GODINA 4, BROJ 4 (2021) ISSN 2566-4522

VISOKA ŠKOLA
"INTERNACIONALNA POSLOVNO-INFORMACIONA AKADEMIJA" TUZLA

ZBORNIK RADOVA

Book of Proceedings

4. MEĐUNARODNA NAUČNA KONFERENCIJA O DIGITALNOJ EKONOMIJI DIEC 2021

4th INTERNATIONAL SCIENTIFIC CONFERENCE ON DIGITAL ECONOMY DIEC 2021

TUZLA, 2021. GODINA

GODINA 4, BROJ 4 (2021) ISSN 2566-4522

VISOKA ŠKOLA
“INTERNACIONALNA POSLOVNO
– INFORMACIONA AKADEMIJA” TUZA

ZBORNIK RADOVA
Book of Proceedings

4. MEĐUNARODNA NAUČNA KONFERENCIJA O DIGITALNOJ EKONOMIJI DIEC 2021

4th INTERNATIONAL SCIENTIFIC CONFERENCE ON DIGITAL ECONOMY DIEC 2021

Tuzla, 2021. Godina

Dizajn / Design
Katarina Andrejaš

Grafički urednici / Graphic editors
Selmir Pajazetović
Jilduza Pajazetović

Urednici / Editors
Damir Bećirović
Haris Delić

Izdavač / Publisher
Visoka škola za savremeno poslovanje, informacione tehnologije i tržišne komunikacije
"Internacionalna poslovno - informaciona akademija" Tuzla

ISSN 2566 - 4514 (Print)
ISSN 2566 - 4522 (Online)

CONTENTS

doc. dr. sc. Tado Jurić[1] *Keynote paper*

GOOGLE SEARCH ANALYSIS IN INTERDISCIPLINARY RESEARCH (CASE STUDIES: COVID-19, BIRTH RATE AND TOURISM DEMAND)

Abstract

The analysis of data obtained through Google search is gaining in importance in numerous social sciences. This paper will show that this approach can be very useful in public health, demography and forecasting tourist demand in Croatia. The need for such non-standard modelling approaches is necessary on the one hand due to the delay of official data and on the other hand, because there is great uncertainty regarding future trends.[2] We present the first studies of this type in South-eastern Europe. We have also developed a new approach and method by which data obtained through Google Trends (GT) can be standardized for comparison with official databases. Despite the many advantages of this approach, we consider the specifics and limitations of such data systems and warn in which cases the validity of interpretations and conclusions may be jeopardized.[3]

In the first case study, we present the results of testing a method on the example of the Republic of Croatia that allows the detection and prediction of new cases of COVID 19 at an early stage. The main benefit of the proposed approach is reflected in the timely detection of new locations and hotspots of the pandemic. Such detection can redirect public health resources promptly and act preventively in the further spread of the infection, for example by intro-

1 Tado Jurić, Catholic University of Croatia, tado.juric@unicath.hr

2 The paper is based on the previously published results of the author Tado Jurić:1.) Tado Jurić, Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic, Athens Journal of Mediterranean Studies 2021, 7: 1-25, https://www.athensjournals.gr/mediterranean/2021-4210-AJMS-Juric-05.pdf; 2.) Tado Jurić, Primjena analitičkih alata aplikacija YouTube, Google Photo i Google Web u predviđanju dolazaka turista u Republiku Hrvatsku s osvrtom na izazove zdravstvene sigurnosti, Medix, 2021, 147/148. URL: https://www.medix.hr/index.php?p=pdf&pdf=google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19; 3.) Tado Jurić, Deep demographic aging of Croatia - predicting of natural population change with digital demography tools in: Strategic Approach to Aging Population: Experiences and Challenges, Ekonomski fakultet u Osijeku, 341-366, https://www.ceeol.com. /search/chapter-detail?id=960442; 4.) Tado Jurić, 2021, Facebook i Google kao empirijska osnova za razvoj metode digitalnog praćenja vanjskih migracija hrvatskih građana, Ekonomski pregled (in publishing); 5.) Google Trends kao metoda za rano detektiranje pojave novih slučajeva COVID-a 19, 2021, Medix, 147/148, https://medix.hr/google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

3 See: Tado Jurić, 2021, Facebook i Google kao empirijska osnova za razvoj metode digitalnog praćenja vanjskih migracija hrvatskih građana, Ekonomski pregled (in publishing)

ducing additional measures in a certain area. This method can also be used in demography for forecasting the birth rate. Using the method, we correctly predicted that in 2021 there will be between 12 and 14% fewer births in Croatia compared to previous years, ie 31,000 to 32,000, instead of the expected 36,000 - 37,000. In the third case study, we show that the use of GT for forecasting tourist demand is a useful method both at the state level and at the level of individual regions and cities in Croatia. Our results showed, and the official five months later confirmed, the recovery of Croatian tourism at the level of 15% better attendance than the previous season (2020).

Keywords: COVID-19; Google; Google Trends; Croatia; pandemic spread forecast, tourist season, forecasting, the birth rate

1. Introduction

The "googling" is an activity that individuals take first to find answers to many questions (Jurić, T., 2021). Google trend data was used in a different type of research: unemployment (Ettredge et al., 2005); influenza outbreak (Doornik, 2009, Ginsberg 2009); predicting consumer behaviour (Goel et al., 2010); predicting inflation rates (Guzman, 2011); housing market forecasting (McLaren and Shanbhoge, 2011); forecasting changes in the stock market (Curme et al., 2014), forecasting migration trends (Jurić 2021) etc.

The basic thesis of the paper is that the analytical tool Google Trends is a useful source of data for interdisciplinary research and that this data correlates with official dates. We show that GT can be used in public health in a time of the COVID-19 pandemic for identifying, estimating and predicting an increase in the number of new active cases both at the national level and by region in Croatia. Furthermore, in demography to forecasting a birth rate, and finally in tourism for forecasting a tourism season in Croatia.

