motivated and led the researchers to find methods that would redefine the life cycle of plastic waste from linear to circular.

**Key words:** white pollution, circular economy, sustainable development, ecotourism, green tourism.

## 1. Introduction

Tourism, especially during the peak of the tourist season sees an increased number of people highly concentrated in an often small area (for example mountain resorts, small seaside villages or hotel resorts). During that time, the human impact on the area and its surrounding is increased and may cause negative effects on nature and biodiversity. Due to high demand for good service and hospitality, hotels and tourist providers may cause irreversible damage with the overcrowding their respectful premises which may also affect the culture and the identity of the region. Tourists also, bring with them increased pollution and waste, which might further cause environmental damage to the destination (closing down beaches, permanent damage to the life in sea).

Overabundance of tourists during the tourist season evokes serious pressure, if the possible capacity of the region is overexert. In that context, the basic factors are: the loss of biodiversity, the usage of available land for the lodging of tourists, local transportation caused by the tourist traffic, the increased usage of water, the increased usage of electrical energy, water pollution caused by the waste which is difficult or impossible to dissolve or break down (plastic, metal, etc.). Especially strong pressure might, also, be occurred by mega-tourist objects and manifestations or tourist activities that include the intensive usage of nature and its surroundings (example golf courses or skiing) or by motorized

activities of any kind (which also may increase the pollution caused by the emission of greenhouse gasses like CO2 from the engines).

According to the portal Booking.com sustainability travel report from 2019, over half (55%) of global travellers report being more determined to make sustainable travel choices than they were a year ago, but barriers include a lack of knowledge and available or appealing options when trying to put this into practice.These sustainable decisions include accommodation (TrekkSoft, 2019). Therefore, the initiatives for sustainable development are on the rise (for example in hotels, sustainability practices of 'reuse, reduce, and recycle' policy involve educating all hotel staff on the importance of conservation, using environmentally friendly products, and employing sustainable practices in hotel operations). Within destination offers in the UK, France, Spain, and the rest of Europe, we can find new forms of accommodation called "glamping" (luxury camping with amenities), with tree houses, pods, bell tents, yurts, and shepherd's huts.

## 2. White Polution and Sustainable Development

Since plastics contain various additives, like dyes, fillers, or flame retardants, very few plastics can be recycled without loss in performance or aesthetics. Even the most recyclable plastic, PET -- or poly(ethylene terephthalate) -- is only recycled at a rate of 20-30%, with the rest typically going to incinerators or landfills, where the carbon-rich material takes centuries to decompose (Christensen, Scheuermann, Loeffler, Helms, 2019) as it can be seen at Picture 1.

Picture 1. Main types of plastic, their identifiers, typical applications, and recyclability

| Polymer | Identifier symbol(*) | Typical relevant applications | Example | Recyclability |
|---|---|---|---|---|
| Polyethylene Terephthalate | 01 PET | Drinks bottles; food containers; condiment containers. |  | Very good. Recycled into new bottles and clothes. |
| High Density PolyEthylene | 02 PE-HD | Chemical containers (e.g. detergents, cosmetics); water pipes; garden furniture; other outdoor equipment such as water butts, potting trays, flower pots. |  | Good. Recycled to produce new bottles or pipes. |
| Polyvinyl Chloride | 03 PVC | Bubble-wrap packaging; cling film for non-food use; electrical cable insulation; rigid piping; window and door frames. |  | Poor owing to additives. |
| Low Density Polyethylene | 04 PE-LD | Shrink wraps; frozen food bags; squeezable bottles; cling films; flexible container lids. |  | Poor owing to economics and frequent contamination of films with e.g. food. |
| Polypropylene | 05 PP | Reusable microwavable ware; kitchenware; yogurt containers; margarine tubs; microwavable disposable take-away containers; disposable cups; plates; bottle tops; nappies. |  | Poor. Wide range of types and grade make recycling difficult. |
| Polystyrene | 06 PS | Egg cartons; packaging protection; disposable cups, plates, trays and cutlery; disposable take-away containers. |  | Poor owing to economics. |
| Other (e.g. polycarbonate) | 07 O | Beverage bottles; baby milk bottles; compact discs; 'unbreakable' glazing; electronic apparatus housings. |  | Poor because often present in components of mixed plastic. |

Source: (Styles, Schönberger, Galvez Martos, 2013)

BBC series 'Blue Planet II' highlighting the scale of plastic debris (so-called "white pollution") in the oceans, developing processes to breakdown, recycle or re-use waste plastics is of critical importance (Sciencedaily, 2018).

For a better understanding of how plastic makes its way into the oceans, the researchers analyzed dozens of research articles on plastic pollution in waterways. The studies involved 79 sampling sites along 57 rivers around the world. The researchers' calculations indicated that the amount of plastic in

rivers was related to the mismanagement of plastic waste in their watersheds. Additionally, the top 10 rivers carrying the highest amounts accounted for 88 to 95 percent of the total global load of plastics in the oceans, according to the researcher's calculations. The researchers say halving plastic pollution in these 10 waterways -- eight of which are in Asia -- could potentially reduce the total contribution by all rivers by 45 percent (Sciencedaily, 2018).

The key and turning event in the more serious engagement of the entire world community on the problem and the overall development is the United Nations Conference on Environmental Protection and Development, the World Summit, held in Rio de Janeiro in the year 1992 which gathered members of the Governments of 182 countries. During this Conference, the Agenda 21 was adopted, document which held the framework concept of sustainable development and defined action related to the questions of environmental protection and development, respectively presented plan of securing sustainable development for the future of the planet (Popesku, 2002).

The United Nations General Assembly declared World Environment Day through a resolution adopted on 15 December 1972. Since 1973, it has been celebrated every June 5, the same date as the opening of the 1972 Stockholm Conference, whose central theme was the environment. In parallel with its sports activities, the EcoRun also features activities for charitable causes, such as the collection and recycling of plastic bottle caps to help underprivileged children who need treatments or orthopaedic devices, in collaboration with the SEUR Foundation (UNWTO, 2017).

As a continuation in the area of tourism, the World Tourist Organization, the World Travel and Tourism Council adopted in the year 1996 the Document – Agenda 21, for tourist economy which offers guidelines to the Governments competent for tourism, national tourist organizations, business associations and companies which operate in tourism to fulfill their potentials in order to achieve sustainable development on local, regional, national and international scale. The United Nations, in the year 1999 committed to a special session of the Commission for sustainable development on the subject of "Tourism and Sustainable Development", in order to enact the appropriate initiatives for all those involved in the process of sustainable development of tourism.

In July 2018, UNWTO submitted to the 73rd UNGA, the report on the "Promotion of sustainable tourism, including ecotourism, for poverty eradication and environment protection". The report features the advances in sustainable tourism policies made since 2016 and includes recommendations on ways and means to promote sustainable tourism, including ecotourism, as a tool for fighting poverty and promoting sustainable development in its three dimensions - economic, social and environmental - in a balanced and integrated manner. The UN General Assembly adopted, on 20 December 2018, by consensus the resolution, entitled, "Promotion of sustainable tourism, including ecotourism, for poverty eradication and environment protection". The resolution was sponsored by an impressive total of 94 delegations.

International organizations such as ECEAT and EuroGites, play a special role in this process. Representing non-governmental sector, these organizations, as the associations of national organizations, contribute greatly to the development of different forms of sustainable tourism and also to the local initiatives. CenORT, as a member of ECEAT and EuroGites, from its side will strive to expand this process on Serbia as well (Cenort, 2019).

As many texts have confirmed, rural areas have become increasinglysignificant in the (re)production of tourism over recent years. It is equaliy clear, however, that tourism has become increasingly significant in the (re)production of rurality, particulary in view of a clearlychanging set of relationships between space and society in relation to the countryside (Richards, Wilson, 2007).

## 3. Ecotourism as Pollution Prevention

For the World Tourism Organization, *green tourism* consists of "tourism activities that can be maintained, or sustained, indefinitely in their social, economic, cultural and environmental contexts" (UNWTO, 2012). Also, the term green tourism is often used to try to brand a hotel as environmentally friendly without practicing many sustainability efforts, such as basic recycling or water-conservation programs. Initiatives can include having recycling programs in place, using environmentally friendly

cleaning supplies, making room keys out of sustainable materials instead of plastic or having a water-conservation program (Culture Trip, 2019).

Industry consensus agrees *ecotourism* is more focused on ecological conservation and educating travelers on local environments and natural surroundings, whereas *sustainable tourism* focuses on travel that has minimal impact on the environment and local communities Integra, (2012).

Illustrating and interesting example is so called *Ten golden rules for sustainable tourist (*CENORT, 2019):

1. Looks for the accommodation which is dedicated to lower the impact on environment.
2. Choosing the tour operator which possesses awareness on environmental impact of tourism.
3. Redirection of his funds towards to the less polluting transportation options in order to reach his tourist destination.
4. During his visit he is using public transportation as well as environmentally friendly ones such as a bicycle.
5. Create less waste and contribute to its differentiated collection.
6. Reduce the water consumption.
7. Reduce the electrical power consumption.
8. Give the advantage to locally manufactured handmade works and local gastronomical specialties.
9. Do everything possible to respect and preserve environment in the places you visit.
10. Offer advices and suggestions in order to improve the quality of environment in the place of your visit.

The International Ecotourism Society (TIES), formed in 1991 has given one of the first definitions on ecotourism as (Epler Wood, 2002) "…a responsible journey in the nature area, wich protects the environment, supports the well-being of the local populace". Eco-tourism is *defined* through its results in sustainable development: *environmental protection, education of visitors on sustainability, and the creation of benefits for the local populace*. World Conservation Union (WCU) has defined in 1996 eco-tourism as *"*environmentally responsible journey and the visit of relatively untouched areas of nature, in order to enjoy nature and for the nature to be appreciated (also all the accompanying objects of culture from the past and from the present), which promotes preservation, has a low number of visitors and allows useful active socially-economical involvement of the local populace" (Epler Wood, 2002).

Ecotourism is a subcomponent within the area of sustainable tourism and represents primarily the sustainable version of nature based tourism, but also includes rural and cultural elements of tourism.
Therefore, basic principles of eco-tourism can be distinguished (Epler Wood, 2002) as:

- Minimization of negative impacts on nature and culture which may degrade the destination; education of tourists and visitors on environmental protection;
- Emphasizing the importance of responsible business, which works in cooperation with local authorities, government and with the population in order to meet local needs and create the benefits of environmental protection;
- Directing the profits towards protection and management of natural and protected areas;
- Emphasizing the importance and the need for creating regional tourist plans and for the plans on managing the visits to regions and areas of nature which are determined to be eco-destinations;
- Emphasizing the use of basic environmental and social studies as well as long-term monitoring program to assess and minimize impacts;
- The tendency to maximize economic benefits for the host country, local entrepreneurship and communities, especially for the population living in and around natural and protected areas;
- Supporting the economic training of communities through training and employment of local workforce, providing appropriate wages and benefits, buying from local suppliers and the support to local ownership or joint ventures with external partners or non-governmental organizations - partners of tourist facilities, as well as support for concessions;
- The tendency to ensure that the development of tourism does not go beyond the social and environmental limits of acceptable changes identified by the researchers in cooperation with the local population;
- Reliance on an environmentally-friendly infrastructure;

- Minimizing the use of fossil fuels, preserving the local flora and fauna and adhering to the natural and cultural environment.

In the year 2000, special Initiative has been adopted (*Tour Operations' Initiative for Sustainable Tourism)* by large international tour operators, with the help of leading international organizations (UN, UNESCO, WTO). The most important goals of this Initiative are closesely connected to the exchange of positive experiences in the field of resolving environmental issues, the more efficient usage of energy and other resources, the creation of the arrangements which will have less impact on both social and natural surroundings (Spasić, 2005). Besides the joint activities, standing out are other numerous individual initiatives by worlds leading tourism stakeholders.

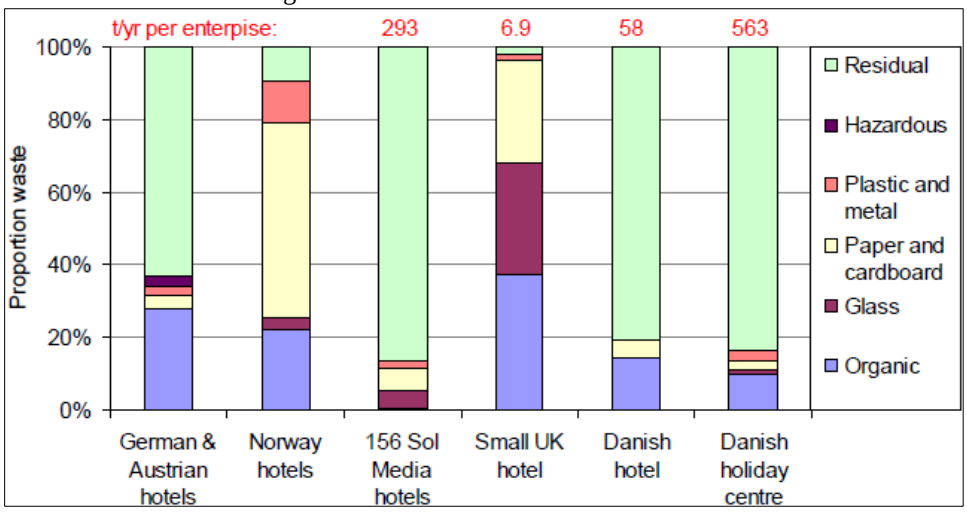
**Plastic Waste Initiatives in Tourism – Cases**

At the hotels and resorts YTL group of resorts, Malaysia (UNWTO, 2017), in keeping with the Group's sustainability practices, along with a wide range of energy saving practices, a 'reuse, reduce, and recycle' policy has been adopted for all its hotels and resorts:

- Plastic bags and laundry bags are re-used where possible, waste material and rubbish is managed properly, and all maintenance and building material is recycled and/or donated for other use (For example, waste wood and building material is not burned but instead reused, donated, or resold where possible to locals or recycling facilities);
- Guests are given the option to reduce water wastage and detergent release by having their towels and bed linens replaced every other day instead of every day;
- Shower gels from guest rooms are recycled for staff use at the canteen for washing hands;
- Plastic laundry bags have been replaced with a reusable version at most of our resorts;
- Non-harmful, biodegradable chemicals and detergents from an environmentally-friendly company are used;
- Eco solutions are employed wherever possible (For example, dried coconut husks are used to help prevent hillside soil erosion due to heavy downpour);
- As a spin-off from hosting the 2009 Asia 21 Summit, JW Marriott Kuala Lumpur has begun to offer guests a choice of holding sustainable meetings and events - through not serving bottled water, straws, or coasters, and serving a menu comprised of locally-sourced cuisine;
- Pangkor Laut Resort and Tanjong Jara Resort have stopped serving bottled water at all food and beverage outlets - in instances where bottled water is used, the bottles are sold to recycling plants.

There are different types of waste produced in a hotel, as shown in (Figure 1), which classifies various waste in hotels and percentage of their proportions.

Figure 1. Classification of waste in hotels




Sources: (Ecotrans, 2006; SFT, 1998; Sol Media, 2011; Envirowise, 2008; Miljøstyrelsen, 2000)

Figure 2. shows an example of recycling point (or 'Ilha ecológica') in the Portuguese resort of Alvor, highlighting some important features of good practice. Plastic and metal (easily separable), glass and paper and card fractions are collected separately (Styles, Schönberger, Galvez Martos, 2013).

Figure 2. An example of a recycling point in the Portuguese Algarve resort of Alvor


Source: (Styles, Schönberger, Galvez Martos, 2013)

The Rafayel Hotel in London provides electronic newspapers for guest viewing on large TV screens in rooms, and has a 'no plastics' policy. Guests are provided with water filtered in-house and served in reusable glass bottles using Vivreau bottling technology. The Ascos Beach Hotel in Paphos, Cyprus, invested EUR 867 to purchase 3,000 reusable plastic cups to replace disposable plastic cups, and stopped using plastic bin liners in guest rooms. In the first year of operation, the disposal of 100 000 plastic cups was avoided, saving almost €2,000, and 50 % fewer bin liners were disposed of, saving a further €300. Guest satisfaction has not been affected (Travel Foundation, 2011). Other initiatives concerning plastic waste included in 2014 a group of Huizhou tourism volunteers at the West Lake in Huicheng district of Huizhou City that celebrated World Tourism Day by picking up plastic bottles to keep Huizhou scenery clean and beautiful (UNWTO, 2019). In order to minimize impact of inflight services, Thomson Travel avoids plastic packaging for blankets, has reduced the weight of magazines, and recycles all soda cans on inbound flights (recycling of one million cans per year and avoiding using 900,000 plastic bags per year) (Styles, Schönberger, Galvez Martos, 2013).

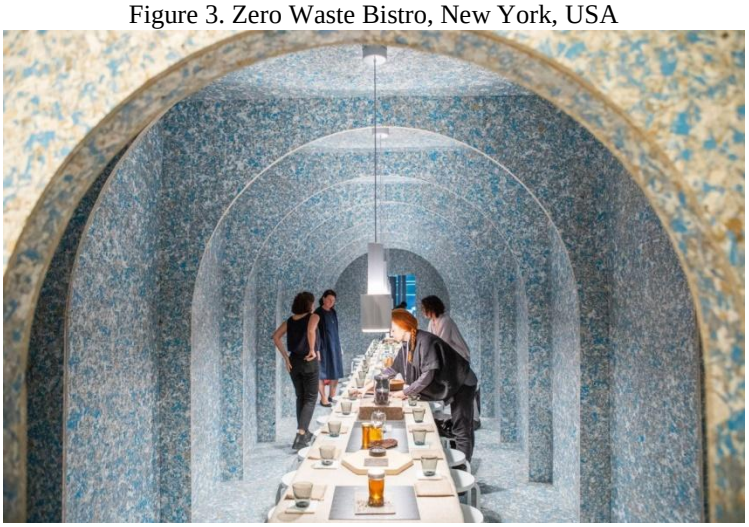
Based on criteria contained in the Travelife Sustainability System (Travelife, 2011), some key points, in reducing environmental impacts associated with material consumption and waste, are (Travelife, 2011):

- Single-use disposable items are avoided where possible (e.g. plastic bin liners are avoided, toner/ink cartridges are refilled and rechargeable batteries are selected),
- The company has implemented packaging material reduction measurements and is not using non-recyclable or non-biodegradable package materials,
- Filtered tap water and reusable glasses are provided for drinking, to avoid the use of non-recyclable plastic bottles, unnecessary water transport, and disposable drinks cups,
- All recyclable materials (including glass, paper, organic waste and plastics) are separated for collection by recycling services. Where recycling collection services are not provided by local authorities, the enterprise contracts appropriate service providers,
- Cleaning materials are non-hazardous, non-eutrophic and bio biodegradable (ecolabelled where possible).

One of the best examples of reducing environmental impacts associated with material consumption and waste has been a pop-up restaurant Zero Waste Bistro, an event which lasted for four days to coincide with the NYCxDesign festival and had been set up at the WantedDesign Manhattan fair, commissioned

by the Finnish Cultural Institute in New York, USA. Its installation has provided circular-economy model that has been built from recycled food packaging and has composted all of its leftovers (Figure 3) (Dezeen, 2018).

Figure 3. Zero Waste Bistro, New York, USA



Source: (Healthy Materials Lab, 2019)

Research statistics show that 73% of global travellers intending to stay at least once in an eco-friendly or green accommodation when looking at the year ahead. Additionally, 70% of global travellers say they would be more likely to book an accommodation knowing it was eco-friendly, whether they were looking for a sustainable stay or not" (Trekksoft, 2019).

Glamping accommodation is a relarively new form of spending time in nature across in England, France and the rest of Europe. From safari and bell tents (most classic glamping structure), yurts (with different sizes and levels of luxury), shepherd's huts, gypsy caravans, and all-weather pods to treehouses in all shapes, re-configured train carriages, transformed horse-boxes, etc., create unique experience of living in nature. In Cotna Eco Retreat in Cornwall eco-accommodation, one of tree yurt (Picture 4) is located within a 10-acre organic farm where visitors can enjoy organic food or participate in one of courses, learning about wild food foraging & cooking. The ammenities auch are: showers, compost loos, recycling, BBQs, and washing machine can be provided on request. Yurts include rugs, double bed (and bedding), wood-burner, solar LED lights, kitchen equipment and basic provisions. Solar and wind energy provides the power and water is all sourced from a natural spring on the farm (Coolcamping, 2019).

Picture 4. Gilliflower Yurt At Cotna Eco Retreat Cotna Barton, Gorran, UK

Source: (Coolcamping, 2019)

Further statistics show that this nature based speciality travel makes up 7% of international travel, which proves it is increasingly popular to a large portion of the population. Depending on the type of glamping business, it can help consumers avoid pre-packaged and processed food products cutting down on the waste they generate (Iinspiredcamping, 2019). It stands to reason that if a camping or glamping business is able to meet the needs and key principles of ecotourism, then they will be able to benefit from this strong segment of the tourism industry, which is set to continue to grow.

## Conclusion

The need for consumers to make a responsible choice of travel is becoming more and more a key determinant for the goals of eco-tourism, making increasingly important that they understand what is necessary and good for a well eco-touristic experience. According to booking trends, sustainability is driving accommodation decisions (Globalnews, 2019).

To achieve this goal, numerous initiatives have been introduced to the tourism business and made visitors and guests acknowledged by the set of rules which would not in any way minimize their vacation or holiday experience. The same comfortabilities could be provided to them by using products or services which comply with environment safeguard and the corporate social responsibility of stakeholders in tourism sector.

Education of consumers and providing guidelines for future choosing eco-touristic experience will benefit greatly to the official eco-touristic market and reduce the efficiency of false claims about the environmentally and social responsibility („greenwashing“ example).

Therefore, the introduction of international standards and initiatives, given by international and tourism organizations (UN, UNESCO, WTO, etc.) is crucial for implementing the concept of sustainable development in tourism (a policy “reuse, reduce, and recycle” example).

Along with compliance with sustainable procedures given in international legal acts, stakeholders in tourism should keep up with latest science achievements concerning reuse of plastics and apply them to their long term business strategy.

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# Post-akvizicione promjene u menadžmentu target kompanija: slučajevi u Jugoistočnoj Evropi

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**Apstrakt:** Ovaj rad se zasniva na analizi post-akvizicijskih promena, koje su karakteristične za međunarodni menadžment i marketing. Na bazi sprovedenih upitnika i intervjua, prezentirani su rezultati koji su bili fokusirani na dvadeset četiri kompanije i promene u menadžmentu koje su nastale nakon međunarodnih akvizija u različitim zemljama regiona Jugoistočne Evrope. Svaka menadžment promena je analizirana specifično sa komentarima i posledicama na budući poslovni opstanak. Na osnovu rezultata istraživanja moguće je definisati više preporuka koje su važne za praktično upravljanje međunarodnih akvizicija, posebno u fazi integracije.

**Ključne reči:** akvizicija, menadžment, marketing, strategija, finansije

# The Post-Acquisition Changes in Management of Target Companies: Cases in South Eastern Europe

**Abstract:** This paper analyses the post-acquisition changes, which are very applicable for international management and marketing. Based on conducted survey and interviews, the results presented here had a focus on twenty-four target companies and management changes that have occurred after international acquisitions in different countries of the region of South Eastern Europe. Every management change was analyzed separately with comments about its repercussions on the future survival of the businesses. Based on the findings from this research it is possible to define many recommendations important for practical management of international acquisitions, especially for the phase of post-acquisition integration.

**Key words:** Acquisition, Management, Marketing, Strategy, Finance

## Introduction

The importance of international acquisitions in terms of management theory and practice of international marketing is primarily in the fact that this phenomenon involves transnational exchange of different business principles. Problems of international acquisitions are subject of interest among many international business schools. The authors from the British Oxford University (Child et al., 2003) have observed the international acquisitions in terms of country of origin of the acquirer and came to the conclusion that many of the changes that occur in the process of post-acquisition management are global and that they are not specific on the country origin of the acquirer. This primarily refers to the process of cost control and management of human resources, especially in the area of increased training of employees upon an acquisition of a target company. Grotenhuis and Weggeman (2003) have focused on the role of knowledge management in international acquisitions.

According to many surveys, the failure rate of international acquisitions ranges from 49 to 59% (Angwin, 2005), as shown in the Table 1.

Table 1: Data of selected consulting firms on failures of acquisitions

| **Consulting firm** | **Year of survey** | **Method** | **Failure rate %** |
|---|---|---|---|
| Business International | 1973 | 400 questionnaires sent by mail | 49 |
| | 1978 | 150 questionnaires sent by mail | 48-56 |
| Coopers and Lybrand | 1992 | Focus interviews with CEOs of top 100 UK companies | 54 |
| Coopers and Lybrand | 1996 | The sample of 125 companies | 66 |
| A.T. Kearney | 1997 | The sample 115 companies | 58 |
| Mercer MC | 1995 | The sample 150 companies | 50 |
| Mercer MC | 1997 | The sample 300 companies | 57 |
| Mc Kinsey | 1995 | The sample 58 companies | 58.6 |

Source: (Angwin, 2005)

Therefore, legitimate question is why many acquisitions do not create additional value for the acquirer? The most important reasons are as follows (Perovic, 2016):

1. Problems of integration and post-acquisition management,
2. The acquisition price is too high,
3. The lack of synergies following the acquisition,
4. Low-quality diagnostic studies (due diligence), and
5. The lack of rational decision-making, so-called 'CEO arrogance'.

The integration between the acquirer and the target company is necessary in order to achieve synergies (such as sharing resources, reducing costs, increasing market). The problem of integration is complicated by the lack of continuity in all phases of the acquisition (prior, during, and after the deal making).

In order to better understand strategic and financial success coming from the acquisitions in the region, it is important to investigate business climate that was influencing dynamics of foreign direct investments (FDI). Since the international acquisitions represented the largest part of FDI in the region, it is possible to make reasonable assumption that the business climate has been positive for increase of international acquisitions in the region. The most prevailing type of acquisitions belong to "privatizations" or change of state ownership to private capital. Official national data (Perovic, 2016) have been showing that Serbia had more than 20 billion US dollars of inward FDI (2000-2010), same stands for Croatia within the same period, Montenegro close to 3 billion US dollars (2000-2008), Slovenia close to 7 billions US dollars (2000-2008), Bosnia & Herzegovina more than 6 billions US dollars (2000-2010), and Macedonia close to 3 billions US dollars (2002-2009).

## Methodology of the research

The sample was composed of twenty-four target companies, operating in thirteen branches of the economy, and whose international buyers came from thirteen countries. The changes which have cured in the management of the target companies after the acquisition by international acquirer s are different and various. Significance of post-acquisition management comes from the recognition that most of the acquisition fails because of defects in the implementation phase following the acquisition, and not because the research phase before the acquisition. Correlation between successful implementation and the overall success of the acquisition was 83% (Howson, 2006). Further, it is believed that a large proportion of the acquisitions that fall had a cause in the inadequate management after the acquisition. On the other hand, the pre-acquisition factors are bad for predicting post-acquisition performance (Angwin, 2005). Through primary research using interviews and surveys on a total sample of twenty-four target companies from the region of Southeastern Europe that belong to different industries (food industry - confectionery production, fruit, meat, wine, beer, pharmaceuticals, processing and transport of oil; road maintenance; production of glass packaging; chemical industry; telecommunications; banking; cement production) and various countries of origin (United Kingdom, Russia, Austria, Switzerland, Germany, Denmark, Iceland, Lithuania, Hungary, Belgium, Holland, France, Greece), the goal was to identify the changes and systematically explore them.

**Analysis of strategic changes**

In summary, on the basis of this study, all the post-acquisition management changes can be represented as follows:

Table 2: Summary of all post-acquisition changes

| **Type of a change** | **% companies with this change** |
|---|---|
| Focus on the core business | 91 |
| Spreading of the corporate culture | 95 |
| Integration with the acquirer | 87 |
| Increased role of the management hierarchy | 71 |
| Increased openness in communication between employees and managers | 83 |
| Increased cost control | 100 |
| Increased profits | 88 |
| Increased financial control and planning | 100 |
| Stricter selection of customers and suppliers | 90 |
| Tighter planning of new products launching | 95 |
| Development of an outreach strategy in the international market | 90 |
| Greater application of marketing principles and marketing research | 84 |
| Increased quality control | 91 |
| Increased modern logistics | 95 |
| Increased number of meetings | 79 |
| Increased training and educational programs | 95 |
| Increased rotation of managers | 63 |
| Key managers leaving | 67 |
| Reduction of number of employees | 63 |
| Increased use of information systems and information technology | 95 |

The goal of the research was related to 'survivors' acquisitions, bearing in mind the high share of failures among total number of international acquisitions. Besides the analysis of post-acquisition changes, the focus was to investigate primarily the strategic guidelines which helped development of the surveyed companies after the international acquisitions, but also to compare results of other authors of similar studies. The first five changes from the table above are strategic in nature, because they are focused on the long term. From these changes, most companies (95%) after acquisitions increased the spread of corporate culture from the acquiring to the target company, which is to amend the attitude of management and employees to the basic values that their company represents. This fact is aligned with

sharing values, skills and competences as a necessity to obtain organizational fit between target and acquiring companies (Lahovnik, 2005), but also with the fact that new capabilities in the target companies have to be developed in "an evolutionary pattern on the basis of the firm's knowledge, organizational culture, and, possibly, individual value systems" (Meyer, 2002).

