ISSN 2466-4693
UDC/UDK: 005:62

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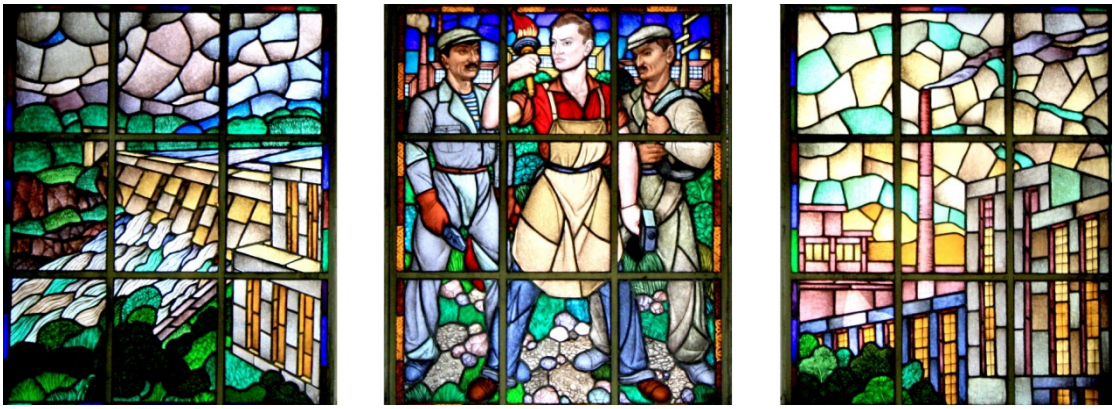

Serbian Journal of Engineering Management

Vol. 7, No. 1, 2022

Belgrade, January 2022

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Beograd, januar 2022.

Serbian Journal of Engineering Management
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Published semiannually (January and July)/Izlazi dva puta godišnje (januar i jul)

Publisher/Izdavač:
University "Union – Nikola Tesla", School for Engineering Management, Belgrade
Univerzitet „Union – Nikola Tesla", Fakultet za inženjerski menadžment, Beograd

For publisher/Za izdavača:
Prof. dr Vladimir Tomašević

Press/Štampa: Black and White, Belgrade

Circulation/Tiraž: 300

ISSN: 2466-4693

Contact/Kontakt:
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CONTENT/SADRŽAJ

A Message from the Editor-in-Chief

Serbian Journal of Engineering Management is a scientific journal, published by School of Engineering Management and Society of Engineering Management of Serbia. The Journal is cathegorized by the Ministry of education, science and technological development of the Republic of Serbia. From 2020, the Journal is indexed in EBSCO databases. This international Journal is dedicated to the wide scope of themes associated to engineering management and industrial engineering and is published semiannualy. The papers are presented in English.

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, Leadership, Organizational behaviour, Organizational culture, Financial management, Information systems, High technologies management, Environmental management, Waste 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 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. Časopis je takođe od 2020. indeksiran u EBSCO bazama. Ovaj međunarodni časopis je posvećen temama povezanim sa inženjerskim menadžmentom i industrijskim inženjerstvom i izlazi dva puta godišnje (u januaru i julu). Zastupljeni jezik za članke je engleski.

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

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

Informacije o časopisu i poziv za autore, na srpskom i engleskom jeziku, nalaze se na web stranici časopisa: https://fim.edu.rs/istrazivanje-i-saradnja/naucno-strucni-casopis/.

Prof. dr Vladimir Tomašević, FRSA

Original Scientific Paper/Originalni naučni ra UDC/UDK: 004.7:004.92]:004.85
Paper Submitted/Rad primljen: 27. 10. 2021.
Paper Accepted/Rad prihvaćen: 21. 1. 2022.
DOI: 10.5937/SJEM2201001J

Novi pristup modelu rudarenja podataka koji je zasnovan na grafovima

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Apstrakt: Ovaj rad predstavlja novi pristup analize komunikacionih mreža (CNA) koja je interdisciplinarna podoblast naprednog koncepta analize društvenih mreža (SNA). Predlaže se identifikacija relevantnih vrhova unutar povezanih komponenti u grafovima telekomunikacionih mreža . Pored ovog rezultata, algoritam opisuje ponašanje između članova komponente, istraživačke interakcije između komponenti i korišćenje telekomunikacionih usluga . Algoritam se zasniva na kombinaciji dve važne tehnike mašinskog učenja – tehnike klasifikacije Ekstremno povećanje gradijenta (XGB) i algoritma grafa koji se sastoji od Izrezivanja, K-susedstva, Izolovanih ostrva i izračunavanja Mere centralnosti. Ovaj model data mininga se koristi u telekomunikacionim kompanijama kao deo marketinških strategija i procesa upravljanja kampanjama jer se influenseri nagrađuju za doprinos širenju i usvajanju mrežnih usluga među članovima.

Ključne reči: CNA, SNA, Graph algorithm, Pruning, K-Neighbourhood

New Approach for Graph Based Data Mining Model

Abstract: This paper presents new approach of Communication Network Analysis (CNA) that is interdisciplinary subfield of advanced concept of important Social Network Analysis (SNA). Objects in CNA are members of network discovered as vertices that are linked by edges. Identification of relevant vertices within connected components in telecommunication network graphs, such as influencers are proposed. Beside this result, the algorithm describes behaviour between component members, research interactions between components and telecom services usage. Algorithm is based on a combination of two important machine learning techniques - Classification technique Extreme gradient boosting (XGB) and Graph algorithm that consists from Pruning, K-Neighbourhood, Isolated islands and Centrality measure calculation. This data mining model is used in telecommunication companies as part of marketing strategies and campaign management processes since influencers are awarded for contribution in network services spreading and adopting between members.

Key words: CNA, SNA, Graph algorithm, Pruning, K-Neighbourhood

1. Introduction

Graph theory

Graph theory is based on mathematical structures such as graphs. The graph representation is ordered pair $G = (V; E)$, where V is is a finite, non-empty set of vertices (tops, vertices), and E is a set of two-element subsets of set V, i.e. a set of edges (arcs, branches). Graph is a mathematical structure that consists of vertices (vertices or points) which are connected by edges (links or lines). Graph find its application in many areas, from fundamental mathematics, combinatorics, over data science and machine learning.

Graphs could be undirected and directed, depending on whether the edge connecting the vertices u and v is the same as the edge that connects the vertices v and u.

We consider neighbors of every vertex, that is, a set of vertices between which there is an edge. Two vertices are adjacent if there is an edge which connects them, that is, $= \{u, v\} \in E$. For graph G it is denoted set of neighbours that is $N(v) = \{u \in V \mid (u, v) \in E\}$. Degree of vertex v is $d(v)$ and it is the number of neighbours for vertex v. The loop in the graph is the edge which connects the vertex with itself. A graph that has no loop or parallel edge is called prime. Examples of graphs that are investigated in the literature are “zero graph”, ”trivial graph”, ”simple graph”, ”undirected graph”, ”directed graph”, ”complete graph”, ”connected graph”, K-”partite graph”, ”disconnected graph”, ”weighted graph”, ”regular graph”, ”cyclic graph”, ”acyclic graph”, ”star graph”, ”multigraph”, ”planar graph”, etc. (Diestel R 2000).

There are different variants of representing graphs on a computer, and each of them depends on the nature of the problem being solved and the computer resources at its disposal. Under the term computer resources, it mainly refers to the available memory space. Usually, the vertices of a graph are enumerated with $0, 1, 2, \ldots, n-1$ or $1, 2, \ldots, n$, where n is a number of vertices in the graph. The set of edges is represented by one in two ways:

1. The adjacency matrix is represented by the elements that provide information about whether there are edges in between vertices corresponding to the indices of these elements. If the graph is not weighted then the elements of the matrix neighbourhoods only contain information about the existence of an edge between the corresponding vertices. If it is a weighted graph, then the matrix element contains information about the weight of the edges. Formally, the neighbourhood matrix of dimension nxn of G is written as (Janicijevic, 2016):

$$A_G = \left(a_{\{ij\}}\right)_{(i,j)\in VxV} \qquad (1)$$

   Example of the adjacency matrix is:

$$\begin{pmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{pmatrix}$$

2. A graph can be represented by a list of neighbours such that each of the vertices of the graph is an element to which a list is formed in which the neighbours of that vertex are placed in the graph. When working with the sparse graph (a graph in which the number of edges is proportional to the number of vertices), neighbour lists are used because all edges of the graph are described with relatively few data.

However, the list variant is expensive because, for example, a very simple operation such as testing if some two vertices are neighbours requires reviewing the list of neighbours. In practice, the number of such tests can be very large and the performance of the program will be significantly compromised. If they have enough memory, then it is best to present the graph in both ways, to be after they used information either from the neighbourhood matrix or from a list of neighbours, depending on where they were located information that is relevant. The neighbour list is usually made on the basis of distance, so that it is first in lists the vertex neighbour that is closest, and the last vertex the neighbour that is farthest (Amer, 2015).

Well known problems that are solved by graph algorithms are Hamilton loop problem, Graph k-colouring problem, Minimal partition problem, Minimum dominating set problem, Independent set problem, Maximal clique problem, Longest path problem, etc.

Graph applications are wide: Internet, telecommunication networks, scheduling, road network, railway network, power transmission system, etc. Certain problems that are successfully solved are optimal transport of goods, optimal energy transfer, protection against accidents, etc.

Social Network Analysis

Social network analysis (SNA) is also a real-life graph application that finds its purpose in Internet and telecom companies. One of the first difficulties is that this problem belongs to the class of NP-complete (NP-difficult problems), since finding an optimal solution for such problem is almost impossible in real

life time. Solving NP difficult problem with exact methods is expensive and often impossible to do, so it is usually found some heuristic with the help of which an approximate solution is obtained. That solution may not be optimal, but if the heuristics are good enough the solution will be close to optimal. This problem belongs to the problems of combinatorial optimization. For the most part it is possible to write them in the spirit of mathematical programming.

SNA has arisen from the broader field of graph theory and network systems. Interaction between vertices or objects provides approaches for distinguished algorithms to develop insights from communities to predict behaviour of a network.

Social network analysis is analysis of connected objects in any sort of networks and graphs. The Internet is growing and according to that, social networks are growing through the world. We could say that social networks can be viewed as a set of connected entities. Most of the time we represent it by a collection of vertices and edges. A vertex is an abstraction for a user in the network whereas edges are relations between these users (Ahmed and Ismail 2020).

SNA applications provide relations entities and people over the globe. Most social networks are based on friendship and family linkage (Facebook, Instagram, Twitter), but there are also professionally networking (LinkedIn) or advanced expert networks (DNA App, Trading View).

Communication Network Analysis

Large-scale is specialty of telecommunication networks. It is very common to create network with over a million vertices and many more edges. Also, in industry-based cases, number of edges is smaller than the maximal number of edges. A common characteristic of telecommunication graphs is that they are scale free, which means that the distribution of the number of relations of every user follows power law behaviour. One of main characteristics of a network is big data approach. It is very usual to explore networks with millions and millions of users and billions of edges. Another characteristic is sparseness, since complete subgraphs or maximal cliques are very hard to be found for a significant number of vertices (Kihl, 2010).

The process of defining usage communications based on both the network and the graph theory is known as Communication network analysis. Communication Network Analysis (CNA) is the subfield of Social Network Analysis where vertices and edges are common graph-based approach features such as users and relations between them, but conceptually CNA is different than SNA since, edges are developed according to telecommunication traffic such as voice and SMS system.

CNA and SNA methods have become a powerful tool for studying networks in various issues of telco field.

Big Data

Big data occurs in science, industry, and commercial applications. These include government, military, telecommunications, medical, biotechnology, astrology, ecological, pharmaceutical systems, as well as many others. Big data sets are faced with challenges such as data storage, data warehousing, data compression, visualization, information insights, clustering, pattern recognition, algorithm performing. Addressing these issues requires special interdisciplinary efforts in developing sustainable techniques. Big databases imply with them complex and content issues and thus represent a challenging field to address. In many cases, big data sets are represented as large graphs with remarkable attributes that are connected with vertices and edges. Remarkable attributes may contain special information that characterizes the information. Analyzing the structure of such a graph is important to understand the structural characteristics of the application which is represented, such as improving information retrieval and memory organization. Current trends in analyzing large graphs are developed mostly on market graphs, telecommunication graphs and Internet graphs (Ahmed and Ismail, 2020).

2. Problem Formulation

CNA objective is identification of influencers in a network based on the number of connected users and based on the traffic between them, so this paper explores the identification of influencers in the telecommunications network. Regarding to this, there is methodology for identification of the

influencers proposed. This research is based on CNA methodology. The main pillars of CAN are voice, SMS and data traffic.

Msisdn is the mobile station international subscriber directory number and the CAN model is based on it. CNA adopts a record of data produced by the telephone exchange. These data record emanates the details of each Telecom transaction (VOICE, SMS, MMS, GPRS, internet using...) that passes through mobile devices. In conjuction with msisdn, CNA emanates various data sources such as customer data to analyse users' relationships. Coupling this information equable with CAN, "it provides better insights and values that affect the revenue and the customer satisfaction" (Amer, 2015). Msisdn and usage data collected for 4 months. It was implemented ETL (Extract, Transform and Load) to data.

"It is used CNA to analyse relationships among interacting vertices (users, products ...etc.), therefore we discovered the structure of individuals or organizations. Relationships in a network can be directional or non-directional. When we talk about directional relationship, we could say that one person is the initiator (or (source) basis of the relationship) while the other is the one who receives (receiver) (or destination of the relationship)" (Amer, 2015). Weight is indication of the vitality of the connections that can be added.

In CNA most important is the concept that present communications over network flow, such as voice and messaging system. Networks are used to represent group of users or vertices of a network with their linkage characteristics or edges.

3. Related Work

In the paper written by Molhem et al. (2019), the authors are trying to explain what exactly SNA analysis in Telecom data is. "Networks and SNA concepts were applied using Telecom data such as call detail records and customers' data in order to construct a weighted graph in which each relation carries a different weight, representing how close two users are to each other. SNA is used to explore the Telecom network and calculate the centrality measures. Centrality measures help to determine the vertex importance in the network".

"Finding Multi – SIM users within the same operator or across different operators presents another important concern to Telecom companies because it allows improving campaigns and churning models. The paper is based on a real dataset of 3 months MSISDN and customer data provided by a local Telecom operator. Accuracy of 85% was achieved for users from different operators and 92% for users from the same operator".

In the paper written by Pham et al. 2015, the authors survey "recent advances in the study of influencer identifications develop from big data perspectives, and present state-of-the-art solutions of vertices whose removal would breakdown the network. They proposed survey methods to locate the essential vertices that are capable of shaping global dynamics with either continuous or discontinuous phase transitions. The solution implies recommender system in social networks".

In the paper written by Bethu et al 2018, the authors argue that "data science is a concept to unify statistic, data analysis and their related methods in order to "understand and analyze actual phenomena" with data. The principal idea in designing different marketing strategies is to identify the influencers in the network's communication. Targeting influencers usually leads to a vast spread of the centrality measures to identify and assign an influence score to each other. Higher score – better influencer".

The aim is to find the best influencer between users among given pair of users. Algorithm is basically developed to scale all cases over the graph. Data is used for researching pattern and scoring the new data with the prediction for every user among the given pair of users.

3. Model building and validation

Methodology

CNA is a model that explores a user's telecommunications network through the behaviour of each user individually, based on the number of users with whom a specific user comes into contact, but also based on the intensity of communications that user has in the network. The model highlights influencer

users within prominent groups of connected users. In addition, the model provides insights into the mutual relations of network members, but also insights into the relations of users towards telecommunication services.

Main methodology of influencer identification consists from combination of two approaches: Classification algorithm XGB and Graph based algorithm which considers K-Neighborhood, Pruning, Isolated islands and Centrality measures calculation.

Together, they are forming machine learning system for CNA. One of the goals involves modelling the mechanisms that underline human learning. It was developed learning algorithms that are generally consistent with knowledge of the human cognitive architecture and that are also designed to explain specific observed learning behaviors. This machine learning can transform training data into knowledge using algorithm.

The phases of the CNA model are:

- Data preparation,
- Model development,
- Model evaluation.

Data preparation

Data preparation is a very demanding and important process. It implies scrubbing, wrangling, munging and auditing which is performed over tables for A number and for AB numbers communication. These two tables are final and they contain independent and dependent variables that enter the model, which means, selection of variables, deleting redundant variables, working with missing values, editing outliers, normalization of data, etc. Table A number consist from the predictors such as voice count, SMS count, voice duration, gprs count, long voice duration, short voice duration, etc., while the target variable is y.

It is defined according to formula:

$$y = \{1,\ where\ minimum\ 6\ relevant\ predictors\ are\ achieved\ for\ at\ least\ 50\%\ of\ value\ \ 0,\ otherwise\ \} \quad (2)$$

Where:

$$x_i \in X, X \in \{voi_{cnt}, voi_{dur}, sms_{cnt}, data_{cnt}, voishort_{cnt}, voilong_{cnt}, voishort_{dur}, voilong_{dur}, voiin_{cnt}, smsin_{cnt}, voiout_{cnt}, smsout_{cnt}\} \quad (3)$$

Target variable is used for calculation potentially most valuable vertices - influencer vertices with y = 1, so we positively labelled every A number that has more communication than variable median for at least 6 variables predictors.

Model development - Extreme gradient boosting (XGB)

The core of extreme gradient boosting (XGB) itself is the “group algorithm based on the gradient boosting tree. Gradient boosting is an algorithm of boosting in the ensemble algorithm. XGB algorithm is an efficient implementation version of gradient boosting algorithm. Because of its excellent efficiency in application practice, it is a widely-praised technique in industry. XGB is similar to gradient boosting decision tree (GBDT) and is based on the classification and regression tree theory. It is able to build multiple weak evaluators on the data and then summarizes the modelling results of the weak evaluators. In parallel, the XGB model can effectively deal with regression and classification problems to obtain better performance than a single one” (Bhattacharya, 2020).

“Gradient boosting involves the creation and addition of decision trees sequentially, each attempting to correct the mistakes of the learners that came before it. Most implementations of gradient boosting are configured by default with a relatively small number of trees; it is because adding more trees beyond a limit does not improve the performance of the model. The reason is in the way that the boosted tree model is constructed, sequentially where each new tree attempts to model and correct for the errors made by the sequence of previous trees”.

The objective function is formed of two levels. The first level is used to measure the discrepancy between the predicted cost and the actual cost (represents the deviation of the model), and the other part is the regularization term (the variance of the control model). The prediction accuracy of the model is regulated by the deviation and variance of the model.

XGB aims to target and predict a possible influencer. It is used to reduce the user base to a size that is optimal for management, transformation, and manipulation.

1. Initialize $f_0(x) = arg\ arg\ min_\gamma \sum_{i=1}^{N} \quad L(y_i, \gamma)$.
2. For $m = 1\ to\ M$:
   a. For $i = 1, 2, \dots, N$ compute
   $$r_{im} = -\left[\frac{\delta L(y_i, f(x_i))}{\delta f(x_i)}\right]_{f=f_{m-1}}$$
   b. Fit a regression tree to the targets r_{im} giving terminal regions
   $$R_{jm}, j = 1,2, \dots, J_m.$$
   c. For $j = 1,2, \dots, J_m$ compute
   $$\gamma_{jm} = arg\ arg \min_{\gamma} \sum_{x_i \in R_{jm}} \quad L(y_i, f_{m-1}(x_i) + \gamma).$$
   d. Update $f_m(x) = f_{m-1}(x) + \sum_{j=1}^{J_m} \quad \gamma_{jm} I(x \in R_{jm})$.
3. Output $\hat{f}(x) = f_M(x)$.

The goal of XGB is to eliminate vertices with low values of total traffic, and thus to reduce the dimension of the initial graph. Based on the target variable, XGB creates a decision about which user is an influencer.

The final set of users is selected in a new table which is the basis for creating a graph.

XGB is designed for speed and performance. Two reasons to use XGB are execution speed and model achievement. In addition, XGB has proven to be great combination of software and hardware optimization techniques to achieve superior results using fewer computing resources in the shortest amount of time.

XGB consists of following steps:

- Parallelism in tree construction,
- Pruning using the DFS algorithm,
- Computing in external memory,
- Regularization due to reduced overfitting,
- Efficient handling of missing data,
- Built-in cross validation.

Model evaluation parameters:

- Coincidence matrices,
- Performance evaluation,
- Evaluation metric (AUC&Gini).

Model development - Graph algorithm

Graphs are a structure and a powerful tool for modelling and analysing data such as telco and social networks, websites and links, as well as vehicle locations and routes. When there is a set of objects that are interconnected, then they can be represented by graphs.

The graph algorithm aims to observe the interrelationships between influencers and other users on the basis of which the final set of influencers is determined. A graph algorithm is used to highlight measures of significance of each vertex in interaction with other vertices.

The vertices with their edges that formed graph are users that the XGB model has classified as potentially influencers with their connections.

Based on the created table, the weight of the edges between A and B numbers is calculated, defining the calibration parameter for the call length, the number of calls and the number of SMS communications. The greatest weight is assigned to the length of the call, and the least to the number of SMS in accordance with the distribution of the database

$$w = (alpha * 6/8 * row['VOI\_DUR'] + alpha * 2/8 * row['SMS\_CNT'] + (1 - alpha) * row['VOI\_CNT']) \quad (4)$$
$$where\ alpha = 0.5$$

K-Neighborhood

The K-neighborhood method determines the vertex degree, indegree, and outdegree of the 1st level neighbours. They are calculated for each vertex based on this initial graph.

Pruning

"The problem of determining the proper size of an artificial neural network is recognized to be crucial, especially for its practical implementation in such important issues as learning and generalization. One popular approach for tackling this problem is commonly known as pruning and it consists of training a larger than necessary network and then removing unnecessary weights/vertices. The algorithm also provides a simple criterion for choosing the units to be removed, which has proved to work well in practice. The results obtained over various test problems demonstrate that effectiveness of the proposed approach" (Zhang and Mingyang, 2019).

Data set consists from vertex-level information for all vertices that are still included in the graph after removal of weaker edges. Weak edge considers all edges smaller than median weights of all edges.

Isolated islands

Isolated island gives an answer to the standard question: "Counting the number of connected components in an undetected graph". A connected component of an undirected graph is a subgraph in which every two vertices are connected to each other by a path, and which is connected to no other vertices outside the subgraph. A group of connected for example voice calls forms an island (Hanneman, 2005).

The graph is reduced to components, eliminating weak components with the remaining weaker vertices. Using the Isolated Islands method, the graph is divided into mutually isolated components of optimal size while less isolated components are discarded. The graph is divided into connected components and further separation is performed, so that no subgraph contains less than the number of vertices defined through minimum list length. The Isolated islands method separates the components at the level of bond strength, so that the edges with the least weight are eliminated first. Within each stronger component, the central vertices (i.e. the carriers of communications in the group) are isolated. BFS algorithm reduce graph on strongly related components. In BFS, we start from a specific vertex and explore as far along each level of vertices as possible before re-searching backwards. We also need to monitor visited vertices. When we implement BFS, we use the stack data structure to support reverse lookup.

Centrality measures

Metrics are the final part of the model that decides who is the influencer among the vertices. Metrics are calculated for each vertex, and, we could say the metrics calculated the importance of each vertex. Typical metrics that are used the closeness and the betweenness. They are based on shortest paths and distances between vertices (Zhang, 2017).

$$CLOSENESS = \sum_{y \neq x} \frac{1}{d(y,x)}. (5)$$

$$`BETWEENESS = \sum_{s \neq v \neq t} \frac{\sigma_{st}(v)}{\sigma_{st}} (6)$$

Targeting influencers usually leads to a vast spread of the centrality measures to identify and assign an influence score to each other.

Higher score means better influencer.

The most important vertices are selected by sorting and comparing the highest values of these metrics, based on previously isolated components for each vertex.

The selection of influencers is made on the basis of the Table 1. These are the strongest users in the network, according to degree and who have many outgoing communications and many incoming communications. In production, the model is realized by hundreds of large groups of connected users, which are shown here.