2. How Google search analysis can support COVID-19 research – case study I

Google Trends has joined the fight against the pandemic by making researchers available sets of search trends to study the relationship between searching for terms related to symptoms and the spread of COVID 19.[4] The use of artificial intelligence in the processing of data from public health surveillance databases in the United States for the first time accurately predicted the spread of COVID 19 (Niiler, E:, 2020). Due to such successes, one of the consequences of the pandemic will undoubtedly be the strengthening of the role of artificial intelligence and the adoption of digital approaches in various fields of scientific research (Gabrilovich, E., 2020). Due to the above, we asked a research question, whether the method can be applied in the Croatian case.

4 See: searchcovid19.com/2020.

In the past, researchers have used Google search data to assess the health impact of heat, improve models for predicting flu outbreaks, and track the incidence of Lyme disease (Gabrilovich, E., 2020). Ginsberg et al (2009) showed a way to improve early detection of the spread of influenza using Google search engine data in the United States (for a detailed review see Jurić, T., 2021).[5]

This method is, of course, the more successful the more users use the Internet, ie the Google search engine. By mid-2020, 58% of the world's population were internet users, compared to almost 90% in the European Union (Internet World Stats, 2020). Within the EU, the same survey showed that usage ranged from almost 98% in Denmark to less than 70% in Bulgaria, while in Croatia the ratio was 79%. As for the most popular search engine in Croatia, it is without a doubt Google with 91.8% of users (Jurić, T., 2020).

2.1. Methodological explanation

Google Trends is a trend search tool that shows the term's popularity when searching on Google, and you can see if a particular trend is on the rise or in decline (https://trends.google.com). When using this tool, we kept in mind that GT does not publish the total search volume. Instead, it standardizes search volume on a scale of 0 to 100 over the time being examined, with higher values indicating the time when the search volume was greatest, allowing for verifiable metrics (Jurić, T., 2021). When interpreting the results, it is therefore important to take into account that only estimates of the rate of change of the trend and comparisons of terms can be given (Ibid). This problem can be overcome by reconstructing the number of searches in a more detailed analysis of trends over a longer period, and the fact that GT indexes only those searches that exceed tens of thousands of queries help (Ibid).

The basic thesis of the paper is that the analytical tool Google Trends is a useful source of data for interdisciplinary research. We show that GT can be used in public health in a time of the COVID-19 pandemic for identifying, estimating and predicting an increase in the number of new active cases both at the national level and by region in Croatia. Furthermore, in demography to forecasting a birth rate, and finally in tourism for forecasting a tourism season in Croatia.

The basic methodological concept is tracking digital search traces by the key terms that give the most relevant results.[6] We tested the method by comparing Google index results with official indicators, based on which we calculated correlations.

Within this method, the most important is to correctly identify the terms whose search gives the most clues.[7] To standardize the data, data sets for the period

5 Tado Jurić, Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic,Athens Journal of Mediterranean Studies 2021, 7: 1-25, https://www.athensjournals.gr /mediterranean/2021-4210-AJMS-Juric-05.pdf;

6 www.trendovi.google.com

7 Only anonymous, aggregated data were used in the paper. All data were collected following the GDPR and ethical principles and no query in the database of the described project can be linked to a specific person. The database does not contain information about the identity, IP address or geolocation of any

from 20. January 2020, to 20 February 2021 were taken. The keyword frequency for the selected terms was then divided to obtain a search frequency index which was then compared with official statistics to show the relevance of the gained results (see further explanations in Wilde et al., 2020). A WHO report was used to select the most common terms (WHO, 2020) on the symptoms of infection and terms that have shown that they are predictive, specific and sufficiently common in use in the Croatian language. After the analysis, the following keywords and topics were selected:

Table 1. Keywords and topic selection criteria

Symptoms	What is/How to?	Terms	Activities
Asthma Anosmia Common cold Cough Depression Fatigue Fever Headache Nausea Shortness of breath	What is coronavirus? What is Zoom? How to make a face mask? How to make hand sanitiser?	Influenza Complication Cold/Flu Remedy General Influenza Symptoms Term for Influenza Symptoms of an Influenza Complication Antibiotic Medication Remedies for corona General Influenza Antiviral Medication	Coronavirus testing PCR test Application for a minimum wage

Source: Tado Jurić, Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic, Athens Journal of Mediterranean Studies 2021, 7: 1-25, https://www.athensjournals.gr/mediterranean/2021-4210-AJMS-Juric-05.pdf, (edited by author)

Although previous research in this area has shown the feasibility of using these digital data, at the same time it is important to highlight the problems associated with assessments and conclusions (Zhang B., et al, 2020). Namely, it is unquestionable that there are still significant open methodological issues related to the use of large data sets in research, especially concerning their representativeness. In parallel, there is a general debate in science about whether a statistical conclusion can be drawn at all from unrepresentative samples. But to date, there is no definitive answer to this question (Jurić, T., 2021). There are more and more studies that indicate that such data have numerous advan-

user.

tages compared to classical data sources (interviews, surveys, etc.) (Jurić, T., 2021).

In Croatian:		
Upala pluća Prehlada Kašalj Depresija Umor Groznica Glavobolja Mučnina Kratkoća daha Upala pluća + korona Suhi kašalj + korona Curenje iz nosa + koronavirus Bol u mišićima + korona	Gripa Lijek protiv gripe/ koronavirusa/COVID-19 Opći simptomi gripe/ COVID-19 Simptomi gripe Simptomi COVID-19 Antibiotik Lijekovi za koronu Antivirusni lijekovi Sumamed Neofen	Testiranje na koronavirus PCR test Zahtjev za minimalnu plaću

Source: Tado Jurić, Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic, Athens Journal of Mediterranean Studies 2021, 7: 1-25, https://www.athensjournals.gr/mediterranean/2021-4210-AJMS-Juric-05.pdf, (edited by author)

As for working with the Google Trends analytics tool, it should be noted that part of the increase in search trends can be attributed to the general increase in Internet penetration. There is a special problem in the education of researchers who go this way because they must be skilled in programming and computational methods and accustomed to the interdisciplinary environment (Ibid).