The dominant number of 91% of the companies surveyed is focused on the core business, divesting the majority of those segments that have distracted prior management. Such a decision will leave a long-term positive effect on the company. There is a dominant participation of integration between the companies (87%).

On the other hand, 83% of the surveyed companies increased openness in communication, which also has long-term positive effects for the target companies in a way that open communication between employees and managers encourages innovation and creativity, as the basis for business development. Similar studies have also concluded importance of the role of transformative leadership as having positive influence on post-acquisition performance in countries of the region (Savovic, 2017) where encouraging employees delivers positive effects on target companies through their increased dedication and work efficiency (Babic et.al, 2014). The role of the management hierarchy that reflects the important influence of managers on the final result of the company and its long-term development, increased in most companies in the participation by 71%. It is expected that this indicator will increase its importance in the future and bring value to other strategic changes presented in the table above.

Importantly, marketing changes, which were guided by greater application of marketing principles, marketing research, more stringent selection of customers and suppliers, planning and management of international engagement, and the introduction of new products, have a clear strategic orientation, because they determine the success of the target company after the acquisition, not only in the short and medium period. Most of the companies realized a marketing function much more serious than before the acquisition, and it was particularly evident that most companies confirmed this by adopting the principle of planning the introduction of new products (95% of companies). Slightly less, but still dominant share represents 90% of companies having the selection of customers, suppliers and international engagement, raised to a higher level. That is the essence of strategic changes in a different understanding of the importance of marketing, and building marketing organization of companies in a way that clearly shows that the marketing and sales personnel are crucial for the long-term success of the company. It is through the Customer Relationship Management (CRM) system, that marketing becomes an essential guiding lever of any respective business.

Regarding other changes, it is interesting that the same number of companies, 95%, introduced modern logistics and information systems and made HR investments in the implementation of various training programs, while 91% increased quality control. In these changes there was a generally clear sequence. The company defined first focus on the core business, in line with competitive advantages and the criteria of future integration. Then it conducted defensive or offensive restructuring. Defensive restructuring, which is based on the rapid control of costs and downsizing, while offensive is based on the strategy of sales and marketing, characterized by the growth of investment in production, introduction of quality standards, information systems, and new trainings. Offensive restructuring involves significant changes in the management and relationships with employees, in accordance with the above table. In the spirit of offensive changes, comes to the employment growth, although initially after international acquisitions, reduction of the workforce occurred in many organizations.

In the analysis of strategic changes following an international acquisition, three important aspects can be discussed:

- Changes of existing functions,
- The introduction of new functions, and
- The presence of integration.

Certain pre-acquisition functions have changed, such as turnover in key managers, as happened in most of the companies surveyed. Marketing function in most firms changed, as did the relationship with employees, introducing greater openness in communication. Quality control is improved, and staff training increases.

Many new functions have been introduced, which prior to the international acquisitions were not there, as modern logistics, new brand management function, new sales tools, new technologies, financial planning and control, use of modern information systems, the use of strategies for the selection of customers, suppliers and performance at international markets, and the new role of management hierarchies through modern corporate governance.

Finally, integration was performed in most companies. Every type of integration is very specific for each target company.

**Analysis of financial changes**

A phenomenon of international acquisitions by itself is not the cause of positive or negative results. The changes it brings are the cause of these results. In order to determine if a certain international acquisitions have been successful, there are few methods used in the practice (Jauck, 2009): shareholders returns using stock prices, operating financial indicators, management appraisals via surveys and interviews, and so called alternative indicators (time limit set high which is a constraint for this paper). Since the fact of underdevelopment of stock exchange in most of the countries of South Eastern Europe, other two methods have been used in this research. Now, let's follow the financial results, which were recorded upon acquisition at international examples of several different industries. We have analyzed the eventual profit growth by comparing the results that the target company had prior to the international acquisitions, and within a few years after the acquisition. Although the influence of international acquisitions may follow in relation to the performance of local companies which were not the subject of acquisitions, belonging to the same or similar branch of the economy, this paper did not focus on the comparison with these companies, but only to compare performance before and after international acquisitions for the same company in order to confirm financial success. Among other things, a comparison with other local companies would have to include the assumption that the target company, as a subject of international acquisitions, was likely to be on a higher degree of efficiency in comparison to those that did not attract international acquisitions, as well as the theory reasonably believes (Salis, 2005). Other studies (Savovic, 2016) have also confirmed financial success of international acquisitions in the region of South Eastern Europe.

In this paper different economic sectors (industries) were analyzed, in order to provide a greater degree of objectivity. Each industry is specific, so was the growth rate of profits among the different industries. However, this work has the focus to show the extent to which there has been a change in the financial result of the target company after international acquisitions. For each industry it was calculated an average annual rate of ***t*** using the following formula (Perovic, 2015):

$$\mathbf{Po \times (1+t)^n = Pn} \qquad (1)$$

• ***Po*** is the weighted sum of net profit at the industry level in the year when international acquisitions occurred;
• ***t*** is the average annual growth rate of profits;
• ***n*** is the number of years of follow-up;
• ***Pn*** is a weighted sum of net profit in the *n* year after international acquisitions.

Using the above formula the following comparative table of the change of profit has been created.

Table 3: Change in net profit after international acquisitions

| **Industry** | **Average annual profit growth after international acquisitions occurred** | **Note** |
|---|---|---|
| Food-industry confectionery | 22% | The follow-up period of six years |
| Retail sales of petroleum products | -8% | International acquisitions of Russian origin into the largest Serbian company in this field; there has been a growth in revenue but falling profits due to high capital investment and restructuring costs; the follow-up period of five years |
| Oil processing | 78% | The follow-up period of three years |
| Chemical industry | 80% | The follow-up period of four years |
| Telecommunications | 21% | The follow-up period of three years |
| Food Industry-Meat Packing | 18.5% | The follow-up period of four years |

Source: (Perovic, 2015)

The nature of any industry is defined by the strength of customers, suppliers, substitutes, competitors and barriers to entry (Porter, 2008). Therefore, the changes in the profit depend on specific characteristics of each branch of economy or industry. It is observed that most of the analyzed sectors have high growth rates of profit after international acquisitions. This is an indication that these industries were burdened with high costs and irrational management prior to the international acquisition, so it were many opportunities for change, which jointly led to rising profits in respective years.

## Recommendations of the research

As the outcome with practical applications, it is important to define certain recommendations for the academic and professional public regarding post-acquisition management.

Marketing principles should be guiding leverage for the company's development and that was why the marketing changes were critical in most companies. In this regard, the importance and significance of changes that marketing and sales managers heavily contribute to in the total constellation value of a company was introduced, since most companies in the pre-acquisition phase were predominantly production oriented.

Focus on the core business, since it provides a competitive advantage and cost efficiency through synergy with the acquirer. Also, focus implies the need of long-term estimates of future market positions of the target company.

Foster corporate culture because the main reason why international companies have developed corporate culture is the need to preserve the integrity and belief in the proven value, in order to minimize the risk of wrong decisions in repetitive situations. Transfer of corporate culture must respect the specific features of national culture of the country of origin of target companies, as well as micro-culture of the company itself.

Increase the importance of the responsibility of management in final market and financial results, as key managers depend on the overall success or failure of the company.

Increase openness in communication, since open, clear, honest and timely communication between employees and managers, on the one side, increase innovation and creativity important for the long term development of the company, and on the other side, openness means a greater degree of understanding of management and their responsibility for the final results of the company.

The primary instrument to increase profits after the acquisition was cost control, and therefore financial planning and controls should be introduced as the first new functional segment of post-acquisition organization.

It is necessary to define strategy in foreign markets, because in most international acquisitions binding motives were foreign markets, not only the local market.

Increase quality control, which applies not only to the introduction of mandatory standards (such as HACCP), but also to other relevant international standards for the protection of employees and the environment.

Introduce modern logistics, because the management of the physical flow of the company depends on the level of customer service, and thus their loyalty.

Increase the number of training courses for employees, because after international acquisitions it was necessary, on the one hand, to transfer the knowledge and skills from the acquiring company, and on the other hand, increase of staff training was critical in order to meet the demands of the global economy. The trainings were also significant instrument of staff motivation.

Pre-acquisition key managers of target companies should be prepared to be most probably removed after the acquisition. The most 'secure' among these managers were those who build a good relationship with key customers. Also, it is best to plan a structure of post-acquisition management prior to the acquisition closure.

## Conclusion

This article has identified both strategic and financial changes in post-acquisition management in the region of South Eastern Europe. Main recommendations as a practical implications of this study were presented, and eleven most important were structured with appropriate explanations, such as focus on core business of the target companies, fostering corporate cultures, management accountability, open communication, financial control and planning and importance of marketing principles on the management, as well as international quality standards.

It should be stated that there are several limitations of the research presented in this paper. Sample size was limited, as well as the number of years of post-acquisition performance monitoring. Future research should follow seven to twelve years, as suggested by management experts (Jauck, 2009).

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# Primer višekriterijumske optimizacije primenom Expert Choice

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**Apstrakt:** U procesu odlučivanja je moguće koristiti veći broj metoda i tehnika. Prvi sistemi koji su počeli da se bave podrškom u odlučivanju, kao zasebnom naučnom disciplinom, bili su sistemi za podršku odlučivanju. Cilj je bio da se kreiraju elementi odlučivanja i na osnovi toga napravi kvalitetan izbor za prijem kandidata/nastavnika u radni odnos. Polaznu osnovu kod izbora kandidata za radno mesto nastavnika je predstavljala verbalna provera/ocena, odnosno intervju, ocena na internom testu i radno iskustvo. Pomoćni elementi su definisani kao komunikativnost, odnosno snalaženje u datoj radnoj situaciji, i prosek ostvaren tokom studija. Metoda koja je korišćena u procesu odlučivanja je AHP metoda. AHP omogućava interaktivnu analizu osetljivosti postupka vrednovanja na konačne rangove elemenata hijerarhije. Strukturiranjem problema, odnosno, definisanjem cilja i kriterijuma odlučivanja za izbor nastavnika u radni odnos određeno je optimalno rešenje.

**Ključne reči:** odlučivanje, AHP metoda, sistemi za podršku odlučivanju

# An example of multi-criteria optimization using Expert Choice

**Abstract:** A number of methods and techniques can be used in the decision making process. The first systems that began to support decision-making, as a separate scientific discipline, were decision support systems. The goal was to create decision-making elements and, on the basis of this, make a quality choice for admission of candidates/teachers into employment. The starting point for the selection of candidates for the post of teacher was verbal check /assessment, ie interview, assessment at the internal test and work experience. Auxiliary elements are defined as communicativeness, that is, in the given work situation, and the average achieved during the studies. The method used in the decision-making process is the AHP method. AHP provides an interactive analysis of the sensitivity of the evaluation process to the final ranking elements of the hierarchy. By structuring the problem, that is, by defining the goal and the decision criteria for the selection of teachers in the work relation, an optimal solution is defined.

**Key words:** decision making, AHP method, decision support systems

## 1. Uvod

U poslednje vreme proces odlučivanja sve više dobija na značaju u poslovanju organizacija i poprima značajnu ulogu, ne samo u naučnim krugovima, već i u praktičnom smislu, a odnosi se na poslovanje preduzeća iz različitih poslovnih delatnosti. Da bi menadžment organizacije doneo kvalitetnu odluku potrebno je da raspolaže relevantnim ulaznim podacima, koje će primenom kvantitativnih i drugih metoda i tehnika koristiti u procesu odlučivanja. U ranijem periodu, kada su uslovi poslovanja na tržištima bili daleko mirniji, primarnu ulogu u procesu odlučivanja su imali individualni donosioci odluka. Danas je to reletivno drugačije, pre svega, zbog postojanja velikog broja informacija koje je potrebno obraditi u procesu odlučivanja, što je dovelo do toga da proces odlučivanja postane izuzetno složenen i zahtevan.

Savremeno poslovanje odlikuje povećanje složenosti organizacije, koje prate ubrzane društvene, ekonomske i političke promene. U takvim uslovima poslovanja ključne faktore uspešnosti preduzeća predstavljaju brzina odlučivanja i implementacija donetih odluka, koje za posledicu imaju ostvarivanje planiranih ciljeva. Savremenom poslovnom menadžmentu na raspolaganju su informacioni sistemi i poslovna inteligencija koji u značajnoj meri ubrzavaju i olakšavaju donošenje kvalitetnih poslovnih odluka. U izrazito turbulentnim uslovima tržišnog privređivanja koji su odlika današnjeg, globalnog, poslovanja odlučivanje i informacioni sistemi koji olakšavaju proces odlučivanja poprimaju sve veći značaj. Pored navedenih benefita koji se njihovom primenom mogu očekivati značajan efekat, koji se ponekad prosto podrazumeva, je svakako i ušteda u vremenu potrebnom kod odlučivanja.

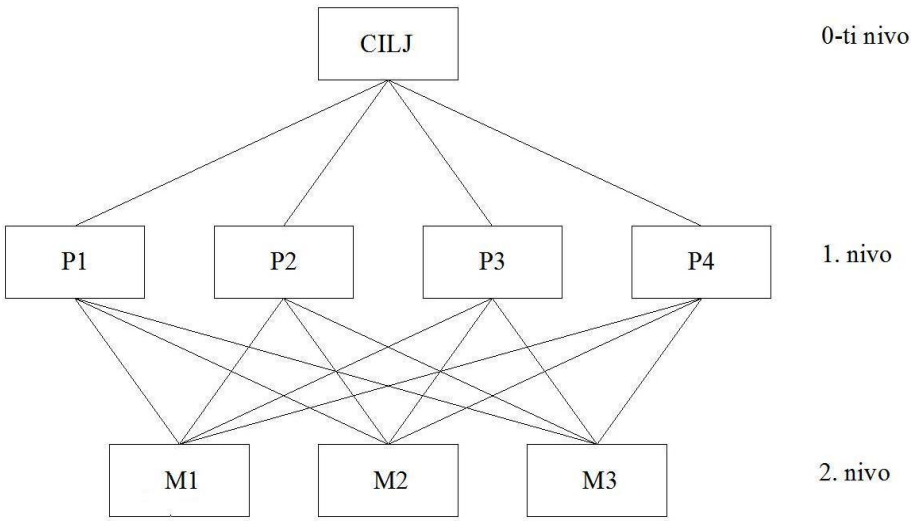
U današnjim uslovima postalo je jasno da primena sistema za podršku odlučivanju i primena veštačke inteligencije unapređuju proces odlučivanja u savremenim organizacijama. Pored navedenog oni obezbeđuju kvalitetne analize, izveštaje, ali i moguće pravce delovanja u budućem periodu. Preduzeća teže ka tome da budu, u svojim oblastima poslovanja, prva koja će prihvatiti nove tehnologije i iskoristiti ih na optimalan način, čime sebi stvaraju bolju tržišnu poziciju u odnosu na konkurenciju.

## 2. AHP metoda

Analitički hijerarhijski proces (engl. Analytic Hierarchy Process), ili kraće AHP, je metoda koja je nastala 70-tih godina prošlog veka. AHP je matematička metoda i predstavlja jednu od najpoznatijih metoda analize scenarija i donošenja odluka konzistentnim vrednovanjem hijerarhija, čije elemente čine: ciljevi, kriterijumi, podkriterijumi i alternative (xxxx, 20xx). Mnogi su mišljenja da je AHP sistem za podršku odlučivanju, odnosno SPO. Metoda je bazirana na principima višekriterijumskog odlučivanja, gde se iz jedne raspoložive grupe alternativa bira najpovoljnija na osnovi kriterijuma za odlučivanje(xxxx, 20xx). Reference o AHP, pregledi Interneta, ali i činjenica da je metod detaljno proučavan i unapređivan u brojnim doktorskim disertacijama i naučnim radovima, na prestižnim svetskim univerzitetima, pokazuju da se ova metoda intenzivno koristi za odlučivanje u oblastima menadžmenta, upravljanja, alokacije i distribucije (Pažun, Grujčić, Langović i Ralić, 2015).

AHP spada u klasu metoda za meku optimizaciju. U osnovi se radi o specifičnom alatu za formiranje i analizu hijerarhija odlučivanja. AHP najpre omogućava interaktivno kreiranje hijerarhije problema kao pripremu scenarija odlučivanja, a zatim vrednovanje u parovima elemenata hijerarhije (ciljeva, kriterijuma i alternativa) u top-down smeru. Na kraju se vrši sinteza svih vrednovanja i po strogo utvrđenom matematičkom modelu određuju težinski koeficijenti svih elemenata hijerarhije. Zbir težinskih koeficijenata elemenata na svakom nivou hijerahije jednak je 1 što omogućava donosiocu odluka da rangira sve elemente u horizontalnom i vertikalnom smislu (Saaty & Tran, 2007; Saaty, Peniwati & Shang, 2007).

Slika 1. Opšti hijerarhijski model u AHP




Izvor: (Grujčić, Cvijanović, Lazić, 2010)

AHP omogućava interaktivnu analizu osetljivosti postupka vrednovanja na konačne rangove elemenata hijerarhije. Pored toga, tokom vrednovanja elemenata hijerarhije, sve do kraja procedure i sinteze rezultata, proverava se konzistentnost rezonovanja donosioca odluka i utvrđuje ispravnost dobijenih rangova alternativa i kriterijuma, kao i njihovih težinskih vrednosti. Metodološki posmatrano, AHP je višekriterijumska tehnika koja se zasniva na razlaganju složenog problema u hijerarhiju. Cilj se nalazi na vrhu hijerarhije, dok su kriterijumi, podkriterijumi i alternative na nižim nivoima. Kao ilustracija, na slici 1 je data hijerarhija koju čine cilj, tri kriterijuma i četiri alternative. Hijerarhija ne mora da bude kompletna, što znači da element na nekom nivou ne mora da bude kriterijum za sve elemente u podnivou, pa se hijerarhija može podeliti na podhijerarhije, kojima je zajednički jedino element na vrhu hijerarhije.

Analitički hijerarhijski proces je fleksibilan jer omogućava da se kod složenih problema sa mnogo kriterijuma i alternativa relativno lako nađu relacije između uticajnih faktora, prepozna njihov eksplicitni ili relativni uticaj i značaj u realnim uslovima i odredi dominantnost jednog faktora u odnosu na drugi. AHP drži sve delove hijerarhije u vezi, tako da je jednostavno videti kako promena jednog faktora utiče na ostale faktore.

Hijerarhijski strukturiran model odlučivanja u opštem slučaju se sastoji od cilja, kriterijuma, podkriterijuma i alternativa, što pokazuje slika 1. Cilj je na vrhu i on se ne poredi ni sa jednim od drugih elemenata. Na nivou 1 je n kriterijuma koji se u parovima, svako sa svakim, porede u odnosu na neposredno nadređeni element na višem nivou.

Aksiomi na kojima se AHP zasniva su:

- *Aksiom recipročnosti*. Ako je element A n puta značajniji od elementa B, tada je B element 1/n puta značajniji od elementa A.
- *Aksiom homogenosti*. Poređenje ima smisla jedino ako su elementi uporedivi (ne može se porediti težina insekta i težina kita).
- *Aksiom zavisnosti*. Dozvoljava se poređenje među grupom elemenata jednog nivoa u odnosu na element višeg nivoa, tj. poređenja na nižem nivou zavise od elementa višeg nivoa.
- *Aksiom očekivanja*. Svaka promena u strukturi hijerarhije zahteva ponovno računanje prioriteta u novoj hijerarhiji (Saaty, 2016).

AHP metoda se sprovodi u četiri faze:

- Strukturiranje problema, odnosno, kreiranje hijerarhije;
- Generisanje podataka;
- Ocenjivanje relativnih težina;
- Definisanje rešenja problema.

AHP metoda može identifikovati i analizirati nekonzistentnost donosioca odluke u procesu upoređivanja elemenata hijerarhije.

Zbog svojstava matrice A vredi $\lambda_{\max} \geq n$. Razlika $\lambda_{\max} - n$ se koristi u merenju konzistencije procena. Što je $\lambda_{\max}$ bliža n, procena je konzistentnija.

Ako je stepen konzistentnosti (CR) manji od 0.10, rezultat je dovoljno tačan i nema potrebe za korekcijama u poređenjima i ponavljanju proračuna. Ako je stepen konzistentosti veći od 0.10, rezultate bi trebalo ponovo analizirati i ustanoviti razloge nekonzistentnosti, ukloniti ih delimičnim ponavljanjem poređenja u parovima, a ako ponavljanje procedure u nekoliko koraka ne dovede do sniženja stepena konzistentnosti do tolerantnog limita 0,10, sve rezultate treba odbaciti i ponoviti ceo postupak od početka. U praksi se često dešava da stepen konzistentnosti bude veći od 0.10, a da se izabrana alternativa ipak zadrži kao najbolja (Saaty, 2016).

## 3. Metodologija istraživanja

Softver Expert Choice (EC) služi za rešavanje polustruktuiranih i nestruktuiranih problema odlučivanja. Zasnovan je na AHP metodi. Osnovu metode AHP i softvera Expert Choice predstavlja način kojim se dolazi do tabele odlučivanja (TO). Ideja je da ocenu važnosti kriterijuma i potkriterijuma, kao i ocene važnosti alternativa u odnosu na kriterijume vrši donosilac odluke (DO). Na

ovaj način je obezbeđeno da metoda bolje obuhvati sve subjektivne poglede i ciljeve koje DO koristi pri odlučivanju (Borghans, Golsteyn & Stenberg, 2015).

Da bi ocenjivanje bilo lakše, ono se vrši upoređivanjem u parovima (pairwise comparison). AHP omogućava da se sve preferencije DO vrše upoređivanjem u parovima uz pomoć Satijeve skale od devet tačaka. Kada se izvrši ocena svih parova kriterijuma kao i svih parova alternativa u odnosu na svaki od kriterijuma, tada softver agregira važnost alternativa u odnosu na globalni cilj. Tako se dolazi do ranga alternativa, što može biti direktno iskorišćeno za donošenje odluka (Saaty, 2016).

Poslednji korak je analiza osetljivosti, gde se uz grafičku pomoć softvera utvrđuje osetljivost/stabilnost rešenja. Ukoliko za „male“ promene u oceni važnosti kriterijuma dolazi do promene ranga alternativa, tada se kaže da je dobijeno rešenje nestabilno, tj. osetljivo na takve promene. Iskusni DO pažljivo analiziraju stabilnost rešenja, jer shvataju da je to možda i najbitnija faza u celokupnom procesu donošenja odluka (Cvijanović, Dimitrijević i Grujčić, 2002).

Postupak korišćenja softvera se odvija u nekoliko koraka:

1) definisanje cilja,
2) definisanje kriterijuma i potkriterijuma, odnosno, strukturiranje problema,
3) definisanje/generisanje alternativa,
4) upoređivanje kriterijuma u odnosu na cilj i određivanje uticaja kriterijuma na cilj,
5) upoređivanje alternativa u odnosu na kriterijume (određivanje relativnog uticaja svake alternative po određenom kriterijumu),
6) sinteza alternativa u odnosu na cilj ili agregacija rešenja i
7) analiza osetljivosti.

## 4. Rezultati istraživanja

Da bi se navedeni primer mogao rešiti upotrebom Expert Choice, potrebno je prvo definisati cilj zadatka, a zatim definisati kriterijume, eventualno i potkriterijume, koji utiču na ishod rešenja i izbor najpovoljnije alternative (Turban & Watkins, 1986). U ovom slučaju alternative su kandidati A, B, C, …, J koji apliciraju na radno mesto nastavnika. Cilj je, logično, izbor jednog od deset kandidata prijavljenih za radno mesto nastavnika, a kriterijumi koji utiču na taj izbor su:

- prosek studija;
- radno iskustvo (godina u datom poslu, prosveti);
- ocena komunikativnosti;
- ocena na internom testu i
- ocena intervjua.

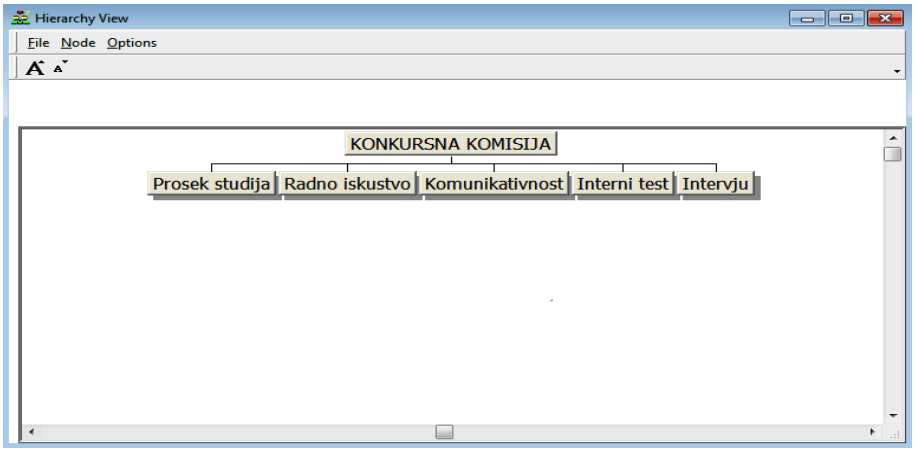
Na osnovi postavljenog cilja odlučivanja, kriterijuma koji utiču na donošenje kvalitetne odluke i raspoloživih alternativa, odnosno kandidata, kreirana je tabela odlučivanja.

Tabela 1. Tabela odlučivanja kod izbora kandidata za radno mesto nastavnika

| KANDIDATI ZA IZBOR NASTAVNIKA | | PROSEK STUDIJA | RADNO ISKUSTVO (godina) | KOMUNI-KATIVNOST | OCENA NA TESTU | OCENA INTERVJUA |
|---|---|---|---|---|---|---|
| KANDIDATI | Kandidat A | 8.25 | 10.00 | 7.00 | 8.00 | 9.00 |
| | Kandidat B | 8.00 | 7.00 | 8.00 | 9.00 | 9.00 |
| | Kandidat C | 8.40 | 15.00 | 8.00 | 7.00 | 9.00 |
| | Kandidat D | 7.80 | 25.00 | 6.00 | 7.00 | 7.00 |
| | Kandidat E | 7.65 | 8.00 | 7.00 | 10.00 | 7.00 |
| | Kandidat F | 8.85 | 12.00 | 8.00 | 7.00 | 9.00 |
| | Kandidat G | 8.63 | 15.00 | 6.00 | 7.00 | 6.00 |
| | Kandidat H | 7.15 | 10.00 | 7.00 | 8.00 | 9.00 |
| | Kandidat I | 7.35 | 20.00 | 7.00 | 6.00 | 8.00 |
| | Kandidat J | 7.65 | 5.00 | 9.00 | 6.00 | 8.00 |

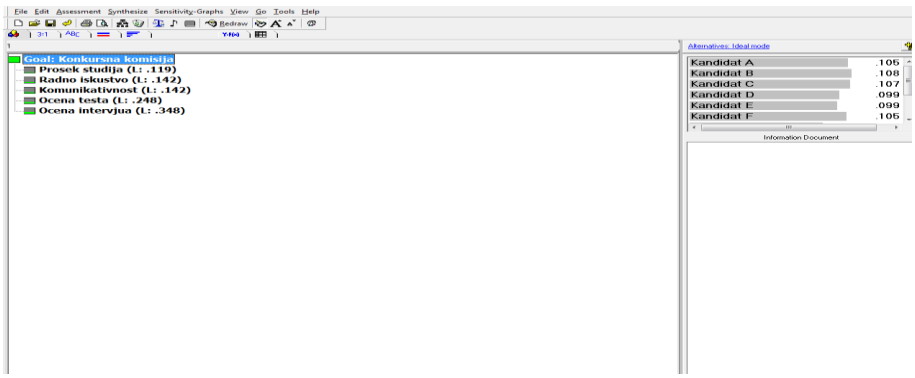
Kriterijumi „Prosek studija" i „Radno iskustvo" su elementi koje je lako kvantifikovati, dok je kriterijume „Komunikativnost", „Ocena na testu" i „Ocena intervjua" kvantifikovala izborna komisija od 5 članova (direktor, koordinator teorijske nastave, koordinator praktične natave, nastavnik stručne grupe predmeta i školski psiholog). Postavka problema, odnosno prikaz hijerarhije problema, je pripremljena u EC – u i predstavljena na slici 2.

Slika 2. Hijerarhijski prikaz modela izbora nastavnika




Nakon što je aktuelni problem odlučivanja strukturiran, sa postavljenim ciljem i kriterijumima odlučivanja, sledi generisanje alternativa i dodeljivanje težinskih koeficijenata kriterijumima, poštujući pravilo konzistentnosti, što je predstavljeno na slici 3.

Slika 3. Generisanje alternativa modela izbora nastavnika




Komisija za izbor nastavnika je svakom od kriterijuma dodelila težinski koeficijent i na taj način ukazala na to koji kriterijumi su pri izboru nastavnika u radni odnos dominantniji. S tim u vezi, veći značaj je dat kriterijumima „Ocena intervjua" i „Ocena na testu," u odnosu na ostale kriterijume, vodeći, pri tome, računa o uslovu konzistentnosti (A>B, B>C =>A>C), odnosno o tome da zbir težinskih koeficijenata kriterijuma ne prelazi 100%.

Sa Slike 7. se može uočiti da su kriterijumi, prema značajnosti, ocenjeni respektivno na sledeći način:

- ocena intervjua 34.82%,
- ocena na testu 24.82%,
- radno iskustvo 14.22%,
- komunikativnost 14.22%,
- prosek studija 11.92%.