Table 1. Table of final result after isolated islands and centrality measures calculations

	group id	msisdn	degree	closeness	betweenness
604	301	38*******63	1930	0.002142531	1861383.467
521	902	38*******27	1628	0.002141762	1324349.875
868	87	38*******30	1415	0.002141815	939444.9204
58	149	38*******24	1311	0.002142061	856551.797
871	406	38*******10	849	0.00214199	342381.3873
59	640	38*******00	767	0.002141245	293623.2

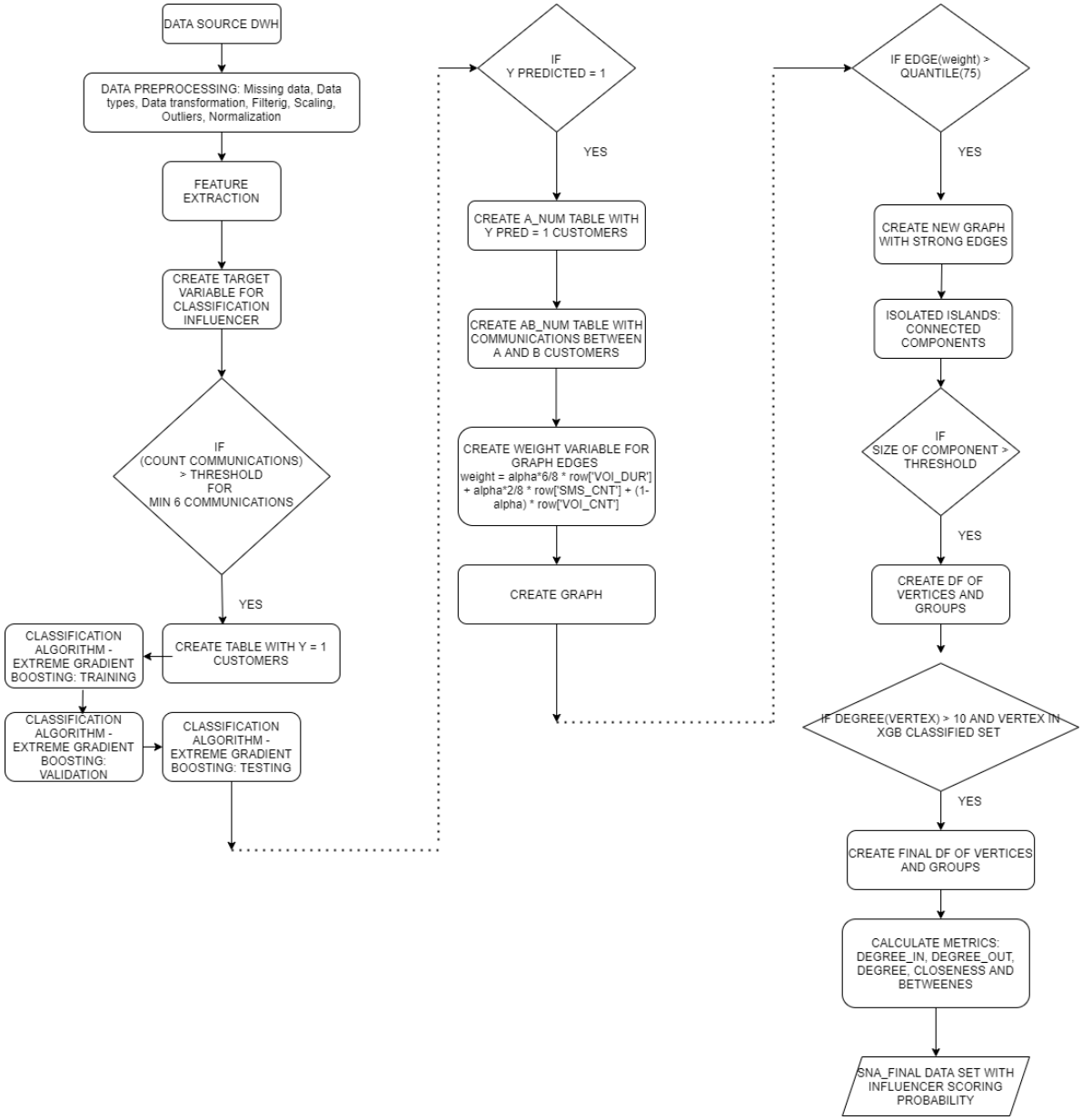

Figure 1. Algorithm CNA Source: Authors

Pseudocode

1. $Initialize\ f_M(x), where\ \ f_M \in f^N\ space\ of\ classified\ subscribers$
2. Create weighted graph and adjacency matrix

$for\ i = 1\ to\ M$
$for\ j = 1\ to\ M$
$x[i,j] = w(i,j)$
$iterate\ through\ all\ connections$

3. $Calculate\ K - Neigborhood$

$for\ i\ =\ 1\ to\ M$
$for\ j\ =\ 1\ to\ M$
$if\ (G{-}{>}\ x[i][j]\ ==\ 1)$
$degree++$

4. $Pruning$

$Input$: $A\ weighted\ graph\ G\ =\ (V,E)$
Output: Subgraph $H \subset G$
1: Sort edges E by weights in an ascending order.
2: $F \leftarrow E$
3: $n \leftarrow (|E| - (|V| - 1))$

4: { Iteratively prune the weakest edge which does not cut the graph }
5: i ← 1, j ← 1 { j is an index to the sorted list of edges }
6: while i ≤ n do
7: if C(u, v; F \ {ej}) is not − ∞ then
8: F ← F \ {ej}
9: i ← i + 1
10: j ← j + 1
11: Return H = (V,F)

5. $Isolated\ islands$

```
for i = 1 to M
    for j = 1 to N
      if (x[i][j] && !visited[i][j]) {
        // visited yet, then new island found
        // Visit all cells in this island
        BFS(x, i, j, visited)
        // and increment island count
        ++count
```

6. $Calculate\ centrality\ measures$

4. Results and interpretation

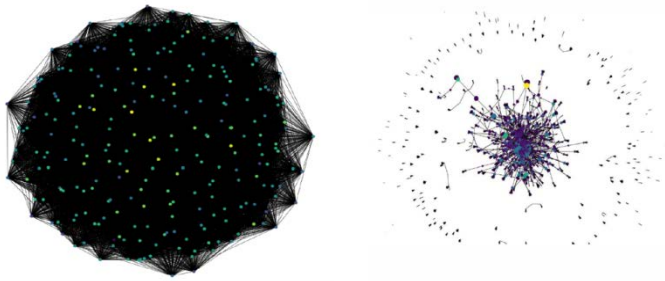

Figure 2. These are population graph and sample graph
Source: Authors

Classification method is trained on 1130925 unique MSISDN data set. Target variable y is equal 0 on 601350 MSISDN and 1 on 529575 MSISDN. After classification, it was calculated contingency matrix distributed on TP, FP, TN and FN as follows:

Table 2. Extreme Gradient Boosting Y - Train set

XGB - Y/TRAIN	**0**	**1**
0	537488	63862
1	58725	470850

Table 3. XGB results for different parameters combinations on train data set

Classification	***AUC***	***GINI***	***Accuracy***	***Precision***
XGB (max depth = 10, boost = 5, min child weight = 0.1, max delta step = 0.7)	0.698	0.720	63.3%	74.83%
XGB (max depth =20, boost = 10, min child weight = 1.0, max delta step = 0.5)	0.713	0.731	65.7%	76.24%
XGB (max depth =25, boost = 10, min child weight = 1.0, max delta step = 0.6)	0.762	0.791	69.4%	79.14%
XGB (max depth =35, boost = 5, min child weight = 1.1, max delta step = 0.4)	0.	0.837	74.3%	82.51%
XGB (max depth =40, boost = 10, min child weight = 1.1, max delta step = 0.2)	**0.904**	**0.802**	**83.16%**	**88.91%**

Best approach is last combination of parameters for this model. Parameters are:

- Tree method: basic,
- Number of boosts: 10,
- Max depth: 40,
- Min child weight: 1.1,
- Max delta step: 0.2
- Objective function: binary logistic,
- Sub sample: 1.0,
- Eta: 0.3,
- Gamma: 0.0,
- Alpha: 0.0
- Scale pos weight: 1.0.

After selection of best combination of parameters on training data, it is applied model on evaluation set. Number of unique MSISDN was 2038410. Comparation between total population and $y = 1$ population according to features distribution:

Table 4. Extreme Gradient Boosting Y - Eval set

XGB - Y/EVAL	**0**	**1**
0	971640	132346
1	111081	823343

Table 5. Comparing $\$XGB$ with y

Correct	1,794,983	88.06%
Wrong	243,427	11.94%
Total	2,038,410	

Table 6. Evaluation Metrics

Model	**AUC**	**Gini**
%XGB - y	0.907	0.815

For the evaluation set it is achieved 16234 strong vertices (influencers) in 2341 isolated components.

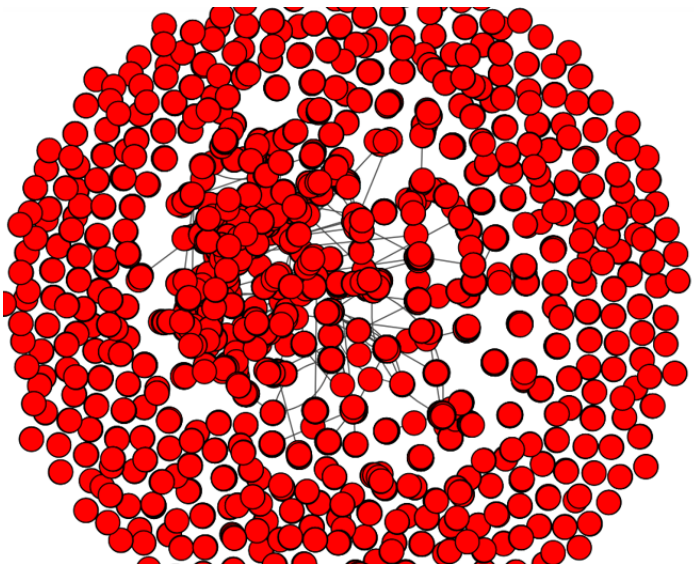

Figure 3. This is influencer graph
Source: Authors

Conclusion

Global graph search is currently the most optimal method of processing large data; all large systems such as the Internet and telecommunications use graph-based algorithms since other heuristics are almost impossible without it. The CNA model provides and regularly submits a list of users and groups sorted by the highest probability. A list of users from the most influential to the least influential according to K-Neighbourhood degree in the selected group of influencers is submitted. For related groups, information on group size and strength is provided, which is also sorted by probability from largest to smallest.

The results of the model present possibilities for telco industry and for advanced analytics.

The model approach is very well applied for the big data concept for HDFS but also for DWH concept. It is possible to research telco sparse graphs and calculate different thresholds for pruning weak edges and threshold for the number of components. Based on that table, it is possible to form reports at the aggregate level, as well as at the individual level.

The questions that the model answers are:

- Who are the most influential users - central network users?
- Which groups can be spotted in the network?
- In what way is the network divided into less loosely connected groups?
- How is the network evolving?
- Will the network be maintained or cease to exist?
- How do ideas-information spread through the network?

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Review Scientific Paper/Pregledni naučni rad UDC/UDK: 628.4.042:502.131
Paper Submitted/Rad primljen: 30. 9. 2021. 628.353:502.174.2
Paper Accepted/Rad prihvaćen: 21. 1. 2022.
DOI: 10.5937/SJEM2201013M

Upravljanje otpadnom biomasom iz prehrambene industrije: Potencijala primena koštica breskve za prečišćavanje otpadnih voda

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Apstrakt: Biomasa koja preostaje kao otpad iz poljoprivredne i prehrambene industrije ima veliki potencijal da se, kao jeftina i lako dostupna sirovina, upotrebi za prečišćavanje otpadnih voda. Pokazano je da se, uz minimalan hemijski ili mehanički pretretman, otpadna biomasa može kosistiti za sorpciju teških metala, organskih i bioloških zagađivača kako u otpadnoj tako i u pijaćoj vodi. S obzirom da je biomasa obnovljiv resurs koji se kao otpad svakodnevno generiše i zahteva skladištenje, njeno uključivanje u održivi razvoj i cirkularnu ekonomiju predstavljalo bi višestruku dobit za celokupno društvo. Primena otpadne biomase za prečišćavanje otpadnih voda pozitivno bi se odrazila na ekološku, energetsku i ekonomsku dobrobit svake države, a posebno one u razvoju.

Ključne reči: Otpadna biomasa; prehrambena industrija; koštice breskve; tretman otpadnih voda.

Management of Waste Biomass from Food Industry: Potential Application of Peach Shells for Wastewater Treatment

Abstract: As available at low- or zero-cost, agricultural and food industry waste biomass has great potential to be used for wastewater treatment. It has been shown that, with minimum of chemical or mechanical pre-treatment, waste biomass has great adsorption capacity for different heavy metals, organic and biological pollutants from both drinking and wastewater. Since biomass is a renewable resource that is generated daily as waste and requires storage, its inclusion in sustainable development and the circular economy would have multiple benefits for society as a whole. The use of waste biomass for wastewater treatment would have a positive environmental, energy and economic impact on a country's welfare, especially developing ones.

Keywords: Waste biomass; food industry; peach shells; wastewater treatment.

1. Introduction

The 2018 edition of the United Nations World Water Development Report specified that global water demand has increased by 600% over the past 100 years. The same Report predicted that until 2050 almost 6 billion people will suffer from clean water insufficiency (UNESCO, 2018). The gap between global water supply and increasing demand for water is the result of reduction of water resources, and increasing water pollution, driven by population growth, economic development and changing consumption patterns (UNESCO, 2018).

Approximately one-third of global drinking water requirement is attained from surface sources such as rivers, lakes, and canals. These water sources also serve as sinks for the discharge of industrial, agricultural and domestic wastewater containing heavy metals, organic and biological pollutants which are constantly contaminate the available water (Boretti & Rosa, 2019). In developed countries, strict environmental laws with *water*-related *legislation* and monitoring for compliance prevent undue

pollution to freshwater sources. However, developing countries, like the Republic of Serbia, need both increased environmental protection awareness and good waste management technologies, while the removal of pollutants should be considered as a priority issue for drinking water and wastewater treatment.

A basic requirement for the human utilisation of water is the ability to remove chemical and biological pollutants quickly and efficiently at low-cost. Over the years, a plethora of technologies have been developed and proposed for water purification, among them are aerobic and anaerobic microbial degradation, chemical oxidation, sorption, coagulation, membrane separation, electrochemical treatment, dilution, filtration, flotation, softening, hydrogen peroxide catalysis, and reverse osmosis (Shaheen et al., 2016; Awasthi et al., 2019). The sorption is confirmed as a superior technology for wastewater treatment because of its cost-effectiveness, simplicity of operation, high sorption capacity toward pollutants, etc. (Marković et al., 2015). Due to their abundance, inexpensiveness, environmental safety and recyclability, natural materials such as clays (e.g. kaolin, bentonite, montmorillonite, smectite), zeolites, coal, etc., are the most commonly used sorbents for the removal of heavy metals, organic and biological pollutants from wastewater (Awasthi et al., 2019; Rosales et al., 2012). Since classical methods for wastewater treatment are energy (i.e. economically) demanded and generated secondary wastes (Lopičić et al., 2017a) there is an increased tendency to implement sustainable wastewater treatment through the utilization of biomass waste from agriculture and food industry. In the past two decades variety of waste biomass, such as coconut husks, cashew nut shell, peach nut shell, cork biomass, mango seed kernel, waste coffee powder, dried plant leaves, wool, cotton seed hulls, waste tea, orange peel, rice straw, and many others, has been tested as a (bio)sorbent for wastewater treatment (Kumar & Kumaran, 2005; Febrianto et al., 2009; Marković et al., 2015).

2. Waste biomass from agriculture and food industry

Biomass comes mainly from primary sources such as agricultural crops (51.5%) and their collected residues (9.9%), grazed biomass (11.7%), forestry (26.6%) as well as fisheries and aquaculture (0.3%). Secondary sources of biomass are recycled paper, by-products from wood processing and recovery of wood and other bio-waste (Colmorgen et al., 2020).

The agricultural sector is important for improving the availability of food and achieving food security (Pawlak & Kołodziejczak, 2020); furthermore, agriculture has a strategic role in the process of economic development of a country (Praburaj, 2018). As it is known, agriculture already made a significant contribution to the economic prosperity of advanced countries and it is of vital importance for the economic development of less developed ones. As Praburaj (2018) recently stated "where per capita real income is low, the emphasis is being laid on agriculture and other primary industries".

Generally, a rapid growth of agricultural productivity has yielded a huge amount of waste; most of them is waste biomass, which has harmed the environment (Duque-Acevedo et al., 2021). In recent years waste biomass becomes a resource with great potential for the extraction of by-products with high added value under the approach of the circular economy and the bioeconomy. The bioeconomy, as a renewable part of the circular economy, promotes the use and sustainable recovery of agricultural waste biomass as an essential supply. This bio-based economic model has become one of the main tools for drawing up new development policies based on the Sustainable Development Goals. The circular economy and the bioeconomy are presented as the key of the circular economic production models for the transformation of the current food production system. Additionally, a special emphasis is placed in the management of the agricultural waste biomass and the alternatives for its valorization, which are promoted by the bioeconomy as circular and sustainable practices (Duque-Acevedo et al., 2021).

Figures 1 and 2 show average amounts of the most produced food commodities in the world (Fig. 1) and in the Republic of Serbia (Fig. 2), in the period 2010-2020. Increased production of food commodities simultaneously increases amount of waste biomass. One strategy to manage biomass more effectively is based on the concept of circularity in agricultural production, as proposed in food systems research by de Boer and Van Ittersum (2018). This concept aims to reduce food losses and food waste, using biomass for human consumption first, then for livestock, and finally to recycle any by-products back into the system (Muscat et al., 2020; van Zanten et al., 2016a; van Zanten et al., 2016b).

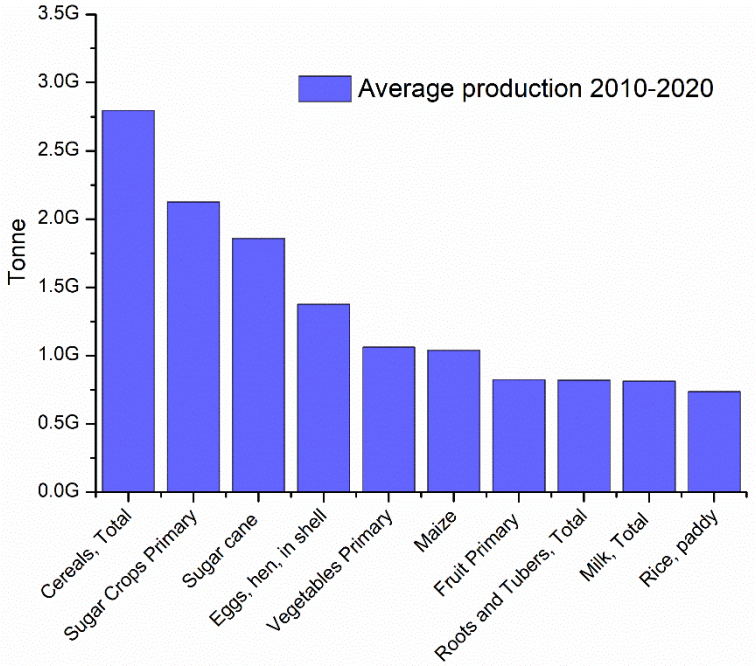

Figure 1: Most produced food commodities in the world; average in period 2010-2020
Source: (FAOSTAT, Retrieved February 27, 2022)

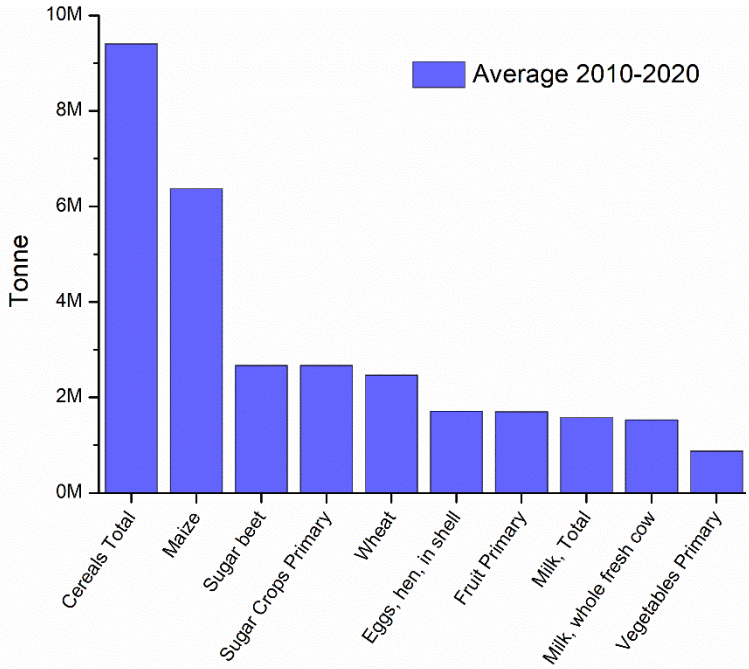

Figure 2: The most produced food commodities in the Republic of Serbia; average in period 2010-2020
Source: (FAOSTAT, Retrieved February 27, 2022)

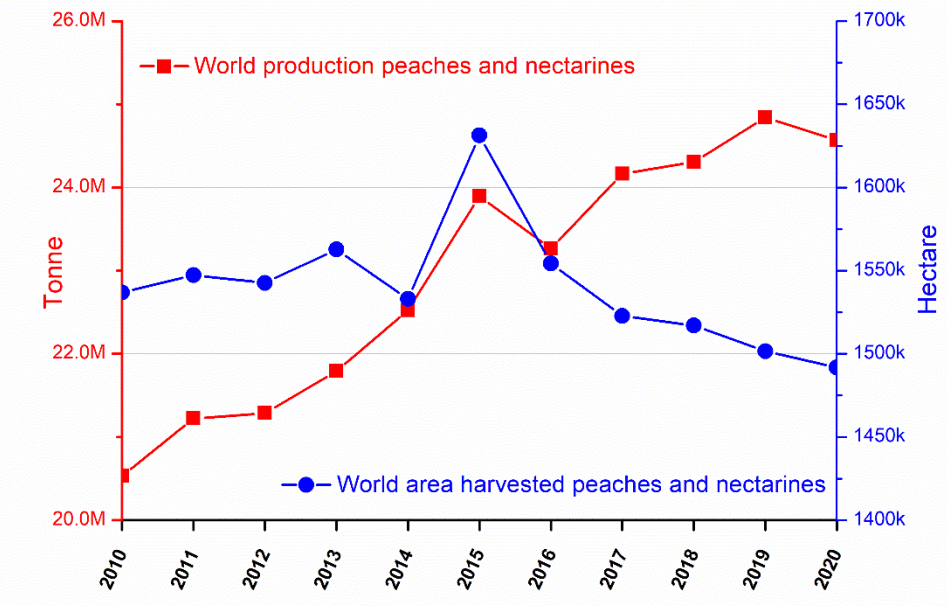

Figure 3: World peaches and nectarines production in the period from 2010 to 2020 (total amount and area harvested)
Source: (FAOSTAT, Retrieved February 27, 2022)

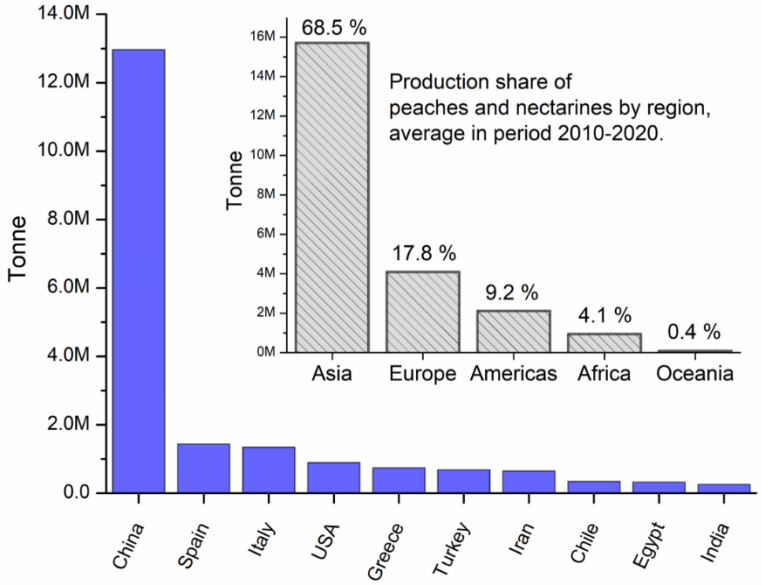

Figure 4: Peaches and nectarines production from 2010 to 2020: Top 10 world producers; as inset picture: production share by regions.
Source: (FAOSTAT, Retrieved February 27, 2022)

According to United Nation Food and Agriculture Organization data (FAOSTAT) in the period from 2010 to 2020, fresh fruits production has growing trend all over the world. Figures 3&4 show world area harvested peaches and nectarines and average amount produced in the period 2010-2020. Stone of the fruits such as peaches, plums, apricots, represent about 20% of the total fruit mass. This unavoidable food industry waste should be managed in most appropriate way, minimizing harmful impact on the environment, avoiding greenhouse gasses emissions and helping in resource depletion by its renewable nature. In 2020, worldwide production of peaches was about 24.5 million tonne (FAOSTAT, February 27, 2022, Figure 3). According to the Statistical Office of the Republic of Serbia data, peach (*Prunus persica* L.) is the fifth most common fruit in Serbia after plums, apples, pears and cherries, with annual production of 60000 tonne in 2020 (FAOSTAT, February 27, 2022, Figure 5). Since approximately 20% of peach mass is its stone, it can be estimated that almost 12000 tonne of this potentially useful waste is generated in Serbia every year (Lopičić et al., 2019). This waste is usually

disposed on open dumps in industrial facility area, presenting a potential risk to the environment and human health. According to available data, in 2011 the Fruit Processing Factory "Vino Župa" Aleksandrovac has generated about 14500 tonne of waste biomass, where about 2500 tonne include solid waste of peaches, cherries, apricots, and plums (Lopičić et al., 2017b). Within the *recent* past, this waste biomass material was ballast for the company because it was disposed of as waste, which led to economic and environmental burden on both the company and the environment. In recent years, efforts have been made to find new solutions for the use of this material, most often through direct combustion. Although peach and nectarine stones possess high caloric values enabling their usage as a fuel; high water (49-60%) and mineral (especially potassium) content significantly complicates the combustion process (Jenkins et al., 1998; Lopičić et al., 2013a) make them challenging and expensive.

Therefore, it is very important to develop new possibilities for the use of waste biomass and thus improve the ecological and economic balance of its life cycle, while relieving already formed open dumps and preventing the formation of new ones. A review of up-to-date literature shows that lignocellulose waste biomass from the food industry has been mainly used as a precursor for production of activated carbon which has further been used for the removal of water pollutants (Attia et al., 2003; Aygün et al., 2003; Guo et al., 2003; Ip et al., 2008). Due to a large amount of water (50-60%) which biomass contains, the pyrolysis process, necessary to convert lignocellulosic biomass to activated carbon, is energy-intensive. Thus, was essential to consider other possibilities where lignocellulosic biomass will be directly applied, with minimal investments. One of the possibilities was to use raw lignocellulosic biomass as a sorbent (Albadarin et al., 2014). The absorption capacity i.e. removal efficiency of raw biomass is lower than that of active carbon but it is an available and inexpensive material; simultaneously, the use of biomass as an agricultural solid waste resolve the environmental problem of its storage.