When using this approach, it should be borne in mind that each of these searches was conducted for its own reason and does not answer the direct questions of the researcher. Thus, for example, "googling" the term "coronavirus testing" („testiranje na koronavirus") is not necessarily an implication that someone is ill or has symptoms (Jurić, T., 2021). Despite the limitations, there is evidence of a high correlation between this type of research and official reports of influenza cases. In addition, statistics offer several tools available to address imperfect data.[8]

8 See: program „R"

2.2. Results

With the outbreak of the pandemic in Croatia and the lockdown in March 2020, Croatian citizens are beginning to intensively "Google" the terms associated with the COVID-19 pandemic. The most commonly searched queries are: "what is a dry cough", "what is considered a fever", "coronavirus", "difference between flu and coronavirus", etc.[9]

The most frequently searched terms were compared with official indicators of active cases, to check the connection between these phenomena.

There is an increase in the search for "cough + corona"; "Pneumonia + corona"; "Dry cough + corona"; "Runny nose + coronavirus"; "Muscle pain + corona" („kašalj + korona"; „upala pluća + korona"; „suhi kašalj + korona"; „curenje iz nosa + koronavirus"; „bol u mišićima + korona") correlates with an increase in the number of new cases. On the other hand, a decrease in the search volume of these terms correlates with a decrease in the number of new cases (Medix. hr, 2021). [10]

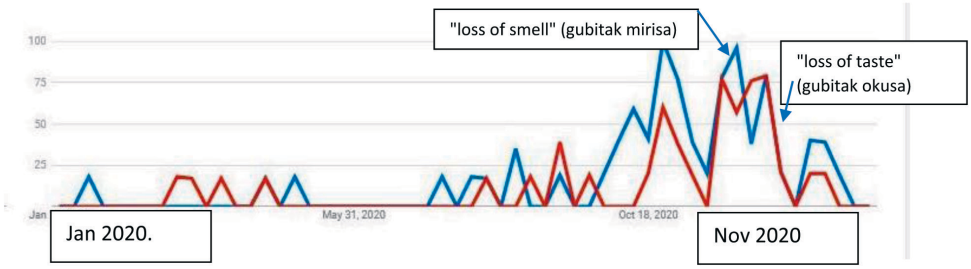


Figure 1. Google search "loss of smell" and "loss of taste" („gubitak mirisa" i „gubitak okusa") from Jan 2020 to Feb 2021 in Croatia
Source: Google Trends kao metoda za rano detektiranje pojave novih slučajeva COVID-a 19, 2021, Medix, 147/148., https://medix.hr/google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

As in the previous case, the increase in searches for "loss of smell" and "loss of taste" („gubitak mirisa"; „gubitak okusa") correlates with an increase in new cases.

9 „što je suhi kašalj", „što se smatra groznicom", „koronavirus", „razlika između gripe i koronavirusa".
10 Google Trends kao metoda za rano detektiranje pojave novih slučajeva COVID-a 19, 2021, Medix, 147/148., https://medix.hr/google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

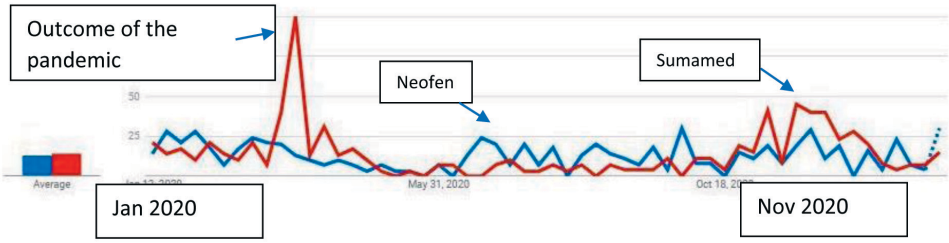


Figure 2. Google search "Neofen" and "Sumamed" from Jan 2020 to Feb 2021 in Croatia
Source: Tado Jurić, Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic, Athens Journal of Mediterranean Studies 2021, 7: 1-25, https://www.athens. journals.gr/mediterranean/2021-4210-AJMS-Juric-05.pdf

Inquiries of "Neofen" (drugs) and "Sumamed" (the most popular Croatian antibiotic) were also investigated, which showed that the demand for these drugs increased especially at the time of the pandemic outbreak and in the fall of 2020 when the largest number of new cases was recorded (Medix.hr, 2021).

The next useful insights are related to geolocations, which can monitor the creation of new hotspots and act accordingly, by introducing additional measures in a certain area, such as closing schools and the like. This approach can also predict an increase in pressure on the health system in a particular region (Jurić, T., 2021).