Rezultati koje je EC ponudio u izveštajima su zaokruženi na tri decimale, pa se može desiti da ukupan iznos u procentima, usled zaokruživanja, pređe vrednost od 100%, i da npr. iznosi 100.1%, ali to nema uticaja na konačan ishod i na izbor alternative/rešenja. Ako se rešenje modela analizira sa većim

brojem decimala ovo se neće desiti. U tabeli 2 su prikazani rezultati ocena kandidata za izbor nastavnika u procentima.

Tabela 2. Ocena kandidata za izbor nastavnika

| OCENA IZBORA KANDIDATA ZA IZBOR NASTAVNIKA | | OCENA KANDIDATA | PROSEK STUDIJA 11.92% | RADNO ISKUSTVO 14.22% | KOMUNI-KATIVNOST 14.22% | OCENA NA TESTU 24.82% | OCENA INTERVJUA 34.82% |
|---|---|---|---|---|---|---|---|
| KANDIDATI | Kandidat A | 10.50 | 10.40 | 9.00 | 9.70 | 10.7 | 11.10 |
| | Kandidat B | 10.80 | 10.10 | 7.20 | 11.00 | 12.00 | 11.10 |
| | Kandidat C | 10.70 | 10.50 | 11.90 | 11.00 | 9.50 | 11.10 |
| | Kandidat D | 9.90 | 9.80 | 18.00 | 8.40 | 9.50 | 8.80 |
| | Kandidat E | 9.90 | 9.60 | 7.10 | 9.70 | 13.00 | 8.80 |
| | Kandidat F | 10.50 | 11.10 | 9.60 | 10.90 | 9.40 | 11.00 |
| | Kandidat G | 8.90 | 10.80 | 11.40 | 8.40 | 9.40 | 7.60 |
| | Kandidat H | 10.10 | 9.00 | 8.30 | 9.60 | 10.60 | 10.90 |
| | Kandidat I | 9.60 | 9.20 | 13.50 | 9.60 | 8.00 | 9.80 |
| | Kandidat J | 9.10 | 9.60 | 4.10 | 11.80 | 8.00 | 9.80 |
| | UKUPNO | 100 | 100 | 100 | 100 | 100 | 100 |

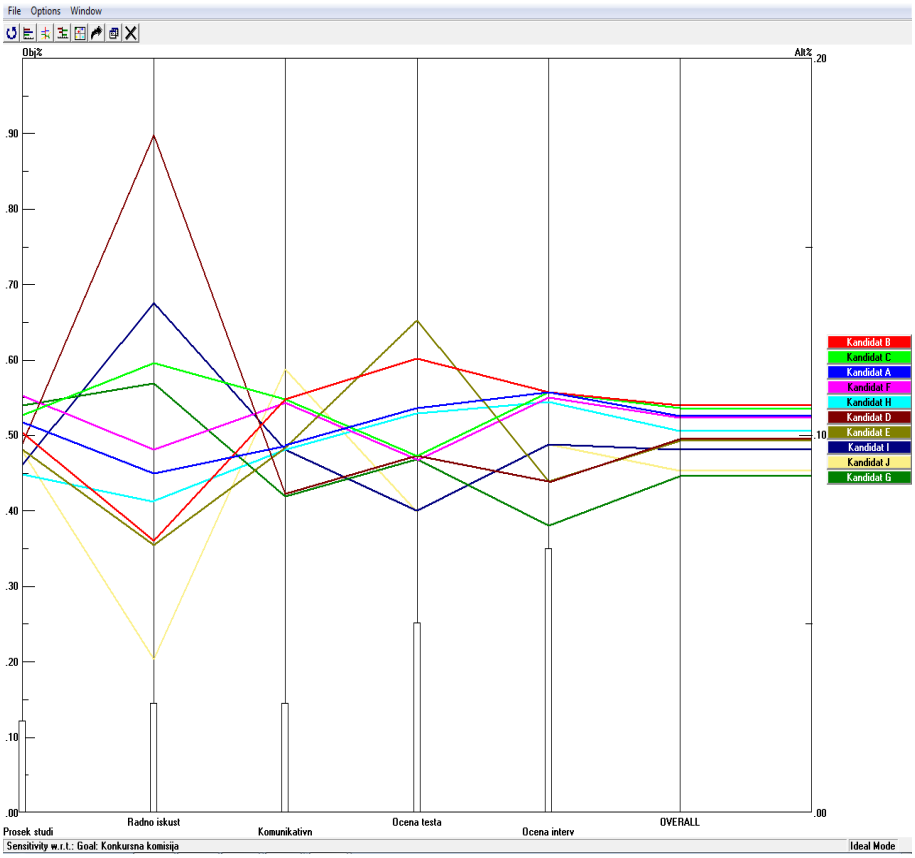
Iz tabele 2 se može zaključiti da je Kandidat B dobio najbolju ocenu, a poređenje alternativa/rešenja u parovima koje je dao EC u tabelarnom prikazu je predstavljeno na slici 4.

Slika 4. Poređenje alternativa u parovima prema postavljenim kriterijumima

| | Pairwise | Pairwise | Pairwise | Pairwise | Pairwise |
|---|---|---|---|---|---|
| Alternative | Prosek studija (L: .119) | Radno iskustvo (L: .142) | Komunikativnost (L: .142) | Ocena testa (L: .248) | Ocena intervjua (L: .348) |
| Kandidat A | .104 | .090 | .097 | .107 | .111 |
| Kandidat B | .101 | .072 | .110 | .120 | .111 |
| Kandidat C | .105 | .119 | .110 | .095 | .111 |
| Kandidat D | .098 | .180 | .084 | .095 | .088 |
| Kandidat E | .096 | .071 | .097 | .130 | .088 |
| Kandidat F | .111 | .096 | .109 | .094 | .110 |
| Kandidat G | .108 | .114 | .084 | .094 | .076 |
| Kandidat H | .090 | .083 | .096 | .106 | .109 |
| Kandidat I | .092 | .135 | .096 | .080 | .098 |
| Kandidat J | .096 | .041 | .118 | .080 | .098 |

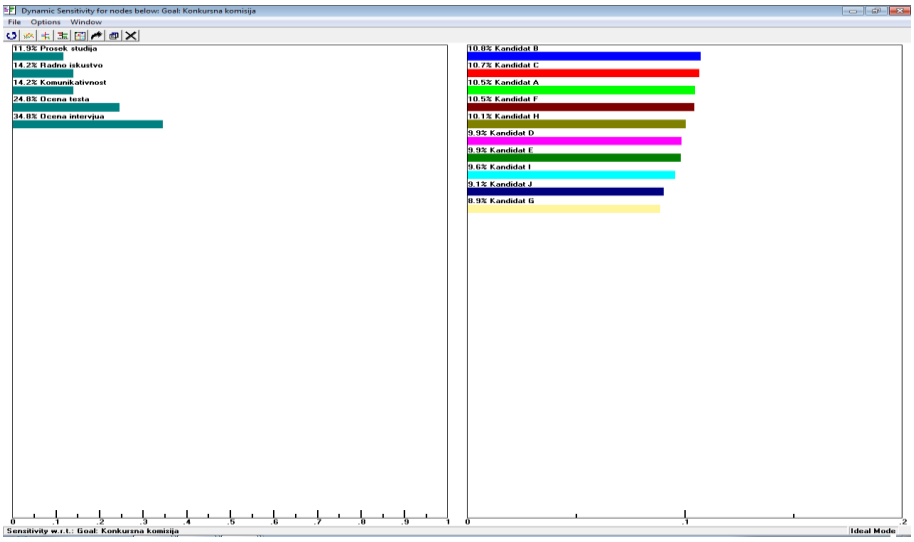
Ako se detaljnije analiziraju rezultati iz tabele 2, a koje je ponudio EC može se uočiti da je najbolje ocene dobio kandidat B koji nema ni najbolji prosek, ni najveće radno iskustvo ni najbolju ocenu na testu, a ipak ima najbolju konačnu ocenu. Obješnjenje je moguće sagledati analizom rezultata koje je ponudio EC, na slici 5.

Slika 5. Pregled alternativa u odnosu na razmatrane kriterijume



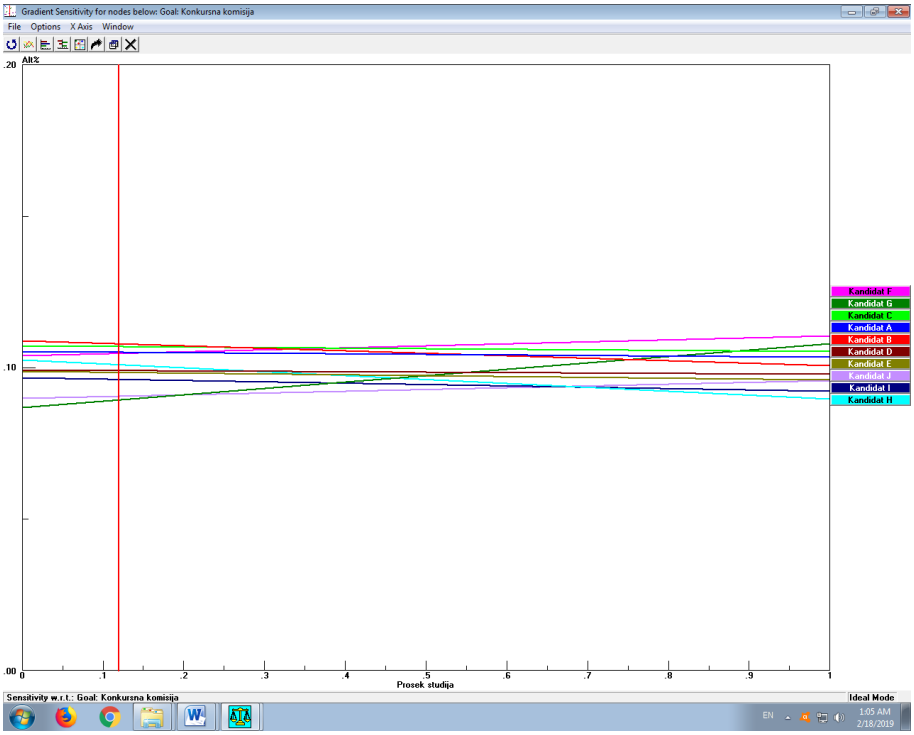

Na slici 5 se jasno može videti koliki je značaj dat pojedinim kriterijumima i kako su pojedini kandidati ocenjeni u odnosu na svaki kriterijum. Prosek studija je kriterijum kome je dat najmanji značaj, pa rangiranje alternativa po ovom kriterijumu najmanje utiče na ishod rezultata. Ipak, po ovom kriterijumu najbolje je ocenjen kandidat F, a najlošije kandidat H. Kada je reč o radnom iskustvu dominira kandidat D, a najošije je rangiran kandidat J. Komunikativnost je najizraženija kod kandidata J, a najlošija kod kandidata D i G. Na internom testu najbolju ocenu je dobio kandidat E, a najlošiju kandidat I i J. Kod ocene intervjua najbolje je ocenjen kandidat A, B, C, F i H, a najlošije je ocenjen kandidat G. Kada se uzme sve u obzir poredak alternativa/kandidata je: B, C, A, F, …, G, što se može videti na slici 6.

Slika 6. Rang kandidata u odnosu na kriterijum odlučivanja




Na slici 7 je predstavljena dinamička osetljivost, odnosno rejting kandidata u odnosu na posmatrani kriterijum odlučivanja, odnosno, prikazana je linearna zavisnost alternativa i kriterijuma. Vertikalni klizač (vertikalna linija crvene boje) je postavljen na vrednost koja je približno 0.1 ili 10%, a koja predstavlja indeks konzistentnosti (engl. Consistency Ratio).

Slika 7. Linearni prikaz osetljivosti alternativa

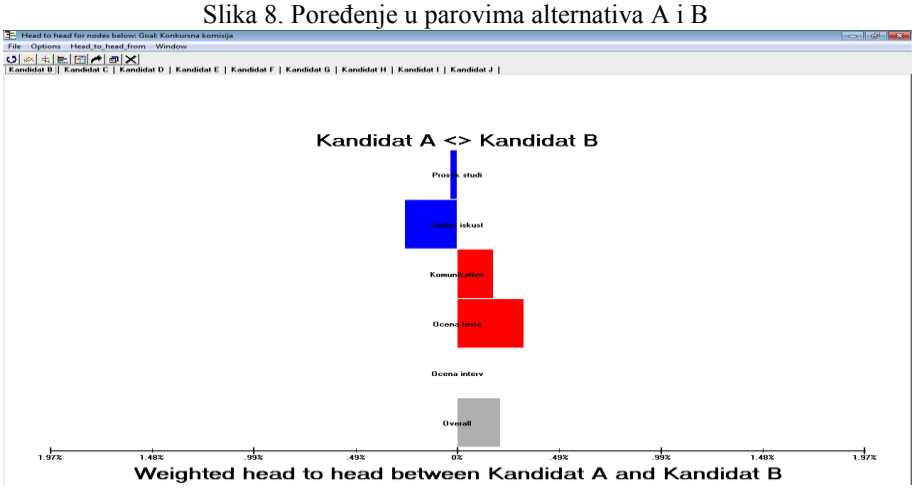



Ako se za malu promenu važnosti kriterijuma menja i konačna odluka, kaže se da je rešenje osetljivo na promenu ocene. U takvim slučajevima (u ovom primeru to nije slučaj) ne može se sa sigurnošću tvrditi da je rešenje jedinstveno, već se razmatraju i druge alternative kao približno jednako dobre.
Ako je stepen konzistentnosti (CR) manji od 0.10, rezultat je dovoljno tačan, rešenje je stabilno, pa nema potrebe za korekcijama u poređenjima i ponavljanju proračuna. Ako je stepen konzistentosti značajno veći od 0.10 rezultate bi trebalo ponovo analizirati i ustanoviti razloge nekonzistentnosti, ukloniti ih delimičnim ponavljanjem poređenja u parovima, a ako ponavljanje procedure u nekoliko

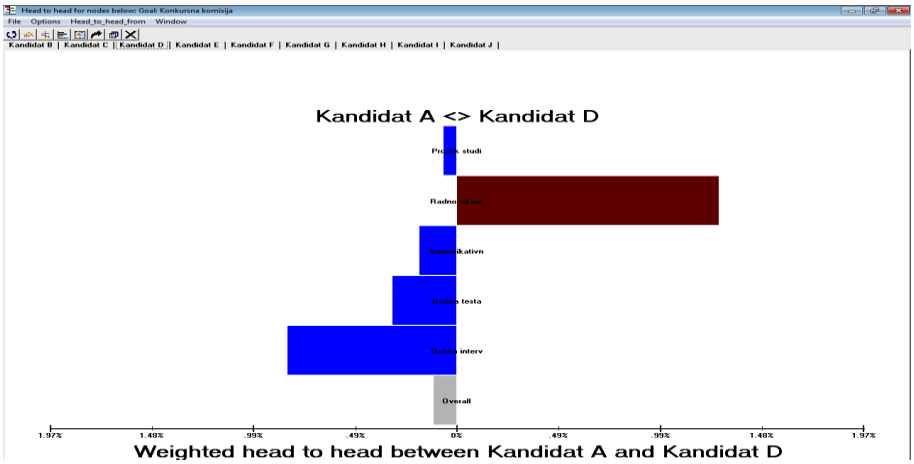
koraka ne dovede do sniženja stepena konzistentnosti, do tolerantnog limita 0.10, sve rezultate treba odbaciti i ponoviti ceo postupak od početka.

Karlsson napominje da se u praksi često dešava da stepen konzistentnosti bude veći od 0.10, a da se izabrana alternativa ipak zadrži kao najbolja (Karlsson, i dr. 1998). Ukoliko pomeranjem klizača (vertikalne linije) za 10% ne dolazi do promena značaja, odnosno, ranga alternativa, odabrano rešenje se može smatrati dobrom odlukom. Na slici 7 se može uočiti da se u ovom slučaju, kad je reč o izboru kandidata za mesto nastavnika, klizač može pomeriti udesno za više od 10%, pri čemu neće doći do promena u rangu alternativa, što ukazuje na to da alternativa B predstavlja ispravno/stabilno rešenje. Pored navedenih analiza EC nudi i poređenje alternativa u parovima. Pojedina poređenja u parovima su predstavljena na slikama 8, 9 i 10.

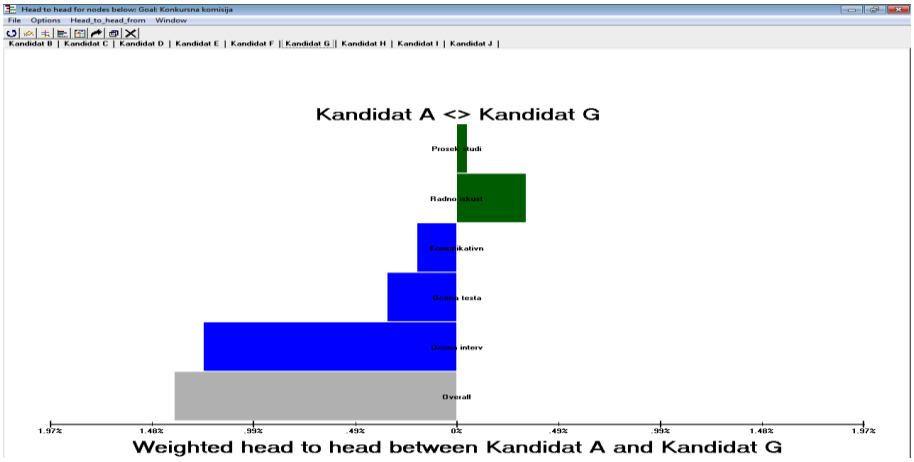
Slika 8. Poređenje u parovima alternativa A i B




Slika 9. Poređenje u parovima alternativa A i D



Slika 10. Poređenje u parovima alternativa A i G




Na slikama 8-10 je dato poređenje alternativa B, D i G u odnosu na altrnativu A. Takođe, jasno se može uočiti, kod međusobnog poređenja alternativa, prema kojim kriterijumima odlučivanja određena alternativa ima bolje ocene u odnosu na drugu. Na slikama 8-10 na levoj strani vertikalnog klizača su prednosti jedne alternative po kriterijumima odlučivanja, a desno od vertikalnog klizača su prednosti druge alternative. Ukupna ocena dobijena poređenjem alternativa u parovima se nalazi na dnu slike, pod nazivom „Overall".

Pregledom dobijenih rezultata može se zaključiti da u odnosu na alternativu A bolje ocene imaju alternative B i C, pa bi u narednom koraku trebalo ispitati, odnosno sprovesti međusobno, poređenje između ove dve alternative. Konačno, svi podaci, nedvosmisleno, ukazuju da je najbolje rešenje pri izboru kandidata za radno mesto nastavnika „Kandidat B". Dobijeno je rešenje kod kojeg je indeks konzistentnosti približno 0.1, što govori da je doneta ispravna/kvalitetna odluka.

## 5. Zaključak

Odlučivanje je staro koliko i čovečanstvo. Čovek je oduvek donosio odluke. Ipak, teorijska poimanja i naučna istraživanja različitih pristupa odlučivanju su se pojavila tek sredinom 20. veka. Empirijski je dokazano da se u strukturi menadžerskog posla oko 90% vremena potroši na odlučivanje. Određeni toretičari za uspešnost u poslovnom biznisu na prvo mesto stavljaju obrazovanost i stručnost, pojedini naglašavaju moralnost, liderske sposobnosti, inteligenciju, ali svet kroz istoriju poznaje i slučajeve gde su veliki biznis napravili neobrazovani ili slabo obrazovani ljudi. Da li će menadžer koristiti samo zdrav razum i iskustvo u donošenju odluka ili će za to iskoristiti široku paletu alata i softvera kao podršku odlučivanju, na njemu je da odluči. Način na koji menadžeri donose odluke, odnosno odlučuju, i koje alate pri tome koriste, definiše i oblik odlučivanja. On može biti intuitivni ili naučni.
U procesu odlučivanja je moguće koristiti veći broj metoda i tehnika.

Do danas je razvijen veliki broj kvantitativnih metoda koje pomažu u rešavanju različitih upravljačkih problema. Prvi sistemi koji su počeli da se bave podrškom u odlučivanju, kao zasebnom naučnom disciplinom, bili su sistemi za podršku odlučivanju. Sisteme za podršku odlučivanju, generalno, definiše rešavanje polustrukturiranih i nestrukturiranih problema, upotreba računarskih sistema, skraćenje vremena za donošenje odluka, pomoć menadžerima u odlučivanju.

U radu je predstavljen primer višekriterijumske optimizacije primenom softvera Expert Choice. Cilj istraživanja je bila namera da se opravda upotreba sistema za podršku odlučivanju, u situacijama gde je primarni zahtev kvalitetan i nepristrasan izbor, odnosno da se napravi kvalitetan izbor za prijem kandidata/nastavnika u radni odnos. Polaznu osnovu kod izbora kandidata za radno mesto nastavnika je predstavljala verbalna provera/ocena, odnosno intervju, ocena na internom testu i radno iskustvo. Pomoćni elementi su definisani kao komunikativnost, odnosno snalaženje u datoj radnoj situaciji, i prosek ostvaren tokom studija.

Metoda koja je korišćena u procesu odlučivanja je AHP metoda. AHP omogućava interaktivnu analizu osetljivosti postupka vrednovanja na konačne rangove elemenata hijerarhije. Strukturiranjem problema,

odnosno, definisanjem cilja i kriterijuma odlučivanja za izbor nastavnika u radni odnos određeno je optimalno rešenje.

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# Proizvodnja i obavezna upotreba biodizela u Srbiji sa aspekta ekonomskog uticaja na stanovništvo

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**Sažetak:** Zbog ekonomskih prilika, u Srbiji postoji značajna potražnja za polovnim dizel vozilima pristiglim iz Evrope i nema naznaka da će u skorijoj budućnosti taj trend biti u opadanju. Ukoliko Srbija sprovede reforme podrazumevane evrointegracijama, koje se između ostalog tiču i primene biogoriva, to će svakako biti konsekventno po građane Srbije na različite načine. Iako biodizel predstavlja biogorivo koje po mnogim karakteristikama predstavlja adekvatan supstitut za fosilni dizel, ono još uvek ima različita fizička i hemijska svojstva koja mogu uzrokovati neočekivane probleme pri upotrebi. To može dovesti do uvećanih troškova održavanja vozila, a time i do povećanja cene transportnih usluga. Uz to, kao produkt prerade biomase uglavnom poreklom iz poljoprivrede, industrija biodizela se pri nabavci sirovina takmiči sa industrijom prehrambenih proizvoda. To ima vrlo ozbiljne implikacije, jer može uticati na dostupnost i cenu hrane na tržištu. Ovaj rad diskutuje ove pojave sa aspekta potencijalnog ekonomskog uticaja na stanovnike Srbije, bilo da spadaju u grupu budućih kupaca i potrošača biodizela ili ne.

**Ključne reči:** Ekonomski aspekt biodizela; Biodizel u Srbiji; Uticaj biogoriva na tržište hrane; Uticaj upotrebe biodizela na motor; Starost vozila u Srbiji.

# Production and mandatory use of biodiesel in Serbia from the aspect of economic impact on the population

**Abstract:** On account of the economic situation in Serbia, there is a significant demand for European second-hand diesel vehicles and there is no indication that this trend will be declining in the near future. If Serbia implements reforms that are relevant to euro-integrations, which, among other things, include the use of biofuels, this will certainly be consequential for the citizens of Serbia through various aspects. Although biodiesel is biofuel that in many respects represents an adequate fossil diesel substitute, it still has different physical and chemical properties that can cause unexpected problems in use. This can lead to increased vehicle maintenance costs and thus, a general increase in transportation costs. In addition, as a product of biomass processing mostly derived from agriculture, the biodiesel industry competes with the food industry in purchasing raw materials. This has serious implications as it can affect the availability and food price levels on the market. This paper discusses these phenomena from the aspect of potential economic impact on Serbia's citizens, whether they belong to a group of future buyers and consumers of biodiesel or not.

**Keywords:** Economic aspect of biodiesel; Biodiesel in Serbia; The impact of biofuels on the food market; Impact of biodiesel on the engine, Fleet age in Serbia.

## 1. Introduction

In 2008, the Republic of Serbia signed the Stabilization and Association Agreement with the European Union, which entered into force on September 1, 2013 (Ministry, 2019). This agreement confirmed the perspective of Serbia's membership in the European Union (EU) and it was the initial phase of relations regulated by a comprehensive agreement between Serbia and the EU. This included certain obligations regarding the increase in the share of renewable energy sources in the total energy balance. Moreover, in 2006, the Republic of Serbia accepted the obligation to submit a plan for the implementation of Directive 2003/30/EC to the European Commission, by ratifying the "Treaty establishing the European Energy Community". This directive implied 5.75% share of biofuels, such as biodiesel and bioethanol, in petroleum fuels, by the end of 2010 (Directive 2003/30/EC). This was regarded as an indicator of a

reliable product placement for biofuel producers, which has led to several significant investments in that direction. One of them was Victoriaoil biodiesel plant in Šid, with a capacity of 100,000 tons of biodiesel per year. However, several moves by the Serbian government have led to a different outcome and almost a complete cut of biodiesel industry in Serbia (Latinović, 2019). Three key reasons were: high excise taxes on biofuels, lack of subsidies for biofuel production and transportation fuel marking regulations. Meanwhile, Directive 2003/30 has been replaced by Directive 2009/28/EC that implies 10% of biofuels in transport fuel by the end of 2020 (Directive 2009/28/EZ). With regards to Serbia's path towards EU integration, as well as the obligations it imposes, it is clear that in the near future, use and production of biofuels will be an important and current topic. Unfortunately, this does not go without inconveniences.

Biodiesel, as a renewable biofuel made of biomass, has numerous advantages over petrodiesel, such as: decreased green-house gas and many other hazardous gas emissions during the combustion; better biodegradability. Its production increases energy security and represents an agriculture and domestic industry boost (Kiš et al., 2005; Lotaro et. al., 2005, Agarwal, 2007; Chauhan, Shukla, 2011; Sinčić, 2014; Knothe, Krahl, Gerpen, 2015). However, there are also many well documented adverse effects of biodiesel production and use, concerning the environment, economy, food availability and price, engine operation and durability, etc. (Chauhan, Shukla, 2011; Knothe, Krahl, Gerpen, 2015, Latinović, 2019).

The aim of this paper is to discuss two of those issues through the prism of economic influence on potential consumers and the total Serbia's population. Also, it is to determine if there is need for a more serious econometric analysis of these effects in the future. The first one is the impact of biodiesel on engine performance, operation and durability (Fraer et al., 2005; Proc et al., 2006; Thornton et. al., 2009; Yüksek et al., 2009; Gili et al., 2011; Suthisripok, Semsamran, 2018) and the second is competition for feedstock between biodiesel and food producers and its impact on feedstock price (Taheripour, Hertel, Tyner, 2010; Du, Yu & Hayes, 2011; Kozumi, 2015; Tomei, Helliwell, 2016; Mensi, Tiwari, Bouri, Roubaud & Al-Yahyaee, 2017).

Effects on engine were discussed based on reviewed studies, chosen among those that correspond to the current state of transport sector in Serbia, in terms of fleet age and technical characteristics. Although they are not conclusive and the majority of them were done on 20% biodiesel fuel blend, they repeatedly pointed towards the existence of adverse effects of biodiesel use that can cause increased maintenance costs. Food market affection was discussed based on several studies, as well as on the experience of other biofuel producing countries. In addition, a recommendation to policymakers was given, regarding the small-scale biodiesel production conducted by agricultural households.

## 2. Technological aspects of biodiesel application

### 2.1. Biodiesel as a subject of standardization

Since the engine technology of compression-ignition (diesel) engine is well established and widespread, biodiesel and its blends with petroleum diesel have to be adapted to it. This is done through a comprehensive standardization aimed at providing the appropriate characteristics of such products on the market. Serbian standard SRPS EN 14214:2019, which fully corresponds to the European Standard EN 14214:2019, considers biodiesel as fatty acid methyl ester (FAME) (SRPS EN 14214). It is most often derived from vegetable oils and animal fats and as such, it is a chemical compound of organic origin with different chemical and physical characteristics.

Concerning its use as automotive fuel in Serbia, parameters of biodiesel are defined by standards mentioned in this heading and they only partially coincide with the parameters of quality of petroleum diesel. Some parameters are, because of substantially different chemical composition, completely non-existing (Sinčić, 2014). These standards have to cope with several issues caused by differences of biodiesel compared to petroleum diesel. Some of the most prominent are: high viscosity and loss of fluidity at low temperatures; low oxidation stability; fuel system compatibility issues and injector nozzle coking tendencies; retention of residual byproducts and impurities and increased volumetric fuel consumption (McCarhy, Rasul, Moazzem, 2005; Lotero, Liu, Lopez, Suwannakarn et al., 2005; Nestorović, Jovanović, Manić & Stojiljković, 2012).

On account of its characteristics, price and availability, pure biodiesel is most commonly used as a component in fuel blend with diesel in different ratios. In this case, its characteristics are specified by

the standard SRPS B.H2.133:2015, which is identical to ASTM D6751-15a (SRPS B.H2). Blends are designated as "B" followed by a number that indicates the percentage of biodiesel. B100 represents pure biodiesel while B20 is 20% biodiesel and 80% petroleum diesel. Analogously, B10 is 10% of biodiesel and 90% of petroleum diesel and it is now widespread in the European Union.