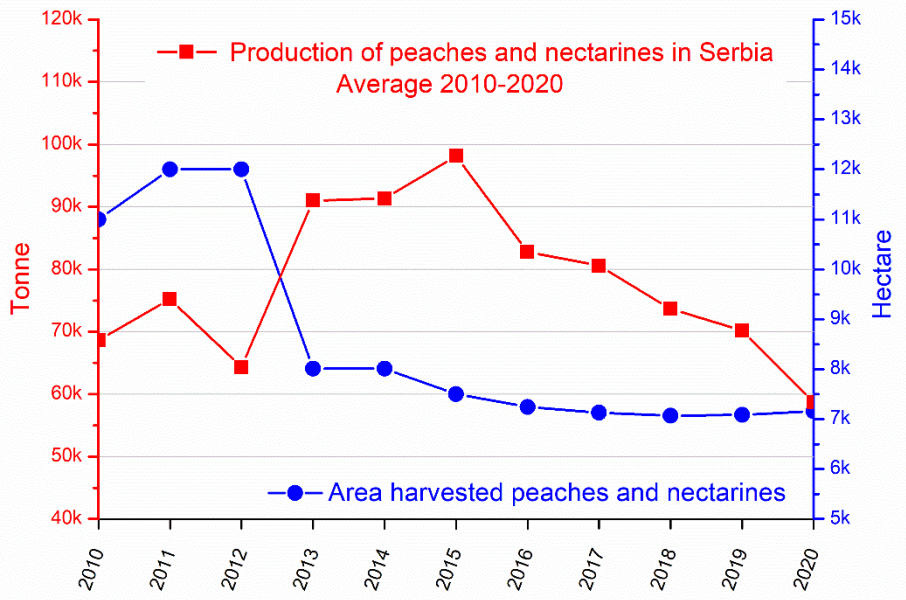

Figure 5: Production of peaches and nectarines in the Republic of Serbia in period from 2010 to 2020 (total amount and area harvested)
Source: (FAOSTAT, Retrieved February 27, 2022)

3. Application of peach shells for water treatment: Scientific approaches in the Republic of Serbia

Removing of dyes from a textile and dye industries

Colour is the first contaminant to be recognized in wastewater. Residual dyes are the major contributors to colour in wastewaters generated from textile and dye manufacturing industries (Mojsov et al., 2016). Contamination of drinking water by some dyes at even a concentration of 1.0 mg per L is highly visible and affects not only the aesthetic aspect and water transparency, but also the absorption and reflection of sunlight, interfering with aquatic life in lakes, rivers and other water bodies. Actually, colour

impedes light penetration, decreases the efficiency of photosynthesis, inhibits the growth of biota, also has a tendency to chelate metal ions which result in micro-toxicity to fish and other living organisms (Mojsov et al., 2016). Thus, it is necessary to remove dye from wastewater before discharging it into sink; it could be done by decolorization or by degradation.

Wastewater decolorization can be performed using waste biomass from food industry as biosorbent for dye. Previously we have shown that raw powdered peach shells are a highly efficient biosorbent for removal of methylene blue (MB), a non-degradable cationic dye, as pollutant from water solutions (Marković et al., 2015). Waste peach shells have been supplied from Vino Župa, Aleksandrovac, Serbia, fruit juice factory. Prior to sorption experiments, the collected peach shells have been pretreated: to remove the adhering pulp, the peach shells were washed several times with boiled water and subsequently dried at room temperature. After drying, peach shells were manually crushed and separated from kernels; shells were milled in vibromill and sieved in different fractions. For the dye sorption experiments, the particles fraction smaller than 100 micrometer was used. Before the biosorption experiments, peach shells particles were washed with 0.01 M HCl to clean out surface impurities, subsequently washed with distilled water and dried for 24h.

It has been shown that the efficiency of powdered peach shells for the removal of methylene blue, i.e. their adsorption capacity toward MB, depends on the initial dye concentration, biomass amount, contact time, and the pH value of the dye solution. Collected experimental results indicate that hydrogen bonding is the principal mechanism for the removal of methylene blue by powdered peach shells. Powdered peach shells with hydrogen bonded dye molecules can be easily removed from water solution by gravity-driven filtration or decanting, thus avoiding additional costs.

Removing of heavy metals

In the last more than twenty years many published journal papers concerned application of waste biomass as biosorbents for heavy metal ions as the most common pollutants in drinking and wastewater in modern societies. Besides, heavy metals are the most investigated due their high toxicity, persistence and bioaccumulation tendency (Arief et al., 2008). World Health Organization declared chromium, cadmium, mercury, lead, copper, aluminum, cobalt, nickel, zinc, magnesium and iron as the most toxic metals that induced human poisonings (Djeribi and Hamdaoui, 2008). For example, lead ions are powerful neurotoxins; over a hundred thousand deaths attributed to lead poisoning have been reported in 2016. Lead poisoning has also been correlated to the appearance of defects at birth and to cancer. Lead is commonly used in the infrastructures for water transportation and supply around the world, and the amount of metal dissolved in drinking water increases with time due to the progressive corrosion of the infrastructure. Furthermore, the recent practice to add chloramine for disinfection in water treatment facilities has led to even higher concentrations of lead ions in drinking water, because of the reaction of chlorine with lead in domestic pipes, which promotes the metal dissolution. Another major pollutant is cadmium, which is extensively used in electronic circuits, batteries, solar cells, paints and pigments, and can enter water sources through industrial waste. Consumption of water contaminated with cadmium can lead to severe gastrointestinal irritation and, potentially, to death.

Removal of heavy metal ions can be accomplished by exploiting the ability of materials with suitable functionality to bind the pollutants, whilst remaining insoluble in water. After binding, they form secondary contaminants and can be easily removed from water source.

The same group of authors examined an influence of pH on the biosorption capacity of lignocellulose waste toward copper (II) ions. They have tested biosorption at several pH values between 2 and 6; they have found significant influence of pH on the biosorption capacity and established pH 5 as the most prominent (Lopičić et al., 2013a). Removal of Cu (II) by biosorption on mechanically treated peach shells has been studied at different operating parameters in a batch sorption system, with special attention on temperature effect on sorption process (Lopičić et al., 2017a). According to collected results, the authors stated fast equilibrium and small amounts of energy enrolled in physisorption process which promoted mechanically treated peach shell particles as a good alternative for Cu (II) removal from aqueous solution. Additionally, the authors examined an influence of mechanical pretreatment on absorption capacity of peach shell particles toward copper (II) ions (Lopičić et al., 2019). Peach shell particles have been pretreated in vibratory disk mill and ultra-centrifugal mill, biosorption capacity has been determined, obtained results have been evaluated and compared. The collected results have shown that regardless of the type of mill used for pretreatment the average

particle size and the size distribution are similar. However, the crystallinity index was lower for particles pretreated in vibratory disk mill than for those pretreated in ultra-centrifugal mill, which was also confirmed by lower crystalline thickness and hydrogen bond intensity index. It has been shown that particles pretreated in vibratory disk mill have lower absorption capacity for Cu (II) than particles pretreated in ultra-centrifugal mill. Different absorption capacity has been explained by different specific surface area and total pore volume influenced by pretreatment in different types of mills.

Beside methylene blue dye and heavy metals, powdered peach shell particles supplied from Vino Župa, Aleksandrovac, Serbia, have been tested as biosorbent of mycotoxins (Adamović et al., 2013; Lopičić et al., 2013b). The obtained results indicate that peach shell particles can be successfully applied as effective biosorbents of mycotoxins, while pretreatment of the particles by acid modification leads to the improvement of their biosorption capacity.

4. Conclusion

In the Republic of Serbia peach shells are widely available and renewable waste from agriculture and food industry, thus, their applicability as a biosorbent has a twofold significance: (1) as an economically viable solution for wastewater treatment and (2) the way to significantly reduce the mass and volume of food industry solid waste from storage places.

Acknowledgements

S. Marković acknowledges the financial support by the Ministry of Education, Science and Technological Development of Republic of Serbia (Contract number: 451-03-68/2022-14/200175).

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Review Scientific Paper/Pregledni naučni rad UDC/UDK: 005.5:316.77]:614.2
Paper Submitted/Rad primljen: 19. 10. 2021.
Paper Accepted/Rad prihvaćen: 23. 12. 2022.
DOI: 10.5937/SJEM2201022K

Upravljanje procesima implementacije kulturne kompetentnosti u zdravstveni sistem

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Apstrakt: Kultura ima značajan uticaj na oblikovanje stavova ljudi o zdravlju, blagostanju i percepciju zdravstvene zaštite. Zdravstvena kulturna kompetentnost je sposobnost da se efikasno funkcioniše kao pojedinac ili organizacija u kontekstu kulturnih verovanja , praksi i potreba pacijenata i zajednica . Kulturna i lingvistička kompetentnost predstavljaju skup ponašanja , stavova i politika koji omogućavaju efikasan rad u interkulturalnim sredinama . Kulturološki različiti pacijenti imaju slabiji pristup zdravstvenim uslugama i suočavaju se sa različitim preprekama. Kulturna kompetentnost zdravstvenih radnika uključuje svest, znanja i kulturne veštine za smanjivanje ovih prepreka. U radu prikazujemo tri modela razvoja kulturno kompetentne zdravstvene zaštite, Campinha-Bacote, Milton Bennett i Darla Deardorff. Modeli se unapređuju u skladu sa novim istraživanjima i saznanjima. Predlaže se da menadžment zdravstvenih ustanova razmotri aspekte kulturne samosvesti, veštine interkulturalne komunikacije i analizu sociokulturnih barijera u zdravstvenoj zaštiti. Obrazovanje i obuka zdravstvenih radnika ka postizanju ravnoteže između interkulturalnog znanja i komunikacijskih veština je najbolji pristup u razvoju kulturnih kompetencija.

Ključne reči: Kulturna kompetentnost, zdravstveni radnici, obrazovanje, globalizacija

Managing the Implementation Processes of Cultural Competency into a Healthcare System

Abstract: Culture has a significant impact on shaping people's attitudes about health, well-being and their perception of health care. Health cultural competence is the ability to function effectively as an individual or organization in the context of the cultural beliefs, practices and needs of patients and communities. Cultural and linguistic competences are a set of behaviours', attitudes and policies that enable effective work in intercultural environments. Culturally diverse patients have poorer access to health services and face different barriers. The cultural competence of health professionals includes awareness, knowledge and cultural skills to reduce these barriers. The paper presents three models of the development of culturally competent health care, Campinha-Bacote, Milton Bennett and Darla Deardorff. Models are being improved in line with new research and knowledge. It is proposed that the management of health institutions consider aspects of cultural self-awareness, intercultural communication skills and analysis of socio-cultural barriers in health care. Education and training of health professionals towards achieving a balance between intercultural knowledge and communication skills is the best approach in the development of cultural competencies.

Keywords: Cultural competency, healthcare workers, education, globalisation

1. Introduction

Culture is a group tool in navigating within the environment. It enables people to create a special world around them, control their own destiny and develop. Sharing the heritage of different cultures promotes our social, economic, technological and human development (Ronra Shimray, 2020). Cultural sensitivity indicates that culture and behavior are relative and that we need to be more careful and less

absolute in interpersonal interactions (Shiraly et al., 2021). Due to globalization, cultures in transition from traditional to western are expected to have poorer health indicators. Faced with unknown environmental, social, economic and physical resources to maintain and improve health, traditional communities are at significantly higher risk of chronic diseases. Local health institutions are not ready to respond to these challenges in a culturally appropriate way (Ratna, 2019).

International literature recognizes the importance of cultural factors on people's attitudes about well-being, holistic health and their understanding of health care. There are pronounced disparities in the perception of health status people living in different cultural and socio-demographic environments (Handtke et al., 2019). Culturally diverse patients as well as those from different language areas have less access to health services than the local population and face different barriers (Stubbe, 2020). It has been proven in the available research about people living in cultural minorities, especially those with language barriers, that they get worse health care compared to ordinary people, experience more accidents and adverse events of treatment during visits to health institutions (Al Shamsi et al., 2020). The authors highlight the same the problem when it comes to all languages, not just English, especially when it comes to health care of immigrants, refugees and ethnic minorities (Szaflarski et al., 2019).

Cultural and linguistic competence in the provision of health care are two inseparable entities and represent a set of behaviors, attitudes and policies within the system and employees and enable effective work in intercultural circumstances (Gulati et al., 2022). Cultural competence is not determined only by the knowledge acquired during education and training, although the importance of this form of knowledge acquisition cannot be disputed, but it represents a constant commitment and awareness of cultural factors that influence attitudes about health and disease (Abubakar et al., 2018). Knowledge from this field helps healthcare workers to understand how the patient perceives his illness and how he feels, perceives and reacts to the disruption of his health. It should be emphasized the importance of knowing the most diverse practices of traditional medicine, which are often practiced among different ethnic groups and which should be understood because they are important for the patient who seeks health care (Abubakar et al., 2018). The essential importance of health workers' own beliefs, attitudes and values towards health, ethnic heritage and own cultural heritage is essential (Abubakar et al., 2018).

The essence of understanding cultural competence is not the acquisition of knowledge about different ethnic groups, but rather the developed awareness of the health worker, his skill and attitude that he should approach the patient in such a way as to overcome all ethnic barriers. With this approach, the patient's perception of the cultural competence of the health care provider is improved, his desirable health behavior is improved, and thus the treatment outcome is better, as well as the reduction of disparities. An important strategy for improving care for racial and ethnic minorities is empowering them to actively participate and communicate actively during health visits (Williams et al., 2019).

In the study of Govere et al (2016), training on cultural competencies had a positive effect on the cultural competence of health professionals and was significantly associated with increased patient satisfaction. Patient-centered communication is an important segment during examination and treatment, as it is necessary to harmonize all aspects in the context of different norms and values perceived by the healthcare professional and the patient (Handtke et al., 2019). Intercultural and patient-centered communication are not formally integrated into medical education, although their function is to improve the quality of health care, and both of these skills show similarities (Handtke et al., 2019).

The world is becoming increasingly diverse. Diversity affects all areas of functioning and work, and it is necessary to adequately respond to all the challenges that diversity brings. Diversity and globalization have not spared the health system either and affect its efficient functioning.

2. Models of intercultural competence development

Culture refers to integrated patterns of human behavior that include language, thoughts, actions, customs, beliefs, and institutions of racial, ethnic, social, or religious groups. Cultural and linguistic competencies are a set of matching behaviors, knowledge, attitudes, and policies that are embedded in a system, organization, or among professionals and enable effective work in intercultural environments. Healthcare competence is the ability to function effectively as an individual or organization in the context of the cultural beliefs, practices and needs of patients and their communities. The goal of

intercultural competence in health care is to acquire specific knowledge and skills that enhance its ability to provide quality service (Chauhan et al., 2020).

We single out three earlier models of development of culturally competent health care.

3.1. Campinha-Bacote's model

The Campinha-Bacote's (2002) model of culturally competent health care was developed specifically for this sector. In this model, cultural competence consists of cultural awareness, cultural knowledge, cultural skills and cultural encounters. This combination offers culturally responsible assessments that will in turn provide culturally relevant interventions. The health care workers constantly achieve the ability to work effectively in the cultural context of an individual or community of different cultural/ethnic backgrounds. Cultural awareness requires recognition and sensitivity of the patient's perspective, especially when patients from different cultures are from the culture of service providers. Exploring one's own beliefs, in order to fully understand how it can have an impact on the relationship with patients from different ethnic and linguistic minorities, is necessary to further develop awareness of the importance of cultural awareness (Campinha-Bacote, 2002).

Campinha-Bacote (2001) states two basic approaches in the work of health workers, namely the culturally sensitive and culturally responsible attitude. The first approach refers to the sensitization of the individual in accordance with the perceived beliefs, lifestyles and sensitive style of work, while the second includes the application of all factors that influence a responsible attitude providing a mutually acceptable relationship towards the patient, including diagnosis, treatment and his monitoring.

Employees in health care institutions, during their work, encounter different attitudes and beliefs about illness and the concept of health, depending on different cultural affiliations, and this is called cultural knowledge. It can be acquired through individual engagement, professional activities, by attending expert meetings, congresses and conferences and during conversations with people which belong to different ethnic and linguistic minorities. Each patient is an individual and has their own experiences, perceptions and beliefs. Accordingly, healthcare workers should be able to obtain the necessary information during history taking from patients with attitude full of respect and consideration for sensitive issues. These skills prevent cultural knowledge stereotype. The purpose of cultural meetings is to involve health professionals directly in intercultural area. Cultural meetings allow employees in the health system to check their attitudes about the differences that exist in different cultures and avoid stereotypical behaviors.

3.2. Milton Bennett's developmental model

Milton Bennett's (1993) developmental model of intercultural sensitivity consists of six stages and is applicable in a complex health care system. The stages of this model lead through the entire psychological flow of understanding the area of intercultural sensitivity. The model starts from ethnocentrism in which there is denial, defense and minimization of problems. With the acquisition of new knowledge and education, the healthcare worker develops and moves into the field of ethnorelativism when he accepts diversity, adapts in accordance with new knowledge and integrates into a new approach to intercultural competence.

During the period of denial, the employee is unaware that there are any cultural differences between him and the patients at all. The health care professional assumes that the patient shares a belief system about the illness with him and therefore does not notice any signs that the patients view of well-being, illness, and treatment modalities are different. We meet this attitude more often among healthcare workers who do not often meet patients belonging to different cultural groups. After the denial, a period of defense develops, when the healthcare worker begins to recognize the differences, but due to the risk that these new findings will threaten his perceived and established reality, he moves to defend himself from this level of awareness.

The next period the healthcare worker goes through is minimization. Then the employee already starts to admit that there are cultural differences between him and the patient, but minimizes it. At this stage, he understands that there are still more similarities between people than differences. What can lead to poor intercultural communication in this period is the assumption of similarity that is not supported by real differences between the health worker and the patient. This can lead to poor patient cooperation,

because what the doctor suggests, for example, the patient may never accept, especially when it comes to treatment modalities. After that comes the phase of acceptance of differences. The employee starts to recognizes and respects the existence of cultural differences between himself and his patients. At this stage, the healthcare worker has an ambivalent attitude, so he recognizes that there are differences, but he does not evaluate them as either positive or negative. Then switches to ethnorelativism, starting to respect intercultural differences and their values.

The next phase is the period of adaptation, while the healthcare worker develops communication skills for better interaction with members of other cultures. There is a perspective adaptation and the ability to see the world through different eyes. The sixth stage, the last one, is integration, when employees appreciate cultural differences, values and different behaviors and improve their identity. They manage to overcome the limitations of the intercultural context and are able to integrate their own cultural perspective with other cultures they encounter during their professional work.

3.3. Darla Deardorff's model

The Darla Deardorff's (2006) model is a process model of intercultural competence. The main topic that arises when analyzing the intercultural competence of healthcare workers is their ability to understand the perceived perspective of the patient. Deardorff created the model based on the contributions of leading experts in intercultural communication, and the only element of intercultural competence understands right on perceived perspective of the patient. Deardorff (2006) presented the model consists of four categories, with skills and behaviors spanning the domain of intercultural competence. Those categories are attitudes, knowledge, skills and outcome. "Attitudes include respect, which is defined as valuing other cultures; openness, which refers to refraining from judgment; curiosity and discovery, so it includes tolerance" (Deardorff, 2006).

The model suggests, as a first step in providing culturally competent treatment, the adoption of these attitudes as they ensure respect for different belief systems about health and illness. Knowledge and understanding in this model implies the existence of self-awareness, both at the cultural and at the socio-linguistic level. When it comes to skills, as the third component of the model, they refer to the ability to listen carefully to the patient, observe him and professional assessment, and then analysis, interpretation of the results and connection of everything into one whole, all with the aim of an appropriate assessment of the patient's health condition. Respecting and learning about the patient's culture ensures a greater ability to provide appropriate care. Adaptability, flexibility and empathy of the healthcare professional are necessary to provide everything the patient needs.

The ultimate goal of this model is effective and appropriate communication with the patient and an appropriate form of employee behavior to the specific intercultural situation. Consequently, the provision of interculturally competent care is certainly satisfactory. Deardorff's (2006) model is flexible in accordance with global and individual changes. The presented model is a continuous process, in constant interaction with both, employees and patients, because the development of skills and behavior has a continuum in the long term during the work process. Attitudes and emotional responses according to Deardorff' are crucial in the successful development of intercultural competence.

3. Health workforce cultural competency interventions

Cultural competence represents a series of interventions used to improve the functioning and work of employees in health care institutions. The goal of these interventions is to improve the competence of healthcare workers and improve their capacity to approach every patient who uses healthcare services in a culturally competent manner (Jongen et al., 2018). In order to achieve the desired cultural competence of the employees, different strategies were applied, such as cultural competency training interventions and professional development. Professional development includes various forms of training. When conducting trainings, supervisor should be careful not to have the opposite results, i.e. increasing cultural misunderstanding if attention is not paid to the diversity of cultural groups. In order to avoid cultural misunderstandings, it is necessary during training to use evidence-based knowledge regarding the provision of health care, as well as the advantages of direct contact with patients themselves and respect for their sociocultural perspective (Jongen et al., 2018). Supervision and reevaluation of knowledge for more effective cultural competence needs to be practiced and applied by health institutions, employees and medical students as well. Outcomes of the intervention that should be monitored are acquired knowledge, improved attitudes and beliefs, new communication skills,

adequate behavior and greater self-confidence in work. It is desirable to adopt a positive attitude about the importance of lifelong learning in this area.

Health care outcomes such as employee and patient satisfaction as well as their trust in the health system and employed health workers are proposed to be followed. The next outcome that can be monitored after cultural competency training is patient assessment, a significantly better option than practitioner self-assessment, which is also used. It is certainly best to use both types of evaluation in order to obtain as strong evidence as possible about the impact of interventions on employed health workers in the field of cultural competence (Hulland et al., 2021).

We should certainly not forget that, in addition to doctors and nurses, non-medical personnel are also employed in health institutions. Patients also come into contact and interact with them every day, so it is necessary to include them in the work on cultural awareness, issues of diversity and power (Gulati et al., 2022).

It is much easier to assess knowledge than attitudes. Also, it is not realistic to expect that a healthcare worker can be familiar with all cultural groups and their specificities in each society, also, "…simply having cultural knowledge and knowing about clients' culture is not sufficient to become a culturally competent healthcare practitioner" (Henderson et al., 2018).

In the field of cultural competence, most of the research has been done so far on trainings and educations and their impact on newly acquired knowledge, improved attitudes, developed skills and adapted behavior of employees.

4. Training of cultural competency

At the international level, cultural competence has emerged as a policy for resolving disparities in health care that may be the result of racial, ethnic and linguistic differences. To improve better health outcomes, the attention is on reducing intercultural misunderstandings by the development of competencies in the health system to address cultural issues during consultations. Acquiring new knowledge from cultural competences implies understanding the significant role of culture in the life of each person and the way in which it shapes the behavior of the individual, accepting cultural differences between people and adopting ways to effectively use culturally adapted practices (Jongen et al., 2018). Good example for health systems adapting in providing culturally competent healthcare is hiring bi-lingual healthcare professional or available interpreters for patients support (Chauhan et al., 2020).

Despite of trying to implement cultural competence in the health care system for a long time, there is no consensus on how to operationalize it. There is a need for current recommendations that comprehensively identify and assess the framework of cultural competences at the individual level. The development of academic frameworks alone is not enough for practical implementation with positive results in this crucial field (Alizadeh and Chavan 2016).

Various synonyms such as cultural intelligence, cultural, intercultural and communication competence are mentioned in the literature. Cultural awareness, knowledge and skills and behaviour are the most important constituents. Some authors combine awareness and knowledge into one cultural element known as cognitive one (Alizadeh and Chavan 2016).

Mannion et al (2018) presented review of efficient policies for changing cultural attitudes in the healthcare organizations. Health care organizations differ a lot, in relation to the different specializations of employees, level of education, levels of health care and the types of services they provide. Obstacles and introducing systematic innovations must be taken into account when creating policies and strategies for improving work, patients' satisfaction, positive trend, increasing success and maintain the positive trend of changes (Mannion et al., 2018). Differences in the manifestation of cultural attributes should be taken into account. Some attributes are widespread and stable, while the others rarely occur, sometimes only in some cultural subgroups. We should not forget the readiness and capacity of the management of healthcare organizations for an innovative approach. It is necessary to analyze in detail the capacities of the management staff before organizational interventions in the field of cultural competence (Truong et al., 2014).

Cultural competence is attractive to professionals and policy makers as an instrument for improving the quality of work and better health care (Jongen et al., 2018). Cultural competence of healthcare workers implies the existence of awareness, knowledge, skills, respect of diversity, understanding cultural differences, ability of individual and organizational self-evaluation, adequate provision of services and support of colleagues in this area. It is necessary to consider aspects of self-awareness, ability to cultural communicate and analysis of existing obstacles in the provision of health care.

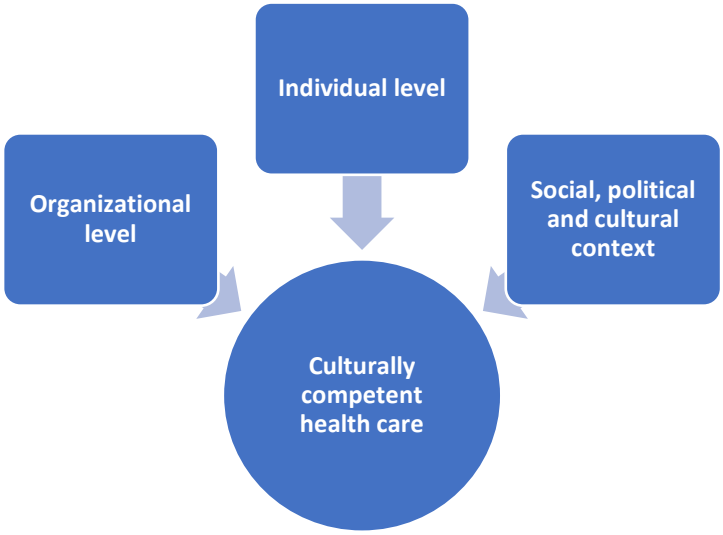

Figure 1. Contexts for implementing the cultural competence of health professionals
Source: Author's source based on literature review

The components of culturally competent health care according to Handtke et al (2019) are, at the organization level, training on cultural competencies for service providers, human resource development, integration of interpreter services, and adaptation of the social and physical environment of the organization. Strategies for providing culturally competent health care are the integration of health workers into the community, educating patients during home or clinic visits, using telemedicine, fieldwork methods, and forming a network of community health facilities. Strategies for the implementation of culturally competent health care creates and promotes intercultural management, which is responsible for monitoring changes within the organization (Handtke et al., 2019).

Incorporating training on cultural competences into didactic and clinical curricula is required to teach new generations of competent medical workers, trained with the facilities necessary to address disparities spread by prejudice. It is also crucial to ensure training on cultural competences to also exists in postgraduate medical education, taking care not to become too mechanical and to remain in line with the basic idea of patient-centered healthcare provision (Grewal et al., 2021). Despite the fact that interventions are needed to improve education related to cultural competence, there is still resistance to it and the attitude that an acceptable attitude, adopted knowledge and adopted values are sufficient for the cultural competence of healthcare workers (Gulati et al., 2022).