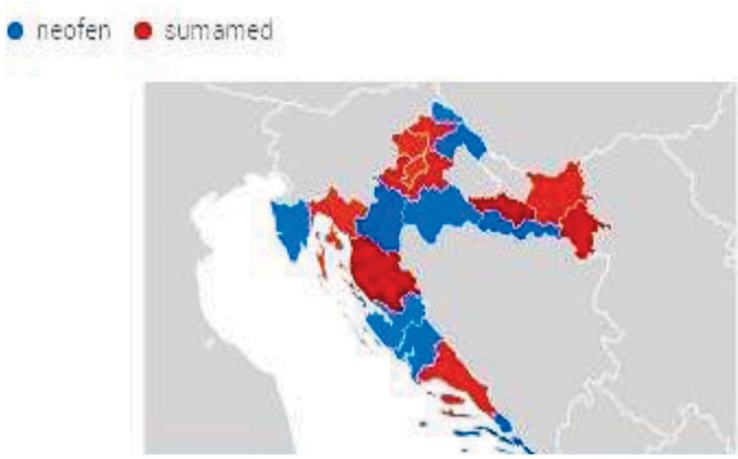


Figure 3. Correlation by regions
Source: Tado Jurić, Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic, Athens Journal of Mediterranean Studies 2021, 7: 1-25, https://www.athens. journals.gr/mediterranean/2021-4210-AJMS-Juric-05.pdf

The search for medicines correlates with a sharp increase in the number of new cases in November 2020 in the northern Croatian regions, as well as the fact that Virovitica-Podravina County had the lowest number of infected in this period (HZJZ.hr, 2021).

The following procedure shows the standardization of data by comparing the search frequency index on Google search engine with official statistics to show the importance of the results (Ibid). A special focus is on the so-called second wave of infection spread when cases began to grow exponentially.

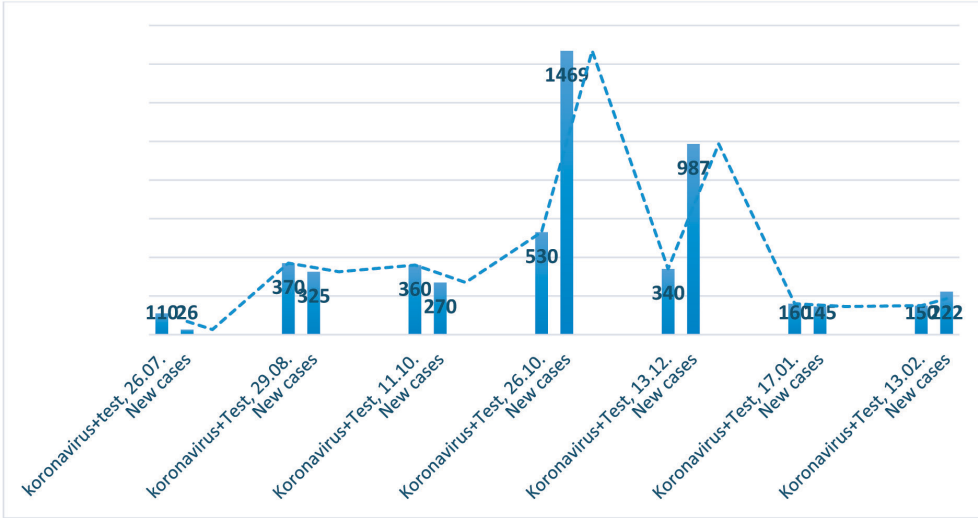


Figure 4. Correlation between Google search index for query "PCR +COVID" and the official number of reported new cases of COVID-19 patients in Croatia by selected dates in 2020 and 2021

Source:Tado Jurić, Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic, Athens Journal of Mediterranean Studies 2021, 7: 1-25, https://www.athens. journals.gr/mediterranean/2021-4210-AJMS-Juric-05.pdf

Search activities with the terms "PCR + COVID"; PCR + test; "Coronavirus + test" are highly correlated with official reports.[11]

In the following, the method is tested according to the most common symptoms: cough, pneumonia and muscle pain.

11 COVID

Figure 5. Correlation between Google's search index for the query "pneumonia + corona" („upala pluća + korona") and the official number of reported new cases of COVID-19 patients in Croatia by selected dates in 2020 and 2021
Source: Tado Jurić, Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic, Athens Journal of Mediterranean Studies 2021, 7: 1-25, https://www.athens. journals.gr/mediterranean/2021-4210-AJMS-Juric-05.pdf

Search activities related to the symptoms of "cough + corona", "pneumonia + corona"; "muscle pain + corona" („kašalj + korona", „upala pluća + korona"; „bolovi u mišićima + korona") are strongly correlated with official data from new cases (Jurić, T., 2021).

3. Predicting birth rate with Google Trends - case study II

Because during the COVID-19 pandemic, most attention was focused on mortality and the economic consequences of the pandemic, its effects on birth rates remained largely unknown.[12] The delay in understanding the impact of a pandemic on birth rates is further caused by the fact that birth rate data are never available for analysis on time, and occur with a delay of at least a year. A new scientific subdiscipline of demography, the so-called digital demographics, could fill these gaps, which also, among other approaches, relies on the Google Trends analytics app.

The big news is that the method of digital demography can be used to estimate the birth rate in the country. In the study from 2020 (Jurić, T., 2021), we have shown that in 2021 there will be 12 to 14% fewer births in Croatia than

12 See: Aassve, A., Cavalli, N., Mencarini, L., Plach, S., Livi Bacci M. (2020). The COVID-19 pandemic and human fertility. Science, 369(6502):370-371. doi: 10.1126/science.abc9520.

usual. According to our projections, the birth rate in 2021 will be in the best case scenario at the level of 87% of the "normal year". Accordingly, the expected number of newborns (live births) will be around 32,000 (Ibid). Subsequently, the CBS provisional data for January and February 2021 confirmed this projection because it was observed that the birth rate was 10% lower than in previous years. The famous baby boom expected after the lockdown did not happen.

Despite the lack of valid information, some of the popular media have suggested that a pandemic will result in a baby boom, with the explanation that couples spend more time together (Jurić, T., 2021). Demographers, on the other hand, viewed such statements with scepticism, citing evidence of short-term effects on birth rates from examples of other crises, including natural disasters and previous pandemics (Wilde, J., et al. 2020). Research shows that the increase in mortality due to crises is accompanied by a decrease in the number of births within a year, with some evidence of a recovery in birth rates only after a few years (Palloni, A., 1988). The decline in birth rates is explained by couples' aversion to having children during periods of economic uncertainty, in unhealthy and dangerous environments, or increased spontaneous abortions due to stress or illness (Sobotka, T., et al, 2011).