Table 1. Part of the SRPS B.H2.133:2015 (B100) fuel marketing specification.

| Property | Limits | Units |
|---|---|---|
| **Methanol Content** | ≤ 0.2 | % mass |
| **Flash Point** | ≥ 130 | degrees C |
| **Water & Sediment** | ≤ 0.05 | % vol. |
| **Kinematic Viscosity,** | 1.9 - 6.0 | $mm^2/sec.$ |
| **Cetane Number** | ≥ 47 | |
| **Acid Number** | ≤ 0.50 | mg KOH/g |
| **Total Glycerine** | ≤ 0.240 | % mass |
| **Phosphorus Content** | ≤ 0.001 | % mass |
| **Distillation, T90** | ≤ 360 | degrees C |

Source: (Institute for Standardization of Serbia, SRPS B.H2.133:2015).

Serbian standard SRPS EN 16734:2019, which is identical to EN 16734:2016+A1:2018 CEN/TC 19, specifies requirements and test methods for marketed and delivered automotive B10 diesel fuel, containing up to 10,0% (V/V) FAME (SRPS EN 16734). In addition, further biodiesel share increase in the fuel blend, demands additional changes in petroleum diesel standards so that the quality of final blend can pass the environmental and technological requirements (Hart Energy, 2014).

### 2.2. Effects of biodiesel on engine operations, performance and durability

Although standards aim to reduce differences between biodiesel and petroleum diesel relating to certain parameters, cannot eliminate essential chemical differences. Depending on the engine model and year of production, biodiesel blends may affect engine operation, performance and durability. It is necessary that all the engine components in contact with the fuel are made of compatible materials. This is especially unlikely to be the case in all older cars, as they weren't meant to have used biodiesel to any extent. This particularly impacts fuel injectors, filters and other fuel system components and it was found to be a cause of a significant deterioration in engine performance (Proc, Barnitt, Hayes et al., 2006; Yüksek, Kaleli, Özener & Özoğuz, 2009; Gili, Igartua, Luther & Woydt, 2011; Suthisripok, Semsamran, 2018).

A possibility exists, with all engines, that some amount of fuel will penetrate into the engine's crankcase and dilute the lubricating oil. This leads to its faster aging and engine's durability issues (Thornton, Alleman, Luecke et. al., 2009; Yüksek, Kaleli, Özener & Özoğuz, 2009; Suthisripok, Semsamran, 2018). Gili, Iguartu, Luther & Woydt (2011) stated that the esters are liquids with strong penetration and solvency properties. This leads to a greater penetration of unburned biodiesel into the engine lube oil in the crankcase, resulting in its dilution. Also, as one of the reasons, distillation temperature of the FAME shifted by about 100° K upwards was suggested. They stated that it results in the accumulation of methyl esters in the engine oil and leads to its long-term dilution. Furthermore, they stated that numerous tests have shown that at the end of the conventional oil discharge interval, up to 20% of methyl esters could be found in the engine lube oil, and this percentage was usually between 5% and 10% (Gili et al., 2011). Thornton et al. also found that, during a 750h aging test of lube oil using B20 blend, viscosity of the lube oil decreased and dilution occurred between 5-10%, or 4-8% depending on the system used (Thornton et al, 2009).

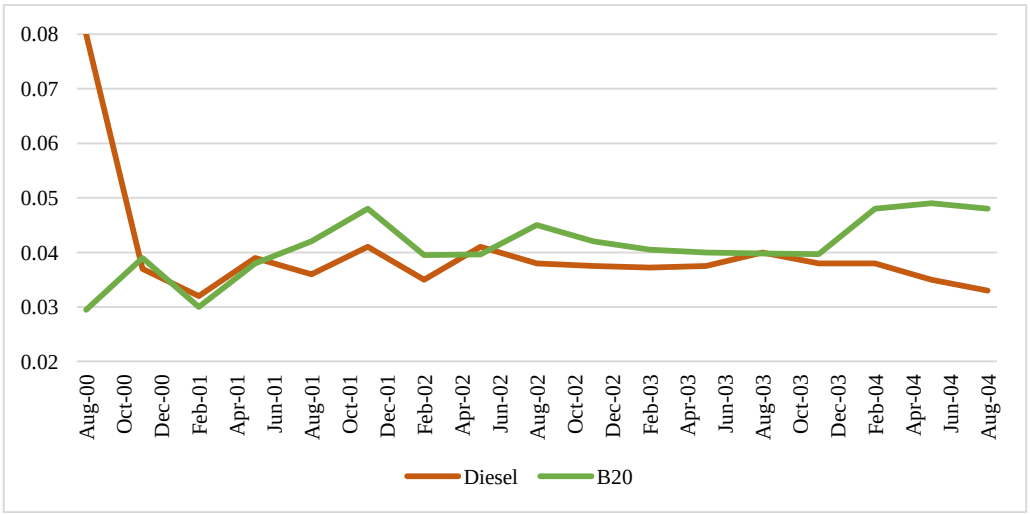
With this in mind, it should be noted that biodiesel is believed to have good lubricity properties. It turned out that the addition of small amounts of biodiesel (1-2%) to petroleum diesel with removed sulphur, returns its original lubrication characteristics (Suresh, Jawahar & Richard, 2018). Agarwal et al. (2004) found that replacing petroleum diesel with biodiesel blends decreased the wear on aluminium, chromium, iron and lead. These particles were reduced by approximately 35%, compared to diesel, during a 512h engine test on B20 (Agarwal, Bijwe, & Das, 2003). However, they tested lubricity of biodiesel compared to petroleum diesel and not compared to engine lube oil (Agarwal et al., 2003). This is only important for the engine parts not lubricated by crankcase oil, but rather with fuel itself. The most important of these components are valve seats in cylinder head and high-pressure fuel pump. The problem of diluted crankcase lube oil for lubricating other vital parts of engine subjected to

high friction remains. Porte et al. (2012) found that during a 280h engine run, on residual frying oil biodiesel, wear metal (Fe, Al, Cu, Cr, Pb and Mn) contamination of crankcase oil was increased with time. Thornton et al. (2009) also found that iron wear was increased by 55 ppm during the test. These phenomena raise the question of durability and maintenance costs. Based on diesel engine technology applied at the time of production and the average age of the fleet in Serbia, which is 17.1 years (see heading 4), several studies were chosen that are believed to be the most appropriate.

In the study conducted by Proc, Barnitt, Hayes et al. (2006), 9 identical buses over a period of two years were followed. Five buses worked exclusively on B20 fuel and four buses worked on diesel fuel. The study showed 1.2% lower fuel costs of group B20 compared to diesel. During the study, there were no significant differences in material wear on buses that used B20 and diesel, and even the soot in engine oil was lower in buses that worked on fuel B20. However, before the end of the study, it was necessary to replace some of the engine parts such as the injectors and the cylinder head, thus increasing the average cost of the B20 group compared to the diesel group.

Unrelated, but similar occurrence appeared in a study conducted by Fraer, Dinh, Mccormick, Chandler & Buchholz (2005). Two groups of Mack tractors were followed for 4 years and more than 600,000 miles. One group used B20 and the other group used petroleum diesel. Near the end of study, engines were torn down for the analysis. For most of the B20 data period, vehicles had essentially identical maintenance costs. However, in November 2003, a B20 tractor had the complete set of six injectors and a fuel pump replacement because of operational problems. The occurrence caused the cumulative average cost of maintaining the two B20 Mack tractors to increase by $0.01/mile or 28%. Figure 1 shows the step change. Also, one group that had started using B20 at the end of year 2000 quickly stopped using it because of the fuel filter-plugging problem (Fraer, Dinh, Proc, Mccormick, Chandler & Buchholz, 2005).

Figure 1: Average cumulative running engine-and fuel-related maintenance costs per mile for the Mack tractors




Source: (Fraer, Dinh, Proc *et al.* 2005)

National Biodiesel Board carried out a longitudinal durability test that lasted for 1000 h on 1987 Cummins NI4 engine. B20 fuel was used. Although the test was planned to last for 1000h, it had to be terminated after 650h due to failure of the engine pump. It was suggested that the experienced operational problems were caused by instability due to oxidation of the B20 fuel. Fuel filters and lines and fuel transfer pump were replaced during this shut-down at 700h. At the end of final 250 h, they dissembled the engine and found substantial deposits on many components. They stated that the source of these deposits appeared to be the lube oil. Cavitation erosion of the injector needle valves had caused injectors to deteriorate to the point that almost no fuel atomization could occur. Deteriorating fuel pump seals were proposed to have introduced microscopic air bubbles into the fuel, causing the cavitation erosion. Elevated soot wear metals in the lubricant, softening of fuel system seals and broken fire and compression rings on several cylinders were observed (Ortech 1995).

Filter clogging was also found to be a major problem in the USA, as increasing animal fat and soybean-based fuels were being introduced nationwide (PTSA 2005; Proc, Barnitt, Hayes, Ratcliff, McCormick,

Ha *et al*., 2006; Dhiraj, Mangesh, 2010). Humberg, Hansen, Schumacher et al. (2004) analysed the experiences of state transportation agencies with B20. They found that around a half of the states using B20 reported more fuel filter plugging issues with B20 than with petroleum diesel. Many states also reported small declines in fuel economy with B20.

## 3. Biodiesel feedstock market and its impact on the food market

Three basic raw materials used for production of biodiesel are lipid materials (vegetable oil or animal fat), alcohol and catalyst for the reaction, which facilitates and accelerates the reaction between the lipid raw material and alcohol (Stamenković, Banković-Ilić, Stamenković, Veljković, Skala, 2009). Lipid materials are the most important and the most expensive feedstock for biodiesel production, therefore, attention will be paid to them. Since the extensive amounts of biomass feedstock can be provided through the agricultural cultivation of different oilseed crops, vegetable oils are the most common feedstock for biodiesel production. More than 600,000 hectares of arable land are considered available for the production of oilseeds in Serbia, where the most important are: sunflower, soybean and rapeseed. Sunflower is the most popular and covers an area of about 220,000 hectares per year (Babić, Đurišić, 2008). The total area suitable for the cultivation of oilseeds intended for processing into biodiesel was estimated at about 350,000 ha (Tešić, Kiš, Janković, 2008; Tešić, Kiš, Marinković, 2009). Depending on the processing technology, technology of biodiesel production and usage of arable land, Tešić et al. estimated biodiesel production potential on 212,800t up to 250,600 tons of biodiesel *per annum*. This was estimated to be enough to substitute up around 15.5% of Serbia's diesel consumption which is more than enough for domestic needs (Latinović, 2019). This implies that no biodiesel, nor feedstock would need to be imported.

As land is a limited natural resource, it is clear that biodiesel industry is competing for the same processing surface against food manufacturers, and it represents one of its most crucial impediments towards sustainability. Using crops for biofuels production creates concerns with food (Koizumi, 2015) and livestock feed (Taheripour, Hertel, Tyner, 2010) prices and availability and raises the important question of how far along that route Serbia could move. On account of relatively high prices of petroleum products as compared to the relatively low prices of food and livestock feed products, biodiesel producers, boosted by subsidies, are willing to pay a higher purchase price for the feedstock compared to food and livestock feed producers. This provokes the inflation of food and livestock products prices, produced from these plants (Kozumi, 2015; Tomei, Helliwell, 2016). Du, Yu & Hayes (2011) showed the existence of volatility spillover from crude oil to biofuel feedstock. Corn is feedstock for bioethanol, a biofuel substitute for petrol, but the same principle can be applied to biodiesel feedstock. Mensi et al. (2017) stated that "the recent expansion of biofuel cereal production, in light of the US government fuel policy, has further intensified the price linkages between energy and agricultural prices and raised concerns about a stronger volatility linkages and potential adverse impacts on economic actors."

Haixia and Shiping (2013) found double-directional spillovers between the corn market and the bioethanol market, which leads to bioethanol market impact on the corn price levels directly and indirectly. Therefore, they concluded, "fuel ethanol prices seem to also induce an increase in the prices of grain" and that the evidences suggest that there is a closer linkage between the corn and bioethanol markets (Haixia, Shiping, 2013). In Serbia, after the opening of 100,000 t/y Victoriaoil biodiesel plant in Šid, in 2007, in year 2008 food price inflation was noted (Tešić, Kiš, Janković, 2010), although not conclusively to which extent and for what reason. Around the same time, in 2007, Jean Ziegler, a sociologist and UN special adviser for food issues, explained that 280 kg of corn was enough for a one-year diet of a single child. From the same amount of corn, only one tank of 50 litres of bioethanol could be produced. That amount, as he said, would be enough for one SUV car to cross around 200 km. Given that, Jean Ziegler from the UN called for the urgent five-year moratorium on biofuel production. The same example also applies to biodiesel (UN News Centre, 2007).

On the other hand, part of agricultural waste biomass and waste frying oil represent the most suitable feedstock for biodiesel production from the environmental and economic aspect. Their use as feedstock would help solving the problem of their disposal as waste and reduce the share of the agriculture feedstock usable for food production. If such feedstock is used by small-scale production conducted by agricultural households, it is believed to contribute to rural development even more. Unfortunately, such feedstock remains unused on the account of inadequate legislation. Petrol product and biofuel monitoring regulation (Uredba o monitoringu, 2015) and fuel marking regulation (Uredba o

obeležavanju, 2017) introduced fuel marking by specific markers in precisely determined concentration. Market inspectors in Serbia were allowed to control fuel tanks of business entities. Blending marked fuel with unmarked fuel, such is self-made biodiesel, would lead to dilution of markers which means that in a case of market inspection, entities caught with the illicit fuel would face huge penalties. This specifically affects agricultural households since, as business entities, they are subjected to these regulations, thus prevented from producing and using biodiesel from its own production.

## 4. Potential consumers of biodiesel and state of the fleet in Serbia

Consumers of petroleum diesel fuel represent the most significant group of potential biodiesel consumers. For the purpose of this paper, they were categorized into three most important groups: passenger cars, commercial vehicles and working machines. There were 1,999,771 passenger cars in Serbia in 2018 (Statistical Office, 2019b) with the average age of 16.4 years (Road Traffic Safety Agency, 2019a). Precise data on the ratio of the number of diesel/petrol vehicles was not available at the moment of writing this paper, but the final energy consumption of diesel fuel in Serbia, in 2017, was 1,571,130 t (Table 2). For comparison, only 419,822 t of petrol was used in the same period, which is almost four times less (Statistical Office, 2019).

In 2018, 228,900 freight vehicles, 9,980 buses and 8,979 work machines were registered in Serbia (Statistical Office, 2019b). Owners of these vehicles are primarily interested in price, fuel consumption and biodiesel quality. Any increase in fuel and maintenance costs is expected to be compensated by increased prices of final products and services that include transportation costs. The total average age of Serbian fleet, consisted of all registered vehicles in 2018 was as high as 17.1 years and in South-Eastern Serbia, over 20 years (Road Traffic Safety Agency, 2019).

Table 2: Final energy consumption in Serbia, in 2017.

| | **Transport diesel** | **Heating and other gas oil** |
|---|---|---|
| | **t** | **t** |
| **Final energy consumption** | **1,571,130** | **122,571** |
| **Industry** | 55,932 | 16,305 |
| **Construction** | 15,083 | - |
| **Transport** | 1,444,026 | 16,605 |
| **Households** | - | - |
| **Agriculture** | 56,089 | 71,759 |
| **Other users** | - | 17,902 |

Source: (Statistical Office of the Republic of Serbia 2019).

## 5. The economic situation in Serbia – latest indicators

In order to gain insight into the economic status of its average citizen, few crucial economic and social indicators of Serbia were given in Table 3. Values represent the official calculations of the Statistical Office of the Republic of Serbia. Values given in RSD were converted to European monetary union currency (€), based on the official middle RSD exchange rate formed on 04/06/2019 by the National Bank of Serbia.

Another indicator that may be used for better understanding the situation of a society is Bloomberg misery index. It is an indicator relied on the age-old concept, which assumes that low inflation and unemployment rate could be taken as a good illustration of how good an economy's residents should feel (Serbian Monitor 2019). The country with the highest ranking is the one with the highest index of misery. It is calculated as the sum of a country's unemployment rates and inflation. (Bloomberg, 2019). In 2019, Serbia was listed in 10th place (Bloomberg, 2019).

Table 3: Economic and social indicators of Serbia

| Indicators | Reference | Value | Units |
|---|---|---|---|
| **Industrial production index, same month of previous year = 100** | 2019, April | -0.8 | % |
| **Industrial production index by activity, period of the current year compared to the same period of the previous year** | 2019, April | -1.5 | % |
| **Average net earnings** | 2019, March | 460.3 | € |
| **Personal household consumption, monthly** | 2017 | 528.16 | € |
| **Consumer price indices, same month of** | 2019, April | 3.1 | % |
| **Consumer price index, previous month = 100** | 2019, April | 0.7 | % |
| **Gross domestic product** | 2017 | 2 | % |
| **Quarterly gross domestic product, same** | 2019, I | 2.5 | % |
| **Gross domestic product per capita** | 2018 | 6,128.95 | € |
| **Unemployment rate** | 2018 | 12.7 | % |

Source: (Statistical Office, 2019a)

In addition to these indicators, the average age of the vehicle fleet discussed in the previous heading (5) is also one of the economic indicators to be considered.

## 6. Discussion

Regarding the biodiesel effects on engine operation, performance and durability, it is highly likely that overall increased maintenance costs are to be expected. Two main concerns are: compromised fuel system (fuel filter clogging, leakages on rubber sealants and fuel injector coking) and diluted engine lube oil (decreased engine life by the excessive friction and wear). Although serious engine damage can be prevented by timely servicing and decreased service intervals, this directly results in increased maintenance costs. Reviewed studies mostly compared B20 blends to petroleum diesel. B10 is expected to have less impact on engine operation, performance and durability. Cost increase levels were not conclusively determined but they are expected to occur. It is highly likely that all business entities would adjust their product and service prices so as to cover increased transport and processing costs.

The second issue discussed was biodiesel feedstock availability and its impact on food prices on the market. If Serbia at some point achieves the target of 10% share of biodiesel in diesel fuel, around 157,113 tons of biodiesel will be consumed *per annum*. With regards to biodiesel feedstock production capacity of Serbia, as well as to the production capacities of biodiesel producers, it is highly likely that feedstock or biodiesel import would not be needed. However, the biodiesel industry would be able to consume almost all available oilseed feedstock, otherwise intended for food and livestock feed production. Such a level of demand is expected to have a significant impact on the nutrition market. At the same time, agriculture itself, which would use biodiesel from its own production and for its own needs on a voluntary basis, faces legislation ineffectiveness. The problem with policies remains and potential large cumulative effect of a numerous smaller manufacturers (Latinović, 2018) stays neglected. This is a huge hindrance for circular and bio-economy as the agriculture industry is one of the most important sources of pollution and greenhouse gas emissions (Jovanović, Joldžić, Jovanović, 2015). This is exactly where using waste biomass and waste edible oil as feedstock would have the most obvious positive effects on the environment. Around 127,848 tons of transport diesel and heating and gas oil *per annum* is used in agriculture and a large part of that would be substituted by biodiesel made of waste biomass.

Creating jobs and improving living conditions are some of the economic benefits of biodiesel industry. Biodiesel industry would be especially beneficial for producers and, finally for all commercially involved in it. However, their number is negligible in relation to the number of those not involved in the industry. In addition, on account of high feedstock and processing costs of biodiesel, compared to crude oil, the biofuel industry is dependent on state subsidies. If Serbia is to achieve the set target of 10% of the share of biofuels in fossil fuels in the market, it is clear that state incentives and subsidies are to be introduced. Needless to say, these incentives and subsidies would come from taxpayers' money. Considering economic indicators of Serbia, it is clear that the economic power of the average

citizen of Serbia is relatively small and ironically, it would be them who pay for something that then financially burdens them further.

## 7. Conclusion and recommendations

Based on various studies and global biodiesel industry experiences, this study provided enough evidence for safe conclusion that mandatory use of biodiesel on a large scale would lead to increased overall price levels in Serbia. Although this study did not conclusively determine to which extent, it is likely that production and mandatory use of biodiesel in Serbia would have negative economic impact on the overall population. In the economic context, the biodiesel industry seems to be a "zero-sum game" between producers and citizens.

The ethical question arose as to whether and by what means, the profit of those involved in this industry is more valuable than the burden, borne by all citizens of Serbia, regardless of whether they are consumers of biodiesel or not. With the all economic indicators taken into account, a question arises as how would the overall price level increase affect market activity and standard of living in Serbia. With already a noticeable decline in industrial activity and a low income of an average citizen, this issue should be considered by the state with the utmost seriousness. A more extensive econometric analysis is recommended.

Additionally, this paper suggests that policymakers induce changes in regulations concerning fuel marking and subsidies in such a way to support biodiesel production and use by agricultural households, thus creating truly positive environmental effects.

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# Uticaj medija na ponašanje kupaca

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**Apstrakt:** U današnjem informacionom društvu, potrošači imaju na raspolaganju sve više informacija o proizvodima i uslugama. Kompanija treba da shvati proces marketinške komunikacije, posebno ko, kome, na koji način i sa kojim efektom treba da pošalje primaocu i preko kog medija. Poruka treba da obavesti potrošača i ubedi ga da kupi nameru potrošača. Kompanije za komunikaciju sa potrošačima koriste različite metode i instrumente. Sa njima, kompanije pokušavaju da primoraju potencijalne potrošače da razmišljaju o korisnosti ponuđenog proizvoda ili usluge. Cilj ovih instrumenata može takođe da obezbedi više održivu potražnju ili informacije o dešavanjima na tržištu. U ovoj studiji smo otkrili da veoma značajan uticaj na kupovno ponašanje potrošača ima lične faktore. Među ličnim faktorima su starost, finansijska situacija, način života, nivo životnog ciklusa porodice, kao i osobine ličnosti i samopoštovanje. Svi ovi faktori su veoma međusobno povezani i međusobno zavisni, ali svakako imaju najveći uticaj na stadijume kupovnih navika potrošača u životnom ciklusu porodice.

**Ključne riječi:** mediji, kupovno ponašanje, kupovne navike, potrošači, Slovenija

# Media influence on consumer buying behaviour

**Abstract:** In today's information society, consumers have available more and more information about products and services. The company needs to understand the process of marketing communication, in particular, what, to whom, in which way and with what effect should have the communication and media to the recipient. The message should notify the consumer and persuaded to purchase intent of the consumer. Companies for communication with consumers use different methods and instruments. With them, companies try to compel potential consumers to think about the usefulness of the offered product or service. The aim of these instruments can also ensure a more sustainable demand or information on developments in the market. In this study, we found that a very significant impact on the purchasing behaviour of consumers has personal factors. Among the personal factors include age, financial situation, lifestyle, the level of the life cycle of the family, as well as personality traits and self-esteem. All these factors are highly interrelated and interdependent, but certainly, has the greatest impact on consumer buying habits stage in the life cycle of the family.

**Keywords:** media, buying behaviour, purchasing habits, consumers, Slovenia

## The purchasing habits of consumers

Before a company can develop a marketing strategy to meet the needs of consumers, must know how consumers make their own purchasing decisions, understand the purchase process and purchase habits. Successful companies usually investigate the process of purchase decisions for their products. They ask consumers when they meet the product and the brand, what is their belief in the product and/or brand, how high is their commitment to purchase, how to choose products and whether they are satisfied with the purchased product. They monitor their consumers at every step, while they pay attention to the changes that will occur the shopping behaviour of their consumers in the future.

Consumers purchase decisions process is a very dynamic and complex. It can be defined as a holistic process the consumer's decision-making process, which mainly takes place in five stages (Wilkie, 1994, pp. 481; Solomon et al., 2006, pp. 258; and Peter Olson, 2005, pp. 156). The model contains all of the items, which meets consumer who buys the product for the first time with a high degree of commitment to purchase. Blackwell et al. (2001, pp. 70-82) distinguish seven stages of the purchase

process: identification of problems/needs, collecting data and information, evaluation of alternatives, consumer choice, after purchase behavior/outcome, an added are the use of purchased alternatives (satisfaction or dissatisfaction with the purchased product) and how they drop-off unused products or their parts. Although the models are not identical to the last detail, all have in common that, due to the complexity of the phenomenon include the large number of steps to try to present consumer behaviour in the most obvious way.

The consumer is the person who has the ability (resources and capacity) for buying and purchasing products and services. Their buying intent is to satisfy personal or collective (e.g. Family) interests. Studying the shopping habits of consumers is to study processes created when individuals or groups choose to shop, used products, services to meet their needs and desires. We can define consumer behaviour as behaviour by consumers when they search, purchase, use, abandon and evaluate the products, services, ideas, which they expect to meet their needs (Schiffman and Kanuk, 1997, pp. 7).

We can see consumers as complex individuals, which vary depending on the psychological and social needs and desires. The company must therefore know and understand consumers, especially consumer buying habits. Typically, an enterprise should, therefore, consider the demographic, social and anthropological characteristics of consumers as well as their psychological characteristics (adapted from Mumel, 1999, pp. 19-20).

According to Schiffman and Kanuke (1997), researching consumer behaviour includes research, what, why, when, where and how often buy specific products. Therefore, the company is studying consumer preferences, perceptions, attitudes and purchasing behaviour; we can develop new products and define their characteristics, sales prices, channels, messages, and other elements of the marketing mix. One of the tasks of research of consumer purchase behaviour is to explain why consumers prefer to buy certain products or products with a particular brand.

The globalisation of markets, specialisation and increasing competition, are changing purchase indicating consumers. Increasingly companies consumers actively involved in the design, development and supply of products (Wang et al., 2004, pp. 171). Consequently, this requires that companies that actively monitor consumer behaviour and the factors that affect consumer buying habits. We can divide the factors that most often and most strongly influence the buying habits and purchase decision-making processes of consumers can into four categories, namely these factors are psychological, social, personal and cultural.

Among the most important psychological factors that have an impact on consumer purchasing habits include motivation, attitudes, perception, learning and memory.

Among the social factors that have an impact on the purchasing habits of consumers counted reference groups, family, and the role and position of the individual. Most important cultural factors that affect consumer buying habits we can classify particular culture and social class. Also, culture is one of the less obvious factors compared to other influential factors, although it has a very significant impact on consumer buying habits. We should note that the impact of culture consumers are less aware of that culture adapts to the living environment and includes diverse areas such as knowledge, art, morality, religion, laws and customs, passed on from generation to generation, and thus the samples warrants habits and ways of purchase decisions. For social classes, we can say that they are uniform and lasting hierarchically social group whose members share similar values and interests, and expectations, purchasing habits and ways of purchase decisions.

A very significant impact on the purchasing behaviour of consumers has personal factors. Among the personal factors include age, financial situation, lifestyle, the level of the life cycle of the family, as well as personality traits and self-esteem. All these factors are highly interrelated and interdependent, but certainly, has the greatest impact on consumer buying habits stage in the life cycle of the family.

## Media and their application in enterprises

Successful companies maintain their market position, achieve their goals and grow if they have certain advantages over their competitors. They strive to create satisfied consumers, and the excellent company, therefore, adapt to a changing market with a marketing oriented strategic planning. Consumers are increasingly demanding, so it is now reasonable to divide consumers into groups -

segments and adapt products to each group. By dividing the total market into smaller pieces or segments of consumers who have similar characteristics, the company can better meet their needs and desires. Segmentation and selection of target markets allow the company to position their offer as close as possible to the consumers.

The core of the modern marketing strategies of using different media to influence consumer behaviour in the 21st century is segmentation, target market selection and positioning. Companies find it increasingly difficult to carry out mass marketing and the marketing of diversified products. Mass markets are increasingly narrow and fall hundreds of tiny markets, which is characterised by consuming them looking for different products in different sales channels and to the different communication channels (marketing mix).

Marketing mix means the specific combination of marketing ingredients, developed by the company to affect the demand for their products or services and so encourage responses of consumers in target markets. Marketing mix consists of a combination of marketing variables that a company has monitored and used to interconnect in such a way that it would achieve the desired level of sales in its target market

The media can be defined as information carriers, through which businesses can transmit the information to their consumers (Postma, 2001, pp. 24). In addition to the informative functions of the media including the tasks of education and entertain consumers (Erjavec & Volčič 1999, pp. 17).

The media can be divided into two broad and interrelated quite distinct groups, namely traditional and digital media. Among traditional media can be classified as radio, television, print media, public and private areas and direct mail. Forms of traditional media can also have a public and a private area owned by individuals and companies, surfaces in public transport surface on the exterior and interior parts of buildings as well as specific public and private areas devoted to advertising (Iršič et al., 2016, p. 164 ).

Companies are increasingly turning to the use of digital media. Digital media provide some advantages. One of the major advantages is the possibility of targeted use, depending on the target group of consumers. Also, digital media enable businesses to obtain a significant number of personal data on the consumer (sex, age, place of residence, personal interests). The company can use digital media to obtain information on the time shopping, shopping frequency, the most popular products, the average value of the purchase, whereas digital interactive media (Iršič et al., 2016, pp. 164-165). Among the most commonly used digital media by businesses include web banners, pop-ups, web pages, e-mail, mobile telecommunications, and increasingly a platform for sharing video content, social networks (Solomon et al., 2012 Iršič et al., 2016 pp . 165-166).

Companies with chosen medium, which aims to inform and to inform consumers, media tailor the message communicated to the target group of consumers, and the frequency of communication of information. That has a major impact on the way consumers purchase decisions.

The company must clearly understand the process of communicating with consumers, especially someone whom and what indicates which way (the media) and what effect that would be transferred to the consumer notice, remind him or convinced about the usefulness of purchase. Using the media enables the company to inform consumers, including advertising. We can define advertising as any paid form of non-personal presentation or promotion of products, services or ideas to the potential consumer (AMA 2013).