Providing health care in different languages, recruiting bicultural/bilingual health workers, training health staff on intercultural competencies, integrating health workers into the community, involving the families of individual patients in care, adapting the environment by offering ethnically adapted meals and written material in different languages, cooperating with minority communities and monitoring organizational development, telemedicine, field methods and creating community health networks are some of the proposals for successful implementation of strategies (Handtke et al., 2019). Betancourt et al (2003) believe that sociocultural factors are critical to clinical practice, when develop intercultural education for health workers. She argued that main goal of education should be to provide knowledge and skills with healthcare workers can better understand and manage socio-cultural areas in their workplace.

Training programs in the field of intercultural medicine are usually dedicated to getting the knowledge about the values, lifestyles by members of different cultures. Now, the current approach is focusing on learning appropriate communication and raising the awareness of healthcare workers about respecting cultural issues and habits in relation to health that exist in all cultures. The aim of the training for

healthcare workers is to experience the patient as a person who can help them develop new skills and necessary changes in attitudes (Matthews et al., 2018). Some of the desirable topics of education are improving knowledge about different styles of communication, motives for making certain decisions, relationships in the family, gender issues in a certain culture, prejudices or attitudes about sexuality. It is necessary to emphasize the need to establish a balance between the achieved level of knowledge and skills in communication when planning training in this area (Betancourt et al., 2003).

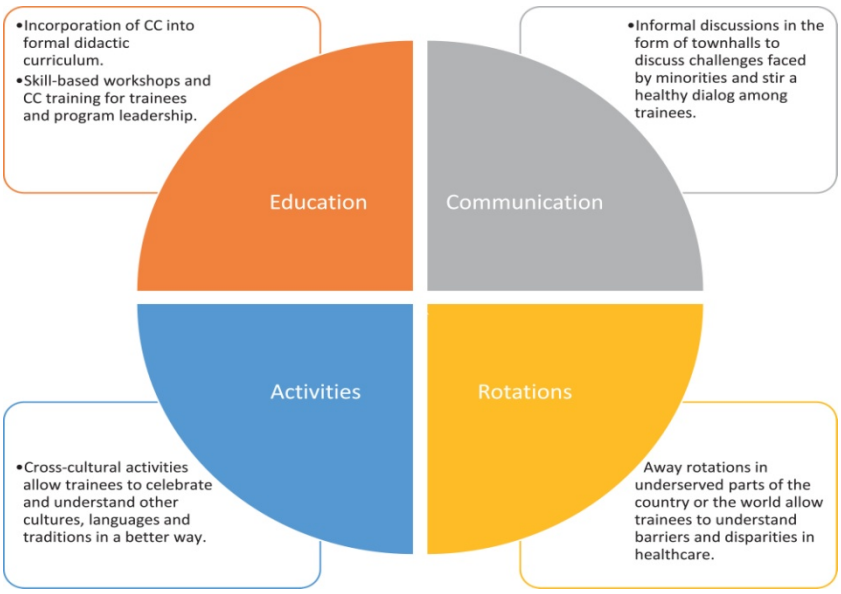

Figure 2. Forms of training of health workers on cultural competence
Source: Grewal et al., 2021

Some types of diversity among people can be influenced through education. It is necessary to carefully consider the ambition that cultural competence can be taught in seminars and training. Also, it is necessary to be aware that all interventions should be implemented in strategies and programs for the development of the health system, so a long-term positive effect can be expected (Gulati et al., 2022).

4. Conclusion

A culturally competent organization is actively created and reviews policies and practices that make services as accessible as possible to diverse populations and provides appropriate and effective services in cross-cultural situations. Such an organization effectively advocates the development of new theories, practices, policies and organizational structures that are more responsive to different groups (Tegarac et al., 2016). They apply the principles of cultural competence at different levels, management of an institution, publicly support cultural diversity and represent all communities that use the services, diversity and human resource management that enables the employment with skills for culturally competent service delivery. If necessary, qualified translators or cultural mediators should be engaged in their daily work (Chauhan et al., 2020).

The goal of health institutions should be promoting the reduction of health inequalities and the development of sustainable and cost-effective policies. It is necessary to ensure continuous training of employees, especially in the field of raising awareness of the impact of discrimination, free access to health care and developing a culturally competent approach to vulnerable groups. The potential of mentoring and supervision approaches to improve health practitioner cultural competence is a a research area worth further exploration and testing for its efficacy and impact. Physical access to health services must be ensured for the most vulnerable groups. Communication with users' needs to be improved, including the elimination of the consequences of the imbalance of power in communication between the user and the healthcare professional. The development of trust, respect, openness and empathy in dealing with customers is significant.

Service providers should take into account the experiences and opinions of the individual when

planning the health care process and learn to bridge differences and build relationships. Community participation is widely believed to be beneficial to the development, implementation and evaluation of health services. Promoting the active participation of service users and the local community in the planning, implementation and evaluation of health care, through partnerships to provide better services to vulnerable groups and inter department initiatives for more comprehensive addressing of health determinants. Cultural competence enables health care professionals to revolutionize the delivery of care, providing their patients with knowledge, the absence of language barriers, and a new space to explore the most critical dimensions of cultural differences.

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Review Scientific Paper/Pregledni naučni rad UDC/UDK:316.77:004.738.5]:659.4
Paper Submitted/Rad primljen: 9. 9. 2021.
Paper Accepted/Rad prihvaćen: 17. 12. 2021.
DOI: 10.5937/SJEM2201031T

Uloga Tik Tok društvene mreže u razvijanju odnosa s javnošću

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Apstrakt: Važnost uspostavljanja komunikacije s korisnicima i potrošačima, putem društvenih mreža, sve je više prepoznata i prisutna u savremenom poslovnom svetu. Odnosi s javnošću omogućuju izgradnju poverenja i sticanje lojalnosti među korisnicima, a delovanje ove poslovne funkcije sve se više dešava putem digitalnih, društvenih medija. Uspostavljanjem bliskog odnosa između potrošača i kompanije, razmena najvažnijih i novih informacija ostvaruje se na svim društvenim mrežama, ali na različite načine. Zbog svoje specifičnosti, Tik Tok kao društvena mreža postaje sve raširenija i dobija sve veći broj korisnika. U radu autori analiziraju važnost korištenja ove društvene mreže u savremenim odnosima s javnošću i promene koje Tik Tok društvena mreža donosi u procesu komuniciranja s javnošću.

Keywords: odnosi s javnošću, komunikacija, društvene mreže, tik tok

The Role of Tik Tok Social Network in Developing Public Relations

Abstract in English: The importance of establishing communication with users and consumers, through social networks, is increasingly recognized and is present in the modern business world. Public relations enable building trust and gaining loyalty among users, and the activities of this business function are increasingly manifested through digital, social media channels. Establishing a close relationship between consumers and the company, the exchange of the most important and new information is achieved thought all social media, but in different ways. Due to its specificity, Tik Tok as a social network is becoming more widespread and gaining an increasing number of users. In this paper, the authors analyze the importance of using this social network in modern public relations and the changes that Tik Tok social network brings in the process of communicating with the public.

Keywords: public relations, communication, social networks, Tik Tok.

1. Introduction

Globally, public relations revenue was over $ 14 billion in 2016, and much of that money is just spent on social media communication (Chadwick, 2021). Public relations is very important for companies, especially in recent decades with the emergence and popularity of social media. This segment has especially advanced and become much more complex because it includes other organizational activities in the company. It is no longer enough for a company to have one-way communication with the public through the print media or television. Consumers demand communication in the form of dialogue, where the company will hear their remarks and suggestions, but also support social goals and stand by their consumers in times of social crisis or injustice.

The development of social media and their diversity, with the rapid flow of information, has enabled a conversation between the public and organizations at a very close level. The diversity of digital media has also led to a division of the population in relation to social media preferences, so that companies have a choice of which segment they want to be in contact with and in what way. In addition to the

rapid dissemination of information, the way in which that information is shared is also of great importance precisely because of population preference. Social media has changed a lot compared to a couple of years ago (Lawlor, 2019), so it is very important to adequately and at the right time choose a suitable social media and create a strategy for the company to be successful and reach the desired audience. According to Whiting and Williams (2013), social networks are used for various purposes, such as video sharing (YouTube), picture sharing (Instagram), microblogging (Twitter) and the like.

In the last few years, there has been a rapid growth in the number of users of the Tik Tok social network. Although it was initially famous as a social network used by teenagers, it quickly spread to the rest of the population due to the specifics of its use. Unlike other social media, social trends on the TikTok network are created and spread very quickly, regardless of the number of accounts that the user follows. By measuring user interaction with content, the algorithm decides how interesting and quality the content is and displays it to a larger or smaller number of users. The function enables companies to quickly achieve quality communication with a larger number of people. In this paper, the authors find connections between the essential activities within the framework of public relations and the observed new social networks. They review its value in building a brand and providing added value to customers in order to build trust among the target segment and improve competitiveness.

2. Public relations

The importance of public relations in the US, Australia, Brazil, Germany, Britain and other parts of the EU is reflected in investment in education programs and universities that deal with communication through the media (Botan, Taylor, 2004). This has led to the emergence of many scientific journals dealing with this form of communication. The first forms of this relatively young branch of science are most often attributed to Sallot et al. (1975), who were the first to try to lay the foundations of public relations. Subsequently, Ferguson (1984) identified three categories important for quality public relations: social ethics, social problems and their management, and public relations. Although seemingly separate categories, all three form a unified process by which companies communicate to the public.

The most important transition that has taken place in the theory of public relations is certainly the transition from a functional perspective to a cocreational one. According to Botan and Taylor (2004), the functional perspective is the observation of the public and communication towards it as a tool for achieving various organizational goals, therefore marketing and advertising arise from this perspective. However, as the theory of public relations developed as well as its application, the whole concept expanded beyond simply thinking about achieving organizational goals.

The cocreational perspective views the public as a partner in creating two-way communication about common goals. This way of observing the tools of public relations is much longer-term because it focuses on nurturing the relationship with the public and puts the importance of this relationship above the achievement of organizational goals. This perspective can also be seen in the authors Grunig and Huang (2000). The focus is on building trust, as the most important element of public relations. Such a relationship enables the contribution that public relations can have outside the company, so they can encourage social change, participate in solving social problems and initiate activities aimed at improving certain aspects of public life (Taylor, Vasquey, Doorley, 2003). With the use of social media as a tool for these processes, the work of companies has been made much easier.

The emergence and development of social media has had a profound effect on public relations. Social media platforms have enabled communication in different contexts. As many as 38% of CEOs in the U.S. said they use social media as their main tool for communicating with the public (USC Center for Public Relations, 2019). The influence of social networks is so strong that it has led to the development of social media related public relations (Wang, Cheng, Sun, 2021). Various authors deal with other aspects of social networks such as time spent in the use of social networks, user perception of social networks, as well as communication on social networks. Broom and Sha (2013) define public relations as a function of management that identifies, establishes and maintains beneficial relationships between companies and the public, while Huang, Wu and Huang (2017) define digital public relations as budding, diversification and advancement in relation to the public.

Diga and Kelleher (2009) note that public relations practitioners who use different social media in their work are much more aware of the expertise, structure and advantages that their company has over the

competition. According to the same authors, in addition to using social media for public relations, communication with the population through the same tools can also contribute to the improvement of strategies in other spheres of business, as well as other public concerts in education, culture, politics, health and marketing. If a company represents the same public goals as its consumers, it makes much stronger connections with its market segment and builds its brand using added value. This enables the company with competitive advantages that can lead to profit increasing (Krivokuća, 2020). In this way, the company invests in its long-term future, especially in times of crisis, and thus ensures the success of its business.

3. Social networks and brand building

Digital technologies have a strong impact on businesses and can help a company use its full potential improve productivity and efficiency (Pavlović, Nestić, Bošković, 2021). Building a brand and providing added value to customers has become a key aspect of modern business. Through quality public relations, companies create a brand image and promote positive relationships between them and the public. Previously, this relationship was nurtured directly through products and services, but it is no longer enough to passively provide customers with certain information without feedbacks, but it is necessary to communicate things that are not product related and create a "product character" or connect the brand with values supported and nurtured by the company. The development of technology as well as e-commerce has led to a significant impact of social networks as well as the online presence of the brand on business. For every company, regardless of the activity it is engaged in, it has become very important to communicate with its customers through social networks. In addition to the possibility of online promotion and sale of products and services, social networks are also an excellent tool for developing good public relations, as well as for brand building and consumer loyalty.

Social networks enable the population to identify with the brand in a much closer way than conventional media advertisements, precisely because of two-way communication. This is made possible by social networks that provide a channel for creating and sharing content in a very easy way. Social networks have completely transformed the relationships between companies and the population by creating multi-way communication (Tsimonis, Dimitriadis, 2014). Information on social networks has become interactive, so users, in addition to consuming, have the opportunity to create and share content.

Rapid changes in the market lead to rapid changes in trends, so the popularity of certain social networks is changing on social networks. The most famous examples are certainly MySpace and Vine, social networks that have gone from a large number of users to a complete shutdown (McAlone, 2015). It is very difficult to predict these trends, and yet it is of great importance for the company to start building its brand on time on a network that gathers the target population. In addition, it is important to avoid wasting resources on the wrong social networks. That is why it is important to follow the trends, make a correct and timely decision on the choice of an adequate social network as a channel for communication, promotion and public relations. If the population perceives a certain brand positively, it will contribute to the brand image, increase customer loyalty and increase competence (Yunan, Yongshui, Jian, 2020).

Social networks cannot force users to communicate in a certain way, but the design of the application can in a specific way require or encourage certain social dynamics through the inclusion of certain digital features. For example, Twitter with its limit of 280 characters encourages short texts full of information, while Facebook's algorithm displays video content more than photos, encouraging users to share video content, and Instagram requires visual posts without the possibility of text-only content. The previously highlighted features in a certain way also create a population of users, so companies will, depending on their needs, use social networks in completely different ways.

Finally, online social networks primarily serve as a modern version of offline social networks, and allow people to gather around various social, cultural, political and other events, provide them with a platform for exchanging ideas, all without borders in geographical and linguistic terms (certain networks allow automatic translation into certain languages).

With the development of the Internet, as well as technology, from writing emails in the form of letters, networks now allow live streaming of various content. Following these trends, social networks have also changed. The trend can be noticed in the last few years, where short looping videos and live

streaming have emerged from content creation and sharing (Anderson, 2017). From retelling jokes and probably fictional anecdotes, social networks have progressed to creating video memes that have become part of mainstream culture. One of the networks that enable the creation of video memes and create mainstream culture is TikTok. This social network was created in 2017, and at the end of 2019 it already had 176 million downloads (Business of Apps, 2020).

4. Tik Tok as a public relations tool

In his work, Bresnick (2019) describes Tik Tok as a creative medium, not as a social network, because with the help of audiovisual effects, it enables users to easily create technically very interesting video content. Algorithms for displaying content very quickly "learn" from the user and a personalized "for you page" is quickly created, which at first glance seems chaotic. This element of uncertainity, which provides a large number of diverse videos in a short time, allows users to awaken the desire to see what's next and thus keep them for a long time. This feature of an online world is the cultural mind-set called metamodernism (Weil, 2019), or a set of nostalgic and cynical, knowing and naive, as well as directed and spontaneous videos. Such contrasts make the application intriguing and interesting, but they can also be confusing for people who are not used to the metamodern structure of new media.

Tik Tok is an application that is primarily driven by an algorithm, unlike other social networks that are modeled by followers, so accounts without followers can quickly gain popularity if the content they create is interesting to the public (Anderson, 2020). Based on this way of functioning, TikTok motivates users to create content which the audience wants to interact with, and not to create a large number of followers. Because of this feature, some authors (Tolentino, 2019) describe Tik Tok as a social network that is not connected to one’s social network. As the algorithm is the one that controls the display of video content, in addition to the option to choose the interests themselves, users are created a unique "for you page" based on the interaction with the content. In this way, users will be shown the videos in which they spend the most time using the application, or similar videos compared to those they shared, saved and/or marked as favorites. This is a very different principle compared to social networks such as Facebook, Instagram or Twitter where users are shown content in relation to which profiles or channels they follow. For these reasons, Tik Tok makes it interesting and unpredictable for users because there is a trend of viral videos that are becoming a kind of part of modern culture among the population.

It was these features that made Tik Tok a very popular application that quickly gained a large number of users, especially due to Covid-19 lockdowns. According to Palupa, Meifilina and Harumike (2020) TikTok is a very addictive network, which means that users stay using this network for a long time, which is a good channel to approach and communicate with them. The same source states that 85% of users are under 35, which is a population that spends a lot of time online and follows online trends in communication and the virality of metamodernism trends. Recognizing these trends, and implementing them, is a tool for companies, with the purpose of getting closer to the target audience. Companies must follow trends and participate in them, in order to get involved and achieve positive communication with the present customers. This form, the model of identification, creates an emotional connection that can have a very positive impact on the company's business in times of crisis and the diversity of the brand in relation to the competition.

Companies on Tik Tok can advertise independently through their own accounts or through other users, ie "influencers" who can share their experiences about certain products or services that the company offers. For the company itself, it is desirable to follow viral trends and use them in its communication to customers, without product placement, because it creates a positive connection between customers where they do not feel threatened that they have to consume the product, but nurture a brand relationship through others. values. This added value provides stronger connections than product satisfaction. Also, this way of communication provides the company and/or the brand with authenticity which also influences the building of recognition and improves competitiveness. As the company uses trends to identify different target groups, its positioning among the population will strengthen. This concept of "imitation" of trends represents a kind of phenomenon on the Internet that is practically an evolution in communication (Zulli, Zulli, 2020). Even before the appearance of social networks, this phenomenon was present, but modern technologies have made it possible to better monitor the spread of trends.

Currently, Tik Tok is one of the most influential social networks in the world (Iqbal, 2020), so it can be

assumed that this application will soon have a very strong effect on the population and digital communication. This opportunity motivates world-famous companies and artists to use this platform for promotion and public relations. The Washington Post and New York Times use Tik Tok to post short interesting videos and thus activate the audience to interact. These videos are not directly related to the news and events covered by the print and/or digital editions of these media, but are their take on current viral trends (Nover, 2019). The mentioned trends are also changing the way traditional media function, because the population requires different content. Zaffrano (2019) notes that there are over 170 media and news organizations that create content on TikTok, and that number is now certainly much higher. USA Today, TeenVogue, NBC News, ESPN and many others create content on this social network, according to the same author. From 2018. until now, social networks have completely changed the way the US population consumes news (Shearer, Grieco, 2020), so most Americans say they rely on social networks to get some news. People today have a lot more informations available about services, products and companies (Jagodič, Vukasović, 2019). With this in mind, companies that want to nurture quality public relations must keep in mind the impact of digital social media on the population. This is especially true for platforms with growing popularity, such as Tik Tok, which enables a very fast flow of information and their dissemination.

5. Conclusion

Consumers demand quality public relations that will "convince" them that a certain brand and company nurture similar values as they do. It is no longer enough for companies to offer a product or service of certain characteristics, but it is necessary to communicate publicly about social values that they support or condemn. In this way, brands and companies offer added value and become "more humane" so that it is easier to identify and communicate with the population. Achieving a high level of consumer confidence and loyalty for the company is of great importance in order to achieve success and competitiveness. Moreover, it can be decisive in times of crisis, world economic crisis and the crisis caused by the COVID-19 pandemic. Social networks offer various tools for quality and fast communication with the public, and following the trends in the digital world enables the recognition of the company as modern and up-to-date. If companies want to stay up to date with social trends, they must communicate in two directions using those social networks that allow for the rapid exchange of information regardless of the source that shares that information. This is exactly what is possible through Tik Tok, which shows users content that provokes interaction.

Tik Tok has its controversies, but it does create new patterns in digital communication whose strong impact on marketing, e-commerce and public relations cannot be avoided. Tik Tok has a strong impact on the population that is loyal to this application, and this can be used as an advantage to develop quality relationships with consumers based on added value in creating content, as opposed to promotions and communication in marketing.

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Original Scientific Paper/Originalni naučni rad UDC/UDK: 004.4:681.5
Paper Submitted/Rad primljen: 11. 10. 2021.
Paper Accepted/Rad prihvaćen: 17. 1. 2022.
DOI: 10.5937/SJEM2201037G

Primena softverskih alata u procesu selekcije IT proizvoda

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Apstrakt: Kada je u pitanju donošenje određenih odluka svakodnevnih/rutinskih ili specifičnih, koje često podrazumevaju planiranje, programiranje, izbor najpovoljnije alternative, finansiranje ili realizaciju poslovnog zadatka, ono je uglavnom zasnovano na analizi podataka. Kriterijumi koji se tom prilikom nameću su vrlo raznovrsni i ponekad međusobno suprotstavljeni. Problemi koji se postavljaju pred donosiocem odluka najčešće su nestrukturirani, pa ne postoji matematički algoritam za njihovo rešavanje, a često se postavlja i pitanje objektivnosti pr iizboru optimalnog rešenja.Tema ovog rada je primena Excel Solver-a kod pronalaženja optimalnog izbora proizvoda u preduzeću koje se bavi prometom računarske opreme, uz poštovanje trendova prodaje, raspoloživih skladišnih i ljudskih kapaciteta i finansijskih ograničenja. Na konkretnom primeru prodaje desktop računara, laptop računara i tablet uređaja, predstavljeni su osnovi linearnog programiranja čija implementacija predstavlja osnovu primene Excel Solver-a.

Ključne reči: linearno programiranje, problem optimuma, Excel Solver

Software Tools Application in IT Products Selection

Abstract in English: When it comes to making of certain decisions everyday/routine or specific, which often imply planning, programming, selection of the most favorable alternative, financing or realization of business task, it is mostly based on the data analysis. Criteria which are imposed on that occasion are diverse and sometimes mutually opposed. Problems posed to the decision maker are often unstructured so there is no mathematical algorithm for solving them, and often there is a question of objectivity in choosing the optimal solution.The subject of this work is the use of Excel Solver in finding the optimal choice of products in the company which is engaged in trade of computer equipment, considering sales trends, available storage and human capacities as well as the financial limitations. The fundamentals of linear programming are presented with the concrete example of sales of the desktop computers, laptop computers and tablet appliances, and their implementation presents the base of the use of the Excel Solver.

Keywords: linear programming, problem optimum, Excel Solver

1. Introduction

In the process of managing the company, the manager makes the decisions. Making the decision is not a simple process. It's a process which requires detailed preparation and is based on reliable and relevant information and their interpretation.

Excel is of big help to managers because it allows simple and impressionable graphic review of the results and their interpretation. Program add-ins which can be added by need are the specificity of this software. One of them, the Solver, is especially interesting because it can help to predict the consequences of some decisions and in creating the scenario. Solver can simulate real situation in the sense of the calculation of the best production or marketing mix, resource allocation or making of the business schedule for employees.

In the implementation of this software, it is very important to emphasize the good construction of the mathematical model. Setting the parameters and constraints as well as finely defined relations in the

observed system is the key to defining the model, which, by usage of Excel Solver, will offer the solution which will lead to a good business decision.

2. Basis of Linear Programming

The conditions in the business surroundings, as well as in the company, which are often changing, can be studied by using the analytical simulation modeling, and in that way their effect on the final result can be estimated. That means that it can be estimated in which way their change can lead to the change in the development of some business decision phenomena. By analytical simulation modeling it is considered the use of mathematical models for optimization or simulation.

Optimization is usually a mandatory process in a scientific experimentation and in engineering, supported with mathematical tools, from industrial process to new analytical methods. There are different strategies for gaining optimal values for different cases of optimization, simultaneous (example – Gradient or SIMPLEX) (Candioti et al., 2014; Coello, 2000; Deb &Goyal, 1998; Deb, 1991; Dejaegher& Vander Heyden, 2009) or sequential (example – Box Behnken, central composites, Doehlert and fractional programming**)**. Calculation method must be selected according to the given problem (Candioti et al., 2014, Dejaegher& Vander Heyden, 2009, Sánchez et al., 2012). However, most of the optimization problems in engineering are mostly nonlinear and contain mix (of direct and continuous) variables, with very complex constrictions, and therefore they can not be solved with classical mathematical analysis or with basic methods and strategies (Michalewicz, 1994).

Disadvantages of existing numerical methods have forced researches to rely on heuristic algorithms (Lee & Geem, 2005). The solutions to heuristics, global optimization as well as meta-heuristic method can be found in the literature (Yang et al., 2013). Kannan and Kramer (1994) combine improved Lagrange multiplier method with Powell's and Fletcher - Reeves Conjugate Gradient method for solving optimization problems**,** while Sandgren (1990) proposednonlinear branch and bound algorithms ased on integer programmingto solve the mixed-integer optimization problems.

Heuristic methods are really suitable and powerful way for obtaining solutions for the optimization problem. Heuristic techniques include genetic algorithm (GA), simulated annealing (SA), tabu search (TS), particle swarm optimization (PSO), harmony search (HS), ant colony optimization (ACO), etc. Deb and Goyal (1998), presented the technique of combinedgenetic engineering (GeneAS) which combines binary and real-coded genetic algorithms with the purpose of controlling mixed variables. Coello (2000), Deb (1991), Dimopoulos (2007), Hwang & He (2006) apply genetic algorithms for solving these problems of mixed integer engineering optimization.

Linear programming (LP), however, considers model optimization problem with given constraints. That means that LP is supposed to solve the problem of linear combination of independent random variables in order to achieve maximal and minimal result with gratification of the appointed conditions and/or demands. Optimization includes the choice of variables and determination of their values. LP uses mathematical model to describe the optimization problem which consists only of linear functions. The name "programming" originated before the appearance of the computers as a synonym for careful planning of the activities which would lead to achieving the set goal in the best possible way. The name "linear" comes from the form of the equations which are used.

The entire procedure seems expected and simple. However, formulation (modeling) of the real life problem as the LP problem, firstly requires good knowledge of the problem and great work experience. Although this could be a challenge, the result of model experiment should be the solution which will open the way to a good business decision. Model LP (Ivanović, 2014) should consist of:

- Linear objective function
- Linear constraints
- Allowed set of solutions.