In the following, we will show how we predicted the impact of the COVID-19 pandemic on the future birth rate in Croatia, data obtained by the analytical application Google Trends (GT).).[13] Previous research in the USA (Wilde, J. et al, 2020) confirmed the existence of a correlation between search keywords related to birth rate and future fertility. For example, a search for the term Clear Blue (pregnancy test) in the U.S. is significantly associated with an increase in fertility five to eight months later, with a maximum effect seven and eight months later. In March 2020, there was a decrease in demand for pregnancy tests suggesting that fewer people were trying to conceive during a pandemic. This trend was observed in Croatia by testing correlations (Ibid).

The assumptions were based on modelling the decline in searches of all terms that could refer to pregnancy planning. For example, searching for the terms "pregnancy test", "ovulation" and the like. they were significantly reduced during 2020, and especially after March 2020, when a pandemic and lockdown occurred (Jurić, T., 2021).

In addition to these, several other indications point to factors that can seriously affect fertility in the country. For example, there has been a big jump in the search for the terms "abortion" and "abortion". Using the GT tool, it was noticed that in Croatia the demand for abortion pills increased especially during the pandemic in Croatia. The trend slowed significantly when the spread of the pandemic in the summer of 2020 also decreased.

Indicators related to pregnancy-related search terms are particularly significant in predicting birth rates. All groups of terms refer to pregnancy planning such as "pregnancy by weeks", "ovulation", "menstruation" etc. fell rapidly with the outbreak of a pandemic in Croatia (Figure 6).

13 See:GT: https://trends.google.com/trends/?geo=HR; obrada autor.

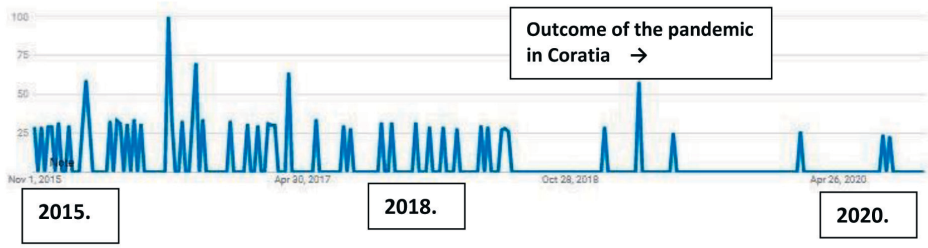


Figure 6. The search of terms "pregnancy by weeks" in Croatia (2015-2020)
Source: Jurić, Tado, The deep demographic aging of Croatia - Predicting of natural population change with digital demography tools, University J. J. Strossmayer, Osijek, 2021., https://www.ceeol.com/search/chapter-detail?id=960442

4. Google Trends in forecasting tourist demand in Croatia - case study III

To forecast tourist demand, it is crucial to have timely data, while official data in the best cases come with a delay of two months. In addition, collecting such data is very expensive, time-consuming and many stakeholders in the tourism industry do not want to make it available. As a solution, analytics from the field of digital demography also appear here, primarily the approach provided by the analytical application Google Trends (GT).

The aim of this study (Jurić, T., 2021) was to examine the extent to which information obtained through the Google trend tool can serve the purpose of predicting the arrival of tourists in the Republic of Croatia. In particular, the extent to which data on searches for terms, photos and videos related to tourist destinations using the Google search engine and the YouTube platform can be used to predict tourist demand in the Republic of Croatia (RH) was examined.

The results of the study show that the use of the Google Trends analytical application for forecasting tourist demand is a useful method both at the state level and at the level of individual regions and cities in Croatia, especially the City of Zagreb. Our study predicted that in the upcoming season (2021), German tourists will record a 15% increase in visits to Croatia. The data showed that the Republic of Croatia will be visited by two million German tourists, which is still less than the average of previous years, which was about 2,800,000, but still half a million more than the previous year (2020). The results also predicted the recovery of tourism in the City of Zagreb by 20-25% compared to the previous year. All these projections from April 2021 were subsequently confirmed in August 2021 by the official statistics of the Croatian National Tourist Board (HZTZ.hr, 2021).

This type of research can be useful to tourist boards in the Republic of Croatia that could use the forecasting method presented here for tourist demand modelling, for marketing purposes as well as to the Government of the Republic of Croatia for estimating seasonal labour market needs. In the area of Southeast

Europe, this type of study has not been conducted and can serve as a template for similar studies.

4.1. Development of Google Trends method for forecasting the tourist season

Google is the first source of information for most users planning a tourist trip. End-users of tourist services via the Internet perform most of the preparatory activities from booking accommodation to administrative issues and collect information related to travel and the selected tourist destination.[14] The analysis of tourist demand arising from the use of the Internet is becoming a key element in forecasting future values given the increasingly present new trends based on the use of information and communication technologies (Ibid). Google Trends has proven to be a particularly useful digital tool in this segment, primarily due to its timeliness ("nowcasting") and almost monopoly in this field.

In recent years, there has been a growing worldwide interest in modelling tourism demand using the Google Trends method: Song et al., 2003; Lim, 2004; Choi, H. and Varian, H., 2012; Pan, Song, 2012; Yang, 2014; Bangwayo-Skeete, 2015. In Europe, Önder and Gunter (2016, 2017) used Google Trends to predict tourist demand in major European cities. Dinis, Costa and Pacheco (2016) investigated the use of Google Trends data to predict the arrival of foreign tourists in Portugal. All the results of the research showed that the use of GT analytical tools can reveal useful insights into tourism intentions (Önder, I., 2017). Xiang and Pan (2011) showed that there is a direct link between web search and the tourism industry. As a result, the use of city or country names for travel-related searches indicates an indication of interest in those destinations (Jurić, T., 2021).