Through various media, the company can use two different strategies to influence the purchasing habits and otherwise push strategy or a pull strategy. The strategy of pushing the company seeks to fundamentally affect the sales staff in the sales chain that might affect the purchasing decisions of consumers, while the strategy of trying to pull the company direct influence on consumer buying habits. The company can use a combination of both strategies.

When planning the use of different media, with which the company wants to communicate and inform consumers and the enterprise should take into account the consistency with its general objectives, adaptation to target groups of consumers, and that can affect the purchasing decisions of consumers (Konečnik Ruzzier, 2011, pp. 211).

## The media influence on purchasing habits of consumers

Marketing Communications encompasses all communications activities to inform and convince consumers in the target market of the company products. The company may target market forms a single message or multiple messages and transmit them simultaneously to the different markets. Marketing communication comprises organisation, means, methods and messages to transmit information about the product to convince the consumer to purchase the selected product.

The communication process begins message sender. When sender encodes a message, must use symbols, codes or concepts that the recipient will know how to decode and understand. If the recipient to understand the message differently than was intended, it is the cause of a disorder that can occur at any stage in the communication process. Sender sending the message through an intermediary, usually the media (newspapers, magazines, television, radio) by impersonal means of communication. Backlinks are the recipient response to the message, which can be positive, negative or non-existent. Communication depends on the capacity of intermediaries, which indicates the amount of information that can be efficiently transmitted

The communication process consists of four elements (Potočnik 2002, pp. 302):

- marketing messages sender,
- messages,
- a communication channel, which can be personal or impersonal, and
- the recipient of the message.

The company needs to understand the process of marketing communication, in particular, what, to whom, in which way and with what effect should have the communication and media to the recipient. The message should notify the consumer and persuaded to purchase intent of the consumer.

Companies for communication with consumers use different methods and instruments. With them, companies try to compel potential consumers to think about the usefulness of the offered product or service. The aim of these instruments can also ensure a more sustainable demand or information on developments in the market. One of the basic components of the marketing mix is also advertising in the media, which is the most useful and indispensable element of the marketing mix.

The definition of advertising given by the American Marketing Association (AMA), is as follows: "Advertising is any paid form of non-personal presentation or promotion of ideas, goods or services to a specific client."

The objectives of the advertising in the media are primarily to create awareness about the product and brand and influence on purchase intention. Companies should also be aware that they do not communicate only through planned, paid messages in various media, but also through unplanned messages and messages that carry the product or service.

The primary task of advertising in the media is the dissemination of information about products, services, companies and to create awareness about the product and brand and influence on purchase intention. On the choice of certain media affect particular objectives and strategies, available cash and the characteristics of the market and the product. Therefore, for a modern enterprise is a fundamental question, in which the media, how and with whom to communicate, what and how often, that the consumer will decide for their product and not for competitive. The provided information should be as close as possible to those used by consumers in their purchase decisions and must convince them to the usefulness of a particular purchase (Potočnik 2002, pp. 302-303). Properly selected set of media usually allows companies to influence the purchase decisions of consumers and to achieve the desired objectives.

By the planning of advertising and the media companies should take into account that (Konečnik Ruzzier, 2011, pp. 211):

- it is in line with the basic strategy of the company,
- is appropriately adjusted depending on the target group and the selected medium,
- is based on realistic foundations, which product can provide the target market, and transmits messages only about those promises that the product will be fulfilled,

- has the ability that consumers can create their opinion about the product,
- is an innovative,
- it creates a distinction between the advertised product and the competitors
- it is cost-effective,
- has a positive impact on the other stakeholders of the company.

We can divide media into traditional and digital. Traditional media are TV, radio, print media, public and private areas and direct mail. Public and private areas include areas of natural persons and companies, surface public transport, surface to internal and external parts of buildings, and also special public and private areas intended for advertising (”jumbo” posters or “"billboards”) (Iršič et al., 2016, pp. 164).

Recently, companies increasingly advertise via digital media. They are interesting because of the many benefits that they provide. One of the main advantages is that advertisers can precisely select target audience to whom they want to convey the message. When registering on websites is a user specified number of data on sex, age, interests and others that are of interest to advertisers. They also have the operators of websites and portals numerous data on how often a user clicks on an ad on the portal, which allows users to measure the response. Advertising on the web is interactive and allows the audience to participate and even helps create an advertising campaign (Iršič et al., 2016, pp. 164-165)

Companies decide to explore consumer behaviour mainly because the latter rather spend their time shopping. Also, consumers spend much time for reflection on green products and services, talking about them and finding information that consumers frequently find in the media.

That the company can influence through the media on the purchasing habits of consumers should know the methods, procedures and approaches in consumer buying decisions. As for finding information, consumers use media; the company must know which media to obtain information, what information they are looking for and how specific the information is relevant or influence on purchasing decisions. Since the process is complex purchase decisions of consumers and the role of consumers in the process of purchase decisions are different, companies must constantly monitor their consumers.

The company must consider when choosing the media economic approach and select the media by means of which will be the fastest and lowest cost transfer message information to the target group of consumers and influence their purchase decision. Many different factors have an influence on the choice of the combination of the media, among which are the most important desired objectives, the target group of consumers, products, market conditions and the diversity of the media.

We have to note that the company has available a wide variety of media for transmitting information and influencing the purchasing decisions of consumers. For best results, the company can achieve if know how to properly combine media such as television, radio, newspapers and magazines, leaflets, the internet and social media. To select the right combination is important to know the characteristic of individual media, and combine them to exploit their strengths and provide consumers with messages that influence their purchasing decisions.

The objective that the company wants to achieve with the use of the media to influence the purchase decisions of consumers and accelerate purchase. With the help of the media to consumers to the relevant information they need so they can make their purchase decision. Moreover, also the transfer of appropriate and timely information is the basic task of the media who are also the indirect role in influencing consumer purchasing decisions. Companies are trying to help the media to provide consumers with the information they persuade the usefulness of purchase (Potočnik 2002, pp. 302-303).

Despite the fact that enterprises realise the importance of using different media to influence the purchasing decisions of consumers, many of them are still using only one of two media to achieve their goals. With this approach, they have less chance of successfully influencing the purchasing decisions of consumers.

From the above written, we tested the following hypotheses in the survey:

- H1 - Among all the media, the greatest influence on purchase decisions have leaflets delivered by traders to consumers in mailboxes.
- H2 - The biggest impact of all media on the purchasing decisions of consumers has Internet.
- H3 - After own view of consumers surveyed have a reception purchasing decisions media, in general, make a big impact.

## Methodology, data collection and sample

### A description of the sample

We interviewed in totally 430 people of which were 331 (77%) respondents female and 99 (23%) male. Regardless of age, below sample included 177 (41%) of people aged 25 years, 137 (32%) of people aged between 25 and 40 years, 94 (22%) of people aged between 40 and 55 years and 22 (5%) of persons older than 55 years. Average monthly income of the respondents amounted to 765.47 EUR per month, while 149 (35%) of them had income of up to EUR 400, 100 (23%) of them between 400 EUR and 800 EUR, 149 (35%) of them between 800 EUR and 1,500 EUR, 24 (6%) of them between 1,500 EUR and 2,500 EUR and just 8 (2%) of them had a monthly income higher than 2,500 EUR. Among the persons interviewed by 275 (64%) live in the house, 155 (36%) were in the apartment. On average, a household in which they live has 3,24 members. In a household with one member live 41 (9%) of respondents, 87 (20%) in a household with two members, 115 (27%) in a household with three members, 128 (30%) in a household with four members and 59 (14%) of respondents live in a households with five or more members.

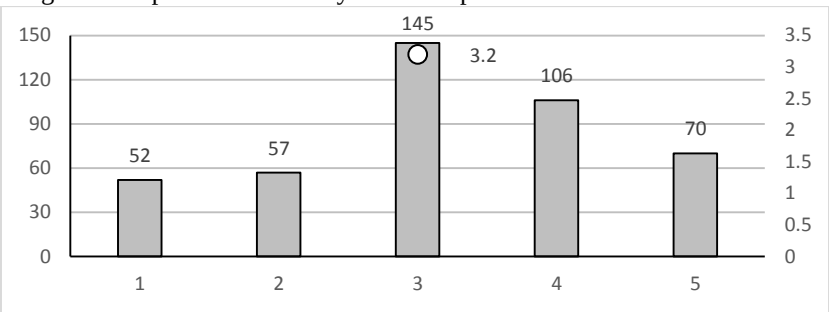
### Research methodology

To carry out the research, we used quantitative research method and personal technique interview. The survey was conducted by personal interview in front of shopping centres in October 2015, and in it were included, passers-by. Acquired responses were statistically analysed and presented in the form of graphs and interpret them accordingly. We checked and evaluated hypotheses by using descriptive statistics. In the end, we are using the data collected and theoretical findings, conducted independently inductive reasoning, and by the results of the hypotheses confirmed or refuted. Restrictions which we faced in the implementation of the research were refractory respondents consequent reduction of the sample surveyed, inconsistent compliance questionnaire and consequently incomplete answers. The survey was not limited to a representative sample. The following article shows the main results of the survey by which we tested the hypothesis.

## Results and discussion

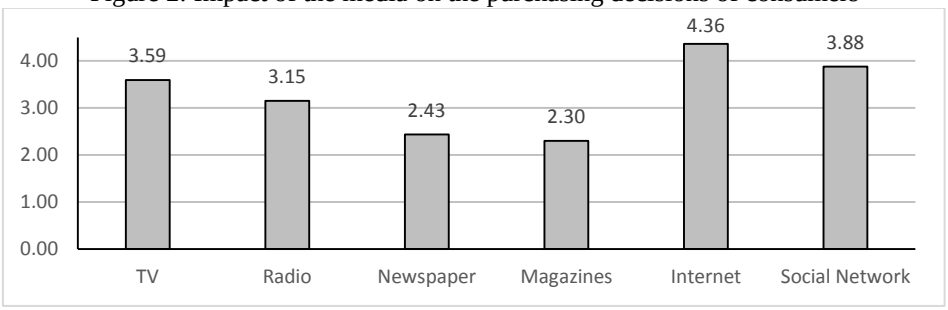
We asked respondents about the importance of leaflets received in mailboxes by traders in their purchasing decisions (Picture 1). For answers, we used the Likert scale ranging from 1 - has no influence, and 5 - has a huge impact. 51 (12%) of respondents answered that flyers do not have any influence on their purchasing decisions, 57 (13%), that impact is very small, 145 (34%) that leaflets sometimes influence their purchase decision, 106 ( 25%) that impact is significant, and 70 (16%) of respondents answered, that leaflets have enormous influence on their purchase decision. The average score of all answers is 3.2, which means that the leaflets are often an important influence on the purchasing decisions of consumers. Based on the results we can confirm the hypothesis 1 (H1), "By all the media have the greatest influence on purchase decisions of the consumers the leaflets delivered by traders to consumers mailboxes".

Figure 1: Impact of trader's flyers on the purchase decisions of consumers



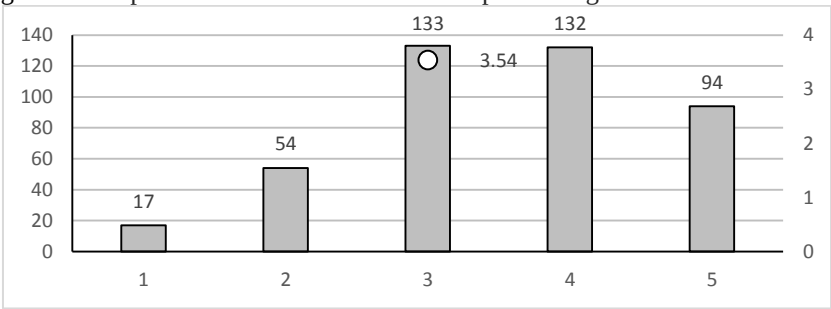

In the study we assessed the impact of the media on purchasing decisions (we used the Likert scale from 1 - no impact to 5 - very strong influence) and found that on average the greatest impact on the purchasing decisions of consumers has the Internet (4.36), followed by a Social Network (3.88) and TV (3.59). Even Radio with an average of 3.15 still has a significant impact, while Newspapers (2.43) and Magazines (2.30) also do not have a major impact on the purchasing decisions of consumers (Picture 2). Based on the results we can confirm the hypothesis 2 (H2), "The greatest impact of all media on the purchasing decisions of consumers have Internet".

Figure 2: Impact of the media on the purchasing decisions of consumers




Since the media play an important role in informing consumers and thus indirectly also affect the purchase decision, we asked respondents how important is the role of the media in general, in their purchasing decisions (Picture 3). We used a Likert scale where 1 is no impact, and 5 has a huge impact. For 17 (4%) respondents the media have no influence on their purchasing decisions, on 54 (12%) media have a very limited impact, on 133 (31%) media sometimes influence on purchasing decisions, on 132 (31%) media often and considerable influence, and on 94 (22%) media have an immense impact on purchasing decisions. The average value of all responses was 3.54, which means that the media often and have an important role in the buying decisions of consumers. Based on the results we can hypothesis 3 (H3), "according to their view of consumers surveyed have a reception for media purchasing decisions very large impact" confirm.

Figure 3: The power of media influence on the purchasing decisions of consumers




The survey shows that the gender does not have an impact of the media on the purchasing decisions of consumers. However, there are statistically significant differences (we used the method of comparison of mean values) about the living space. The media have a statistically significant greater impact on those who live in flats (Table 1 and Table 2). The results are logical because mostly in households purchases are made by women. At the same time, taking care of everyday purchases are in line with the

current economic situation often faced with the choice of an appropriate amount of money. Companies try to make that choice for consumer easier and deliver the leaflets with special offers and advertisements to offer certain products and services, which family need.

Table 3: Compare mean for media impact on buying decision and gender of the respondent

| | gender | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| How strong is the media impact on your buying decision? | Woman | 331 | 3,56 | 1,136 | ,062 |
| | Man | 99 | 3,47 | ,896 | ,090 |

Table 4: Significance of the media impact on buying decision and gender of the respondent

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| How strong is the media impact on your buying decision? | Equal variances assumed | 9,996 | ,002 | ,677 | 428 | ,499 | ,084 | ,124 | -,160 | ,329 |
| | Equal variances not assumed | | | ,768 | 201,004 | ,443 | ,084 | ,110 | -,132 | ,300 |

A statistically significant difference (depending on the method used, the comparison of the mean values) in the impact of media on the purchase decision also occur in conjunction with the monthly income. Those respondents who have a monthly income of 800 EUR is the influence of the media more than those who earn more than 800 EUR. The results reflect the real situation because those with low incomes are more price sensitive and want to spend money they have available rationally. They are looking for action product and more likely to seek an opportunity for bargains compared with those with higher incomes (Table 3 and Table 4).

Table 5: Compare mean for media impact on buying decision and monthly income of the respondent

| | Monthly income | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| How strong is the media impact on your buying decision? | >=800 EUR | 281 | 3,56 | 1,051 | ,063 |
| | <800 EUR | 149 | 3,50 | 1,149 | ,094 |

Table 6: Significance of the media impact on buying decision and monthly income of the respondent

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| How strong is the media impact on your buying decision? | Equal variances assumed | 1,631 | ,202 | ,503 | 428 | ,615 | ,055 | ,110 | -,161 | ,272 |
| | Equal variances not assumed | | | ,490 | 279,469 | ,625 | ,055 | ,113 | -,167 | ,278 |

Depending on the age of the respondents (regardless of the method of comparison of averages) we also observed a statistically significant influence of the media on purchasing decisions. At the respondent older than 40 years, the media have a stronger influence on purchase decisions. Respondents older than 40 years have a family and children and should take care of their household. The needs of families are certainly greater than the person who lives alone, so they monitor a special offer when they purchase. Otherwise, the wishes, needs and interests of older people are different, which certainly affects the ways and approaches to the selling decision (Table 5 and Table 6).

Table 7: Compare mean for media impact on buying decision and age of the respondent

| | Age in year | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| How strong is the media impact on your buying decision? | >=40 | 253 | 3,63 | 1,052 | ,066 |
| | <40 | 177 | 3,41 | 1,120 | ,084 |

Table 8: Significance of the media impact on buying decision and age of the respondent

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| How strong is the media impact on your buying decision? | Equal variances assumed | ,537 | ,464 | 2,131 | 428 | ,034 | ,226 | ,106 | ,018 | ,434 |
| | Equal variances not assumed | | | 2,108 | 363,579 | ,036 | ,226 | ,107 | ,015 | ,436 |

## Conclusion

The study examines the media influence on the buying behaviour of Slovenian consumers. Products and services on the market today due to strong competition becoming increasingly similar, standardised, consumers can collect from a wide range of products of domestic and foreign origin, to satisfy their needs. From the preferences of each, it depends on which product to choose between buying and what factors will influence the purchase decision. Knowing the purchasing process for each enterprise is crucial since both easier and faster to adapt to the wishes and needs of consumers to improve their business. Different media have different, but very often important influence on the buying behaviour of the consumer and on their purchasing process.

In this study, we found that all the media for the reception of the purchase decisions of consumers the greatest impact has internet. The Internet as a global communications and information network launched the biggest changes in the field of marketing. By using the Internet is the interconnected world, in the form of online marketing were also linked companies and their consumers. They communicate with each other through digital media, through which the company closer to its consumers to realise and understand their needs and expectations. Such form of communication facilitates the communication of information on the company and its products or services and the immediate response of consumers. Through the use of online social networks becomes communication between businesses and consumers a dynamic and up to date. Consumers could ultimately become the creators of success stories of companies because their responses, suggestions and criticisms directly affect the company.

With the research, we have found out, that media have a significant influence on the buying behaviour of consumers, if their incomes are lower than 800 EUR and if they are older than 40 years.

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# Procesi upravljanja projektima u kulturi

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**Apstrakt:** Tema ovog rada je upravljanje procesima u kulturi pa je logično da na samom početku objasnimo pojmove menadžment i kultura. Iako su mnogi teoretičari sa različitih aspekata objašnjavali šta je to kultura, jedinstvene definicije nema. U ovom radu pokušali smo da pronađemo najjednostavniju definiciju koja bi omogućila da bolje razumemo ovu obimnu materiju. Pokušali smo da objasnimo povezanost i uticaj projektne organizacije u kulturi, o kulturnim potrebama. Zatim smo se osvrnuli na kulturnu organizaciju kako bi razumeli kako je došlo do potrebe za menadžmentom u kulturi. Detaljnije smo se bavili menadžmentom pozorišta, scenskim projektima, a zatim smo pokušali da objasnimo kako se takve aktivnosti finansiraju. Na kraju smo istakli koje su to veštine dobrog menadžera u kulturi i zašto je neophodno da oni budu veoma obrazovani i sposobni jer od njihovih sposobnosti zavisi realizacija mnogih ideja i zamisli. Detaljnije smo se u radu bavili realizijom konkretnog projekta u pozorištu kao i finansiranjem zadataog projekta.

**Ključne reči:** Upravljanje, projekti, organizacija, finasiranje, kultura, pozorište

# Project management processes in culture

**Abstract:** The subject of this paper is how to manage the processes in culture, so it is logical to explain at the outset the concepts of management and culture. Although many theorists with different aspects have explained what culture is, there are no unique definitions. In this paper we tried to find the simplest definition that would allow us to better understand this extensive matter. We tried to explain the connection and the influence of the project organization in culture, on cultural needs. Then we looked at the cultural organization to understand how the need for management in culture came about. We dealt in greater detail with the theatre management, stage projects, and then we tried to explain how such activities are financed. In the end, we highlighted the skills of good managers in culture and why it is necessary for them to be highly educated and able to depend on their ability to realize many ideas and ideas. In detail, we dealt in detail with the realization of a concrete project in the theatre as well as financing of the given project.

**Keywords:** management, projects, organization, financing, culture, theater

## 1. Introduction

There is a strong need for an organized system that will ensure equitable development, both within the institutions themselves and between institutions at the regional and European level. In order to continue the progress of knowledge, a demand for new skills in activities is necessary, ie exchange of experiences in cultural practice is necessary.

Art education is a part of social science, a system based on the psychological development of a modern man, in which he has a special place. Therefore, cultural institutions become centers of art education, while educational programs provide a permanent audience.

Also, fundraising is one of the important issues within cultural activities, as well as the design and management of certain projects in culture. Modern art and culture are an important addition to contemporary life and link aspects of popular culture, contemporary civilization and developmental development. Through art, a glimpse of the world of values and all open questions is created, which art helps the advancement of a human being and the development of specific thinking.

Project management is a kind of project management technology. However, project management is significantly different from other areas of business management by subject of management. While the subject of production management, marketing, finance and other areas is the business function of an enterprise, the subject of project management is a project. Therefore, project management integrates numerous specific activities on the preparation and implementation of the project, as well as activities from other business areas.

The importance of project management is growing in contemporary conditions characterized by frequent and sudden changes in the conditions of business, accelerating technical and technological progress, shortening the life cycle of products, increasing uncertainty. Project management is such a new approach to governance that encourages creativity and accelerates change. At the end of the eighties, the development of the concept and methods of project management developed a completely new approach to corporate governance, called project management. There is also a question of the possibility of implementing total quality management (TQM) in culture, like in other industries (Ilić, Ilić-Kosanović, 2019) which is not going to be analysed in this paper.

## 2. Types of theater management

Management activity is defined as the process of planning, organizing, managing and controlling the efforts of members of the collective and using all of the company's resources to achieve its goals. This activity is conditioned by the complexity of the organizational structure of the company, which includes a number of elements interconnected horizontally and vertically (Arvola, 2018). Successful functioning of the company is therefore conditioned by the harmonious connection of all elements of its organizational structure and the direction to achieve the planned goals determined by the management activities of its management. In order to ensure the effectiveness and efficiency of the enterprise, it is necessary to ensure the implementation of the principle of division of labor. On this basis, specialists are established of partial tasks in the organizational structure, to which are assigned the management competencies, and hence the responsibility for performing the tasks assigned to them on the basis of division of labor. The thus constituted segments of the organizational structure provide a higher degree of motivation for the partial tasks for contributing to the success of the company's operations as a whole. This motivation is encouraged, on the one hand, by delegation of responsibilities in planning, coordinating, and controlling the execution of partial tasks, as well as the responsibility for the rational use of human and material resources, and, on the other hand, by conditionalizing the salaries of responsible staff contributing to the success of the enterprise as a whole (Ayodeji, McCarthy, Imcha, 2016). In the decision-making and accountability process, in accordance with the degree of competence to achieve the goals of the company, the theory and practice of management distinguish three basic variants of management activities:

- strategic management,
- operational management, and
- management of business areas.

## 3. Project organization in theaters

Great technical achievements and technological innovations have led to a sudden increase in social and economic power. The privileged position of the technique in relation to cultural activity means the general technique of the means of labor. This leads to the extreme specialization that man stops and duplicates to the detriment of his individuality (Considine, 2017).

Today it is obvious that the repercussions of the permanent preference of technology and technology impede the development of humanities and culture, in particular psychology, pedagogy, ethics and aesthetics. The greatest danger for an individual is to be absorbed as an instrument and confined to the field of technique. In the development process of man and society, a holistic approach should be sought. It guarantees a balanced development of scientific fields, art and other creative spiritual forces.

Radical changes and experiences in technology and technology have led to significant modifications in culture. The numerous and diverse options in the development of culture have led to the re-examination of traditional cultural and artistic values (Davel, Liborio, 2012).

The devastating effect in culture is the most effective means of opposing the democratization of cultural life directed against politicization and commercialization.

The process of democratization in the society by favoring free expression and valorizing cultural and artistic creation enables the immediate application and wide use of the original cultural content, with the possibility of the presence of antinomies, multifaceted and sophisticated opinions.

It is true that it is almost impossible to find in the history of any society, an example of the complete overcoming of the antinomy of freedom and the safety of the creator. However, social actions aimed at improving art, when it comes to subsidies, are useful and welcome only if they represent "non-interference assistance" (Harvud, 2010).

Culture as an organized system depends on the creation of general spiritual values. In this process, culture represents the energy that is put into the service of man in order to regulate the human behavior directly related to the maintenance of life.

Culture is expected to open aspects to a higher, cleaner, and spiritually brighter world. The primary task of culture is to act ennobling with the ultimate goal of making humanity the general interest of spirituality.

Within the cultural system, subsystems which effects are not equally represented are expressed. Each subsystem has its own development paths and peculiarities. Art as "the aesthetization of the spirit" creates its "own world" by shaping the artwork (Filippeli, 2019).

The development of art requires a democratic basis for political, and freedom of creation on the individual plane. The artist's freedom of creation is possible only in the cultural climate that mobilizes cultural actions, develops feelings and encourages creativity. In order for the artist to be truly free, and art is a spiritual liberating actor, he should allow him to freely create and use the results of his work In addition to satisfying subjective artistic tendencies, there is a need for those who have the needs to enjoy the arts. It is also a sociological phenomenon that is specific in the field of artistic works. It is a theater work that is at the same time both creative and observer.

Free flow of artistic achievements achieves cultural cooperation among countries, regions, groups and individuals, thus contributing to common cultural permeation and enrichment. Therefore, every cultural particularism means distancing from the world and separation from culture.

Every autochthonous work of art speaks with its own language different from that which is the expression of everyday communication. However, if this untranslated, essential nature of the artistic language was omitted, it would mean that the artistic content must be adapted to the existing reality and lose its autonomy.

With the emergence of possible alienation of culture, the following questions are connected: How and in what way does the cultural activity and cultural influences take place? Are the goals and basic requirements of cultural and artistic creativity realized?

In this case, the artist should not give up his ideals, his chalk, to retreat into himself or move within the given coordinates. Such isolation would inevitably lead to the annulment of the integrity of the artist's personality, and therefore of art. Namely, if such effects would have occurred, it would mean that spirituality from the sphere of culture would fall to the realm of necessity and material elements. This would lead to the rule of culture. The tendencies of such implications exist in the modern world and are threatened to prevail, even where they are established in democratic institutions. Only by critical thinking, reasoning and assessment, based on facts and experience, it is possible to confront such trends in culture.

Realization of a complex organizational project, with a unique program and simultaneous participation of a large number of functionally different organizational units with highly professional personnel profiles, within the available resources and the deadline for completion of works, requires the organization's adaptive structure, flexibility in functioning and management, as well as efficient control of the execution of tasks These tasks can not be successfully implemented by the local sector organization with strictly formulated competence and rigid hierarchical management relations. Namely, for every enterprise that is a specific production and technological unit, it is necessary to create a special team (the team) (Oreste, 2009). The most distinguished problems related to the human

resources management in project oriented organizaitons include, but are not limited to, time constraints and dynamics, multiple roles of the employees on different projects, team competencies, knowledge management, employee development, motivation and rewarding (Ilic-Kosanovic, et al. 2016).

In the first instance, such an organization was present only in scientific research, and then in every slightly more complex project, whose sole aim was to achieve a certain projected program. Its basic characteristic is the team (team) operation of the entire organization. The effectiveness of the projected organization depends on the attitude of associates, their behavior and motivation, interaction, communication and group co-operation, as well as proper control over work. The internal organization makes an adequate connection of the basic activities in certain functional areas. On these organizational premises, the efficiency of dynamic management of the process of work and development is based, and with the help of modern computational techniques.

For each project, it is determined: the goal that is to be achieved, the program tasks, the available resources and the deadline for completion of the project work. Defining a Goal means defining the ultimate results expected from the project. When defining the goal, it is important to point out what the accomplishment of the project task is and what implications can be expected if the project tasks are not realized. Depending on the available resources, human resources, technical and material-financial, it depends whether the projected project will be able to successfully and timely implement it. In that sense, it is necessary to carry out specification of all sources in quantity and quality. Possible restrictions may jeopardize the execution of the project Establishing the time to execute a project is of exceptional significance, since it usually co-operates with the team set up, a large number of other collaborators, so that only coordinated and coordinated work at all stages of the project, using methods and techniques for planning and monitoring of project tasks and activities, can lead to timely completion of all works on the project.

Comparing the planned and realized parameters and indicators in the organization process should also enable identification of causes of deviations in order to eliminate the harmful effects on the causes and, if possible, to establish the planned state. Delays, especially in the later stages of project realization, can be difficult to remedy with subsequent interventions. This is particularly burdensome when simultaneously working on several projects. The organization of work on the project assumes a certain structure, while ensuring the predicted potentials in quantity and quality. However, the full utilization of the potential is difficult to achieve, since certain cadres and other potentials that are formative are necessary, can not be overburdened and exploited for the duration.

Insufficient structural flexibility prevents the allocation of unused potentials to other projects. In order to highlight the organizational deficiencies, the elements of the matrix organization are introduced into the project organization by grouping experts within the specialized organizational units and their detachment into individual projects for carrying out certain expert works. Namely, each project is assigned personnel from specialized units to perform certain tasks. They are members of the project team for that time. The organization is a modification of a pure project organization, but the basis of the project organization remains unchanged. The matrix project organization is particularly suitable for use in conditions where program complex tasks with relatively short deadlines occur. The latest tendencies in the field of modern organization are moving towards the full humanization of work and complete liberation from any given schemes and forms in the design of a specific organization. The organization should be designed depending on the external and internal factors and changes that occur in them, taking into account the conditions underlying the core business.

## 4. Organizational structure

Under the structure is meant the internal composition of a set of factors of a whole, linked by certain relationships, in which each element has its own role. Whether some of the given factors change or some of their significant properties changes, the structure changes.