Objective function has a following form:

$$f\left(x_1,...x_n\right)=\sum_{i=1}^{n} a_i \cdot x_i \quad . \tag{1}$$

Conditions/constraints, which should be confirmed by solutions from the allowed set, are given in the form of inequality: $A \cdot x \leq b$ for the problem of maximum, and, $A \cdot x \geq b$ for the problem of minimum. Therefore:

$$a_{11}x_1 + a_{12}x_2 + ... + a_{1n}x_n \left\{ \begin{matrix} \geq \\ = \\ \leq \end{matrix} \right\} b_1 , \quad (2)$$

$$\vdots$$

$$a_{m1}x_1 + a_{m2}x_2 + ... + a_{mn}x_n \left\{ \begin{matrix} \geq \\ = \\ \leq \end{matrix} \right\} b_m , \quad (3)$$

whereby variables x_1, x_2, …., x_n should meet the requirement of negativity or integer.

$$x_1 \geq 0, x_2 \geq 0, ..., x_n \geq 0 , \quad (4)$$

Here is:

- x – vector variables
- b_i – coefficients,
- A – matrix which contains a_{ij}

Area of the usage of linear programming is diverse: production, procurement, transport and distribution, marketing, telecommunications, financial investment and planning, making the schedule for the employees, etc. All questions which involve the assessment of the maximum profit, minimum risk, assessment of optimality, marketing or product mix, optimal product distribution, assessment of optimal position which will provide minimum cost, are solved by using the LP. However, it is most frequently used to solve the models which are corresponding to profit maximization, as well as cost minimization. Today it is a standard tool which has saved millions of dollars for many companies or smaller firms in industrialized countries all over the world, by which its usage, in all of the sectors of the society, is spreading very fast.

The essence of the manager's activities are the decisions which are made as the function of managing business processes. Decision making implies the usage of specific knowledge, "tools" and knowing the process structure in the purpose of improving its performances. Most of the decisions are made by considering constrained financial and other resources.Management can efficiently use the LP technique in order to gain better business decisions. In practice, with the help of this business approach, general profitability of the companies is increased up to 20%.

3. Specific Features of Excel Solver and Construction Problem

Each business system is specific. Today, in order of making the decisions, there is a big amount of data which need to be analyzed. For that purpose, concepts Big Data, Cloud Computing and Internet of Things are used. Given platforms converge into one resulting information system which provides bigger productivity and system efficiency (Langović &Pažun, 2016).

Developing the system for decision support, considering the complexity of one business system and its interactions with business surrounding, would be a complicated process (Grujčić et al., 2010). One of the alternatives which, in those conditions, could simplify and ease the development of less demanding systems for decision support, is the usage of Excel. It is a popular tool for analysis and solving the LP problem, which, with a program add-inSolver, gives the answers to the questions which are necessary in the process of the business deciding. In Excel, there are 4 main groups of model analysis.

- What-if analysis: the user changes one or more independent, input variables and observes the changing of the dependent, output variable. For example, it is used for insurance risk assessment.
- Sensitivity analysis: the user changes only one independent variable and observes its effect on the change of the dependant variable. For example, how it is reflected on the change of profits.
- Goal seek or How can: the user determines the goal value of the dependant variable and requires the change of the value of one of the independent variables until the goal value of the dependant

variable is reached. If the goal profit is determined, it is observed how to determine the product price in order to achieve the projected profit.

- Optimization: one or more variables should be optimized by changing one or more independent variables with the given constrains. In other words, it is a search for the production mix which will provide optimal result, by which product prices, quantities and expenses are defined, and human and equipment capacity or the sale possibility are available as constraints.

Generally speaking, data base can be realized in the form of electronic tables, and its access is possible also by external data bases through SQL inquiry (Sharda et al., 2014). In the case of usage of Excel, data which is entered in the cells of the Excel table, which is the main database, are the system base. The user interface can be realized by using the tables, as forms for data input, and numerous installed graphic possibilities for the review of output results. Excel also gives the possibility of additional functionalities and fulfillment of specific demands, with the help of the installed program language Visual Basic for Applications (VBA). Excel has a big library with approximately 400 installed mathematical, statistical, financial, engineering and other functions which can be used for making different models. It is empirically proven that in the management structure, 90% of the time is spent on the decision making. Solver is a program add-in designed for solving optimization problems in linear, nonlinear and integer programming. The essence of the entire problem is for it to be described using the system of equations or inequalities, by which requested values and constraints are explicitly shown. Model consists of three basic parts which should be noticed and shown separately: decision variables, goal function and constraints**.**

Decision variables are the variables to which unknown values are added, which are the problem solution. The goal function is an equation which shows the model goal, and depending of the problem nature, it can be maximized or minimized or set as a determined, fixed value. Constraints exist in every real problem. They can be limited quantities of resources, work or requirements demand and they are presented in the form of equations or inequalities.

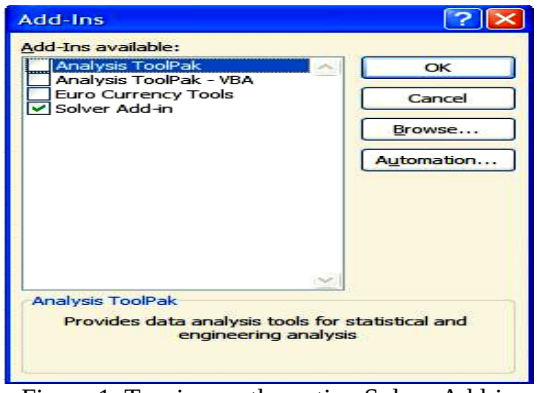

Figure 1. Turning on the option Solver Add-in

Starting the Solver is very simple because it is installed in Excel. It needs to be activated, following the next steps: File→Options→Add Ins→Manage→Excel Add-ins→Solver Add-in→Go. By pushing the button Go, dialog box Add-Ins is opened, like in the Figure 1, the check box Solver Add-in should be confirmed and then the button OK should be clicked on. Once activated, Solver stays available inside the menu Data, from where it can be used by need. Solving the concrete problem, or its mathematical interpretation, begins by entering the data related to the given problem. The goal is to define the problem in the format which will correspond to the given problem.

The data from the model should be presented in the table, on the Excel work sheet. The table can also be filled with textual comments. The company “Monitor System” from Belgrade is engaged in trade of computers and computer equipment, as well as in the consulting services in this area. The model, by which the calculation of the company “Monitor System” is done, includes 3 decision variables and 11 functional constraints. Decision variables are marked with x_1, x_2 and x_3, and they are the number of desktop computer, the number of laptop computer and the number of tablet appliances which should be studied in the purpose of further sales. They are products of average performances and prices which have the highest demand on the market, regardless the manufacturer.

The problem is in the assessment of the number of products which should be ordered from the supplier, with consideration of available storage space, observed sales trend and the number of working hours which servicers, who install the software and assemble the parts, in the case of the desktop computers can realize in one month. The profit should be maximal with the condition that the amount of the ordered merchandise can not be larger than 100000 €. The company profit, whose turnover is under consideration, doesn't depend only of three products. However, because these three products are dominating, provide the biggest profit and are sold the most, the calculation is done only based on them. These are the reasons for setting the constraints on the number of computers which are ordered from the supplier: 150 pieces for desktop and laptop computers and 80 for tablet appliances, as well as 720 hours needed for servicers (4 servicers at 180 working hours a month) for montage and product testing. Tablet appliances are obviously not the problem in terms of storage space, but demand for them is smaller. On the other hand, demand for desktop and laptop computers is approximately the same, but because of the insufficient storage space/warehouse in the company, this constriction is set.

The time needed for servicers to order the computer, enter it in the database, install it, configure it and at the end, sell it, is 3.5 hours for desktop, 1.5 hours for laptop and 0.5 hours for tablet. These data are used as constant. Average computer prices are 436.00 € for desktop computer, 270.00 € for laptop computer and 117.50 € for tablet computer. These values are also taken as constants. According to that, constraints can mathematically be presented in the following manner:

1. $3.5 \cdot x_1 + 1.5 \cdot x_2 + 0.5 \cdot x_3 \leq 720$,
2. $436 \cdot x_1 + 270 \cdot x_2 + 117.5 \cdot x_3 \leq 100000$,
3. $x_1 \leq 150$,
4. $x_2 \leq 150$,
5. $x_3 \leq 80$,
6. $x_1 \geq 0$,
7. $x_2 \geq 0$,
8. $x_3 \geq 0$,
9. $x_1 \in$ integer,
10. $x_2 \in$ integer,
11. $x_3 \in$ integer.

Constraint 1 defines the time used by 4 servicers per month for configuring and testing of desktop and laptop computers and tablet appliances. Constraint 2 defines the amount of the order which can not be bigger than the approved credit of the supplier, respectively not more than 100000.00 €. The conditions from observed sales trends and available storage space impose constraints 3-5, by which it can be ordered at the most 150 desktop computers, 150 laptop computers and 80 tablet appliances. By constraints 6-8, it is required that the variables are nonnegative, and by constraints 9-11 the integer condition for all three variables is set. In this way, the mathematical base for the usage of the Solver is prepared.

4. Application of Excel Solver and Analysis of Results

Before the usage of the Solver it is necessary to create the table with data on the Excel work sheet which will be the base of the budget. It should include:

- Information about the number of hours needed for configuration and testing of the products, which are spent during the ordering, installation, sale preparation and the sale itself of different products,
- Information about the purchase/input price,
- Information about additional servicers' expenses for the price/work on the configuration and testing of the devices,
- Information about retail product price,
- Defined maximal quantities which can be ordered because of the limited storage space and observed sales trends.

	A	B	C	D	E
1		desktop	laptop	tablet	
2	Hours for product configuration [h]	3.50	1.50	0.50	A)
3	Average purchase price [€]	436.00 €	270.00 €	117.50 €	B)
4	Following expenses [€]	11.67 €	5.00 €	1.67 €	C)
5	Price per piece [€]	447.67 €	275.00 €	119.17 €	D)
6	Retail price + 10% [€]	479.60 €	297.00 €	129.25 €	E)
7	Profit [€]	31.93 €	22.00 €	10.08 €	F)
8	Maximum quantities [pieces]	150.00	150.00	80.00	G)
9	Final orders [pieces]	0.00	0.00	0.00	H)
10					
11	Usage of working hours [h]			0	I)
12	Usage of credit €			0.00 €	J)
13	Amount of following expenses [€]			0.00 €	K)
14	Total expense €			0.00 €	L)
15	Profit €			0.00 €	M)

Figure 2. Example of the table for the usage of Excel Solver

The example of the table for the usage of the Solver is shown in the Figure 2, although the design of the table is individual. Other values from the table are obtained by specific calculation using available functions in the Excel.It is important that the cells in the table are interconnected and that adequate functions in Excel are used. The process of obtaining the values in the cells is shown in the continuation.

- **Step 1: Construction of the table for the usage of Excel Solver**

A) Amount of hours needed for appliances to be entered into database, configured, tested and prepared for the sale. These data are entered as constants.
B) These are average prices of the appliances which are sold the most on the market. These data are also entered as constants.
C) Servicer's working hour in the company is 3.33 €/h, therefore the values are obtained in the following way: 3.5 * 3.33 = 11.67 € for desktop computer, 1.5 * 3.33 = 5 € for laptop and 0.5 * 3.33 = 1.67 € for tablet.
D) The values are obtained by adding the cells: B3+B4, C3+C4 and D3+D4.
E) Considering that the profit is limited to 10% of the purchase price, the values are obtained as: 1.1 * B3, 1.1 * C3 and 1.1 * D3 for some appliances.
F) Values in the cells B7, C7 and D8 are obtained by subtracting the cells B6-B5, C6-C5 and D6-D5.
G) Maximal quantities, considering storage space, credit limit and servicers work, are set to 150 for desktop and laptop computers and 80 for tablet appliances. These data are entered as constants.
H) These are the requested values which are set to 0, and Solver should find the optimal solution regarding the appliances which should be ordered.
I) Data in the rows 11-13 are gained by using the function SUMPRODUCT. By activating this function it is needed to select cells B2, C2 and D2 in the first row, and in the second row, cells B9, C9 and D9. At the beginning the value will be 0, because the values in cells B9-D9 are set to 0, but the Solver will offer adequate solution in the cell B11.
J) By using SUMPRODUCT it is needed to select cells B3, C3 and D3 in the first row, and in the second row, cells B9, C9 and D9. The initial value is 0, but with the usage of the Solver the optimal solution will be obtained considering the use of the credit in the cell B12.
K) The values are obtained by using the function SUMPRODUCT in the way that cells B4, C4 and D4 are selected in the first row, and in the second row, cells B9, C9, D9.
L) Values in the row 14, the cell B14, are obtained as the sum of cells B12 and B13.
M) The data in the row 15, respectively the cell B15, is obtained by using the function SUMPRODUCT in the way that cells B7, C7 and D7 are selected in the first row, and in the second row, cells B9, C9 and D9, like in the Figure 3.

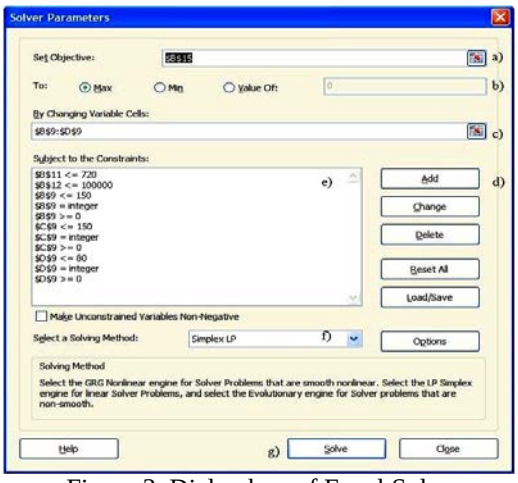

Figure 3. Dialog box of Excel Solver

Step 2: The closing solution

Table with the final solution is given by clicking on the worksheet Sheet 1. All the cells which had the value 0 in the table, and those are cells B9, C9, D9, B11, B12, B13, B14 and B15, which can be seen in the Figure 4., now have new values. These values represent optimal solution of the given problem which is obtained by using Excel Solver, like in the Figure 4. If we look at the constraints which are given and the solutions which Solver has offered, it can be deduced that the obtained values give space for result analysis.

	A	B	C	D	E
1		desktop	laptop	tablet	
2	Hours for product configuration [h]	3.50	1.50	0.50	A)
3	Average purchase price [€]	436.00 €	270.00 €	117.50 €	B)
4	Following expenses [€]	11.67 €	5.00 €	1.67 €	C)
5	Price per piece [€]	447.67 €	275.00 €	119.17 €	D)
6	Retail price + 10% [€]	479.60 €	297.00 €	129.25 €	E)
7	Profit [€]	31.93 €	22.00 €	10.08 €	F)
8	Maximum quantities [pieces]	150.00	150.00	80.00	G)
9	Final orders [pieces]	114.91	150.00	80.00	H)
10					
11	Usage of working hours [h]			667.1788991	I)
12	Usage of credit €			100,000.00 €	J)
13	Amount of following expenses [€]			2,224.58 €	K)
14	Total expense €			102,224.58 €	L)
15	Profit €			7,775.42 €	M)

Figure 4. Optimal solution obtained by using the Excel Solver

The company “Monitor System”, respecting the given constraints of the market, financial situation and available storage space, will maximize the result if it can procure, install and prepare for sale 114 desktop computers, x_1=114, 150 laptop computers, x_2=150 and 80 tablet appliances, x_3=80. Considering the result per product unit, the company will gain maximal profit in the amount of 7,746.42€. With this result, theinitial constraints are fulfilled at the satisfactory level.

Attainable capacity, which implies hiring employees for 720 working hours, is quite exploited. For optimal solution, 664 hours are used, and that is 92.22%. Considering that the employees also have other similar jobs beside this one, in smaller extent, the conclusion is that with this work division, production capacities are being used very efficiently.

Second constraint refers to supplier credit. The company has a 100000€ credit for a month. Optimal division which Solver suggests, implies that 99,604.00€ of this amount should be used, which is 99.6% of the approved sum, which can be seen in the Figure 4.

Third constraint regards the number of products from the category desktop, laptop or tablet appliances, which are sold per month, and the availability of storage capacity. The number of sold products from one of the categories can be increased by stocks or similar procedures which increase the sale.

However, the constraint regarding the storage space, firstly for desktop computers, dictates constraints of quantity. In the same way, the sales of laptop computers are more profitable than the sales of desktop computers. However, the sales analysis suggests that no more than 140 laptop computers are sold per month. Setting the constraint to 150 pieces, the data about conditions on the market is complied, although, elimination of this constraint, for tablet and laptop appliances, would significantly increase the profit with smaller number of employees. The constraint on the number of desktop computers is set to 150, although with them, the situation in practice is slightly more complicated than with other appliances. This constraint in fact is not natural, because the combination of the parts can vary, and it is not necessary to install all of the parts which are ordered from the supplier as computer assembly. However, with all of the ordered components in one month, the number of sold desktop computers per month is not bigger than 115.

It is seen that the number of desktop computers did not reach the maximum possible value, while the other two products gain maximum, limit values. If there were no constraints regarding the appliance quantity, it would be seen that the calculation shows that the most profitable way for the company is to sell tablet appliances, but it would be hard for the company to stay on the market by selling only one type of appliance. With constraints in the number of certain products, it is necessary to also set the integer constraints and negativity constraints, which means that it is impossible to sell 12.6 laptop appliances or -4 tablets.

Thus, the problem solution implies that the company profit will be maximal if 114 desktop computers, 150 laptop and 80 tablet computers are sold. In that case, the company profit would be 7,746.42€. At the same time, 664 working hours of possible 720 would be used, while the credit with supplier, in the amount of 99,604.00€ would be almost entirely used.

5. Conclusion

Because of the big significance of information in the process of business decision, the management expects disposal of relevant, accurate and quality information, in order to create adequate company actions based on those information.

Program add-in Solver which is a part of Excel package is compact and powerful tool which could help the manager in making the business decisions. What is really interesting for Excel Solver is that this approach to problem solving is interactive. After the optimal solution to one model version is obtained, it is possible to ask series of questions and get instant answers. By examining series of different scenarios, many questions could be answered.

By using this model, real life situation can be simulated, and based on the results which Excel Solver provides, it can be estimated how much the business decision would actually be correct and payable**.** Interactivity of Excel Solver makes it not only reliable, but also a fast collaborator in making of the business decisions.

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Review Scientific Paper/Pregledni naučni rad UDC/UDK:005.3:628.4.038]:504.5
Paper Submitted/Rad primljen: 4. 5. 2021.
Paper Accepted/Rad prihvaćen: 15. 7. 2021.
DOI: 10.5937/SJEM2201046K

Identifikacija opasne lokacije u urbanom području

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Apstrakt: U radu je prikazana identifikacija opasnih lokacija u slučaju iznenadnog ispuštanja opasnih hemikalija. U akcidentnim situacijama rizik se procenjuje na osnovu različitih metoda i utvrđuje akcioni plan koji ima za cilj minimiziranje rizika. Analizirane su akcidentne situacije u kojima je PCB i dioksin prosut u velikim količinama . U radu su korišćene metodologije Svetske zdravstvene organizacije, američke EPA i Ujedinjenih nacija. Na mapi su prikazane najvažnije detektovane lokacije u urbanoj sredini.

Ključne reči: akcident, opasna lokacija, hemikalija, rizik

Identification of Hazardous Location in Urban Area

Abstract: The paper presents the identification of hazardous locations in the event of a sudden release of hazardous chemicals. In accident situations, the risk is assessed on the basis of various methods and an action plan is determined which aims to minimize the risk. Accident situations in which PCB and Dioxin was spilled in large quantities were analyzed. The methodologies of the World Health Organization, the American EPA and the United Nations were used in the paper. The most important detected locations in the urban environment are presented on the map.

Key words: accident, hazardous location, chemical, risk

1. Introduction

Chemical accidents

Chemical accidents and management of the assessed accident occurrence risk present an important aspect in the environmental protection. Accident, as defined by the European Union, presents a sudden appearance of considerable emission, fire or explosion as a result of not planned events within a certain industrial activity, occurring within or out of industry, including one or more chemicals (Mihajlov, 2001).

International Labour Organisation (ILO) statistics show that the highest percentage of accidents occurs in the production units (40%), in transport of hazardous substances (35%) and in storage (25%). According to the research that included 1.045 accidents with injured and killed people, in majority of cases it was the accidents with chlorine (125 cases), with hydrochloric acid (68 cases) and ammonia (67 cases). Oil and oil products have not been included in this research. International Labour Organisation has published the data from 40 member countries on the frequency of the appearance of certain chemicals in bigger chemical accidents in the past 80 years (Table 1).

Table 1. Frequency of appearance of certain chemicals in bigger accidents in 40 countries

	Chemicals	**No. accident**
1.	Natural gas, propane/butane	188
2.	Chlorine	123
3	Petroleum naphtha	68
4.	Ammonia and compound	62
5.	Vinyl chloride	41
6.	Chlorohydric acid	32
7.	Hydrogen	30
8.	Sulphuric acid	23
9.	Ethylene	21
10.	Ethylene oxide	18

Approximately 70% of the accidents described by US EPA took place in the plants, while the remaining 30% occurred during the transport of toxic chemicals.

National legal document that defines the risk assessing methodology is «Regulations for the Methodology of Chemical Accident and Environmental Pollution Risk Assessment, by Measures of Preparation and Measures of Consequence Elimination, *Official Gazette of the Republic of Serbia*, No. 60/1994, 63/1994».

The following are defined as the consequences of chemical accidents:

- discharge of hazardous pollutants into the air, water or soil (toxic gases, flammable or explosive substances);
- explosion of matter that creates destructive wave blow (significant input of great quantities of toxic, flammable and explosive matter is discharged into the atmosphere);
- fires creating heat radiation that might burn people and material property (cloud of hazardous and non-hazardous gases, particles and other combustion products is formed);
- combination of the previously mentioned consequences.

Persistent organic pollutants (according to the Stockholm Convention POPs) are particularly important due to their specific properties.

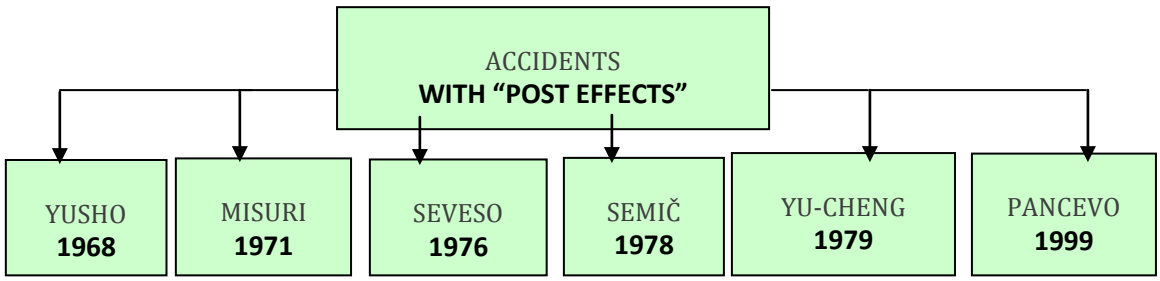

Figure 1. Schematic presentation of the known accidents with «post effect»

ACCIDENT YUSHO: The first reported accident related to the toxicity of polychlorated biphenyls took place in Japan in 1968 (Yusho), where these compounds were used as the cooling fluid in the rice oil production. Leakage or an error in the system occurred thus causing the rice oil to be uncotrollably contaminated with polychlorated biphenyls. This contamination caused in the consumers diseases with hyperpigmentation of the skin and mucous membrane, liver diseases, headache, nausea, edema and birth of children with defects. However, laboratory analyses showed that PCB caused hepatocellular cancer in experimental animals. Exposure to polychlorated biphenyls is practically universal in industrial countries. Due to chemical stability and liposolubility, polychlorated biphenyls are bioaccumulated and biomagnified through food chain. High level of concentration was found in fish, because of the discharge of transformer oil into the river. The total number of contaminated patients in Yushu was 1862, and about 149 people died.

ACCIDENT MISURI: «Shenandoah Stables» was a big horse ranch in the state of Missouri. Their problems started in 1971. In order to reduce the quantities of dust, they covered several acres with 1000

gallons of waste automobile oil. Soon there were tens of dead sparrows to be found. Afterwards, cats and dogs on the farm got sick. Of 85 horses, 43 died in the course of one year. Most of the horses had miscarriages. Animals born at the time would die after only a few months. The owner and his two daughters also got sick. Upon testing of the oil that had been sprinkled over the farm, a high level of dioxins and polychlorated biphenyls was established. Many similar cases were discovered.

ACCIDENT SEVESO: Accident in Seves happened in 1976 in the chemical plant for the production of pesticides and herbicides. Toxic cloud contained tetrachlorodibenzoparadioxin (TCDD) that had been released from the reactor for the production of trichlorophenol. Dioxins were formed as by-products of uncontrolled exothermic reactions.

At that time, there were more than 600 people evacuated from their houses and more than 2000 people were contaminated with dioxins. As a response to this heavy accident, SEVESO I and SEVESO II Directives ensued.

ACCIDENT SEMIČ: On the territory of former Yugoslavia in Semič (Slovenia), an accident occurred in 1978. PCB was discharged from the condenser producing factory into the river. The study analysing the effect of PCB on human population established that there was a more rapid growth of teeth in children.

ACCIDENT YU-CHENG: Omnipresence and slyness of the pollution by polychlorated biphenyls is illustrated in the following accident that took place in 1979 in Thailand. An unused transformer in a slaughterhouse had accidentally been punctured. Polychlorated biphenyls were released and they entered the fat and meat waste recycling system. The obtained product was sold as chicken feed to a big farm. In the following few months, eggs were sold and used by bakers and mayonnaise producers.When contamination was discovered, food all over the country, worth millions of dollars, was withdrawn from the market and destroyed. Later research showed that Yu-chang consequences were serious changes in the development of mobility and memory in children. There were 2008 contaminated people registered in Taiwan. Further research showed that the consequences of the accident inTaiwan were more serious than those of Seveso accident.

ACCIDENT PANCEVO: In 1999, there was a war accident in Pančevo. Namely, there was a big explosion of vinyl chloride monomer and consequently a cloud was formed of unreacted vinyl chloride monomer, phosgene and other chlorine products (Bančov, 2004).