The main hypothesis of such approaches is that potential tourists will search on Google for the destination they want to visit so that the Google Trends index for that particular destination can be used as a variable in forecasting tourist demand (Ibid).

The paper focuses on the analysis of tourist visits from Germany since it is the most represented on the Croatian tourist market in Croatia[15] and makes up 1/3 of all visits. As with the previous example, in this approach, the most important thing is to select words that are predictive, specific, and common enough to be used in predicting intent (Table 2).

14 See:Tea Baldigara (2020), Analiza utjecaja informacijsko-komunikacijskih tehnologija na inozemni turizam Republike Hrvatske, Oeconomica Jadertina 1/2020., UDK / UDC: 338.48(497.5):[007:316.772.5]
15 Hrvatska turistička zajednica (2020), Informacija o statističkim pokazateljima - lipanj 2020.

Table 2. Selection of keywords and topics

The most popular beaches, hotels, camps, destinations
Park Plaza Verudela, Hotel Korsal, Amfora Hvar Grand Beach Resort, Hotel Fortuna, Bluesun Hotel Elaphusa, Radisson Blu Resort & Spa Split, Zaton Holiday resort, The Maritimo Hotel.
Hotelski lanci: Falkensteiner, Valamar, Plava laguna, Kempinski
Prema Booking.com: Valamar, TUI Croatia
The five most visited tourist destinations in Croatia: Dubrovnik, Plitvice Lakes, Istria, Zagreb, Makarska
Kampovi: Camping Savudrija, Camping Stella Maris (Umag), Santa Marina Boutique Camping (Vabriga), Solaris Camping Resort , Straško Camping (Novalja), Bluesun Paklenica Camping (Starigrad Paklenica), Falkensteiner Premium Camping Zadar (Zadar)

Source: Tado Jurić, Primjena analitičkih alata aplikacija YouTube, Google Photo i Google Web u predviđanju dolazaka turista u Republiku Hrvatsku s osvrtom na izazove zdravstvene sigurnosti, Medix, 2021, 147/148. URL: https://www.medix.hr/index.php?p=pdf&pdf=google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

4.2. Results

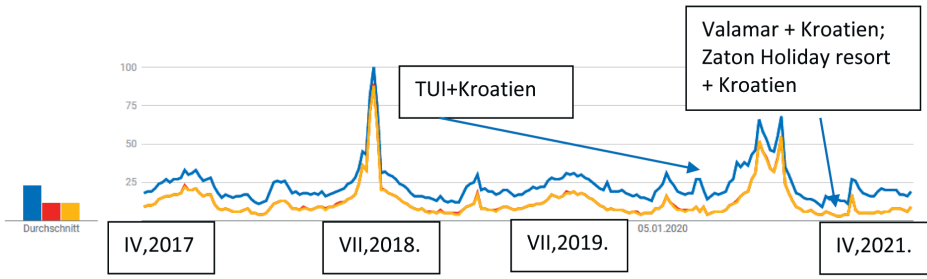


Figure 7. Search in Germany of the most common hotel chains offering tourist arrangements in Croatia in the period from April 2017 to April 2021.
Source: Tado Jurić, Primjena analitičkih alata aplikacija YouTube, Google Photo i Google Web u predviđanju dolazaka turista u Republiku Hrvatsku s osvrtom na izazove zdravstvene sigurnosti, Medix, 2021, 147/148. URL: https://www.medix.hr/index.php?p=pdf&pdf=google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

The analysis indicates a decrease in Google search by an average of 10% in the period March - April 2021 compared to the same periods of the pre-pandemic period. Compared to the pandemic year 2020, an increase of 18% is observed (Figure 7).

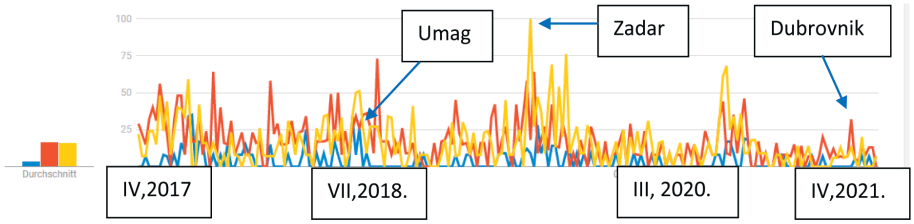


Figure 8. Search in Germany of tourist city destinations "Dubrovnik", "Zadar" and "Umag" in the period from April 2017 to April 2021
Source: Tado Jurić, Primjena analitičkih alata aplikacija YouTube, Google Photo i Google Web u predviđanju dolazaka turista u Republiku Hrvatsku s osvrtom na izazove zdravstvene sigurnosti, Medix, 2021, 147/148. URL: https://www.medix.hr/index.php?p=pdf&pdf=google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

Comparing the results, it was noticed that searches for the cities "Dubrovnik", "Zadar" and "Umag" are on average lower by 20% - 25%, compared to the same periods of the pre-pandemic period. Compared to the pandemic year 2020, there is an increase of 10 - 12%, depending on the city of search (Figure 8).

In the observed period, the camping destinations "Blue Lagoon", "Camping Savudrija", "Camping Stella Maris" and "Camping Starsko" in the period from April 2017 to April 2021 show the weakest recovery in demand, which is possible in connection with the fact that search carried out too early (in April 2021), as camping destinations are more visited in the period September - October, and the difference between search and visit is usually three months.

The search for all five most visited tourist destinations in Croatia: "Dubrovnik, Plitvice Lakes, Istria, Zagreb, Makarska" shows an increase in interest.