In relation to an organization, the notion of a structure is used to denote uniform, standardized features of the parts and elements that make up the composition of an organization. In doing so, one should point out the difference between official, normative attitudes and definitions, and solutions made within the organization itself, which due to divergent attitudes can have serious methodological implications. This particularly applies to a number of determinants that reflect on the organizational structure in different variants. In defining the notion of organizational structure, the most often starts from factors

that significantly influence the "building" of the organization, such as: goals, activity, program orientation, work technology, human factor, social ordering. Thus, the organizational structure is considered to be a mechanism for the implementation of the organization's goal and the way the organization operates as a whole. The organizational structure contains a schedule of functions by organizational units (sectors, departments, units, groups) and individuals (horizontal structure). The interconnection of parts and the functioning of an organization as a whole characterize the structure as a "stable system of coordinated relations" (Rhine, 2006).

By developing the division of labor and the tendencies toward wider decentralization, with the intensification of the process of multifaceted diffraction, the problem of management and management emerged in the increasingly complex structural organizational conditions. Due to the breakdown of the common single goal, the goals of individual organizational parts of different levels are formed. vertical structure, which includes:

- Organization of management,
- Decision levels, prior information, and
- Subsequent enforcement control decision.

This structure becomes more complex in more complex conditions. So the problem of communication between peaks and the lowest level arises. Differences in the conceptual definition of the organizational structure indicate that the analysis and description of the organizational structure is a very studious and responsible task, whose complexity grows in the increasingly complex conditions of designing and realization of the appropriate model of organization. This concept comes from different starting points, so the priority in one definition is given to one element, and in another definition to another element. So the question arises: can it be said about common characteristics or there are significant differences, and what is their essence?

It is known that each organization should ensure the conditions for carrying out activities aimed at achieving the set goals. The technology of performing these activities depends on their nature and nature. The mere fact that such activities can be directed and coordinated in various ways means that organizations can have a different organization structure. Obviously, from the mentioned factors that influence the organization, it depends not only on defining the concept of organizational structure, but also on constructing the appropriate structure, so we conclude that there are several different types of organizational structure. In other words, there is no general, unique and unchangeable type of organizational structure. The number of possible combinations is large, and everything depends on the goals, as well as the external and internal factors. When designing a particular organizational structure, the basic move is to identify important organizational elements in the production process, which united as a whole provide frameworks for the organizational structure. They should include communication threads that connect individual organizational units and functional cohesion forces (Russell, Daniel, 2018).

All of these components are interdependent, and their web serves as a basis for building a consistent mechanism, which will enable normal activity and successful performance of the functions of the organizational unit. The success of building an appropriate organizational structure depends also on the degree of organization of the elements that form the organizational structure.

## 5. Models of organizational structure

Technologies of the basic activity of a particular organization, the organizational structure can be broken down:

a) In the same area of primary activity - by function, with one or more units of core activity, where other, general functions of professional services are entrusted to other specialized institutions. This organizational structure is suitable for organizations with a smaller scope of the same basic activity.
b) By functions, groups of professional services, where the main activity is not structured by special units. Groups of professional services are examples; their number in a production, traffic or service organization may be greater or smaller, and their jobs are different in function (for example: instead of a library, a lab or a control group).

## 6. Creating production process (project)

The creation of a future theater performance differs substantially from the production cycle in standard production. Each performance makes one creative whole. Its structure depends not only on the author of the theater part, but also on the numerous subjects involved in it (Singer, 1992).

The theater performance, from the conceptual point of view or as an aesthetic phenomenon, makes one indivisible totality of events. The complexity of these phenomena is such that their analysis does not lead to any individual independent elements. This indicates that it is necessary to start from the complex concept of the from a point of view, a theater performance as one whole consists of parts and elements that are in a certain relationship. The research of this whole, the relations of elements and elements, as well as their place in the structure, shows that this structure should not be treated as a static category and that no emphasis should be placed on a formalistic approach.

In order to explore the structure of the complex and dynamic organization of the theater performance and the interdependence of components and elements, it is necessary to perform their functional analysis. However, by using only functional analysis we cannot completely and fully explain the development and change of the relationship and phenomenon causally. It is necessary to examine them causally, because each phenomenon and form, as a rule, represents the unity of diversity.

Given that the premiere of the theater performance is preceded by a long and complex process of artistic and professional work on the project of the theater performance, we will first analyze the elements in the design of the play (Smart, 2016).

The period from the idea that some work is imagined and set up to the realization it is the process of designing a theater performance. The organization of the project idea starts from the program tasks and activities defined by the structure of goals. Objectives define the strategic, and the activities are operational goals. The complex nature of the project assignment conditions for most projects decomposition into their components (for example: directing, acting, stage design, costume design, choreography). The degree of complexity of the task depends on how many levels these components will be composed (conceptual solution, tests, technical preparation, workshop drawings, the process of making); at each level, appropriate interaction relations are established, and consolidation is achieved at the level of the whole. The dramatic work, transmitted through the project into the play, is a new autochthonous work, which is not only by the technology of creation, but also by the artistic range and social recognition. These qualities, as already said, give the theater project a character of a special identity.

## 7. Design and implementation of theater

The theater project, or the performance, opens the possibility not only of introducing the appropriate organization. But also the constitution of new relations in theater activities. Unlike other social activities, it can be said that in the stage-art sphere, the subjects of association are the most comprehensive and most directly connected. Their integration ties to full expression come precisely at a stage when a team (team) creates from the individual subjects with the task of designing and realizing the theater play; the new unit assumes the attributes of an artistic, sociological and economic whole, though limited time duration (Stepp, 2009).

In contrast to the classic organizational impact, in addition to the eventual redefinition and redistribution of functions and roles in this organization, the overall impact is reflected in the organization of governance and decision-making. Namely, the members:

- work together effectively in the form of cooperative efforts of an interdisciplinary character, so that a successful outcome represents a new type of satisfaction that exceeds the satisfaction that flows from individual efforts;
- they know where they make decisions and accept them more easily as a result of the authority;
- by the consensus of team members (teams) affect the probability of implementing decisions;
- mutual understanding and trust, allow problems to be addressed and resolved without conflicting situations;

- they should be ready to look for ways and ways to solve the problem, if necessary, to change their attitudes and behaviour, if this is in the interest of the theatre project or the comparison;
- achieving stage results, successes in the short term motivate them and give them the strength to achieve long-term goals;
- by making certain efforts, they must evaluate their own strengths and weaknesses in order to mobilize forces and eliminate the identified weaknesses;
- they should be open to each other and realize that the feelings, attitudes and emotions of each individual are very important, that they must be critically approached to bring hidden problems to the surface.

From these several characteristics, it follows that the behavior of team members is determined by a considerable number of factors. Already the initial step of identifying a particular state and relationship can be of the utmost importance. The organization of the team (s) is crucial to the psychological structure of its members. The understanding of the structure is reduced to the analysis of similarities and differences in certain aspects of cognitive content that reflect on their attitudes and behaviour (Toelle, 2012).

The similarity of attitudes is manifested in the strong dominance of positive mutual orientation, which leads to homogenization for identical interests.

As subjects of the creative process, participants of the performing arts participate in the organization of the theater performance, which is a special satisfaction for every participant.

By initiating and introducing self-organizing elements into the organization of the theater performance, conditions are created for the constitution of such solutions and mechanisms, which will strengthen creative motivation and initiate greater effects and more valuable results (Brext, 1966).

The elements of self-organization appear in a dual sense:

- in a certain autonomy which is the assumption of a project or a performance in relation to the theatre organization as a whole, and
- combining the interests of members, which is a prerequisite for any integration.

In doing so, divergent interests can be solved only by finding a global interest, which is achieved by resolving individual interests and by objectifying partial interests. By integrating and harmonizing the interests of all subjects involved in the design and realization of the theater performance, there is a unity that leads to a common goal.

Self-organizing elements can only be expressed in terms that enable full creative initiative, artistic freedom and equal participation of each member of the ensemble. Starting from these positions, the organization of the theater project or performance will not be depersonalized with the group group, nor an idyllic organizational unit, but an organizational component of the theater production process with the task of realizing a certain performance by the joint efforts and efforts of all its participants.

**Financial issues in theater projects**

Theater work achieves intense effects on public awareness and culture. But in practical social valorization, although qualified as an activity of special importance, it does not achieve that significance of an exponential position.

Namely, in the normative activity the services of social activities are often not differentiated, which means that the stage-artistic activity is equal with the health, social protection, educational and similar. It is true that theatrical art requires certain properties as well as other social activities (knowledge, experience), but it differs in many respects from other social activities. Therefore, every uniform treatment in the legal regulation has negative consequences for the organization of the stage-artistic activity, because it leads to the unidentified application of the legalized legal institutes and stereotypical organizational solutions (Vasic, 1973).

On the other hand, when it comes to social activities, the fact is that the mere functioning of market law cannot be the only basis for harmonizing the work, the need and evaluating the results. Namely, the

scope and intensity of the requirements for these services is such that the application of commodity-market mechanisms would not satisfy the needs and interests of their users.

The repertoire theater as an art and cultural institution performs educational and educational functions in the widest social layers. It is therefore understandable that the prices of theater tickets are accessible to all categories of citizens. But in this case, the theater should compensate for the difference between the actual ticket price and the nominal, benchmarked price. Then this difference will not constitute aid or non-purpose grant, but a refund in the name of a difference to the actual price of theater work. When it comes to price, its function and structure, there is no justified reason that the cost of the theater performance differs substantially from the price in material production. This means that the price is first of all based on the elements of planned calculation with the forecasts of the amount in the course and their resources, direct and indirect costs, as well as the obligations that burden the project or the performance. As the costs in the planning calculation, the fees of the artists and other participants in the project are also represented, as well as the proportion of funds for expanding the material basis of work and for the reserve. In order to optimize the financial parameters of the project or the performance, one should analyze the individual elements of the cost structure in their interconnectedness, and on the basis of the economic calculation. Namely, costs do not always start as planned, because it is not possible to foresee all the circumstances that affect them. Thus, any delay in changing the basic concept of the project idea results in, as a rule, the loss of previously invested funds. Modern information systems provide sufficient opportunities to successfully record and monitor the planned parameters and achieved results. Plan calculation and recording of realized revenues and expenditures according to the project, i.e. present, require appropriate changes in the bookkeeping records, introduction of work orders and operational records of the realization of the project or the performance. The costs should be monitored not only by type, but also by the phases of work. In this case, the project or performance may have a special accounting status (Bogdanovic, 2005).

The economic modeling of the creative and production process in the theater is a very complex task. Namely, in the technological and organizational modeling of this process, different alternative solutions are possible, in addition to artificially worthy, those who are economically advantageous, however, have been adopted. However, any planned capsulation of the theatrical project loses its resonance when the institution for financing the culture compensates for the realization of the project, and exclusively for the whole program activity of the theater, without taking into account the effects of this activity (the performance of the performance, the number of performed performances, the placement in the audience, etc.).

Failure to establish more realistic bases and criteria for the evaluation of theatrical activity means to deny that activity an equal socio-economic position and its individual subjectivity.

A special calculation status allows responsible team members to have a constant and full insight into the status and movement of costs on the project in order to eliminate possible adverse effects by timely interventions. The basic assumption is that members are materially interested and stimulated to make the performance as much artistic and material as possible, and to keep it as long as possible on the repertoire. Through this, the artistic results in the repertoire theater would be correlated with the financial effects, and in this way, members of the artistic ensemble will rationally use all possible resources during the work on the project, or present (Grant, 2006).

Obviously, the previous system of financing theater activities did not give the expected results. Therefore, instead of alimenting the program or repertoire of the theater as a whole, it is necessary to finance projects as units of account, which means with the calculation of revenues and expenditures. The agreed fee must be a billing convention, whose structure and value expression is based on previously established standards and norms specific for covering the theater activity. Previous research in this domain shows that it is possible to objectify the relations in gaining the income of the theater, through: an agreed fee that will compensate for the uncovered amount of the real cost of the cost of the theater performance and the price of tickets for a particular performance. It is evident that the contents and modes of the repertoire theater work, in addition to programming, have i-their economic dimensions, which are often repressed and neglected in the practice, which conditions the existence of disproportions in their material and financial flows (Pajkić, 2005).

The discrepancy between artistic and material-financial proportions objectively leads to disturbances and delays in the conduct of theater activities and negatively repercussions on the overall socio-economic position of the theater.

The former parafiscal character of financing the theatrical activity does not ensure members of the artistic ensemble and other collaborators on the project, that is, present, to decide on their own problems and interests in an objective way.

## 8. Conclusion

Art is characterized by the advantage of creative over ordinary productive work. What characterizes freedom of design in theatrical art is that with each performance the theater play becomes different. However, the principle of the identity of the theater work remains unchanged. This characteristic of the origin and performance of the work is also reflected in the organization of the theater.

The creative-production process and the technology of work in the theater essentially differ not only from material production, but also from other activities in the cultural-artistic sphere, so that their uniform treatment in the field of organization ignores the specificity of theatrical activity. The dynamic character of theater activities, conditioned by frequent changes in the artistic conception of design and realization of the theater performance, requires a flexible structure and adaptation elements in the process of organizing. Therefore, there are no instruments, no solution can be normatively constituted and organizational classical.

Namely, analysis of organizational design and procedures for designing and performing theater performances shows all the variability of technical and technological documentation due to the transformation of process elements, which makes applications on new situations.
The application of normative organizational requirements to the structure of the theater organization is often an expression of voluntaristic and pragmatic asylum solutions rather than scientifically based principles of modern organization.

For effective organization, it is not enough to set up only the appropriate forms of organization. Institutional forms seek to determine the interdependence of the parts with the whole and parts among themselves, in order to avoid organizational deviations that inevitably come due to imprisonment, stiffness and partial organizational regulation. The same consequences lead to favoring the process of atomization of organizational forms. The artistic setting of the theater performance presupposes the organizational shaping and linking of all activities, not only with conformity, but also constitutively. In other words, while analytical analysis of artistic roles and professional tasks is carried out, organizational integration and structural construction are achieved synthetically. In that sense, the theater organization creates the conditions for further improvement and improvement with its instrument.

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# Optimizacija baza podataka u poslovnim sistemima

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**Apstrakt: Sažetak:** Problem istraživanja u ovom radu jeste poboljšanje performansi poslovnog informacionog sistema kroz optimizaciju rada baze podataka. Definisani su procesi optimizacije sistema za upravljanje bazama podataka koji omogućavaju određene prednosti. Predstavljene su tehnike čijom upotrebom se postiže bolja iskorišćenost računarskih resursa, a koja se ogleda kroz veću brzinu izvršenja upita. Dobijeni rezultati čija primena može smanjiti vreme izvršenja upita, odnosno smanjiti opterećenja memorijskih sistema i procesora, dati su u obliku preporuka za optimizaciju. Krajnji rezultat je produktivniji rad baze podataka, pa samim tim i informacionog sistema.

**Ključne reči:** optimizacija, sistem za upravljanje bazom podataka, SQL

# Database optimisation in business systems

**Abstract:** The research problem in this paper is to improve the performance of the business information system through the optimisation of the database operation. Defined optimisation processes for database management systems provide certain advantages. The techniques used to achieve better utilisation of computer resources are presented, which is reflected in the higher speed of the query execution. The obtained results whose application can shorten the execution time of the queries, or reduce the loads of memory systems and processors, are given in the form of recommendations for optimisation. Final result is the more productive work of the database, and therefore the information system.

**Key words:** optimisation, database management system, SQL

## 1. Introduction

By developing the economic and social aspect, the amount of data that is needed to process and store is exponentially increased. Processes characterised by increasing the amount of information influence the development and administration of information systems, that is, database system development. A variable business environment causes faster data processing by the database system in order to meet business requirements. One way to improve database characteristics is the query optimization process.

The subject of research in this paper is based on improving the commands' performance that have a longer execution time and therefore unnecessarily occupy database resources. This can be solved using certain optimisation techniques. The optimisation effects can affect the work of the database in different ways. Non-optimised queries can occupy available resources.

The aim of the paper is to come up with practical recommendations related to database optimisation, whose application leads to the efficiency improvement of SQL commands executing. Given recommendations have a different effect on instruction performance improvement in different environments. Adequate use of recommendations in defining certain commands helps the optimiser to create a preferable execution plan.

## 2. Optimiser functions

The optimiser itself is an essential part of database optimisation, because the optimiser output is execution plan that presents the optimal way of command executing. The plan provides a combination of steps that execute SQL command. The goal of an optimiser is to choose a plan for which execution

requires the least number of resources. Also, the optimiser aims to select the one whose execution time is the shortest due to choosing a plan.

Several steps of the optimiser are given below:

1. The optimiser generates multiple potential plans for SQL commands;
2. Optimiser calculates the cost of each plan individually, based on statistics. The cost is the estimated value proportional to the specific resource consumption required to carry out the execution plan. The optimiser calculates the cost of access paths and join operations, which depends on the estimated consumption of computer resources, i.e., i/o, CPU and memory;
3. The optimiser compares the cost of the generated plans and chooses the one with the least cost.

Optimiser operations include (Oracle, n.d):

1. The SQL command transformation,
2. Total costs estimation,
3. Generating a plan of execution.

The main function of the optimiser is to take into account different plans for executing a particular command and to choose the one with the lowest cost. Different plans are possible due to different combinations of access paths, table join method, the merging table ordering. The order of joining is the order in which specific data is accessed, sush as tables, and the connection is made. The number of possible plans is proportional to the number of objects listed in the FROM clause. Given number increases exponentially with the number of objects being merged increasing. The planner internally eliminates other plans when finding the plan with the lowest costs. Internal check is based on the costs of the current executive plan. If the cost of the current plan is high, the planner is trying to find a plan with lower costs. If the current plan has low costs, the planner terminates further plan searching, as there would not be significant improvements. An internal search will be good if the planner initially finds the order of execution that will produce a cost plan close to the optimum, but this rarely happens. (Boicea, et al., 2016)

The execution plan is formed by generating the execution subplans for some embedded subqueries. The inner part is optimized first and subplan is generated for it. The outer part that represents the complete command, the last one is optimised.

## 3. Some optimisation techniques

The paper presents some techniques for database optimising, that is, techniques which will be used in next pages.

*Memory management*. By setting certain memory parameters, it can be noticed the difference between commands executed in a few seconds, unlike those that take a few minutes. There are three parameters that need to be set due to properly memory managing:

PGA_AGGREGATE_TARGET,
MEMORY_MAX_SIZE,
MEMORY_TARGET.

An important part of optimisation is adequate memory management. If memory allocates inadequately, performance problems could occur, and in this case, optimisation techniques may encounter restrictions when attempting to improve the efficiency of executing commands. It is therefore desirable to know the memory structure in Oracle and MS SQL server database management systems.

*Indexes*. In most cases, the cause of poor performance is the use of tables above which no index for the searching columns is made. When there is a large number of rows in the table, there is also an inefficient set of scanning operations for the entire table in order to find those rows that satisfy given condition. Indices can also have a poor performance impact. When data is added, deleted or updated, all table indexes that affect it must be updated due to maintaining given changes, thus extending processing and increasing the system load. (Microsoft, n.d.).

Indexes have three important uses:

1. Quickly find the appropriate rows without using a full table scan operation;

2. They serve to avoid reading the table if the information is located in the index.
3. They serve to prevent sorting. Sorting is executed for a lot of reasons if there are clauses: ORDER BY, GROUP BY, DISTINCT. If the sorting operation requires the same order as in the index, the data can be read from the table via the index.

*Partitioning.* Partitioning is a method of optimisation, which in most cases is the last one applied. The term means the database division or parts of a database into elements that are independent. Usually it is used to improve performance, simpler data management, as well as to increase data availability. Partitioning is performed by the partition key.

*Hint.* The tips allow us to influence the optimiser's decision during the execution plan generating. Hint is a mechanism that directs the optimiser in order to choose execution plan with certain access paths or operations. The role of the optimiser is to generate an optimal execution plan. If the optimiser performs well, hints should not be used. However, due to frequent data changes, the statistics are outdated, therefore, the optimizer could make mistakes in choosing the best execution plan. In Oracle databases there is a possibility to lock statistics if they are well, making the use of the hint useless. Hints can be complicated, which is why they are often used as the lowest tool due to changing the execution plan of the command (after changing statistics, changing instance parameters, etc.). The use of a hint can serve to override parameters of parallelism, makes indexes visible, can cache an appropriate query, etc. (Nyffenegger, n.d.)

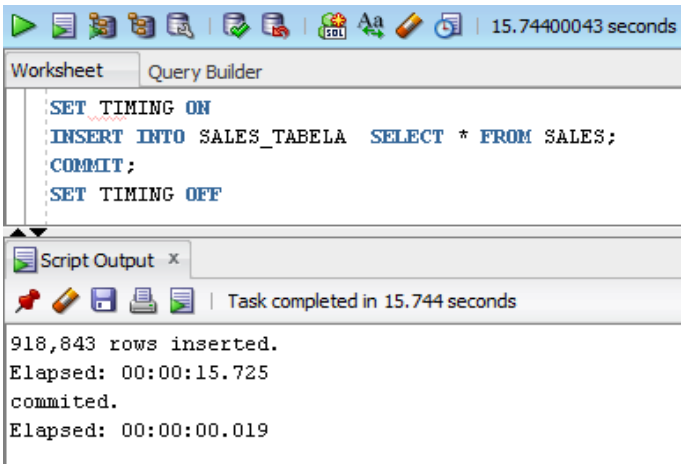
## 3. Optimisation techniques application

In the following example the application of described optimisation technique will be shown. Study is executed in Oracle SQL developer tool. It will be shown that the application of the hint, index, and partitioning techniques reduce the time/ cost of command execution.

First, the SALES_TABELA table will be created, which will be identical to the SALES table of the SH scheme by columns. The time taken to load 918 843 lines with and without using the APPEND hint is included in the table. Using the hint in this table, the data will be loaded 25 times faster than without hitn usage. APPEND hint otherwise reduces the time by bypassing the memory and buffer cache when data is inserted, and, using NOLOGGING, it does not record anything in the regular log files that normally stores all changes related to the database. (Fiorillo, 2012)

```
CREATE TABLE MY_SALES AS SELECT * FROM SALES WHERE ROWNUM < 1;
SET TIMING ON
INSERT INTO SALES_TABELA SELECT * FROM SALES;
COMMIT;
SET TIMING OFF
```

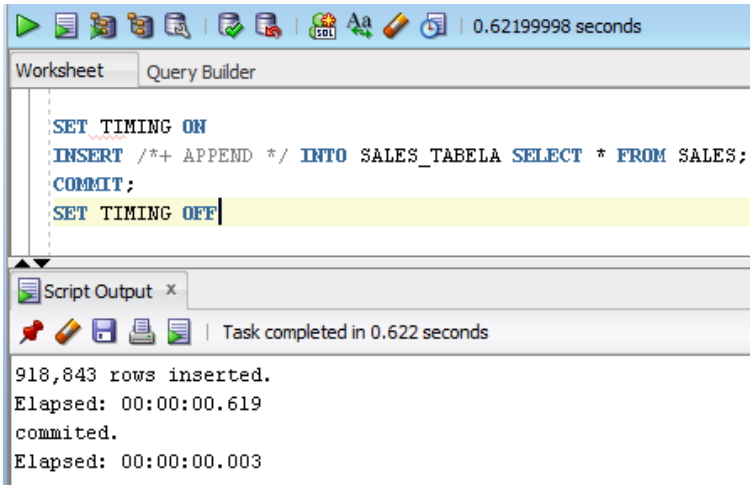
Figure 1: Rows insertion in new table without APPEND hint




Source: Author

```
SET TIMING ON
INSERT /*+ APPEND */ INTO SALES_TABELA SELECT * FROM SALES;
COMMIT;
SET TIMING OFF
```

Figure 2: Rows insertion in new table with APPEND hint



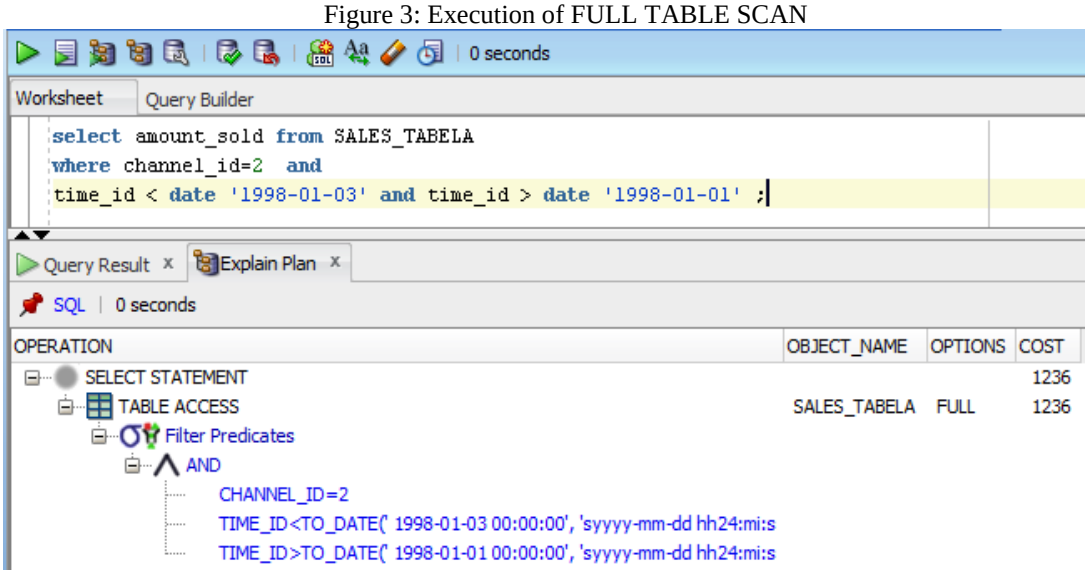

Source: Author

Since the data in the table is inserted, the following command is created:

SELECT AMOUNT_SOLD FROM SALES_TABELA
WHERE CHANNEL_ID = 2 AND
TIME_ID <DATE '1998-01-03' AND TIME_ID> DATE '1998-01-01';

The cost of execution of the command was monitored, which was 1236. The high cost appeared due to FULL TABLE SCAN operation, which was used due to the lack of index.

Figure 3: Execution of FULL TABLE SCAN

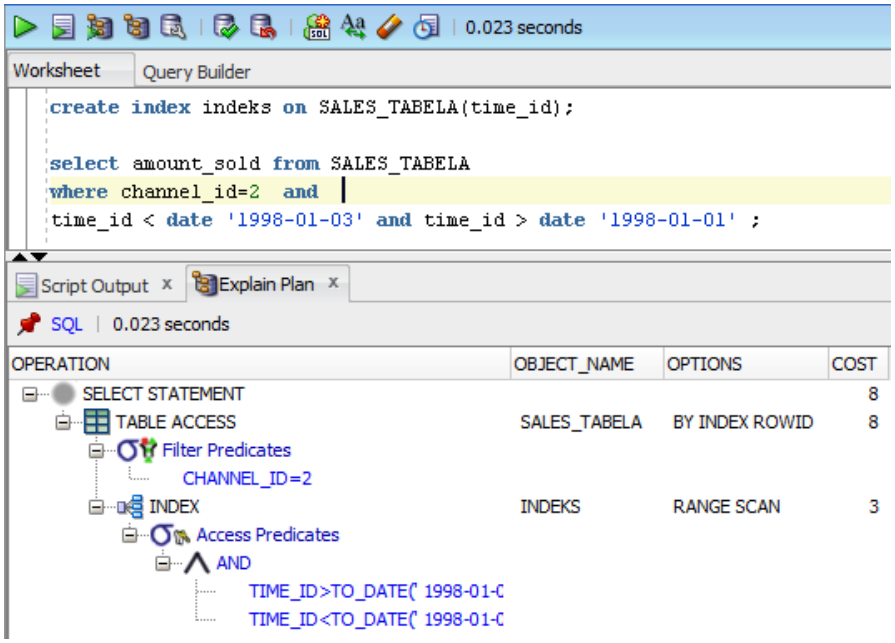



Source: Author

After creating an index over the column time_id, the cost was reduced, even, to 8. Instead of accessing the table, the index from which the data was read, was accessed.