According to some research, by analysing the combustion product samples taken directly above the flame of vinyl chloride monomer burning in the air, the presence of following was discovered: HCl (2,7%), CO_2 (5,8%), CO (0,95%) and phosgene <10 ppm. Significant quantities of phosgene were present only in the immediate vicinity of vinyl chloride monomer flame. Just as in Seveso accident, there were no casualties at the time of the accident, but there were post effect diseases in people who had been exposed to carcinogenic substances. Vinyl chloride monomer is a carcinogenic, teratogenic and mutagenic substance that, when burnt, forms phosgene, a known war (poison) gas and other combustion products of which dioxin is particularly singled out. The effects of dioxin were detected and registered in Seveso accident. Bearing in mind the Seveso accident experience, European Union Directives SEVESO I and II must be applied, as well as the existing national legal regulations for the preparation of the Chemical Accident Protection Plan, which must define preventive measures and chemical accident response measures. The Plan is being prepared on the local level, based on the prepared assessment of the chemical accident hazard for the companies that might cause heavy chemical accidents. The companies categorised as extremely high-risk companies are obligated to prepare the chemical accident hazard assessment and to verify this document with the Ministry competent for the environmental protection.

2. Methods and Methodology

Dioxin formation mechanism

Since dioxins belong to I group carcinogens, the paper presents the mechanism of dioxin formation (Figure 2).

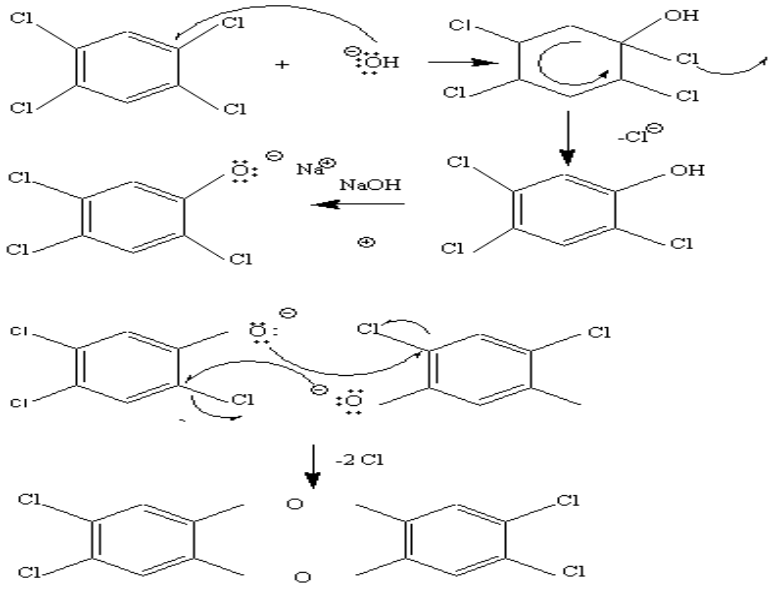

Figure 2. Presentation of dioxin formation mechanism

Solution of environmental problems

For the purpose of prevention and the best possible response in chemical accident situations, cooperation with the Italian Environmental Protection Ministry was initiated resulting in an agreement to apply a new methodology for the chemical accident hazard assessment (REHRA) developed by the World Health Organisation (WHO).The Programme has been implemented in Italy, Hungary, Romania and Bulgaria. The advantage of this Programme is a quick anticipation of possible accident points in a plant.

Preparation for implementation of the new methodology in oil-petrochemical complex in Pančevo is underway.

Monitoring system for air quality control

Monitoring system located in Pančevo industrial zone, parts of Pančevo town, and in Pančevo Municipality building has the following objectives:

- Hazardous substance concentration monitoring
- Automatic exchange of meteorological data
- Assessment of hazard degree for the population in cases of regular plant operation or in cases of chemical accidents on the industrial zone

The necessary input data that can be read from the automatic meteorological station are: temperature (^{0}C), relative air humidity (%), air pressure (mbar), global and Sun radiation balance (W/m^2), wind velocity (m/s) and wind direction (^{0}).

Hazardous substance data base is also required, containing the following elements: chemical element, formula, physical-chemical properties, concentration level per hazard class, synonyms, flammability.

Air monitoring implies imission measurement in compliance with the Air Control Programme passed by the Government every 2 years.

The objectives of the Air Quality Control Programme are as follows:

- Determining the air pollution level
- Monitoring the air pollution trends over several years
- Air quality assessment based on comparisons with the standards
- Establishing remedial measures for the purpose of improving the air quality

- Establishing critical situations and alarming states for the purpose of warning the public and taking the necessary measures.
- Assessment of the polluted air impact on public health, climate and forest ecosystem.

Air Quality Control Programme examines the essential (group of pollutants widely spread and inevitably present in every-day human activities) and specific pollutants (group of pollutants emitted from specific industrial production processes).

Air quality control is achieved by systematic imission measuring, monitoring and analysing the air quality effect on the environment and by reporting the results of this measuring, monitoring and analysing. Network of measuring points was established based on the international model (World Meteorological Organisation (WMO) and World Health Organisation (WHO). The number of measuring points comprised in the monitoring network is determined on the basis of the following criteria: number of inhabitants, number of emission sources and meteorological parametres.

Selection of risk assessment methodology

National methodology

National risk-management strategy has three basic parts:

- Accident hazard analysis.
- Planning the preventive measures, preparedness and response to an accident.
- Planning the accident consequence elimination (remediation).

Accident hazard analysis includes:

- Identification of hazard (preparation, data collecting, identification and change of identification).
- Consequence analysis (preparation, presentation of a possible course of events, effect modelling and analysis of vulnerability).
- Risk assessment (assessment of accident occurrence probability, assessment of possible consequences and risk assessment).

Planning the preventive measures, preparedness and response to an accident includes:

- Prevention (prevention measures and actions).
- Preparedness (accident protection plan).
- Response to an accident (time and place of accident, type of harmful substances present, accident course assessment, environmental risk assessment and other information important for responding to an accident).

Planning the accident consequence elimination measures (remediation) includes:

- Remediation plan (remediation objectives and scope, remediation task force and means, order of application, programme of post-study environmental monitoring, remediation costs, the manner of informing the public about the past accident).
- Report on the accident (analysis of the accident causes and effects, accident development and course and response to accident, accident magnitude assessment and present situation analysis).

Current world methodologies

There are several current world methodologies:

- REHRA Methodology was developed by the World Health Organisation (WHO).
- US EPA Methodology was developed by the American Environmental Protection Agency (EPA).
- APELL Methodology was developed by the United Nations Environment Programme (UNEP).

REHRA (Rapid Environment and Health Risk Assessment) has been implemented in Italy, Hungary, Romania and Bulgaria. Legal acts used in the preparation of this methodology were as follows: SEVESO II Directive, Helsinki Declaration from 1992 and Espoo Convention.

Three basic parts of REHRA Methodology are as follows:

- risk assessment of big accidents.
- continuous emissions risk.
- territory hazard.

Indexes used in the risk assessment calculation according to REHRA Methodology are as follows: Installation Hazard Index (IHI), Accident Risk Index (ARI), Installation Risk Index (IRI), Equipment Risk Index (ERI).

US EPA (United States Environmental Protection Agency)

This Methodology includes several softwares:

- **CAMEO** (Computer-Aided Management of Emergency Operation) is an accident-management programme. It contains a library and chemical substances base, examines accident situations, locations, etc.
- **ALOHA** (Area Locations of Hazardous Atmospheres) is a programme for harmful gases dispersion modelling.
- **MARPLOT** (Mapping Applications for Response, Planning and Operational Task) is a programme for electronic presentation of a certain location.

APELL Programme (Awareness and Preparedness for Emergencies at a Local Level) is implemented within UNEP. A significant characteristic of this programme is distribution of responsibility for planning and implementing the chemical accident protection measures among industry, local management, professional organisations, state agencies and the public. In order to ensure a direct and close cooperation, as well as unique approach and trust among the participants in responding to an accident, **APELL** anticipates formation of local coordination groups, as a bridge between industry and local community.

3. Results and Discussion

Presentig risk assessmnet in Serbia

Project **«Environmental Atlas of Belgrade»** has recently been completed and, in addition to other environmental issues, it has also analysed hazardous industries, plants and accident risks. Transport, chemical industry, storage and the list of all hazardous substances with quantities have been analysed.
On the territory of Belgrade, there are tens of hazardous industries and plants that use, store or produce hazardous substances. Some of them are located in the very centre of the city (Duga, Galenika, Jugopetrol-Čukarica and others). Chemical accidents and fires on these locations would present considerable danger for the residential areas in the vicinity of which these facilities are located. According to the identification of industrial hazards on Belgrade territory from 1990, there were 69 hazardous industries registered that produce, use and store hazardous substances. According to the same source, about 1.250.000 tons of hazardous substances were used, produced or stored yearly in the city, of which 15.000 tons presented harmful waste. Furthermore, the risk of possible chemical accidents in numerous new chemical plants of the small private companies is considerable and not fully identified as yet. These plants are located in residential areas both in marginal and in some central parts of the city. The public is further jeopardised by huge chemical complexes in Pančevo and Barič, which, due to their vicinity, present a significant, still not quantified threat to certain parts of Belgrade (Sacirovic, et al. 2019). From Pančevo industrial zone, as shown by the spreading of contaminated air during the bombing of Petrochemical Complex, as well as by spreading of pollution in the peacetime, possible chemical accidents would present most threat to the north-eastern parts of Palilula municipality, while Barič complex presents most threat in terms of possible chemical accidents to the south-western parts of Čukarica municipality. According to the preliminary assessment of chemical accident risk, all hazardous plants, as identified at the time, were distributed into four risk groups. In the city general plan area, there was not a single plant of extremely high chemical risk, but even today,

there are five plants of high chemical risk (Duga, Galenika, Tehnogas, «Belgrade» Refinery, Jugopetrol-Čukarica), as well as 12 plants that have been assessed as medium-risk units. Today there are no updated and complete records of hazardous substances present in Belgrade, although this is required by the law. Based on the available information, identification and classification of hazardous industries was repeated, and a list of present locations with hazardous substances was made. For these facilities and locations, approximate chemical accident risk assessment and new categorisation of the facilities were carried out, and zones of possible effect were determined. In the city area, in the period 1991-2000, there were about 80 chemical accidents, half of which occurred during the transport of hazardous substances. That is why the question of safe transport of hazardous substances is extremely important, particularly the roads on which greater quantities of these substances are transported. Hazardous substances are transported by way of road, railway and river traffic (Ecoatlas Zdravlje, n.d.).

Table 2. Identification of hazardous industries and locations (Ecoatlas Zdravlje, n.d.).

	Company	**Location**	**Matter**	**The class**	**Type of transport**
1	Duga	Viline vode	organic solvents	**II**	railway
2	Galenika	Batajnicki drum	organic solvents	**II**	road
3	Dalija	Batajnicki drum	organic solvents	**II**	road
4	Grmec	Autoput, Zemun	organic solvents	**II**	road
5	Rekord	Rakovica	organic solvents	**II**	road
6	Rafinerija-Beograd	Pancevacki put	petroleum products	**III**	road
7	Jugopetrol	Radnicka	petroleum products	**III**	road, river
8	Beopetrol	Savska, Ostruznica	petroleum products	**III**	road
9	Tehnogas	R.Vujovica - Čoce, Rakovica	technical gases	**III**	road
10	Petrolgas	Ovca	butane-propane mixture	**III**	railway
11	Grmec-Balkan	Pancevacki put	organic solvents	**II**	road
12	Secerana - Vrenje	Radnicka	ammonia	**I**	railway
13	Tehnohemija	Viline vode	various chemicals	**II**	railway
14	Belgrade waterworks	Makic	chlorine	**I**	road
15	Belgrade waterworks	Bezanija	chlorine	**I**	road
16	Belgrade waterworks	Banovo Brdo	chlorine	**I**	road
17	BIP	Autoput, Beograd	ammonia	**I**	road
18	Hempro	Autoput, Zemun	various chemicals	**II**	road
19	Railway station Dunav	Viline vode	various chemicals	**II**	railway
20	Railway station Bgd	Savski most	various chemicals	**II**	railway
21	Railway station Ovca	Ovca	various chemicals	**II**	railway
22	Railway station Zemun	Zemun	various chemicals	**II**	railway

Substance class **I** - very toxic substances
Substance class **II** - toxic substances
Class of substance **III** - flammable substances

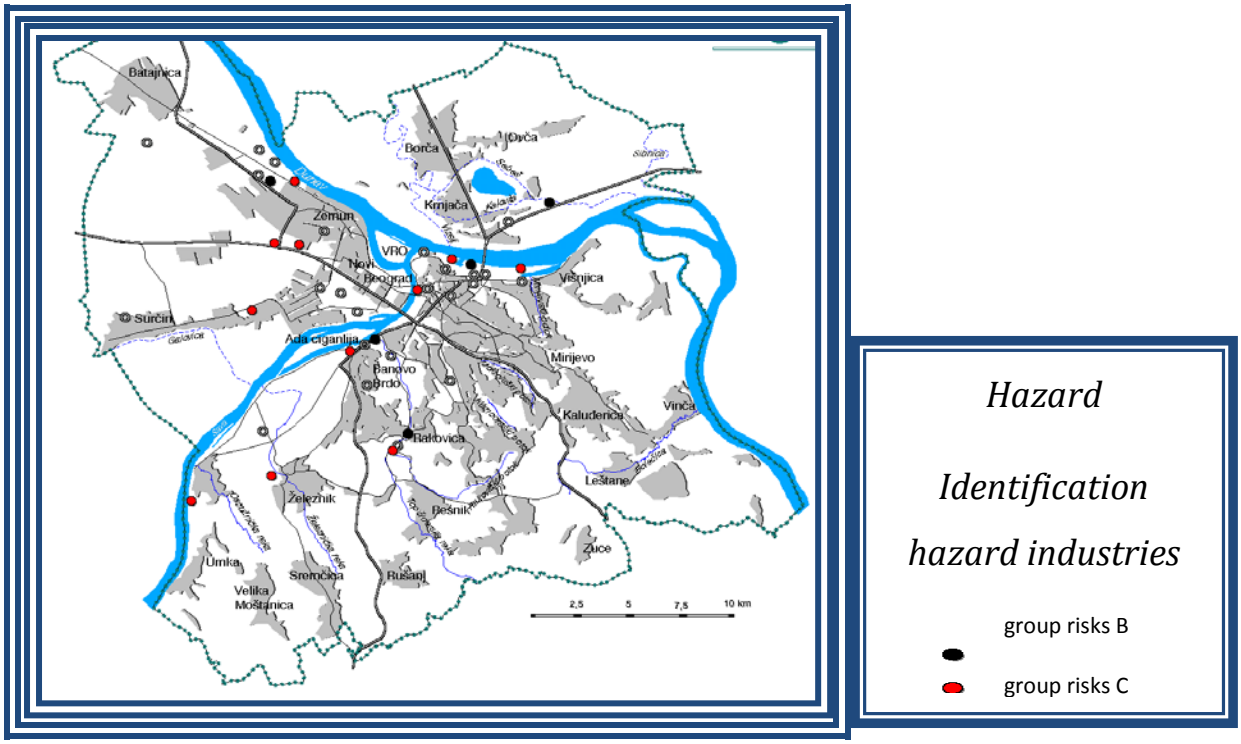

Figure 3. Identification of hazardous products - Ecological atlas of Belgrade (Ecoatlas Zdravlje, n.d.).

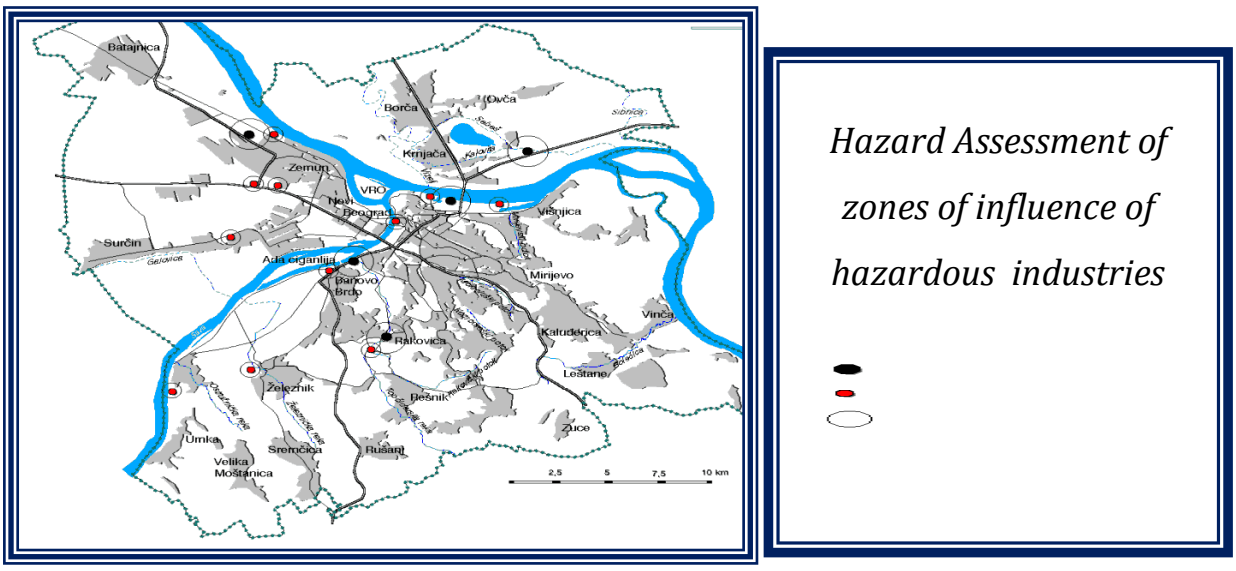

Figure 4. Evaluation of the impact of hazardous zones Industry (Ecoatlas Zdravlje, n.d.).

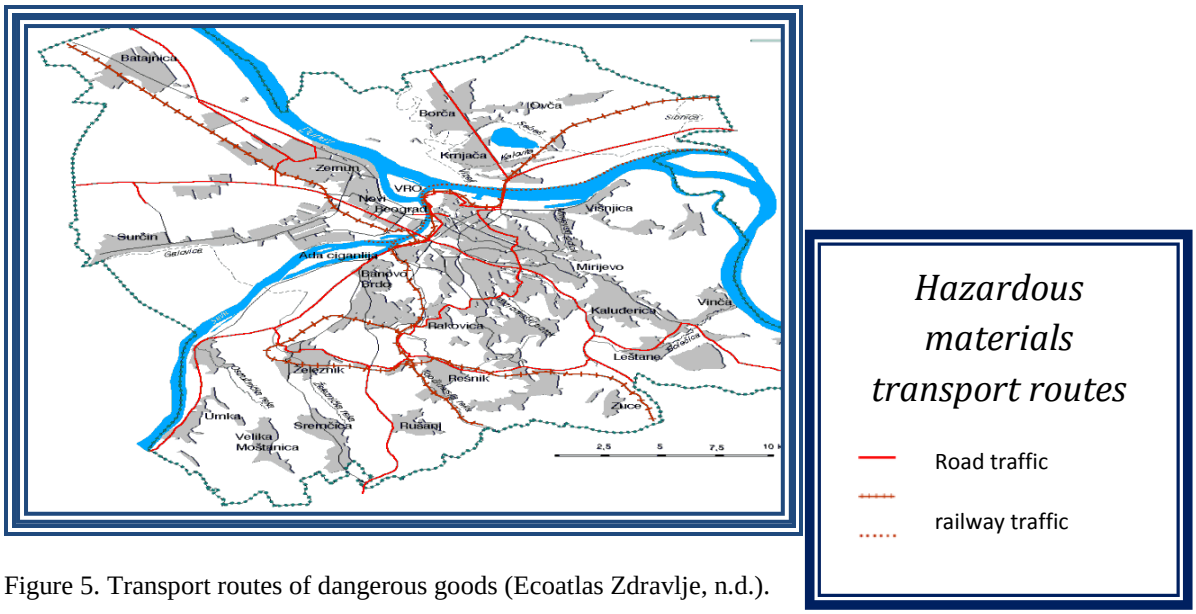

Figure 5. Transport routes of dangerous goods (Ecoatlas Zdravlje, n.d.).

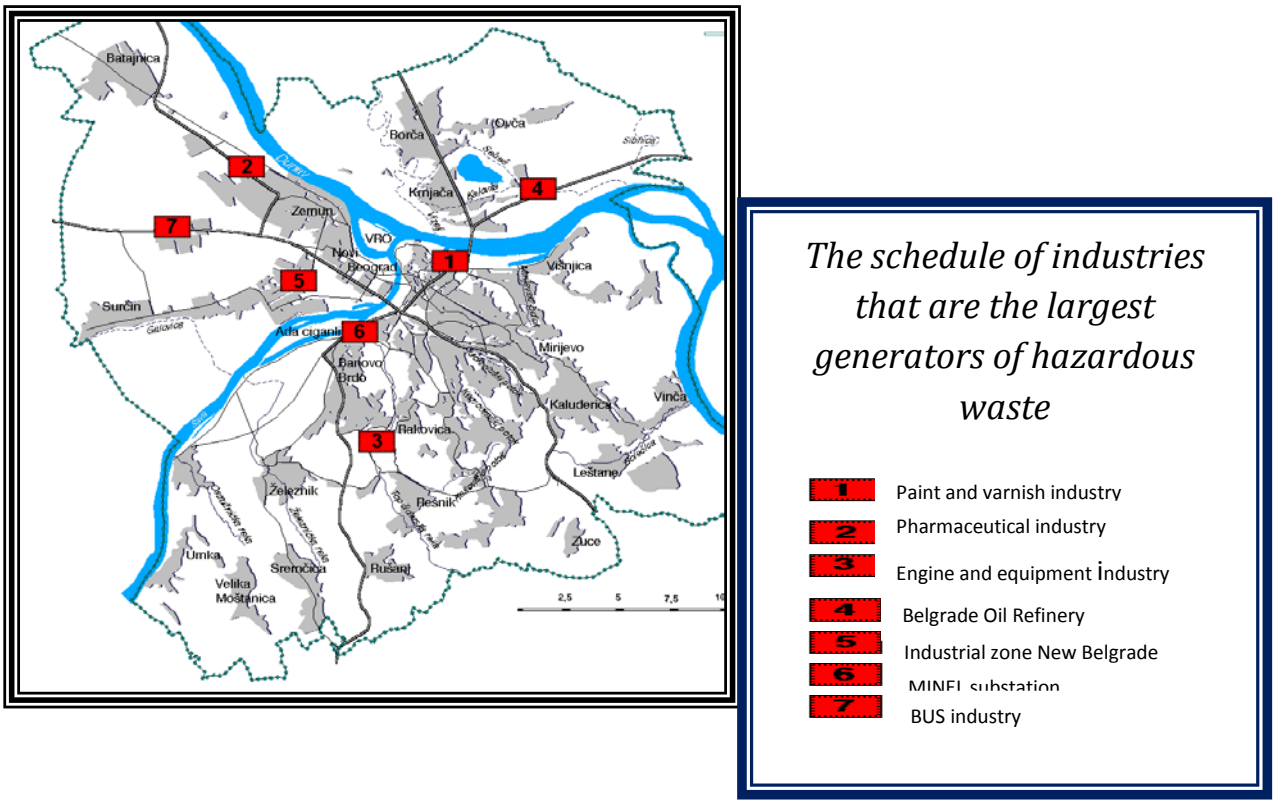

Figure 6. The schedule of industries that are the largest generators of hazardous waste (Ecoatlas Zdravlje, n.d.).

Conclusion

Upon analysing the comparative models for the assessment of chemical accident risk, it can be concluded that the experiences from the accidents in Yusho (Japan), YU-chang (Taiwan), Seveso (Italy), and in many other places, can be applied in the solution of environmental problems in Pančevo. Chemical accidents are particularly important in analysing the post-effects on people's health. Based on the experience from the stated accidents in the world, it can be expected that in Pančevo there would be a negative post-effect on the public health. Risk assessment preparation implies not only the

prevention, but also a significant analysis of the accident's post-effect. Analysis of consequences is important because negative effects of chemical substances on public health can realistically be seen. As conclusion, it can be stated that there are certain substances that at the time of the accident do not cause mortal effects (acute affect), but their effects are manifested after a certain number of years (chronic effect). The fact that such substances exist has caused the experts to include the so-called «post-effects» (proven in accidents, particularly in children) in the chemical accident risk assessments. Chromosome aberration, as a possible direct consequence, changes permanently the genetic structure and may result in a great number of anomalies, as well as in serious diseases of the human population living and working in the area.

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Review Scientific Paper/Pregledni naučni rad UDC/UDK: 004.65:[005.336:027.7(497.11)
Paper Submitted/Rad primljen: 3. 9. 2021.
Paper Accepted/Rad prihvaćen: 16. 12. 2021.
DOI: 10.5937/SJEM2201056M

Informacione inovacije i efektivnost akademske biblioteke - Primer biblioteke Fakulteta za inženjerski menadžment

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Ključne reči: visokoškolske biblioteke, upravljanje podacima, inovacije, pristup informacijama, bibliotečke usluge.

Information Innovations and Effectiveness of the Academic Library - The Example of Belgrade School of Engineering Management Library

Abstract: Data management innovations in business and educational systems are especially reflected in the work of academic libraries. This paper shows how the application of new technologies and use of scientific databases affect the library activities, in relation to teaching and scientific activities. Data analysis indicates the connection between the needs of library users in higher education and the possibilities of library services, and thus explores the use value of library information resources and effectiveness of library operations in higher education.

Case study of the Belgrade School of Engineering Management Library shows the response of users through the process of introducing innovations. Data on the use of the fund, access to scientific databases, monitoring the researchers' bibliographies show that activities at the academic library change and develop according to current user needs. As library and information resources became more comprehensive, the basis for education and scientific research becomes stronger. Traditional and modern approaches are not mutually exclusive, but complement each other. Leadership support and communication with teachers play key roles in planning innovations and activities at the library. In order to access current and reliable data, the paper emphasizes cooperation with related institutions, development and connection of information systems.

Key words: Academic Libraries, Data Management, Innovations, Access to Information, Library Services.

1. Introduction

Activities of the academic library are organized in support of study programs. Users are students, teaching and administrative staff. Library services refer to research and access to relevant and verifiable sources, providing information that in practice should contribute to the achievement of the goals of higher education.

Based on the experience in the organization of the academic library activities and daily communication with users, the effectiveness of library support for teaching, learning and scientific work was researched. After the introduced innovations, connection with scientific e-sources, data on the use of all forms of material are collected and by comparative data analysis, conclusions were reached, that could be guidelines in future work.

The aim of the paper is to show how changes in the business of the higher education library, conditioned by modern circumstances and user needs, contribute to the quality of educational and research processes. How to find balance between needs and interest, and develop the ability to adapt, according to current changes and technological innovations in the higher education library?