In the following, the modelling was performed by regression analysis. The research results show that there is a significant positive relationship between the selected variables. To test this method, we chose the three most frequently searched terms on the Google search engine in Germany: "Urlaub + Kroatien" (vacation + Croatia), "Istrien + Urlaub" (Istria + vacation), "Kroatien + Reise" (Croatia + travel) and compared the correlation between the Google search index and the actual number of visits by tourists from Germany. Correlations were checked also with search results on YouTube, Google Photo, and Google Web (Jurić, T:, 2021).

For an easier comparison of Google index and official data[16], here we first provide data on tourist visits of German citizens in the period from 2018 to 2020 (Table 3).

16 HTZ.hr, https://www.htz.hr/hr-HR/informacije-o-trzistima/informacije-o-tijeku-sezone/arhiva-2020

Table 3. Tourist visits of German citizens to Croatia in the period from 2017 to 2020 (from January to October):

2017.	2018.	2019.	2020.
2.713.555	2.842.995	2.960.535	1.556.060

Source: Tado Jurić, Primjena analitičkih alata aplikacija YouTube, Google Photo i Google Web u predviđanju dolazaka turista u Republiku Hrvatsku s osvrtom na izazove zdravstvene sigurnosti, Medix, 2021, 147/148. URL: https://www.medix.hr/index.php?p=pdf&pdf=google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

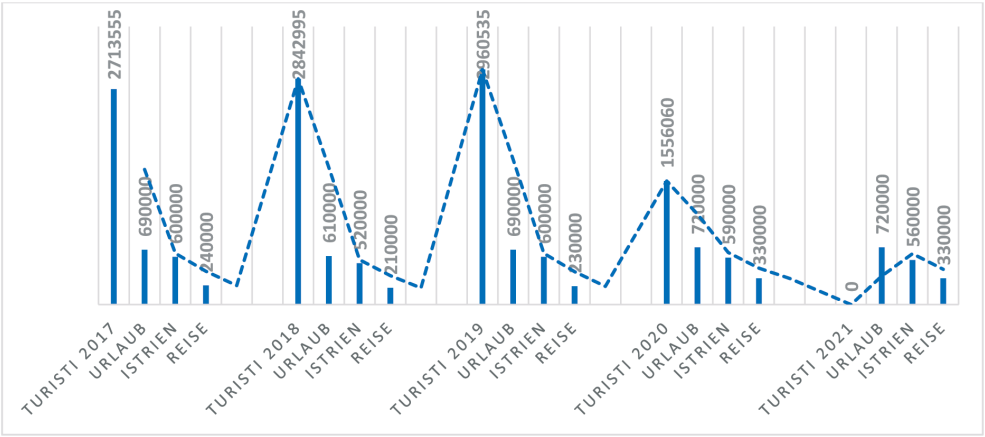


Figure 9. Correlation between the index of searched terms on the web "Urlaub + Kroatien" (vacation + Croatia), "Istrien + Urlaub" (Istria + vacation), "Kroatien + Reise" (Croatia + travel) and official statistics for the years 2017- 2021 (from 01.IV to 22.IV)
Source: Tado Jurić, Primjena analitičkih alata aplikacija YouTube, Google Photo i Google Web u predviđanju dolazaka turista u Republiku Hrvatsku s osvrtom na izazove zdravstvene sigurnosti, Medix, 2021, 147/148. URL: https://www.medix.hr/index.php?p=pdf&pdf=google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

Figure 9 shows that the increase in the search for the terms "Urlaub, Istrien, Reise + Kroatien" results in an increase in the number of German tourists in the Republic of Croatia.

Regarding 2020, as stated in the model limitations, due to special circumstances (pandemic outbreak), numerous searches from 2020 did not result in actual arrivals but were related to the growing interest of potential tourists in arrival restrictions in Croatia, pandemic development, etc.

Another useful approach is the analysis of the search queries in the database of Google Photo and YouTube. Our assumption was that before choosing a

tourist destination, potential tourists would search for what the destination looked like and try to find as much visual material as possible on the YouTube platform and a photo database of a specific destination.

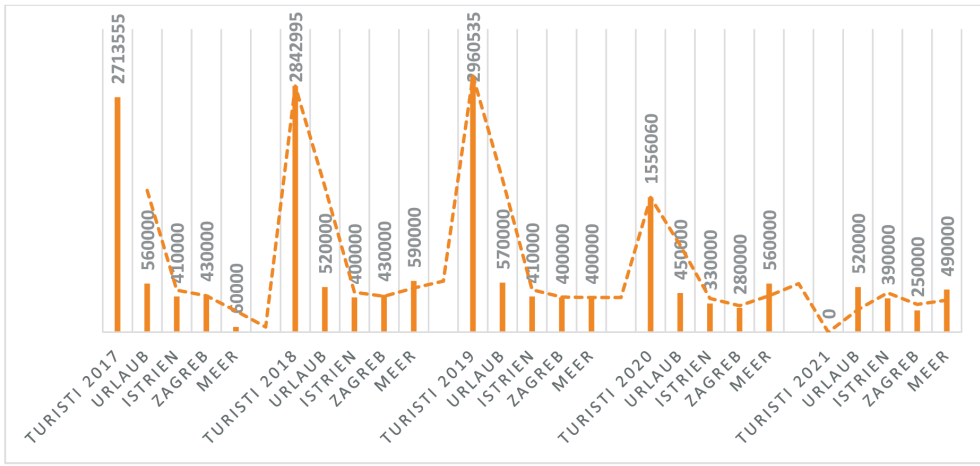


Figure 10. Correlation between the index of searched photos (Google Photo) "Urlaub + Kroatien", "Istrien" "Zagreb", "Meer (more) + Kroatien" and official statistics for the years 2017-202021 (from 01.04. to 22.04.)
Source: Tado Jurić, Primjena analitičkih alata aplikacija YouTube, Google Photo i Google Web u predviđanju dolazaka turista u Republiku Hrvatsku s osvrtom na izazove zdravstvene sigurnosti, Medix, 2021, 147/148. URL: https://www.medix.hr/index.php?p=pdf&pdf=google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

Figure 10 shows that the increase in the search results in Germany of the photographs of potential tourist destinations results in an increase in the number of German tourists in the Republic of Croatia.