CREATE INDEX INDEKS ON SALES_TABELA (TIME_ID);

Figure 4: Execution of FULL TABLE SCAN by index accession

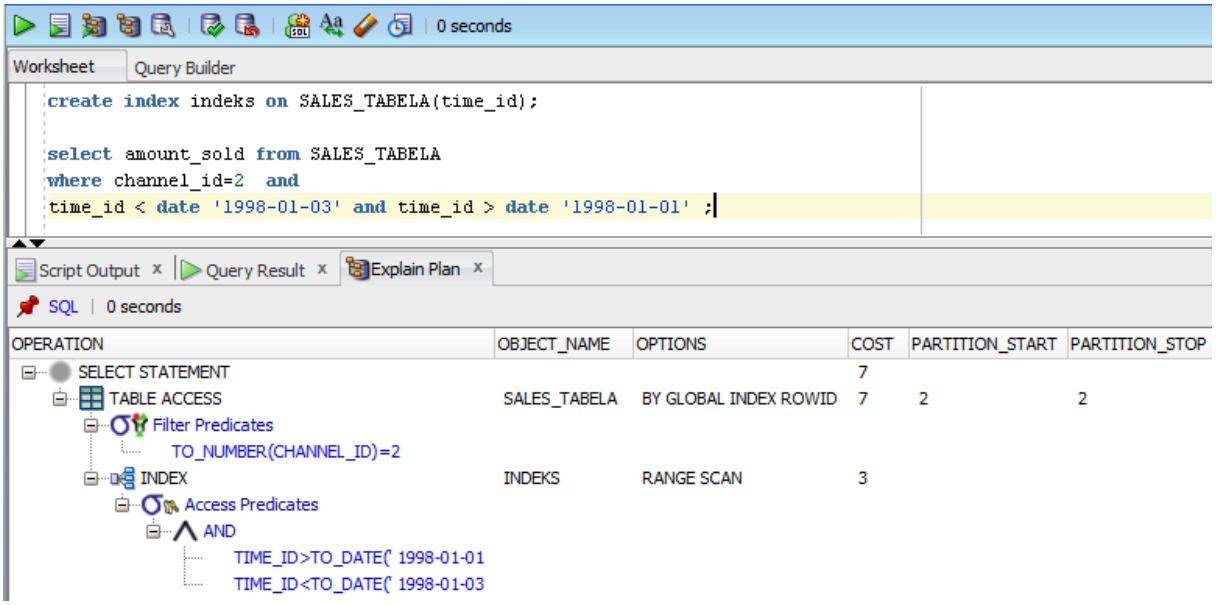



Source: Author

After creating an index, partitions were created, using the RANGE partitioning strategy. Partitioning was performed by the time_id column. 13 partitions have been created, where for each one a certain date range was defined. In the case of performing the same command, but this time with partitions, the cost would be 7. The additional reduction was generated because only partition number 2 was accessed, while the other partitions were eliminated when the command has been performed.

```
PARTITION BY RANGE (time_id)
 (
PARTITION particija_1 VALUES LESS THAN (TO_DATE('01-JAN-1998','dd-MON-yyyy'))
PARTITION particija_2 VALUES LESS THAN (TO_DATE('01-FEB-1998','dd-MON-yyyy'))
    PARTITION particija_3 VALUES LESS THAN (TO_DATE('01-MAR-1998','dd-MON-yyyy'))
PARTITION particija_4 VALUES LESS THAN (TO_DATE('01-APR-1998','dd-MON-yyyy'))
PARTITION particija_5 VALUES LESS THAN (TO_DATE('01-MAY-1998','dd-MON-yyyy'))
PARTITION particija_6 VALUES LESS THAN (TO_DATE('01-JUN-1998','dd-MON-yyyy'))
    PARTITION particija_7 VALUES LESS THAN (TO_DATE('01-JUL-1998','dd-MON-yyyy'))
PARTITION particija_8 VALUES LESS THAN (TO_DATE('01-AUG-1998','dd-MON-yyyy'))
    PARTITION particija_9 VALUES LESS THAN (TO_DATE('01-SEP-1998','dd-MON-yyyy'))
PARTITION particija_10 VALUES LESS THAN (TO_DATE('01-OCT-1998','dd-MON-yyyy'))
PARTITION particija_11 VALUES LESS THAN (TO_DATE('01-NOV-1998','dd-MON-yyyy'))
PARTITION particija_12 VALUES LESS THAN (TO_DATE('01-DEC-1998','dd-MON-yyyy'))
PARTITION particija_13 VALUES LESS THAN (TO_DATE('01-JAN-2019','dd-MON-yyyy'))
 );
```

Figure 5: Implementation of RANGE partitioning strategy




Source: Author

## 4. Recommendations for database optimisation

Instructions written in different ways can generate the same task. Given commands use a different amount of computer resources, and it is necessary to write instructions in the form that provides higher work productivity. Technique optimisation requires adequate management of the computer system memory resources. In other words, certain processes should be allowed the use of memory structures in both, optimal quantity and time.

In general, the most common cause of poor performance is the inefficient use of the index. When performing frequent searches by certain columns, indexes should be created over these columns. If a very small or very large index number is defined in the database, finding the data can take longer, and there exists highly probability of the non-utilisation of certain indexes. Therefore, it is necessary to delete indexes that optimiser does not use. Further, it is necessary to be cautious with the mixing of data types, as well as avoiding the operators, such are: <>, ! =, !>, !<, NOT IN, NOT EXISTS, LIKE '% text'.

If there is a need for aggregated data, materialised views I n Oracle databases could be created. In the case of a static data table, storage with minimal use of the memory space is recommended (ie. data warehouse systems). For tables with many updates, it is necessary to reserve a larger space in memory systems. Historical data should be placed on larger partitions and placed on slower disks. Newer data is placed on faster disks and smaller partitions, therefore due to frequent access to the given data, the processing process is accelerated.

If we have not been able to apply some of the techniques explained in an appropriate way or we believe that the execution plan we have received is not optimal, we could use a hint that will affect the generation of a different execution plan because it would force the optimiser to use another access path. (Pažun, 2017).

## 6. Conclusion

Business users of today's information systems require higher database perfomance. Database properties are 75% to 80% in the function of SQL command quality. High-quality executable instructions enable optimal database performance. This paper covers several optimisation techniques in terms of faster execution of SQL commands and, therefore, more efficient memory management.

Some optimisation techniques in Oracle systems have been described in this paper. Through the optimisation techniques practical recommendations have been contributed, what was the aim. Given application of the optimiser better execution plans could be generated, i.e. command performance could be improved. Improvements are reflected in the speed of execution of given instructions, as well as more efficient CPU engagement, and finally which results higher-quality management of memory systems. The optimisation process positively influences the quality of the database functioning, as well as the entire information system. These improvements increase the productivity and efficiency of the business system as whole.

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# Inovacije! Zelena Pošta: Uvođenje automobila na električni pogon po ugledu na Evropsku poštu

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**Apstrakt:** U današnjem svetu zagađenje i buka predstavlja problem u velikim gradovima. Zbog ograničenih fosilnih goriva na svetskom nivou, operateri u svetu su naterani da pronalaze alternativna rešenja u oblasti transporta. U cilju poboljšanja kvaliteta života i povećanja ekonomske efikasnosti nastala je „Zelena Pošta“, koji su uveli pogodna vozila za dostavu poštanskih pošiljaka na električni i hibridni pogon. U okviru Projekta navedena vozila su testirana u gradovima EU, a studija je pokazala validnost ekonomske investicije i veliku korist za životnu sredinu, zajedno sa rezultatima testiranja koji su načinjeni.

**Ključne reči:** zelena pošta, električno vozilo, hibridni pogon, ekonomske investicije, životna sredina

# Innovation! Green Mail: The introduction of an electric car modeled on the European post

**Abstract:** Electric and hybrid drive vehicles are the vehicles of tomorrow. Not only they produce lower emissions than conventional vehicles do, they are also much quieter all thanks to the new technology implemented in these kinds of vehicles. In today’s world, pollution and noise are the main problems in the big cities and because of limited supply of fossil fuel, operators are forced to develop alternative solution in trasport sector. In order to improve quality of life and increase economical efficiency, Green Mail (Zelena Pošta) has been developed. It should be mentioned that they are using electric and hybrid drive vehicles for delivering postal items. Withing Project limits, said vehicles have been tested in EU cities and studies have shown validity of this economic investition and quite the big benefit for the environment, all together with the test results.

**Keywords:** Green mail, green post, electric drive vehicle, hybrid drive, economic investments, environment

## 1. Uvod

Primer „Zelena Pošta“ ima za cilj da prikaže prednosti automobila na električni pogon i time poboljša energetsku efikasnost i smanji zagađenje vazduha u Evropskim državama i gradovima. Kako su ograničene količine nafte i goriva, godinama se traži alternativni način prevoza poput električnih vozila. Poštanski operateri uvode u svoje redove automobile na električni pogon zbog višestrukih prednosti koje zadovoljavaju niz ekoloških kriterijuma usmerenim ka smanjenju negativnih uticaja na životnu sredinu. Projekat je doveo do pogodnosti primerom zamene vozila na benziski pogon, električnim i hibridnim vozilima što je proizvelo smanjenje potrošnje goriva i smanjenje CO2 emisije izduvnih gasova.

Direktiva Evropskog parlamenta 94/2014 (access to european union law) nalaže razvoj novih tehnologija i inovacija radi poboljšanja kvaliteta vazduha u gusto naseljenim mestima i gradskim i prigradskim sredinama. Svaka država članica treba da odredi infrastukturu za punjenje električnih automobila na zajedničkim parkiralištima blizu stambenih blokova i opština do kraja 2020 godine. Mesta za punjenje koje omogućuje transver električne energije male snage za električno vozilo jednak je 3,7kw, ili jednako ili manje od 22kw instalirani u privatnim kućama. Mesto za punjenje visoke snage je veće od 22kw za električno vozilo. Na državama je da odluče da li će pumpe biti male ili velike snage (Europa.Eu, 2014).

Nacionalna strategija za aproksimaciju u oblasti životne sredine predstavlja bitnu osnovu. Strategijom se nadgrađuje Nacionalni program za integraciju Republike Srbije u Evropsku uniju. Program obuhvata zaštitu životne sredine i nacionalnu strategiju održivog razvoja. Strategija ima dva cilja:

- Da odgovori na izazove promenom zakonodavstva Evropske Unije u oblasti životne sredine u Srbiji.
- Da obezbedi temeljitu osnovu za pristupanju pregovorima u okviru poglavlja 27. Strategija treba da odgovori na izazove nastale pristupanjem EU neophodnim za organizovanje i funkcionisanje nadležnih institucija radi zaštitite životne sredine. Treba premostiti ekonomske nedostatke između dosadašnjeg načina poslovanja i punog poštovanja pravnih tekovina Evropske Unije. Strategija je usvojena u decembru 2011 godine (Ministarstvo poljoprivrede 2015).

## 2. Primeri korišćenja automobile na električni pogon

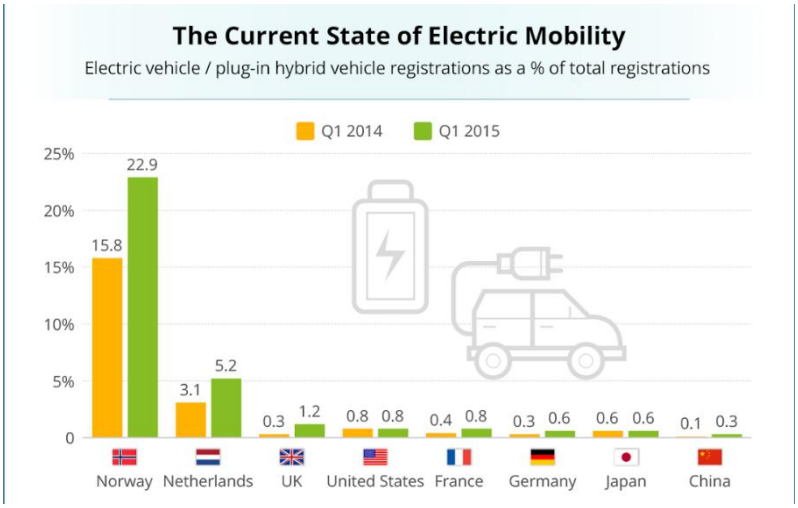
**Automobili na električni pogon u poštama Norveške**

Od mnogobrojnih evropskih država koje danas imaju automobile na električni pogon najviše se izdvaja Norveška u kojoj su „zeleni“ automobili najviše zastupljeni. Namera države je da u budućnosti sve više ovi automobili zažive a na kraju i da skroz zamene „klasične“ automobile u javnim službama, kao i u privredi.

Norveška je bogata zemlja i veoma vodi računa o kvalitetu vazduha u gradskoj sredini. Pošta Norveške je kupila trista automobila na električni pogon Renault Kangoo Maxi, dok stanovnici te zemlje već poseduju oko 50.000 automobila na električni pogon (Carscoops 2015).

Plan Norveške je da zbog malog broja električnih mini-van automobila i lakih komercijalnih vozila (oko 1.000 vozila za 2012 godinu) uvede brojne stimulacije kako bi podstakla kupovinu navedenih vozila. Zbog poreskih olakšica danas Evropsko tržište predvodi Norveška koja je prodala preko 17000 novoregistrovanih električnih automobila modela Nissan leaf do aprila 2016 godine (Newsinenglish, 2015). U daljem tekstu biće opisane prednosti stimulacije i podsticaja države kod uvođenja električnih automobila.

Cilj Norvške države i Pošte je smanjenje štetnih gasova za 40% do 2020 godine. Rezultati su vidljivi zbog ozbiljosti podsticajne politike vlade Norveške. Očekuje se da će biti 200.000 električnih vozila širom zemlje do 2020. godine što čini 10% svih automobila na Norveškim putevima (Renault, 2015).




Slika 1 – prikazuje novoregistrovane automobile na električni i plug-in hibrid, tako da možemo videti da Norveška u prvom kvartalu 2015. godne čini skoro 23% novih vozila. Holandija ima 5% dok su druge zemlje limitirane na 1% ili manje. Postavlja se pitanje: Zašto Norveška ima toliko novoregistrovanih automobila u odnosu na druge zemlje? Odgovor leži u poreskim olakšicama što čini da automobil na električni pogon košta isto kao benzijski (Businessinsider, 2015)

**Norveška – podsticaj države pri kupovini automobila**

Iako je kod stanovnika Norveške razvijena ekološka svest, to nije jedini razlog zbog čega se građani odlučuju za kupovinu automobila na električni pogon. Ekonomski razlozi su jedan od najbitnijih činilaca a to je svakako oslobađanje od plaćanja poreza pri kupovini novog automobila. U zavisnosti od nekoliko parametara, kao što su snaga motora, veličina automobile, vrsta modela, popust može da iznosi od 4.000 do čak 17.000 evra (Electric Vehicle Report, 2014), a to je samo jedna u nizu od beneficija koje Norveška država nudi svojim građanima. Takse za održavanje puteva, naknada za javne parkinge, plaćanje putarina, kao i registracija vozila za kupce ne postoje, odnosno oslobođeni su plaćanja. Još jedna pogodnost je ta što imaju posebu traku za električne automobile tako da su u prednosti u saobraćaju u odnosu na druge učesnike što je jako bitno u gužvama tokom špica. Norveška ima 5,084 miliona stanovnika po popisu iz 2013. godine i mnogi žive u glavnom gradu Oslu ili njegovoj blizini tako da nije velika udaljenost od tačke A do tačke B kretanja vozila i to je još jedan razlog zbog čega su ovi automobili popularni, tako da zbog kratkih destinacija nije potrebno toliko često puniti baterije kao kod automobila koji prelaze veću kilometražu (B92, 2012).

**Automobili na električni pogon u poštama Nemačke**

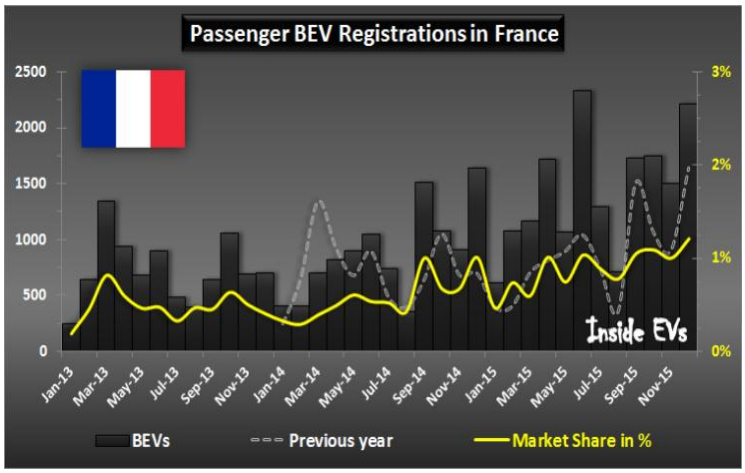
U narednom periodu Nemačka planira da sva mala dostavna vozila budu zamenjena vozilima na električni pogon. Deutsche Post (Nemačka pošta) omogućiće svojim službenicima da dobiju do kraja 2016. godine 2.000 elekričnih van vozila.

U Nemačkoj neprestano raste ekološka svest, pa se i Nemačka poštanska služba uključila u akciju očuvanja životne sredine i čistijeg vazduha. Ona je 2012. godine predstavila elektriični van, a 2014. godine kupila je firmu „StreetScooter“ koja je proizvodila električne vanove sa namerom da započne serijsku proizvodnju „zelenih“ dostavnih vozila. Trenutni cilj Nemačke pošte je da sve automobile (njih oko 30.000) zameni automobilima na električni pogon koje će sama proizvoditi. Za sada, proizvodni kapaciteti će biti isključivo vezani za poštu, dok je za kasnije planirano da se proizvodni kapaciteti prošire i dostavna „zelena“ vozila ponude drugim javnim službama i kompanijama.

Baterija (litijum-jonska 20,4 kWh) kojom raspolaže navedeni van može da preveze poštanski teret u zavisnosti od težine, terena i načina vožnje na rastojanje od 50 do 80 km. Da bi se baterija napunila do 100% potrebno je vreme od 7 sati, dok je za kapacitet do 80% potrebno oko 4-4,5h (Streetscooter.eu, 2018).

**Automobili na električni pogon u Francuskoj**

Grupacija Renault-Nissan je najveći svetski proizvođač električnih automobila koja je prodala 250.000 automobila za proteklih pet godina širom sveta. Francuska podstiče kupovinu elektromobila na domaćem tržištu tako što daje bonuse pri kupovini do 10.000 evra. Na primer kupci koji imaju dizel motore imaju bonus od 10.000 evra ako se odluče da kupe elektromobil tj. ako se odreknu svog automobila na dizel gorivo (Carscoops, 2015b).




Slika 2 – Grafikon prikazuje: Preko 20.000 električnih automobila je registrovano i nekoliko hiljada plug-in u 2015 godini (Insideevs 2018).

Francuska ubrzava razvoj zahvaljujuću različitim inicijativama od strane javnog i privatnog sektora podjednako. Projekat koji finansira Evropska komisija ima za cilj da instalira 200 brzih punionica na glavnim Francuskim putevima odnosno jedna stanica na svakih 80 kilometara. Francuska vlast i kompanije podižu svest o potrebi za više održivih oblika elektronske mobilnosti (Insideevs, 2018).

**Francuska pošta - kamioni na bazi vodonika**

Francuska Pošta i Reno kamioni kao deo eksperimenta pustiće u saobraćaj kamion na bazi vodonika. Da bi se produžila autonomija napravili su vozilo na električni pogon koje je snabdeveno gorivnom ćelijom na bazi vodonika i ta ćelija, koju je napravila kompanija Symbio FCell, udvostručava period autonomije vozila. Težina kamiona Maxity je 4,5 tone a moći će da pređe put od 200 km. Vozilo je bešumno. Testiranje će biti vršeno godinu dana. Cilj je smanjenje buke i zagađenja životne sredine. Ovo je prvi put u Evropi da se testiraju električni kamioni i pretpostavlja se da će biti interesantni za širi krug kupaca, pošto će zagađenje vazduha biti svedeno na nulu.

Najveći vozni park na električni pogon poseduje Francuska pošta. Godinu i po dana francuski poštari testiraju vozila na bazi vodonika, tako što prikupljanje i raspodelu pošte i paketa ovim kamionima. Vodonik je postao nerazdvojni deo prenosa energije, tako da je vodonik efikasno rešenje za poboljšanje autonomije i klase vozila na električni pogon. Kako što je rečeno, vozilo Maxity moći će da pređe do 200 km, a tajna je u tome što je osnovna autonomija vozila koja iznosi 100 km povećana za dodatnih 100km zahvaljujući energiji koju oslobađa gorivna ćelija na bazi vodonika ovog električnog kamiona.

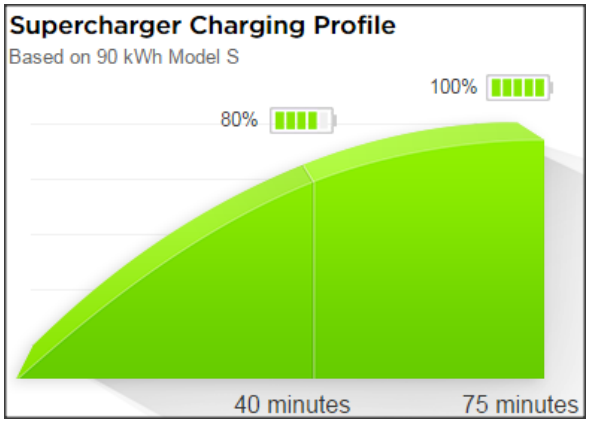
Francuski saobraćaj će imati viši kvalitet zato što Francuska pošta i Reno kamioni udruženim snagama promovišu vozila sa pogonom na bazi vodonika. Radi brže realizacije čitavog projekta, potrebno je da se uključe i druge zainteresovane strane a to su u ovom slučaju korisnici, političari i drugi proizvođača vozila (Renault Trucks, 2015).

**Tesla električni automobili**

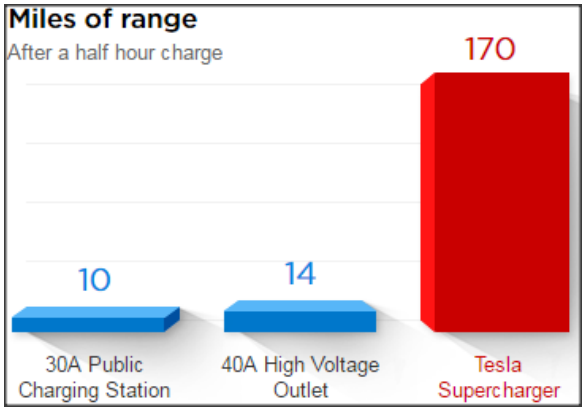
Tesla Motors je poznati proizvođač automobila na električni pogon sa sedištem u Silicijumskoj dolini u SAD. Tesla S spada u luksuzne automobile i važi za najbolji ekološki auto. Najbolje se pokazao na crash testu iz razloga što nema standardan motor i mnogo je lakše raditi amortizaciju pri udarcu s prednjeg kraja. Takođe je velika prednost u odnosu na automobile drugih kompanija zato što je izuzetno tih – ne postoji buka motora zato što ga pokreće električni motor, a i odlično se pokazao na spoljašnu buku. Obrtni moment je odličan pa se osobe koje se voze automobilom osećaju kao da su u avionu zbog ubrzanja od samo 4,4 sekunde do 100 km/h.

Iako druge kompanije i dalje koriste klasičan način za kontrolu klime, radija... kod Tesla S modela je sve zamenjeno jednim velikim displejom od 17 inča, koji sadrži sve kontole, od klime pa do navigacije. Vozila koja imaju napred motor imaju problem sa težištem auta dok je kod Tesla automobila baterija smeštena između dve osovine točkova tako da se postižu odlične vozne karakteristike.

Što se tiče baterije, jednim punjenjem može da se dostigne 400-500 kilometara. Postoje stanice gde se može puniti baterija ali postoji i mogućnost da se kući napuni baterija sa punjačem snage 10kW, a da bi se baterija napunila do kraja potrebno je oko 5-6 sati. Razvijene stanice „supercharger“ imaju (umesto kućnih 10kW) punjače snage 120kW tako da su u mogućnosti da mnogo brže napune bateriju tj. za oko 40 minuta do 80% a za 75 minuta od 80-100% (Slika 3).




*Slika 3 – Tesla S stanica nakon 40 minuta puni bateriju do 80%, dok od 80-100% treba puniti bateriju 75 minuta* (Tesla Motors, 2018)



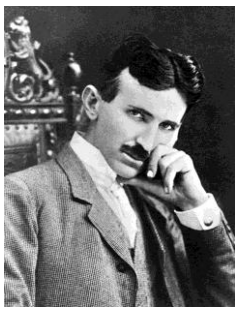

Na slici – 4. prikazano je koliko milja može da pređe Tesla S električni automobil nakon polučasovnog punjenja pri različitim načinima punjenja. Tesla S može da pređe 170 milja, odnosno 274km što je nakon pola sata punjenja dovoljno da se stigne do odredišta ili sledeće stanice za punjenje automobila. Proizvođač neprestano razvija načine punjenja na osnovu povratnih informacija tako što konstantno prati baterije i usavršava ih na osnovu istraživačkog i razvojnog napora (Tesla Motors, 2018)

Da ne bi opao kapacitet baterije u severnoevropskim državama kao i Kanadi u otežanim zimskim uslovima, proizvođač je ostavio dovoljan prostor između baterija kako bi mogle da se leti hlade a zimi greju.

I pre modela Tesla S postojali su električni automobili ali to su bili samo mali gradski automobili ili dvosedi, dok to nije slučaj kod ovog vozila koje je komforno, udobno, luksuzno i u koje može da se smesti pet odraslih osoba, a pri tome ne zagađuje vazduh. Velika prednost Tesla S automobila u odnosu na konvencionalne automobile je i ta da ne postoji centralni tunel iz sledećega razloga: Centralni ekran zamenjuje klasične komande i time štedi prostor pa putnici imaju više mesta za noge. Unutrašnjost je prostrana a to se dokazuje i time da ima sedam sedišta, odnosno kada se otvori gepek moguće je smestiti još dva mala deteta na zadnjoj klupi koja se rastavlja.

Ekran dijagonale 17" koji služi za upravljanje audio sistemom, klimatizacijom, kao kamera za automatsko parkiranje, poseduje i aplikacije za telefoniranje, pregled kalendara, mape i navigacije, web browser, sinhronizaciju sa Android i iOS-om kompanije Apple. Prednost je i ta što nije potrebno odlaziti u servis (osim u slučaju tehničkog oštećenja) zato što se sve obavlja putem računara tako što se kroz update rešavaju problemi. Proizvođač nije štedeo na materijalima tako se da drvo, koža i hladni aluminijum savršeno uklapaju u moderan enterijer ovog luksuznog automobila (SEE Bussines travel & meetings magazin, 2016).

Zahvalnost u oblasti fizike, elektrotehnike i radiotehnike, pripada najvećem naučniku Nikoli Tesli rođenom 10-og jula 1856. godine. Tačno je prošlo 160 godina od njegovog rođenja a 1882 godine, projektovao, proizveo i patentirao asinhroni trofazni motor, koji se istovremeno mogao ponašati i kao generator. Baš takav motor, istih parametara su koristili inženjeri Tesla Motorsa u proizvodnji svojih prvih proizvoda. Tesla automobil je i dobio ime po znamenitom naučniku Nikoli Tesli. Tesla model S je izabran za model 2013. godine, i proglašen je jednim od najboljih automobila koji su ikad napravljeni prema oceni magazina "Forbs". Tesla Motors je najinovativnija kompanija na svetu za 2015. godinu (Tesla Motors, 2018).

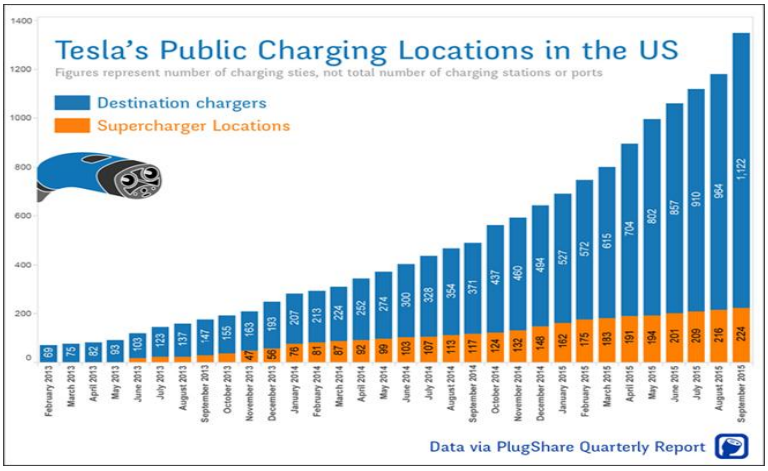


Slika 5 – Zahvaljujući Tesli uskoro ćemo svi voziti vozila na električni pogon (Tesla Motors, 2018)

**Tesline supercharger stanice**

Slika 6 – Mapa prikazuje Tesla supercharger stanice na lokacijama širom SAD. Tesla Motors ukupno ima 710 Supercharger stanica i 4392 kompresora (Hybridcars 2015)

Tesla Motors je razvio veliku mrežu solarnih stanica, tako das pored velike snage kompresora postavljenih dobro duž puteva i autoputeva punjači nalaze na destinacijama i lokacijama gde bi vozači želeli da ostanu i odmore nekoliko sati u jednom trenutku kao što su hoteli, restorani, skijališta i primorska mesta (Chargedevs, 2015).




Slika 7 – Grafikon predstavlja ukupan broj lokacija za punjenje električnih automobila. Tesla Motors je za električne automobile rasporedio stanice za punjenje širom SAD (Chargedevs, 2015)..

Kompanija je dodala 107 Supercharger kompresora i 328 destinacionih punjača na različitim lokacijama u julu 2014 godine. U septembru 2015 godine ukupan broj se povećao na 224 kompresora i 1.122 destinaciona punjača. Broj destinacionih punionica od jula 2014 do septembra 2015 se povećao za 794 što pokazuje ozbiljan pristup razvijanju infrastukture. Sve destinacije punionica se pojavljuju na softveru Tesla automobila tako da vozači u svakom trenutku imaju pregled koja je najbliža stanica za punjenje i koje je snage (Chargedevs, 2015b).