Systemically organized catalogs, as well as databases of scientific sources, have become a necessary tool, a guide through the sea of information that is published every day. The question arises, what does data search management look like in practice? To what extent are students and teachers at the faculty referred to library support? What types of support are represented and to what extent?

2. Information innovations in the academic library - a research framework

Information access, as a field of information science, Jesse Shera linked to the process of communication. The problem is not that one has too much knowledge, but that one does not have enough knowledge of the right kind. "The only remedy for too much knowledge is more knowledge - knowledge how to use the knowledge we have" (Shera 1971:78).

The importance of the Internet in obtaining information at any time is not the question. According to the Millers, from the perspective of a librarian who needs to provide relevant sources, a library that has all the data, open all the time and to the whole world, is still just a dream. Most collections in libraries are not digitized, and those that are digitized, are related to works that belong to cultural heritage and are exempt from copyright. In the information society, the librarian's work is developing in the direction of managing the flow of information, as well as knowing where and how to physically or virtually localize the information carrier (Muller and Muller, 2005: 17), in this sense, it is necessary to focus on content, not on the holder, more on the information than the substrate that carries it (Muller and Muller, 2005: 18).

Elaine Svenonius deals with the system of organizing information and says that the hallmark of the information age is the opening of the possibility of immediate electronic access to digital information, but technology alone is not enough and the effectiveness of the system for accessing information is proportional to the knowledge invested in its organization (Svenonius, 2007: 7).

Koltay deals with the support of research work by academic libraries and points out that changes in the information behavior of researchers call for a major transformation of the role and tasks of academic libraries (Koltay, 2016). In accordance with the changes in the University, it is indicated that the physical space in libraries is now a place to interact with new technologies, visual data, a place to support research (including data management, open access databases, and other types of digital research support).

In a study exploring librarians' experiences managing data for research purposes, Faniel and Connaway address factors that influence the ability to support researchers. Through interviews with 36 academic library professionals in the United States, 5 influencing factors are highlighted: technical resources; human resources; researchers' perception of the library; leadership support and communication, coordination and collaboration (Faniel and Connaway, 2018: 100).

A Case Study on improving communication with PhD students in University libraries, carried out in Great Britain (De Montfort University), highlights the importance of meaningful, timely and two-way communication, introduces the concept of meaningful communicators and suggests that there are several levels at which misunderstandings can occur and misalignment in business communication with users (Petch et al. 2016). Of particular importance is the moment - when students get the necessary information. In order for the messages to be meaningful and timely, the communicators that are closest to the teaching process, the teaching staff, should be included. It is easiest during the teaching process to identify which help in accessing resources is needed and when. In this sense, Montiel-Overall recommends the cooperation of teachers and librarians, because it contributes to learning and teaching processes (Montiel-Overall, 2009).

The Digital Libraries Manifesto (IFLA/UNESCO) emphasizes the importance of bridging the digital gap and making the world's cultural and scientific heritage accessible to all. The digital library is an integral part of library services, as a collection of digital objects of confirmed quality available on the web (Đukić and Trifunović 2012: 66).

In the work on digital libraries as libraries of the future, the solution lies in adapting to new technologies and developing an organized system, which will be able to oppose the chaotic nature of the Internet (Krinulović and Stijepović, 2015: 142). Research and preservation of digital materials are questions that will be asked, and in which the demands of all, primarily scientific and cultural institutions should be unified (Krinulović and Stijepović, 2015: 149). From the above, it can be concluded that, under the influence of the information technologies development, the changes are especially current and evident in academic libraries.

3. Library activities and provision of services in practice

The effects of library activity at the academic institution are not immediately visible, nor do they bring evident material profit. Maintaining a library requires investment. In order to ensure quality, it is necessary to define the library's vision, mission and strategy for its realization, long-term and short-term goals. (Filipi-Matutinović, 2005: 4). The functioning of the higher education library as an organizational unit largely depends on how much the administration of the institution sees its importance for achieving the goals of higher education. Modern working conditions, professional staff, adequate space and equipment for teaching and research activities should be provided. Of particular importance is access to sources of information that are current, reliable, and verifiable and, in the possibilities provided by information technology, easily searchable.

The modern working conditions of the higher education library in Serbia, in accordance with the Law on Library and Information Activity, imply connection into a unique bibliographic and information system. In the National Library of Serbia, the Virtual Library of Serbia (VBS) service maintains a mutual database (on the COBISS platform). Through networking, the library becomes a member of a system. The library's local catalog base is connected to the central electronic catalog, publicly available and searchable, and once the catalog description is entered, it can be used by all libraries in the system. Machine-readable cataloging (using cataloging rules in electronic form) and data exchange via the Internet enables the search of the electronic catalog according to numerous parameters with instant access (author, title, subject and professional classification, ISBN, publisher, place of publication, year of publication, etc.).

Standardized metadata enabled the formulation and exchange of data (Moed 2006: 141). Electronic forms of scientific sources can be linked and are databases whose purpose is searchability, verifiability and reliability of scientific sources. Based on standard data formats, it is possible to instantly search for the title of the paper, view the summary of the paper, or (if available) the document in full text. Also, it is possible to monitor the citations of authors or titles, which is of particular importance when evaluating scientific work, creating bibliometric reports, and indicators of the influence of scientific journals.

Although information technology has provided numerous opportunities for searching and accessing scientific sources with significant time savings, the question is - how much it has been applied in practice? Is it a priority for founders, are they ready to invest and how do you monitor performance? What happens to users' research skills and evaluation of sources (Gruber 2018: 680), to what extent do

participants in teaching and research activities at the University see library services as the first step when accessing scientific and professional materials?

4. User needs and activity plan – the example of the Belgrade School of Engineering Management Library

On the example of the Belgrade School of Engineering Management Library, a description of the real needs and activities in the library during the implementation of innovations is given.
As the processes of teaching and research work have different dynamics and needs for access to sources, interest in library services is different. The needs of users in relation to teaching activities are focused on the basic textbook literature and additional material according to the subject programs. It is the teachers who direct the students to the necessary material.

Business cooperation between librarians and teachers is realized on several levels. Starting from the planning of fund procurement and the formation of library collections, through the provision of services, the establishment of inter-library cooperation and connections with related institutions, to the separation of outdated materials. Library activities at the faculty are conditioned by the organization of study programs and the exchange of information with teaching staff.

In addition to teaching activities at the faculty, library support is also important for research work. Teacher researchers need access to proven and reliable sources of scientific information, with as high an impact factor as possible. Data important for scientific and research work are published in peer-reviewed scientific publications, most of which have electronic access. According to the Law on Higher Education, teachers need published works in categorized journals, recognized sources of scientific information, for selection into positions. The influence factor of a scientific journal can be measured on the basis of citation analysis, in order to evaluate the scientific work. "Evaluation of scientific work through citation analysis is one of several accepted methods that are applied worldwide" (Antonić et al., 2009: 9).

After assessing the needs, at the level of the institution, the goal was set to connect the library with institutions that provide information services and provide access to scientific information bases. In accordance with that, a research plan for effective operations in the higher education library was also set. Along with the development of library activity and the increase of library resources, a record and analysis of statistical data on the use of information sources was carried out for a period of 3 months (December 2018 - February 2019). Library users were students (about 100), teaching staff and teaching assistants (32 in total). The research covered the provision of services and the development of the School's Library activities, the effects of connecting to the EBSCO database of scientific information and the E-CRIS information system on research activities in Serbia.

By the time data collection began, the Belgrade School of Engineering Management Library had already secured the work conditions (space, equipment and staff expertise, according to the Accreditation Standards). Customer service functioned in accordance with teaching needs. Before the research, the library had a collection of 5117 units in local access, formed according to the study program, had a reading room equipped with computers and Internet access.

At the beginning of the first semester, as part of a special course, students were introduced to library services. This type of education enables familiarization with different types of required sources of material and methods of access, skills of searching sources at the very beginning of the educational process. Students are advised to use the library's electronic catalog (COBISS/OPAC), given that the School's Library is a member of the unique mutual library system of the Republic of Serbia.

During the research period, in three months the book fund was increased by 134 units according to the subject programs, which means a total of 5241 units of library materials in local access. Basic textbook literature for students is also provided, according to the plan for the summer semester.

Innovations within library and information services were: provided access to EBSCO bases of scientific and professional sources and updating the bibliographies of the teaching staff.

By accessing the EBSCO databases of scholarly sources, more than 8,500 full-text journal titles, including more than 7,300 peer-reviewed journals, were available. In addition to the full text in the

original (searchable) PDF format, abstracts of scientific papers for more than 12,500 journals and a total of more than 13,200 publications, including monographs, reports, conference proceedings, etc., were also searchable. Cited references were searchable for more than 1,400 journals. After the presentation of the search and access to these electronic sources, use is enabled for students and employed teaching staff.

During the survey period, materials in local access were used as expected. From the beginning of December 2018 to the end of February 2019, a total of 168 units were issued, which includes books, journals, compact discs. The mentioned material includes textbooks and professional literature, classified according to the fields: management, marketing, economy, security, information technology, technological sciences, but also from the fields of foreign languages, art and literature.

Based on data on access to the electronic database and download of sources (Table 1), it was determined that users performed a total of 5763 searches, downloaded 775 documents in full text and 387 in abstracts, a total of 1185 downloaded texts. The full-text documents used are viewed as downloaded library items. The titles of magazines with high impact factors published by Taylor&Francis, Springer, Wiley, Sage Publications and other renowned publishing houses were used the most. Areas related to the study program are represented: management (engineering management, human resources management, and quality management), economy, finance, information technology, artificial intelligence, security, higher education, law, ecology, etc. In addition, usage data refers to topics related to medicine and health, psychology, sociological and cultural issues, etc.

Table 1. Presentation of the use of the database of scientific sources for the period: December 2018 - February 2019.

Report Name (Description):	Database Usage Report (Report Database Usage Metrics)				
Institution Name:	SCHOOL OF ENGINEERING MANAGEMENT				
Run Date:	2019-03-01				
Reporting Period:	2018-12-01 to 2019-02-25				
Database	1) Total Searches	2) Total Requests	3) Total Full-Text Requests	4) Total Linkout	5) Abstract Requests
Academic Search Complete	93	78	57	0	21
Academic Search Premier	888	625	406	20	199
Associated Press Video Collection	268	2	2	0	0
Business Source Premier	725	284	175	3	106
EBSCO Publishing Citations	13	0	0	0	0
Image Collection	890	23	0	0	23
Image Quick View Collection	8	9	6	0	3
MarketLine Company Profiles Authority	719	0	0	0	0
Regional Business News	706	35	20	0	15
eBook Academic Collection	727	125	105	0	20
eBook Collection (EBSCOhost)	726	4	4	0	0
	5763	1185	775	23	387

Full-text electronic units downloaded are compared to the number of units rented in local access. When comparing the numbers of units used, in local access (168) and through the database (775), it can be concluded that users used 4.6 times more units with remote access compared to the material located in

the library, or in percentages 18% to 82%. Therefore, the response of users, for the very beginning of using electronic resources with remote access, justified expectations and confirmed the necessity of connection. Nevertheless, it should be said that both types of access to materials are important and in demand. The fund in the local approach is the basis for supporting the maintenance of the study program, the access to the bases of scientific sources is an upgrade, mostly for the needs of teaching and research work. They are not mutually exclusive, but complement each other, in order to provide effective service.

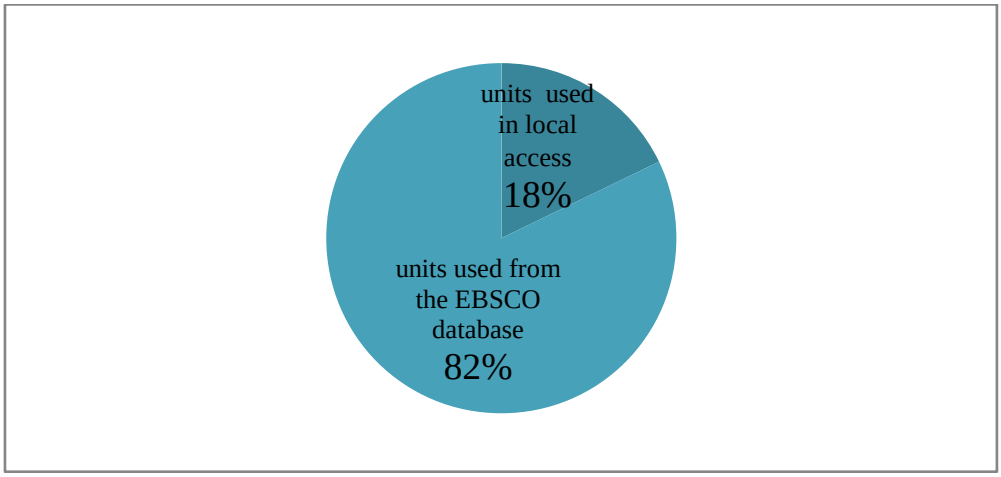

Figure 1. Ratio of used units with remote access and units in local access, expressed as a percentage, for the period: December 2018 - February 2019.

The two way communication that harmonizes the needs of teaching and research activities and the use of library resources is necessary, in order for the resources to have a useful value. That is why teaching staff are "significant communicators". Current sources of information are a point of contact, the basis of the mutual communication - for librarians to plan business, for teachers and researchers to provide access to sources. Teachers who are actively engaged in research transfer their interests to students during the teaching process (regarding the link of requested titles).

According to the interest of the users, activities were also carried out that contribute to monitoring of published scientific works. The personal bibliographies are of particular importance for School's teaching staff. In the E-CRIS information system on research activity, there is the possibility of electronic access to researchers' bibliographies. Within the library and information systems in the network, a record of researchers and institutions has been established, on the basis of which bibliographies can be maintained. Records in the COBISS system, based on the database of authors (CONOR) and the assigned code of the researcher, and according to the established typology of the work, are grouped within the personal bibliography. According to the system, when the researcher's work is recorded in the electronic catalog (COBISS/OPAC), it is also searchable through the researcher's bibliography. Applied in practice, in the records of the School of Engineering Management, as a research organization within the E-CRIS system, at the end of February 2019, 32 researchers (teachers, library users) were recorded, whose scientific and professional work was recorded and searchable in this way. The significance is that there is the possibility of updating bibliographic data, adding new references, following the chronology and current scientific work of the author.

The analysis of the obtained statistical data shows that a connection has been established between the possibilities of information services provided by the library and the real needs of users in a higher education institution.

The example of the Belgrade School of Engineering Management Library displayed the effectiveness of library operations. Data on the fund use, access to EBSCO databases, the researchers' bibliographic data in the E-CRIS system clearly show that the academic library activity is changing, developing and contributing to the quality of higher education.

Changes in library operations can be especially pronounced in higher education institutions, because the need for information for the purpose of education, scientific work can be recorded. The role of libraries is changing from reactive to productive, library services change from day to day and contribute more effectively to the quality of teaching and research activities when they are developed systematically.

This is an example, in a short period of time that includes the introduction of innovations, but even in that case, based on the response of users, the use value of library-information resources was confirmed, and the introduction of access to electronic sources was justified.

Good business decisions brought the balance between the user's needs and the library operation within a higher education institution. In the long term, the good operation of the library improves the educational process, which is shown by the satisfaction of the students and the interest in enrollment.

5. Conclusion

Successful teaching-scientific activities and library activity within a higher education institution are very closely related, and properly coordinated cooperation can be expected to increase the overall quality of work and results of the higher education institution.

In addition to regular activities, as support for the implementation of the curriculum, at a time when information is the most valuable resource, the business activities of the academic library must be directed in accordance with changes in higher education and the current needs of users.

A library is a growing organism (Ranganathan, 1931). Library activity today must keep up with the times. Higher education libraries in Serbia are not isolated collections, but are connected in a unique information system. When providing services in the faculty library, the focus should not be on the content holders, but on the content for which easy access should be provided. Regardless of the form, it is important to enable the search of materials in local access through a unique electronic catalogue.

In addition to searching and using "tangible" collections, an important service of the academic library is access to resources in digital form, which can be in local or remote access. Linking to scholarly databases requires investment, but allows easy searching and instant access to electronic journals and books, which has proven to be a sought-after and useful resource for higher education libraries.

The development of library resources in practice depends on the importance of the support of the institution to which the library belongs. Library services at the faculty are interrelated, conditional and if they are systematically arranged, they can contribute to the quality of work. The more comprehensive the library and information resources are, the better the basis for education, training and research work within the higher education institution is created. In this sense, it is important to recognize the importance of the development and connection of information systems, cooperation with related institutions in order to enable access to the necessary data.

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Original Scientific Paper/Originalni naučni rad UDC/UDK: 005.3:316.46]:159.942(535)
Paper Submitted/Rad primljen: 26. 10. 2021.
Paper Accepted/Rad prihvaćen: 21. 1. 2022.
DOI: 10.5937/SJEM2201064P

Modeliranje strukturnih jednačina (SEM) za testiranje emocionalne inteligencije kao posredničke varijable između liderstva u transformaciji i učinka zaposlenih: sektor telekomunikacija u Sultanatu Oman

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Apstrakt: Cilj studije je da se istraži uloga emocionalne inteligencije kao posredničke varijable za poboljšanje efikasnosti transformacionog lidera u naglašavanju performansi zaposlenih korišćenjem modeliranja strukturnih jednačina. Studija je koristila metod praktičnog uzorka i istraživačku i deskriptivnu metodologiju istraživanja. Ukupna populacija studije je 554 zaposlenih u 2 glavne telekom kompanije u Omanu . Uzorak ispitanika je 211. Modeliranje strukturne jednačine je korišćeno da se empirijski testira predloženi konceptualni model. Rezultati sugerišu da emocionalna inteligencija ima posredni efekat u pomaganju lideru da dovede do boljeg učinka zaposlenog. Emocionalna inteligencija posreduje u odnosu između transformacionog liderstva i učinka zaposlenih. Cilj studije je da pokaže koliko je ključno da transformacioni lider bude emocionalno inteligentan i svestan netangencijalnih aspekata kako bi poboljšao učinak osoblja. Nalazi impliciraju da je emocionalna inteligencija ključna strategija koju koriste transformacioni lideri da razviju jak tim orijentisan na rezultate.

Ključne reči: transformaciono liderstvo, performanse zaposlenih, emocionalna inteligencija, inspirativna motivacija

Structural Equation Modelling (SEM) to Test Emotional Intelligence as a Mediating Variable Between Transformation Leadership and Employee Performance: Telecommunication Sector in Sultanate Of Oman

Abstract: The objective of the study is to investigate the role of emotional intelligence as a mediating variable to improve the effectiveness of a transformational leader in accentuating employee performance using Structural Equation Modeling. The study used a convenience sample method and an exploratory and descriptive research methodology. The total population of the study is 554 employees of 2 main telecom companies in Oman. Sample respondents are 211. Structural Equation Modelling was used to empirically test the proposed conceptual model. The results suggest that emotional intelligence does play a mediating effect in helping the leader lead to a better performance of the employee. Emotional intelligence mediates the relationship between transformational leadership and employee performance. The study's goal is to show how crucial it is for a transformational leader to be emotionally intelligent and aware of non-tangential aspects in order to improve staff performance. The findings imply that emotional intelligence is a key strategy used by transformational leaders to develop a strong result-oriented team.

Keywords: Transformational leadership, Employee performance, Emotional intelligence, Inspirational

Motivation

1. Introduction

The role of a leader has been one of many critical criteria for the survival of organizations in a linked modern society of globalization. High performance leadership is one of the single most important criteria in determining an organization's eventual success or failure. The success of an organization may be tracked by looking at how its leader coordinates and controls it (Waglay et al., 2020). There are many debates about which is the most effective leadership style - although all leaders set the same goal, difference comes in the approach to accomplishing the set goal.

This study mainly focuses on transformational leadership. Followers are developed to be leaders and eventually bear full responsibility for their own development as well as the development of an organization in transformational leadership. To put it another way, the transformational leader is completely focused on guiding followers to their full potential of expected performance while also encouraging them to accept full responsibility for their own development. Transformational leaders improve followers' awareness of the importance of achieving goals and the paths to achieving them, as well as assisting followers in envisioning not only their own benefits but also the organization's benefits (Bass & Riggio, 2006).

How well do we understand the role of Emotional Intelligence in shaping transformational leaders? How important are the individual components of transformational leaders in affecting employee performance? These are a few of the questions this study is trying to empirically test and verify in the given context.

2. Literature Review

Companies and organizations are all oriented towards developing performance indicators for the organization as a whole and employees in specific. This research and literature review is specifically towards understating the effect of transformational leadership in enhancing the output and performance of employees.

We examine the impact of transformative leadership getting performance management changes to the point where organizational actors actively use performance data. It is an effort to understand the role of a transformational leader in enhancing employee performance.

Transformational Leadership and Employee performance

According to the second edition of ‘Transformational Leadership’ (Bass & Riggio, 2006), transformational leaders motivate others to achieve more than they had anticipated. They create an example of themselves to be followed by others for better results. The followers of transformational leaders are more loyal and fulfilled. Furthermore, transformational leaders enable their followers to attain their full leadership potential by empowering them and paying attention to their unique needs and development.

Moynihan et al. (2012) in article ‘Setting the Table: How Transformational Leadership Fosters Performance Information’ explain that employee effort is guided and encouraged by transformational leaders who elevate employee awareness of the relevance of organizational principles and outcomes, as previously stated. Executives must develop a feeling of vision, mission, and purpose in employees, as well as provide assurance and direction about the organization's future, as part of this process. Employees' higher-order needs are activated by appealing to them, motivating them to prioritize the organization and its clients over their personal self-interest. Second, by functioning as a source of idealized influence, a role model, and fostering staff confidence and pride in the organization, transformative leaders inspire others. Third, transformational leaders inspire followers to be achievers and performers by questioning the traditional beliefs.

Chammas & Mauro Da Costa Hernandez (2019) research paper ‘Comparing transformational and instrumental leadership: The influence of different leadership styles on individual employee and financial performance in Brazilian startups’ has stated that transformational leadership positively and significantly effects all types of performances, and it has a strong influence on employee performance.

Specchia et al. (2021) research on 'Leadership Styles and Nurses' Job Satisfaction. Results of a Systematic Review' has recommended on understanding the various effects of leadership styles. This enables understanding of how they affect people, as well as enhanced organizational accomplishment by determining when a certain leadership style favors or hinders organizational goals. Research also indicates that transformational leaders inspiring and motivational behavior psychologically motivates employee's behavior.

H1: ***There is a positive relationship between transformational leadership and job performance***

Emotional Intelligence and Transformational leadership

In recent years, academicians studying the function of leadership in virtual environments have attempted to address several questions, the most of which were targeted at examining the role of leadership in virtual environments and in face-to-face situations. Goleman (2002) in his book 'Leadership the Power of Emotional Intelligence' has mentioned that leadership is an art and not science. It's not that IQ and technical skills don't matter; these are entry level requirements for executives, but the prime requirement of any leaders is the EQ. Based on his studies of competency model of 188 companies he stated a relationship between performance and EQ of a leader. Self-awareness, self-Management, social skills, and empathy are the component of EQ required by a leader to motivate people to performance. Leaders with low EQ were rarely ranked high on performance.

Ruggieri (2009) in the conclusion of his research paper 'Leadership in virtual teams: A comparison of transformational and transactional leaders' has stated that, the figure of a more charismatic transformational leader emerges, one who is more focused on the future and the development of the workgroup, and who is less focused on the task and more on relationships. This leader is frequently regarded in more positive words, and is thought to be not just intelligent, but also original and creative. The transactional leader, on the other hand, is regarded as being more authoritative, self-assured, and focused on the work at hand. Furthermore, there are no distinctions in the negative words used to describe the two sorts of leaders. Overall, both appear to be equally favorable figures who are intelligent and sensitive, though transformational leaders are credited with a higher emphasis on sensitivity.

Jiménez (2018) in the article 'Leadership style, organizational performance and change through the lens of emotional intelligence' states that the transformational leaders who are emotionally balanced can smoothly adapt to the changes in the organization. Such managers can also keep track of the emotional impact of the changes on employees and motivate accordingly which otherwise may lead to high cost to the organization.

Richard Lopez (1997) PhD research on 'Leadership Styles and Emotional Intelligence of Federal Employees in Diversified Work Environment's' gave following finding which directly related the relationship between transformational leadership and emotional EI:

- The data revealed that EQ was associated with a wide spectrum of leadership styles, particularly transformational and transactional leadership.
- Skills in emotional intelligence were linked to active leadership approaches like transformational leadership. Other leadership styles, such as management-by-exception (active/passive), laissez-faire, and passive/avoidant, have a negative relationship with EQ.
- While not all leadership styles are linked to EQ abilities, there is a link between transformational leadership and EQ abilities.

In the research paper 'Emotional Intelligence as Mediator between Leadership Styles and Leadership Effectiveness: A Theoretical Framework' (Badri-Harun et al., 2016) it was concluded that emotional intelligence plays a role of mediating variable between leadership style and effectiveness of leadership (although this research has not very clearly stated which leadership style is more influenced by emotion).

Harmon (2013) in the PhD dissertation 'The relationship between leadership style and leadership effectiveness, Followers satisfaction and followers' extra effort in Christian nonprofit organization' strongly recommends training leaders because transformational leadership has a strong positive relationship with organizational outcomes (dependent variables). He recommends that both leaders and followers pay attention to the components of transformational leadership provided by (Bass & Riggio,

2006): (a) Idealized influence, in which followers hold an idealized vision of the leader and seek to identify with him and his mission; (b) Intellectual stimulation, in which leaders urge followers to challenge their own views, assumptions, and values by assisting them in approaching old problems in new ways. By being creative and ingenious, followers learn to approach and solve challenges on their own; (c) Individual consideration, in which leader tries to meet not only current needs, but also expands and evaluates those needs to maximize and develop each follower's full potential and respects each follower as an individual; (d) Inspirational motivation.

Waglay et al. (2020) extensively tested and proved that emotional intelligence has been discovered to have a full mediating influence between transformative leadership and job performance, resulting in a productive workplace. They also quoted Goleman (1995) extensive work on emotional Intelligence and stated that personal and professional success will be heavily influenced by emotional intelligence. The findings of the study reveal that a leader's emotional intelligence explains performance achievement through the leader's social interchange.