*Slika 8* – Mapa prikazuje Tesla supercharger stanice na lokacijama širom Evrope (Insideevs, 2016) U jednom trenutku Tesla Motors je planirao 2 stanice u Srbiji (Digjitale, 2015)

**Solarne stanice**

Izgradnjom fotonaponskih panela došlo bi do značajnih ušteda, jer bi se napajala baterija automobila iz obnovljivih izvora energije. Višak električne energije bi se koristio za napajanje objekta u blizini garaže gde su stacionairani električni automobili. Ova tehnologija se dobija direktno od Sunca preko solarnih panela iz potpuno obnovljivih izvora energije. Tehnologija za skladištenje energije ne proizvodi emisije CO2 jer se automobili kreću na električnu energiju (Zelena Energija, 2012).


*Slika 9* – Teslina Supercharger solarna stanica (Quora, 2018)

**Infrastuktura**

Električna vozila zahtevaju znatno manja ulaganja za razliku od ostalih alternativnih goriva u razvoj infrastukture. Električna energija je dostupna u svakoj kući, na radnom mestu, šoping centru i centrima grada. Za razliku od postojećeg rasporeda benzijskih stanica gustina zastupljenosti punionica na električnu energiju na raznim urbanim područijima biće znatno veća, zbog napredne infrastukture (Zelena Energija, 2012).

| SPORO I BRZO PUNJENJE | VREME PUNJENJA | NAPON/MAX STRUJA | NAPAJANJE |
|---|---|---|---|
| Sporo punjenje kod kuće | 6-8 h | 230VAC/16A | 3,3kW(1f) |
| Sporo punjenje kod kuće | 2-3 h | 400VAC/16A | 11kW (3f) |
| Brzo punjenje | 1-2h | 400VAC/32A | 22kW (3f) |
| Ultra brzo punjenje | 15-30 min | 400-500 VDC/100-125A | 50-250kW ( DC) |

*Slika 10* – Tabela: Brzo i sporo punjenje električnog automobila

Punionice za brzo punjenje putem kojeg se baterije mogu napuniti u roku od 30 minuta je od 50-250 kw, trofaznog napona. Većina punionica instalirana na javnim gradskim površinama i garažama omogućuje srednju brzinu do 3 časa trofasnog priključka 230/16A, čija je snaga manja od 11kw. Uglavnom vlasnik električnog automobila puni svoj automobil kod kuće koji poseduje punjač u vlastitoj garaži. Danas kapacitet baterija je dovoljan da se mogu pokriti dnevne potrebe vozila. Svetski proizvođači baterija najavljuju povećanje kapaciteta, pa se očekuje autonomnost dometa do 350 km sa jednim punjenjem. Električna vozila zahtevaju manja ulaganja i napore u razvoj infrastukture za njihovo punjenje, za razliku od ostalih alternativnih goriva. Tek se očekuje povećanje konsenzusa svetske automobilske industrije od 2020 godine, zbog direktiva EU koje nalažu povećanje širenje infrastukture do navedene godine (Zelena Energija, 2012).

## 9. Ekonomija električnog automobila

| Troškovi na pređenih Km 100 km | | | |
|---|---|---|---|
| | Električna energija 15kwh/0,07197€ | **Evro Dizel 6l/100** | Benzin bmb 95 8l/100 |
| Potrošnja u dinarima/kWh | **Din/kWh 9.19** | **din/L 140.40** | **din/L133.70** |
| € | 1,13 | 7,86 | 8,71 |
| din | 137,85 | 842,4 | 1069,6 |
| Emisija ugljeničnog dioksida | 5 kg | 16 kg | 19 kg |
| Površina šume potrebna za aspsorciju CO2 | 2 m2 | 5 m2 | 6 m2 |
| Proračun potrošnje u din/100km po skupljoj tarifi/ jeftina tarifa | 251.02/ 136,9 | | |
| Proračun potrošnje za dostavno vozilo Pežo expert Pošte Srbije Prosečna potrošnja na 100km/10l | | 1404,00/10l | |
| Ušteda/100km = 1.267,00 din | | | |
| Ušteda/100km za 10 el.aut. = 11529,80 din, 100 aut. = 115298,00 din, 1000 aut.= 1.152980,00/ **9166,25 evra** | | | |

*Slika 11* – Tabela ELEN Razvojni Prijekat HEP grupe, proračun potrošnje goriva i uticaja na okolinu (Hep, 2018)

Dostavno vozilo Pošte Srbije na benzijiski pogon proračun:

**din/l Evro dizel 140.40 x 10l = 1.404,00 dinara na pređenih 100 km**

Dostavno vozilo na električni pogon proračun:

**Din/kWh** 0,07197 x 15,5 kw = 1,16 eura odnosno 136,9 = na pređenih 100 km

= 1404 – 136,9 =1.267,00
Ušteda na 100 km je **1.267,00 dinara**

**Održavanje automobila na benzin i električni pogon.**

Prema Calstart organizaciji koja je posvećena rastu tehnologija za čistiji vazduh 70% sastavnih delova električnog vozila može biti različito od konvencionalnog automobila. Spolja električno vozilo izgleda kao na benzijski pogon sa izuzetkom da električni nema auspuh.

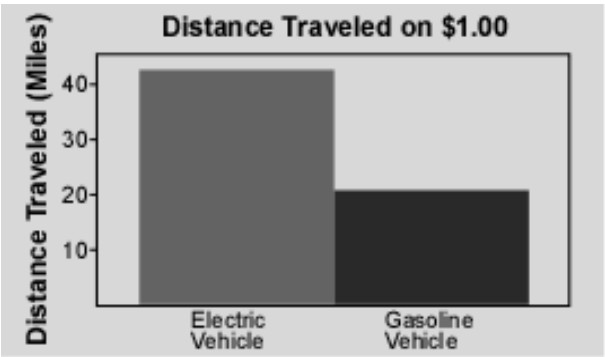
Elektično vozilo imaja nekoliko jedinstvenih komponenti koje služe za isto funkcijonisanje kao vozilo na benzijski pogon. Jedan od značajnih razlika između električnog vozila i na benzijski pogon je broj pokretnih delova. Vozilo na benzijski pogon ima na stotine pokretnih delova, dok električna vozila imaju jedan deo koji se kreće, motor. Dolazimo do još jedne važne razlike, električno vozil ima manje pokretnih delova za razliku od benzijskog. Navedeno vozilo zahteva periodično manje održavanje i pouzdani je, što je bitno jer dovodi do finansijskih ušteda. Ove uštede bi se osetile u održavanja voznog parka Pošte Srbije.

Napajanje vozila na benzin zahteva širok spektar održavanja, podešavanje i popravke izduvnih sistema, promena čistog ulja, zamena filtera, periodične preglede, zamena za komponente, kao što su pumpe za vodu, pumpe za gorivo i alternator. Održavanje električnog vozila je manje zahtevnije stoga su troškovi održavanja niži. Elekrični motor ima samo jedan deo koji se kreće, u osovini, koja je veoma pouzdan i zahteva malo ili nikakvo održavanje. Litijumske baterije koje se koriste u strujnom vozilu su zapečaćene i ne održavaju se.Međutim trajnost ovih baterija je ograničena i zahtevaće periodične zamene. Inženjeri u industriji razvijaju nove tehnologiju za baterije koko bi produžili vek trajanja i eliminisale potrebe za zamenom baterije što će povećati potražnju za električnim vozilma. Danas baterije trajo 7 do 10 godina što je sasvim dovoljno ali ide se prema još naprednijim tehnologijama.

| Benzin vozilo | Funkcija | Električno vozilo |
|---|---|---|
| Benzin rezervoar | Čuva energiju za pokretanje vozila | Baterija |
| Benzin pumpe | Zamenjuje energiju za pokretanje vozila | Punjač |
| Benzijski motor | Daje snagu za pokretanje vozila | Električni motor |
| Karburator | Kontrola ubrzanja i brzine | Kontrolor |
| Generator | Omogućuje napajanje za dodatnu opremu | DC/DC Konvertor |
| | Pretvara DC u AC do snage AC motora | DC u AC Pretvara |
| Zagđive komande | Smanjuje toksičnost izduvnih gasova | Nema zagađenja |

*Slika 12* –Tabela prikazuje poređenje funkcija kod benzijskog i električnog automobila (AVT, 2018)

Dolazimo do zaključka da su električna vozila jeftinija za održavanje i efikasnija nego benzijski motor. Efikasnost električnog vozila gledano na 3 milje odnosno 4,8 km/kwh i troškovi električne energije na 7“ po kwh, električna vozila će preći oko 43 milje odnosno 69km za $ 1.00 ili 110 din.




*Slika 13* – Grafikon prikazuje 43 milje za 1 dolar (AVT, 2018)

Na osnovu proseka 22 mpg za benzijska vozila, benzin košta $ 1.25/gal odnosno 137. din, automobil prelazi 18 milja odnosno 28.9 km.

Pređena udaljenost za 1.oo dolar je više nego dupla sa električnim vozilom. Dok će EV vozila biti jeftinija za održavanje veliki broj izazova i dalje postoji za vlasnike EV automobila.

Prvo i najvažnije ograničen opseg u km dostupan sa aktuelnim tehnologijama baterija. Raspon vožnje između punjenja korišćenjem postojećih baterija je 50 do 150 milja, 80.46km do 241km. Novi sistemi baterija se razvija pa će povećati domet, a prototipi ovih baterija su pokazali da se domet kreće 200 milja odnosno 320 km između punjenja.

Primer redovnog održavanja za model Zoe Z.E. do 150 000 km iznosi 530,7 evra, a za model Clio za benzinskim motorom 0,9 Tce90 je 1450 evra. Za oba modela važi da u servis nije uključeno: zamena kočionih pločica, pneumatika i brisača.

Servisi električnog Zoe-a predviđaju pre svega redovnu kontrolu i zamenu filtera putničkog prostora, tečnosti za hvađenje, ulja kočnica, čišćenje kočionih bubnjeva. Kod benzinskog Clio-a zahvati su detaljniji. Pored toga što zahteva električni Zoe, Clio Tce90 zahteva još i redovnu zamenu motornog ulja, filtera ulja i svećica, kaiševa i još toga (Avto finance, 2018).

Još jedan izazov sa kojim se suočavaju vlasnici ev automobila je dostupnost obučenih servisera za servisiranje i održavanje električnih vozila. Programi obuke se razvijaju radi unapređenja standardnih auto tehničara sa veštinama koje su potrebne za održavanje EV vozila. Da bi se osposobio kadar za održavanje napravljen je program obuke dve godine za maturante iz srednjih škola kako bi osposobili veštine za buduće tehničare električnih vozila. Takođe potrebna je infrastuktura za dopunu baterija. Najznačajniji element već postoji: električna energija je dostupna na skoro svim lokacijama. Preostali element je da se osiguraju stanice za punjenje sa odgovarajućim vrstama usluga tj. napajanje strujom koja je dostupna na strteškim lokacijama za podršku električnim vozilima. Angažman mora da se obezbedi do maksimum punjenja do bi se dobila najniža komunalna cena.

## 3. Diskusija i zaključci

Automobili na električni pogon su budućnost auto industrije. Konvencionalni automobili zagađuju vazduh dok je kod „zelenih“ automobila isključena emisija štetnih gasova jer smanjuje CO2 i svodi ga na nulu. Litijum - jonske baterije imaju veliku prednost kao što su punjenje na solarnu energiju Sunce i vetar što dovodi do zaštite životne sredine i obnovljivih izvora energije. Takođe su rešile problem skupih i kratkotrajnih baterija tako da će cena vozila biti sve niža. Mnoge države daju određene subvencije, popuste i beneficije na kupovinu električnih automobila što je dodatni podsticaj za rast prodaje a ti popusti mogu se odnositi na oslobođenje plaćanja putarine, besplatno parkiranje, niža cena registracije, osiguranja.

U Srbiji nisu zastupljeni automobili na električni pogon zbog nepostojanja stanica za punjenje, administrativnih problema prilikom registracije (ne postoji jasna procedura), skuplji su od motornih vozila pritom ne postoje olakšice pri kupovini, dok zemlje u okruženju stimulišu kupovinu tako što država pomaže u vidu smanjenja cene za nekoliko hiljada evra. Trenutno u Srbiji ne postoji mogućnost kupovine ni novih ni polovnih (na autoplacevima) „zelenih“ automobila.

Pošta Srbije ima za cilj da se pozicionira kao nacionalni i regionalni tržišni lider, koji će inovacijama obezbediti razvoj novih, profitabilnih usluga i biti odgovoran prema stanovnicima Srbije i životnoj okolini. Pošta Srbije je punopravni član Svetske poštanske unije (UPU), i može se očekivati u narednom periodu da će intenzivnim međunarodnim aktivnostima, praćenjem, primenom i usaglašavanjem važećih svetskih propisa i preporuka u oblasti poštanskog saobraćaja, davati svoj puni doprinos radu Svetske poštanske unije.

Pošta Srbije poseduje veliki vozni park za transport pošiljaka kroz celu zemlju tako da je pokrivena kompletna teritorija Srbije. Među tim vozilima nalaze se nedavno kupljena vozila sa motorima najnovije generacije i sa minimalnom emisijom ugljen-dioksida. Predlažem da naša Pošta uvede „zelena“ dostavna vozila i time se pridruži naprednim evropskim poštama kao što su na primer Norveška, Francuska i Nemačka Pošta.

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Zelena Energija. (2012) Kako će izgledati stanice za punjenje električnih vozila? 20.07.2012.
http://www.zelenaenergija.org/clanak/kako-ce-izgledati-stanice-za-punjenje-elektricnih-vozila/3790

**Guidelines for the Preparation of Papers for Publication in the Serbian Journal of Engineering Management**

# Title of Paper in Serbian

**Authors' Name and Surname[1]*, Name and Surname[2], Name and Surname[3]** [in this stage leave it empty for the peer review purpose]

[1] Institution and E-mail address [in this stage leave it empty for the peer review purpose]
[2] Institution and E-mail address [in this stage leave it empty for the peer review purpose]
[3] Institution and E-mail address [in this stage leave it empty for the peer review purpose]

**Summary in Serbian:** This document is a template for formatting the papers in order to prepare them for printing. This summary provides briefly the information related to the content of the article so that the reader can rapidly and accurately assess its relevance. Authors should explain the goals of research or state the reason (reasons) why they have written the article. Then, it is necessary to describe the methods used in the study and briefly describe the results they have obtained in the research. The abstract should be between 100 and 250 words long.

**Keywords:** 3-5 keywords for indexing and search purposes

# Title of Paper in English

**Abstract in English:** This document presents a template for preparing the print-ready papers that will be included in the Serbian Journal of Engineering Management. The abstract briefly summarizes the article and gives the reader the opportunity to assess its relevance. 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 long.

**Keywords:** 3-5 keywords for indexing and search purposes

## 1. Introduction

The paper should be written using MS Word for Windows (on Serbian Cyrillic, Latin or English – UK keyboard). The length of work should not be more than 10 pages including text, diagrams, tables, references, and appendices.

The format is **A4**. Use **2 cm** for the lower and upper margin and **2.5 cm** for the left and right margin. The spacing within one paragraph should be one (single), while the spacing between paragraphs is double. To format the text, it is recommended to use font Times New Roman.

## 2. Structure of the paper

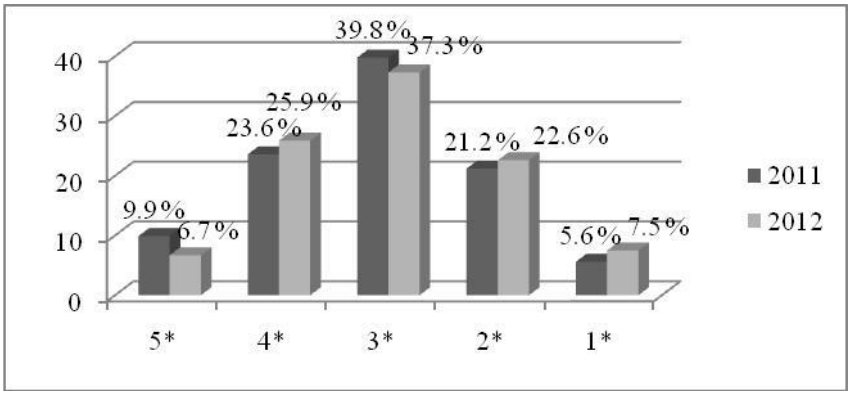
In the first line of the first page the title should be written in Serbian language (16 pt). Under the title of the paper the spaces for name(s) of the author and the names of the author's institutions should be indicated as specified and aforementioned in this Guideline. After the space for the institution of the last author, leave one blank line and write the short summary (10 pt) in Serbian. After the summary, provide an overview of key words. After the paper title you indicated, include the summary and key words in the Serbian language, whereas they should be indicated in English like above.

Numbered subtitles of the first level must be formatted using the font 12 pt bold, a second-level sub-titles should be 10 pt bold. The text, and a list of references should be formatted using the font 10 pt.

## 3. Graphs, tables and formulae

All illustrations, regardless of whether they are diagrams, photographs or charts are referred to as images. The name and number of images should be displayed as centred.

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




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

The title and number of the table should be presented above the table as centred

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)

Submit your article, including tables, images, etc., as a single file. In addition, you should submit all figures and tables (which are entered in black and white) as separate files in TIFF or JPF format with a minimum resolution of 300dpi.

Formulae should be centered on the page and properly numbered, as in the following example. It is recommended that you format the rows with formulae in Microsoft Word (using MathType).

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

## 4. Conclusion

In conclusion, the authors should summarize the results they have obtained in the research.

## 5. Literature

When quoting the literature, the APA referencing system should be used. For more information, see the Publication Manual of the American Psychological Association (6th ed.).

**When quoting within the text,** as in the sentence where you mention the author and specify his words, then after the author's name you should indicate the year of publication of the quoted text in parentheses, at the end of the sentence there should be the number of page in which the text should be indicated: according to Čerović (2012) ,,quoted text''(p.10). When the author is not mentioned in the sentence, then his last name, the year of publication and the number of page should be indicated in parentheses at the end of a sentence, and if the quote was created by paraphrasing or summarizing, then data about the page number is not required: (Čerović, 2012). If there are two or more references by the same author, but they were published at the same time in the same year, the referencing should look like this (Harish, 2008a; Harish, 2008b). When two authors wrote the paper together, the surnames of both authors are written as follows (Petković and Pindžo, 2012), or (Tew & Barbieri, 2012). The call for references in the text requires working with more than two authors and should be stated as follows (Luque-Martinez et al., 2007). When citing a source that does not show the number of pages (such as electronic sources) use the author's name and year of publication if the author is known, and if the author is a corporation or an organization, write down the organization name and year of publication (Ministry of Finance and Economy, 2013).

**References should be given at the end of the main text in alphabetical order,** following the last name of the author. Below are shown examples of using APA style for citations appearing in various forms (books, journal articles, proceedings, electronic resources, etc.).

**A book with one author:**
Example: Hrabovski, Tomić, E. (2009). *Health tourism destinations.* Novi Sad: Prometheus.

**A book with several authors:**
When you have multiple authors, all of them are supposed to be mentioned, but as soon as the last surnames are added and if there are more than seven authors, mention the first six and then write … at the end of the last author.

Example: Barrows, C. & W. Powers, T. (2009). *Introduction to the Hospitality Industry.* 7th edition. Hoboken, New Jersey: John Wiley & Sons, Inc.

**A book which was translated from a foreign language:**
Example: Spic, E. H. (2011). *Art and psyche: a study of psychoanalysis and aesthetics.* (A. Niksic, prev.). Belgrade: Clio.

**A book with an editor for a collection of papers; proceedings:**
If the book is a collection of papers on the appropriate topic, the authors should mention the editor of their work with the surname and first initial in parentheses as they add "edit" if the person is editor, or "Ed." as editor if the book is written in a foreign language.

Example: Đurković, M. (ed.) (2007). *Serbia 2000-2006: state, society, economy, Belgrade:* Institute for European Studies.

**Papers in the proceedings:**
Example: Cerovic, S. (2012). *Modern concepts of strategic tourism destination management.* Scientific conference with international participation "Tourism: Challenges and Opportunities", Trebinje.

**Papers published in the journal by one author:**
Example: Harish, R. (2008). Brand Architecture and its Application in Strategic Marketing. *The Icfai University Journal of Brand Management,* 7 (2), 39-51.

**Papers in a journal with two authors:**
If the article to which you refer has a DOI number, references need to be added.

Example: 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

**Papers in a journal with more than two authors:**
Example: Luque-Martinez, T. Castaneda-Garcia, A. J., Frias-Jamilena, D. M., Munoz-Leiva, F. & Rodriguez-Molina, M. A. (2007). Determinants of the Use of the Internet as a Tourist Information Source. *The Service Industries Journal*, 27 (7), 881 to 891. doi: 10.1080 / 02642060701570586

**Newspaper article with the aforementioned author:**
Example: Muscle, M. (days 1 February 2012). US Steel has reduced its losses. *Politika,* p. 11

**Newspaper article with no author specified:**
Example: Straževica ready in two months. (Days 1 February 2012). *Politika*, p. 10

**Thesis in the printed version:**
Example: Dewstow, R. A. (2006). *Using the Internet to enhance teaching at the University of Waikato* (Unpublished master's thesis). University of Waikato, Hamilton, New Zealand.

**Document or database from the Internet, the private or official web page for which we know the database author:**
Example: Kraizer, S. (2012). Safe child. Retrieved on 29 October 2012, from http://www.safechild.org/

**Document or databases from the Internet, the official web page for which we do not know the author:**
Example: Penn State Myths. (2006). Retrieved December 6, 2011, from http://www.psu.edu/ur/about/myths.html

**Document or databases from the Internet, private or official web page where the author is a corporation or organization:**
For example, the Ministry of Finance and Economy. (2013). Information on tourist traffic in Serbia. Retrieved on 06 February 2013 from http://www.turizam.mfp.gov.rs/index.php/sr/2010- 02-11-17-24-30

The sources which were not used in the paper should not be included in the list of references. References should be cited in the language in which they are published without translating them into the language of paper.

**Obrazac za pripremu radova za objavljivanje u časopisu**
**Serbian Journal of Engineering Management**

# Naslov rada na srpskom jeziku

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

[1] Institucija i i-mejl adresa [ostavite u ovoj verziji prazno za potrebe recenzije]
[2] Institucija i i-mejl adresa [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

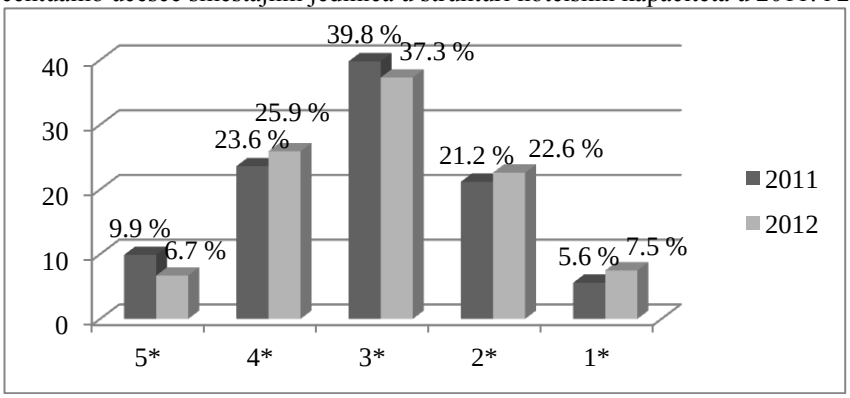
U prvom redu na prvoj strani treba napisati naslov rada na srpskom jeziku (16 pt). Ispod naslova rada treba ostaviti mesto za navođenje ime(na) autora, nazive institucija autora onako kako je naznačeno u ovom Obrascu. Nakon institucije poslednjeg autora, ostaviti jedan prazan red i u sledećem napisati 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.).

**Prilikom citiranja unutar teksta,** kada u rečenici spominjete autora i navodite njegove reči, onda posle imena autora treba navesti godinu izdanja citiranog teksta u zagradi, a na kraju rečenice potrebno

je navesti broj strane na kojoj se nalazi rečenica u tekstu iz koga navodite: prema Čeroviću (2012), „citirani tekst“ (str.10). Kada se autor ne spominje u rečenici onda njegovo prezime, godinu izdanja rada i broj strane u radu navesti u zagradi i na kraj rečenice, a ako je citat nastao parafraziranjem ili rezimiranjem, onda podatak o broju strane nije neophodan: (Čerović, 2012). Ukoliko se navodi dve ili više referenci istog autora, a pri tom su objavljene u istoj godini, poziv na reference treba navesti na sledeći način (Harish, 2008a; Harish, 2008b). Kada su dva autora rada, navode se prezimena oba autora na sledeći način (Petković i Pindžo, 2012), odnosno (Tew & Barbieri, 2012). Poziv na reference u tekstu za radove sa više od dva autora treba navesti na sledeći način (Luque-Martinez i sar., 2007). Kada citirate izvor koji ne prikazuje broj strana (kao što su elektronski izvori) koristite prezime autora i godinu objavljivanja, ukoliko je autor poznat, a ukoliko je autor korporacija ili organizacija, naziv organizacije i godinu objavljivanja (Ministarstvo finansija i privrede, 2013).

**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.).

**Knjiga sa jednim autorom:**
Primer: Hrabovski, Tomić, E. (2009). *Destinacije zdravstvenog turizma.* Novi Sad: Prometej.

**Knjiga sa više autora:**
Kada imamo više autora navodimo ih sve, s tim što pre poslednjeg prezimena dodajemo i, odnosno &, ako imamo više od sedam autora, navodimo prvih šest, zatim pišemo pišemo tri tačke, i na kraju poslednjeg autora.

Primer: Barrows, C. W. & Powers, T. (2009). *Introduction to the Hospitality Industry*. 7th edition. Hoboken, New Jersey: John Wiley&Sons, Inc.

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

**Knjiga sa urednikom ili priređivačem, zbornik radova:**
Ako je knjiga zbornik radova na neku odgovarajuću temu, kao autora navodimo priređivača tog dela i uz njegovo prezime i inicijal imena u zagradi dodajemo "ured." ako je urednik, ili "prir." ako je priređivač, ili pak "Ed." kao editor ako je knjiga pisana na stranom jeziku.

Primer: Đurković, M. (ured.) (2007). *Srbija 2000-2006: država, društvo, privreda, Beograd:* Institut za evropske studije.

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

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

**Rad u časopisu sa dva autora:**
Ako članak na koji se pozivate ima DOI broj, treba ga dodati referenci.

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

**Rad u časopisu sa više od dva autora:**
Primer: Luque-Martinez, T., Castaneda-Garcia, J. A., Frias-Jamilena, D. M., Munoz-Leiva, F. & Rodriguez-Molina, M. A. (2007). Determinants of the Use of the Internet as a Tourist Information Source. *The Service Industries Journal,* 27(7), 881-891. doi: 10.1080/02642060701570586

**Članak iz novina sa navedenim autorom:**
Primer: Mišić, M. (1. feb. 2012). Ju-es stil smanjio gubitke. *Politika,* str. 11.

**Članak iz novina bez navedenog autora:**
Primer: Straževica gotova za dva meseca. (1. feb. 2012). *Politika,* str. 10.

**Teza-štampana verzija:**
Primer: Dewstow, R. A. (2006). *Using the Internet to enhance teaching at the University of Waikato* (Unpublished master's thesis). University of Waikato, Hamilton, New Zealand.

**Dokumenta ili baze podataka sa interneta, privatne ili zvanične internet stranice kojima se zna autor:**

Primer: Kraizer, S. (2012). *Safe child*. preuzeto 29. oktobra 2012, sa http://www.safechild.org/

**Dokumenta ili baze podataka sa interneta, zvanične internet stranice kojima se ne zna autor:**
Primer: *Penn State Myths*. (2006). Preuzeto 6. decembra 2011, sa http://www.psu.edu/ur/about/myths.html

**Dokumenta ili baze podataka sa interneta, privatne ili zvanične internet stranice kojima je autor korporacija ili organizacija:**
Primer: Ministarstvo finansija i privrede. (2013). *Informacije o turističkom prometu u Srbiji*. preuzeto 06. februara 2013. sa http://www.turizam.mfp.gov.rs/index.php/sr/2010-02-11-17-24-30

Izvori koji nisu korišćeni u radu ne treba da se nalaze u popisu literature. Reference treba navoditi na jeziku na kome su objavljene bez prevođenja na jezik rada.

# Instructions for Authors

The Journal Committee strives to maintain the highest academic standards. The submitted papers should be original and unpublished until now. Also, it is forbidden that papers are in the process of reviewing in some other publication.

The papers would be subjected to check. The paper should fit the outlined academic and technical requirements.

**Paper Types**

Original unpublished scientific paper:
- Original scientific paper;
- Plenary lecture and paper presented at the conference;
- Review;
- Scientific review; discussion.

Original unpublished professional paper:
- Original professional paper;
- Contribution
- Book review.

Papers may be written in Serbian and English for authors from Serbia and the region or English for authors from other countries.

Submitted papers must be in alignment with guidelines for authors. In case they have not followed these guidelines, they would be reviewed for correction.

All manuscripts are subject to *double blind review*, i.e. the process of double "blind" anonymous reviewing. The papers must not contain any references which may indicate the author(s).

**Paper Submission**

Authors should send their papers via email casopis@fim.rs in .doc or .docx format.

The application consists of two separate attachments:
- Attachment 1, which contains the following data: the title of paper, author's name (without professional title), institution and address (email, postal address, phone number), as well as the asterisk next to the author in charge of correspondence;
- Attachment 2, which contains the paper with the following elements: paper title, abstracts, key words, the middle part of the paper, tables, graphs, references and attachments.

Authors, who pass the *double blind* anonymous review, will receive the document called the Author's Statement of Originality, which will be filled in, underlined, scanned and sent to the email: casopis@fim.rs.

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