Saxena et al. (2017) article 'Goleman's Leadership styles at different hierarchical levels in medical education' mentions that since emotional intelligence may be developed and refined through emotional competency training and coaching, leadership education could be expanded to include knowledge and application of many leadership styles, particularly at the entry and intermediate levels.
Mokhber et al. (2015) in 'Effect of Transformational Leadership and its Components on Organizational Innovation' studied individual components of transformational leadership and its effect on organizations innovation. Test results stated that transformational leaders do have a positive impact on innovativeness of the organization although not all components have the same effect on the innovation. Three components of transformational leadership (attributed charisma, inspirational motivation, and intellectual stimulation) were found to be positively and significantly related to organizational innovation, while the effect of idealized influence on organizational innovation was found to be insignificant.

Minhaj et al. (n.d.) article 'Role of Transformational Leadership and its Components on Organizational Innovation through Employee Engagement: Evidence from Pakistan' states that employee engagement is inextricably linked to transformational leadership and its components. As a result, it can be concluded that the characteristics examined in this study have a major impact on organizational innovation, which can benefit both management and employees in business organizations.

- **H2:** ***There is a positive relationship between transformational leadership and emotional intelligence***
- **H3:** ***There is positive relations between emotional intelligence and performance***
- **H4**: ***Relationship between transformation leader and employee performance is mediated by emotional intelligence***
- **H5:** ***Relationship between individual consideration of transformational leader and employee performance is mediated by emotional intelligence***
- **H6:** ***Relationship between intellectual simulation of transformational leader and employee performance is mediated by emotional intelligence***
- **H7:** ***Relationship between inspirational motivation of transformational leader and employee performance is mediated by emotional intelligence***
- **H8:** ***Relationship between idealized influences of transformational leader and employee performance is mediated by emotional intelligence***

3. Research Design

A quantitative research technique was applied in this study, with standardized measurements being used to collect data through Google forms. The research hypotheses were empirically validated using exploratory and descriptive research design. Because the researchers have used convenience sampling, the results of this study cannot be legitimately applied to the rest of the population. Reaching the population of workers and managers in telecom sector in Oman was difficult so convenience sampling was adopted.

Context of study

The context of the study is the Telecommunications Sector in the Sultanate of Oman. Currently, the population of the Sultanate of Oman is 4,697,440. Oman's telecom sector has 16 telecom service providers operating in multiple categories: The main category has two participants, Omantel and Ooredoo. The population of Omantel Company is (4000), and the population of Ooredoo Telecommunications Company is (1010) employees, i.e. (5010) employees in both companies.

Sample of Study

Sample of Study selected number is 227 employees who work in the medium and senior management as inspecting the unit, according to the table of sample size, which is extracted from the size of society provided in (Sekaran et al., 2012). The sample unit is the employees of Omantel and Oreedoo. The research depended on Convenience sampling. Questionnaires were distributed to the study sample (227), of which 206 responded.

Participants and Sampling

The participants in this study were employees of a Telecom sector organization. The population refers to the entire group of people who are the subjects of the investigation. Given the organization's entire population of 5010 employees, according to simulation experiments, an appropriate sample size for a simple CFA model with normally distributed indicator variables and no missing data is around N = 150 (Muthén and Muthén, 2002) in this research, the sample size was 227. The research objectives were met using a Convenience sampling technique.

A total of 227 self-administered questionnaires were distributed to the organization's employees, and 211 were returned to the researcher. Of the sample size of 206; 112 were male, 90 were female, and 4 responses were blank. Out of 211 questionnaires, 206 were useable responses where 5 respondents were deleted as unengaged responses based on standard deviation.

Data collection Method and Ethical Consideration

Respondents of the Telecom sector received an email link to the survey. The email includes information on the study as well as information about research participants' rights. Participants could only continue filling out the questionnaire if they gave their consent. All efforts were made to ensure the privacy and confidentiality of collected data. Participants were also told that they could drop out at any time without any consequences.

Material and Methods

The survey instruments utilized in this research included following: Transformational leadership (3 latent variables included 9 items); Employee Performance (7 items), and Emotional Intelligence (4 latent variables including 33 items). Transformational leadership was measured using Multifactor Leadership Questionnaire (MLQ) Form 6S. There are 4 latent variables related to Transformational leadership style: Idealized influence (3 Items), individualized consideration (3 Items), intellectual stimulation (3 items), and inspirational motivation (3 Items) (Tejeda, 2001). These 4 components of transformational leader is also clearly mentioned in the book 'Transformational Leadership' second edition (Bass & Riggio, 2006).

The questionnaire used for measuring Employee Performance is scale developed by Pradhan & Jena (2017).

The measure was created after scholars and corporate practitioners discussed their views on workplace performance. Experts offered empirical comments on the suggested dimensions and statements of the instrument. Finally, the questionnaire of employee performance measurement model included 3 latent dimensions with accompanying indicators: task performance (12 indications), adaptive performance (12 indicators), and contextual performance (12 indicators). For the current research only Task Performance indicator is adapted to test the impact of Transformational leader on Employee performance with Emotional Intelligence as mediator.

Borman and Motowidlo (1997) have stated that performance has either a direct or indirect contribution to the organization. Employees who participate in direct contributions help the company by executing some of its technological procedures. The provision of necessary and desired supplies or services, on the other hand, is referred as an indirect contribution. Borman and Motowidlo went on to remark that task performance is not the same as contextual performance. Employee assistance in shaping the organizational, social, and psychological context, which serves as a stimulant for task completion, is referred to as contextual performance.

Emotional intelligence current research has adopted Trait Emotional Intelligence Questionnaire - Short form (TEIQue- SF) Petrides and Furnham (2000) to test the Mediation effect. Emotional intelligence is measured by three latent variables for Perception of Emotions (10 items), Managing (self) Emotions (9 items), Social skills and managing other's emotions (8 items), Utilizing Emotions (6 items). All together 4 factors, 33 items.

Measurement Model: To assess the conceptual model SPSS was used for computing the items of variables for final analysis. AMOS Direct Indirect effect and Bootstrapping is used to evaluate the effect of Emotional intelligence as a mediating factor for a transformational leader and employee performance.

Statistical Analysis

First phase of our analysis was to outliers and out of range responses. This was accomplished using descriptive statistics. Value of the Shapiro-Wilk test was used to test the Normality of the distribution. P value less than 5 indicated that the distribution is not normal. Unengaged respondents were eliminated by using the standard deviation score. Respondents having standard deviation around zero were eliminated. The number of eliminated respondents were 5 out of 211. The Percentage of elimination being very small indicates well responded Reponses. The concept of validity and internal consistency reliability of each measure employed in the study were assessed, prior to undertaking regression. The associations between variables will remain confusing without construct validity and reliability (Santos & Reynaldo, 2013) As said by Baron & Kenny (1986), mediation analysis is a technique for determining the extent to which indirect paths through the mediator explain the relationship between the independent and dependent variables. Variable can be called a mediator "to the extent that it accounts for the relation between the predictor and the criterion" (Baron & Kenny, 1986)

4. Results

Cronbach alpha is a statistic that is frequently used to show that tests and scales that have been created or adopted for research projects are appropriate. Alpha values were described as relatively high if value is between (0.70– 0.77) (Taber, 2018). Cronbach value in Table 1 of all the variables used is relatively high which is appropriate to be tested for Direct and Indirect effect.

Table 1. Cronbach value

		Cronbach's Alpha	**Sample**	**Units**
EMOTIONS	**Abbreviated names in the system**			
Perception of Emotion	PE	0.678	206	10
Managing Emotions in the self	ME	0.746	206	9
Social Skills or Managing others' emotions	SS	0.726	206	8
Utilizing emotions	UE	0.748	206	6
TRANSFORMATIONAL LEADERSHIP				
Idealized Emotion	TLIE	0.754	206	3
Inspirational Motivation	TLIM	0.784	206	3
Intellectual Simulation	TLIS	0.743	206	3
Individual Consideration	TLIC	0.764	206	3
EMPLOYEE PERFORMANCE	EP	0.844	206	7

Table 2 shows the construct validity for all the items related to transformational leadership. Employee Performance was tested to Pearson correlation. R value between 0.5 and 0.69 is considered moderated correlation, r value between 0.7 and 0.89 is considered strong correlation (Schober & Schwarte, 2018) . As the result shows the r values for all items are good with strong association. The r value is more than the critical value for all the items which indicates the value of item related to Employee performance and Transformational leadership.

Correlation is significant at the 0.05 level (2-tailed).

Table 2. Employee performance

EP	EP1	EP2	EP3	EP4	EP5	EP6	EP7
r Value	0.648	0.67	0.678	0.686	0.742	0.773	0.784
Critical value	0.138	0.138	0.138	0.138	0.138	0.138	0.138

Table 3. Transformational leader

Trans leader	TLIC1	TLIC2	TLIC3	TLIE1	TLIE2	TLIE3
r Value	0.695	0.646	0.584	0.674	0.72	0.723
Critical value	0.138	0.138	0.138	0.138	0.138	0.138
Trans leader	TLIM1	TLIM2	TLIM3	TLIS1	TLIS2	TLIS2
r Value	0.67	0.7	0.7	0.736	0.7	0.7
Critical value	0.138	0.138	0.138	0.138	0.138	0.138

- TLIE- Transformational Leader Idealized Influence.
- TLIM- Transformational Leader Inspirational Motivation.
- TLIS- Transformational Leader Intellectual Simulation.
- TLIC- Transformational Leader Individual Consideration.

Testing the Direct effect

The Direct and Indirect links with mediating effect was based on literature review. For 'Testing the mediated effects' the results were first examined by looking at the direct effects, then the indirect impacts, and finally the mediation results.

Regression analyses were used to operationalize and empirically test the theoretical model

H1: ***There is a positive relationship between transformational leadership and job performance***
H2: ***There is a positive relationship between transformational leadership and emotional intelligence***
H3: ***There is positive relations between emotional Intelligence and performance***

Fig 1 (H1)

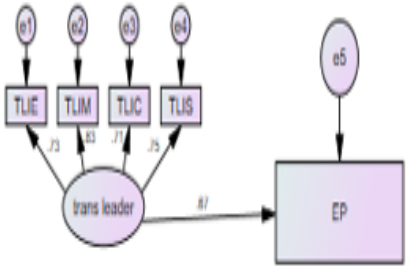

Fig 2 (H2)

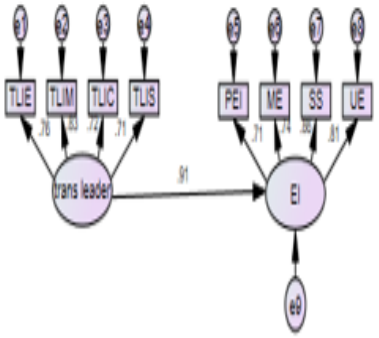

Fig 3 (H3)

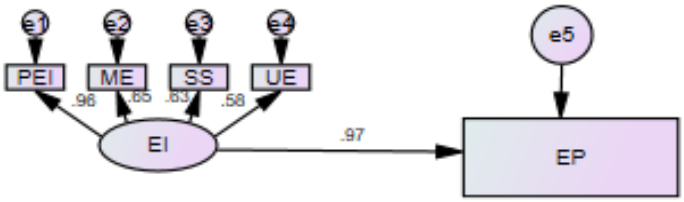

Figure 1, 2 and 3: Path diagram for H1 (Fig 1), H2 (Fig2), H3 (Fig 3)

Test Results of Direct Effects

H1: Transformational leadership has significant positive relation with Employee Performance. P value is less than 0.05 and B value is 0.63.
H2: Transformational leadership has significant positive relation with Emotional Intelligence. P value is less than 0.05 and B value is 0.556.
H3: Emotional intelligence has significant positive relation with employee performance P value is less than 0.05 and B value is 0.733.

Testing the Indirect Effect

H4: ***Relationship between transformation leader and employee performance is mediated by emotional intelligence***

H5, H6, H7, H8: ***Components of transformational leader and its effect on employee performance - Mediating effect of Emotional Intelligence***

Fig 4(H4)

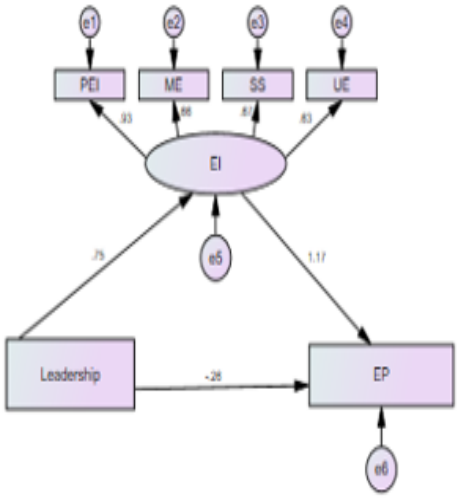

Fig 5 (H5, H6, H7, H8)

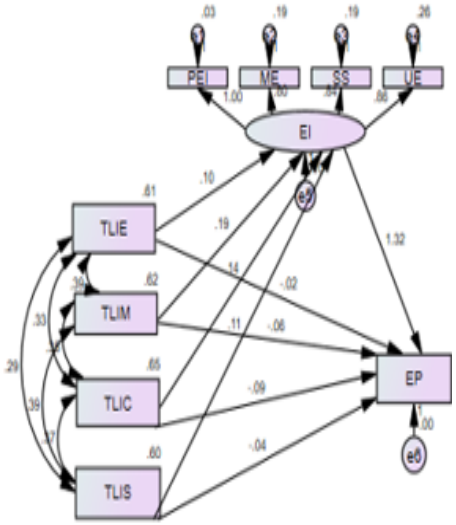

Figure 4 and 5: Path Diagram for Indirect effect H4 (Fig 4); Path diagram for Indirect effect H5, H6, H7, H8 (Fig5)

Table 4: Test Results of Indirect Effect - H4

	Testing Paths	**Standardized estimation**	**P value**	**Result**
Total effect	IV transformational leader its effect of employee performance DV with mediating variable of Emotional intelligence - Total Effect which includes H1 and H2	0,556	0.001	significant
Direct effect	H1: IV transformational leader its effect on employee performance DV	-0.262	0.001	significant
Indirect Effect	H4: IV transformational leader its effect on employee performance DV with Emotional intelligence as mediating variable	0.877	0.001	significant

Significant Test results of Direct Effect H1, H2, H3 confirmed the possibility of testing the Mediating effect of Emotion Intelligence for Transformational leader and employee performance

Total Effect – total effect of leadership IV on DV employee performance is 0.556, which is very significant as P value is 0.001. The total effect if significant indicates there is possibility of Direct or Indirect effect.

Direct effect - standardized estimation of transformational leader as an effect on employee performance goes down -0.262. Negative standardized estimation of direct effect is an indication that transformational leadership does not work without the mediation of emotional Intelligence. This path too is significant as the $p<0.05$.

Indirect Effect –This path shows the Mediating effect of Emotional Intelligence. When mediating variable Emotional Intelligence was added in the path the estimation value increases to 0.877 which indicates that Transformational leadership has a positive effect on employee performance only if mediated through emotional intelligence. This path is also significant as the $p<0.05$.

Total effect, Direct Effect and The Indirect Effect (P value < 0.05): This indicates that all paths are significant. Direct and indirect effect both are significant where there is a Full Mediation of Emotional

intelligence between Transformational leader and Employee performance as the value of estimation increases with the inclusion of emotional intelligence in the path diagram. This clearly indicates that emotionally intelligent transformational leader enhances employee performance. Without emotional intelligence the effect of transformational leadership on employee performance is negative.

Table 5. Test Results of H5, H6, H7, H8

	H5 TLIC	**H6 TLIS**	**H7 TLIM**	**H8 TLIE**
Path	**Path: H5**	**Path H6**	**Path: H7**	**Path:H8**
Total effect	0.144	0.153	0.312	.170
P value	0.109	0.107	0.001	0.036
Significance	Not significant	Not significant	significant	significant
Direct Effect	-0.136	-0.054	-0.093	-0.093
P value	0.001	0.224	0.082	0.649
Significance	significant	Not significant	Not significant	Not significant
Indirect Effect	0.279	0.207	0.364	0.198
P value	0.007	0.50	0.001	0.041
Significance	Significant	significant	significant	significant

H5: ***Relationship between individual consideration of transformational leader and employee performance is mediated by emotional intelligence***

Test results: Individual consideration of transformational leader total effect is not significant (B=0.144, P>0.05), but indirect effect is significant. The total effect being insignificant clearly eliminates the possibility of mediating effect. Thus, this component of transformational leadership is playing any role in the given context.

H6: ***Relationship between intellectual simulation of transformational leader and employee performance is mediated by emotional intelligence***

Test results: Intellectual simulation of transformational leader total effect is not significant (B= 0.191, P> 0.05), but indirect effect is significant. The total effect being insignificant clearly eliminates the possibility of mediating effect. Thus, this component of transformational leadership is playing any role in the given context.

H7: ***Relationship between inspirational motivation of transformational leader and employee performance is mediated by emotional intelligence***

Test results: inspirational motivation of transformational leader total effect is significant (P<0.05). Direct effect is not significant, whereas indirect effect is significant. Beta value of the total effect is more than the direct effect. This indicates that relationship between inspirational motivation of transformational leader and employee performance is fully mediated by emotional intelligence.

H8: ***Relationship between idealized influences of transformational leader and employee performance is mediated by emotional intelligence***

Test results: latent variable idealized influence of transformational leader total effect is significant (P<0.05). Direct effect is not significant, whereas indirect effect is significant. Beta value of the total effect is more than the direct effect. This indicates that relationship between idealized influence of transformational leader and employee performance is fully mediated by emotional intelligence.

1. Discussion of the Test results

The purpose of this study was to explore how emotional intelligence influences work performance when transformational leadership is used. A model of correlation between variables established Direct and Indirect relation between transformational leadership and employee performance with mediating effect of Emotional Intelligence.

Theoretical support was found for all the eight hypotheses. Relationship support of hypothesis H1, H2, H3, H4, H5, H6, H7, H8 has been statistically tested and verified.

The study's findings back up the main concept that transformational leadership is not fully effective in altering job performance on its own. Statistical results of the hypothesis imply that, emotional intelligence impact the link between transformative leadership and work success.

Literature review does support the point that transformational leaders have a constructive effect on the group they lead. Emotional intelligence fosters the development of transformational leader.

Test results regarding to components of leadership - H4, H5, H6, H7, H8 clearly indicate the effect of emotional intelligence as a mediating variable to enhance the effect of transformational leader on employee performance. There is a difference in the test result if leadership is taken in totality and if the taken components are tested individually. Bass & Riggio (2006) has mentioned that transformational leaders go beyond regular exchange with employees. Their act may involve all the components of leadership or only one or two components as per the context and requirements.

Jordan et al. (2010) argued that EI may have varied impacts depending on the situation in which the ability is used, they stress on the issue of context in which the study is being made.

H4: Transformational Leadership effect on employee performance is significant directly and indirectly with emotional intelligence as a mediating variable.

H5 and H6: which involves leadership component individual consideration and intellectual simulation have insignificant total effect, but indirect effect is significant. The direct effect has negative effect in case not being mediated by the emotional intelligence.

For the mediation to be effectively proved, total and the indirect effect need to be significant - test result of H5 and H6 just validates what Bass & Riggio (2006) have mentioned in their book that transformational leaders always use all the components to be effective. In this research the transformational leaders don’t involve individual consideration and intellectual simulation to enhance employee performance.

H7 and H8: which involves leadership components inspirational motivation and idealized influence have a very significant total and indirect effect. The Value of indirect effect is far higher than direct effect which clearly indicates that transformational leadership in the given context use these two components to enhance employee performance.

2. Conclusion

The main objective of the research tests the conceptualized model to check the effectiveness of emotional intelligence as a mediating variable between transformation leadership and employee performance. Research helped understanding the role that emotional intelligence plays in the effectiveness of transformational leadership. It has been discovered that emotional intelligence has a full mediation influence between transformative leadership and employee performance.

One important conclusion to this research in the given context is related to the components of the leadership. Among the given four components only two components TLIM (Inspirational Motivation) and TLIE (Idealized influence) are effectively demonstrated in enhancing employee performance with active involvement of emotional intelligence. TLIC (Individual consideration) and TLIS (Intellectual Simulation) are insignificant.

According to the findings, emotional intelligence is at the heart of successful leader-follower interactions and work performance. Inferentially, one would predict emotional intelligence is used by transformative leaders.

However, current research reveals that several interpersonal and contextual factors may alter and mitigate the correlation between transformative leadership and job performance.

Emotional intelligence's mediating role and high-quality links between transformative leadership and performance have been proven to have strong empirical backing.

Statistical evidence proves that emotional intelligence is a tool used by transformation leaders to build bond with followers and people in the workplace.

Finally, organizations should use this article as a foundation for understanding the relevance of leaders with advanced emotional intelligence in improving staff performance. Organizations need to select leaders with strong emotional intelligence or nurture leaders with emotional intelligence skills since they are more likely to succeed.

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23. Specchia, M. L., Cozzolino, M. R., Carini, E., Di Pilla, A., Galletti, C., Ricciardi, W., & Damiani, G. (2021). Leadership Styles and Nurses' Job Satisfaction. Results of a Systematic Review. *Public Health*, *18*. https://doi.org/10.3390/ijerph18041552

24. Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, *48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-

25. Waglay, M., Becker, J. R., & Du Plessis, M. (2020). The role of emotional intelligence and autonomy in transformational leadership: A leader member exchange perspective. *SA Journal of Industrial Psychology*, *46*. https://doi.org/10.4102/sajip.v46i0.1762

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

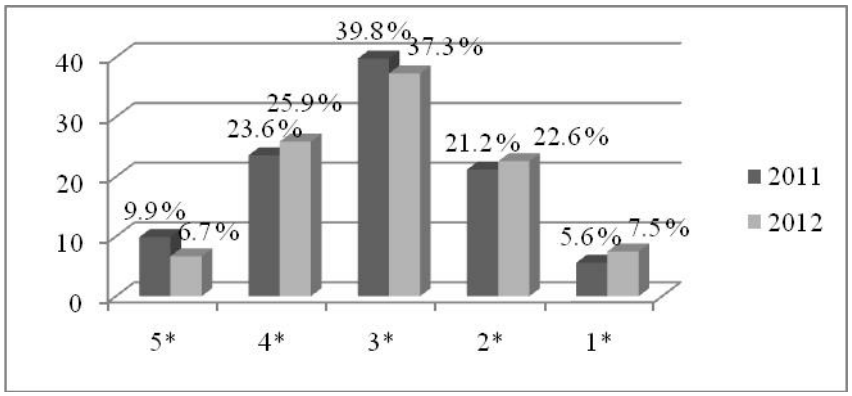
In the first line of the first page the title should be written in Serbian language (16 pt). Under the title of the paper the spaces for name(s) of the author and the names of the author's institutions should be indicated as specified and aforementioned in this Guideline. After the space for the institution 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]
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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

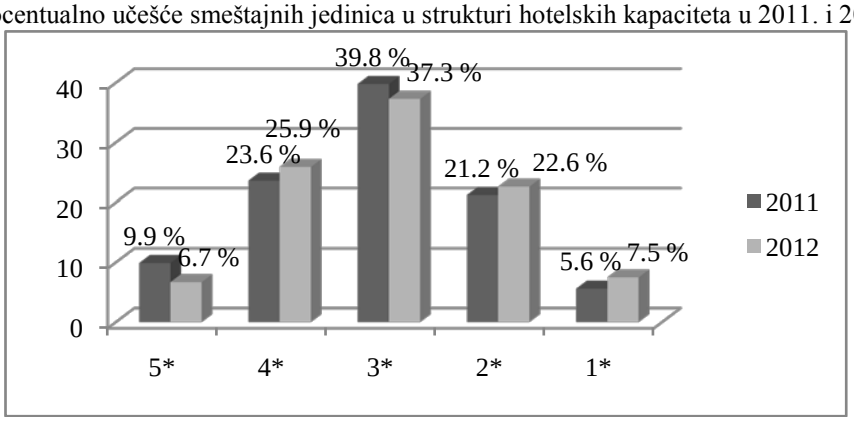
U prvom redu na prvoj strani treba napisati naslov rada na srpskom jeziku (16 pt). Ispod naslova rada treba ostaviti mesto za navođenje ime(na) autora, nazive institucija autora onako kako je naznačeno u ovom Obrascu. Nakon institucije poslednjeg autora, ostaviti jedan prazan red i u sledećem napisati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

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

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.

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Primer: Straževica gotova za dva meseca. (1. feb. 2012). *Politika,* str. 10.

Teza-štampana verzija:
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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.

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Paper Types

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

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Uputstvo za autore

Uredništvo časopisa nastoji da održi visok akademski standard. Radovi, koji se podnose, treba da budu originalni i do sada neobjavljeni. Takođe, radovi ne smeju da se nalaze u postupku recenzije u nekom drugom časopisu. Radovi će biti podvrgnuti proveri. **Tekst rada mora da odgovara akademskim i tehničkim zahtevima.**

Tip rada

Originalni naučni rad, koji nije objavljen:

- Originalni naučni rad;
- Plenarno predavanje i rad prezentovan na konferenciji;
- Pregledni rad;
- Naučna kritika, odnosno polemika.

Originalni stručni rad, koji nije objavljen:

- Stručni rad;
- Informativni prilog;
- Prikaz knjige.

Jezici radova mogu biti srpski i engleski za autore iz Srbije i engleski za autore sa drugih govornih područja.

Podneti radovi moraju biti usaglašeni sa uputstvom za autore. U slučaju da nisu usaglašeni, biće vraćeni na ispravljanje.

Svi rukopisi podležu tzv. *double blind* recenziji, odnosno procesu dvostruko „slepe“, anonimne recenzije. Tekst rada ne sme da sadrži bilo kakve reference koje mogu da ukažu na autora/e rada.

Prijava radova

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Editorial Board concluded this issue on January 31, 2022.
Uređivački odbor je zaključio ovaj broj 31. januara 2022.

ISSN: 2466-4693

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CIP - Каталогизација у публикацији
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005:62

SERBIAN Journal of Engineering Management /
glavni i odgovorni urednik Vladimir Tomašević. - Vol.
1, no. 1 (2016)- . - Beograd : Univerzitet "Union -
Nikola Tesla", Fakultet za inženjerski menadžment,
2016- (Beograd : Draslar Partner). - 30 cm

Polugodišnje.
ISSN 2466-4693 = Serbian Journal of Engineering
Management
COBISS.SR-ID 224544524