Figure 11 shows that the increase in the search results in Germany of the video in YouTube of potential tourist destinations results in an increase in the number of German tourists in the Republic of Croatia.

The results of correlation support the thesis that the analytical application Google Trend can be used to predict the arrival of tourists in Croatia. The increase in tourist demand search terms is directly related to actual visits (Jurić, T., 2021).

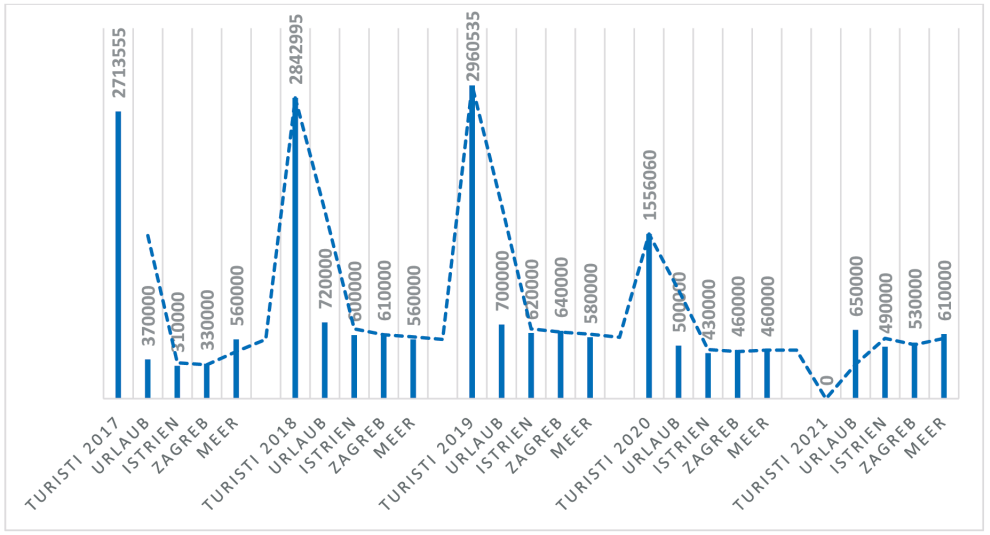


Figure 11. Correlation between the index of searched videos on the YouTube platform "Urlaub + Kroatien", "Istrien" "Zagreb", "Meer" + Kroatien" and the official statistics for the years 2017-2020/21 (from 01.04. to 22.04.)
Source: Tado Jurić, Primjena analitičkih alata aplikacija YouTube, Google Photo i Google Web u predviđanju dolazaka turista u Republiku Hrvatsku s osvrtom na izazove zdravstvene sigurnosti, Medix, 2021, 147/148. URL: https://www.medix.hr/index.php?p=pdf&pdf=google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19

5. Conclusion

The contribution of this paper is to promote the application of innovative data sources in interdisciplinary research and to encourage methodological discussion on the opportunities and challenges of studying digital records. This paper analyses the predictive possibility of search data on Google search engine to predict tourist demand in Croatia, birth rate and to predict the further spread of coronavirus in the population of Croatia. Studies of this type in Southeast Europe have not existed so far, and this paper is an appeal to researchers to join the development of this method.

Our studies have shown that Google Trends is an analytics tool that provides one of the most innovative broadband tracking systems of COVID 19 available today. Google search activities using "PCR + Covid", "PCR + test" or symptoms such as "cough + corona", "pneumonia + corona"; "Muscle pain + corona" („kašalj + korona ", „ upala pluća + korona "; „bolovi u mišićima + korona") are strongly correlated with officially reported cases of the disease, while the decline in these tests is correlated with the decline in the number of new cases (Jurić, T., 2021.

Testing of the method has shown that this approach can also be used concerning geolocations. Such an approach can monitor the creation of new hotspots and accordingly act preventively by introducing additional measures at a certain location, such as closing schools, etc., as well as anticipate an increase in pressure on the health system in a particular region. The main advantage of this approach versus official indicators is that in this way the outbreak of new hotspots is detected promptly and can therefore serve as an early alarm. With this method, public health gets new additional weapons in the fight against the pandemic (Ibid).

This method can also be used in demography for forecasting the birth rate. The delay in understanding the impact of a pandemic on birth rates is complicated by the fact that birth rate data are never available for analysis on time and occur with a delay of at least a year. Using the method of digital demography, we correctly predicted that in 2021 there will be between 12 and 14% fewer births in Croatia compared to previous years, ie 31,000 to 32,000, instead of the expected 36,000 - 37,000 (Jurić, T., 2021).

Testing Google Trends for forecasting tourist demand showed that this is a useful method both at the state level and at the level of individual regions and cities in Croatia, especially the City of Zagreb. Our results showed, and the official five months later confirmed, the recovery of Croatian tourism at the level of 15% better attendance than the previous season (2020). The main advantage of this approach is the timely detection of tourist demand, thus avoiding the delay time that is a feature of official statistics. This type of research can be useful to tourist boards in Croatia that could use the forecasting method presented here for modelling tourist demand, for marketing purposes as well as to the Government of the Republic of Croatia for estimating seasonal labour market needs.

There are, however, important limitations to the use of large data sets, and anyone who chooses this approach should devote a great deal of space to considering the specifics and limitations of such data systems as well as the overall social context (Jurić, T., 2021).

References:

1. Aassve, A., Cavalli, N., Mencarini, L., Plach, S., Livi Bacci M. (2020). *The COVID-19 pandemic and human fertility*. Science, 369(6502):370-371. doi: 10.1126/science.abc9520.
2. Baldigara, Tea, (2020), *Analiza utjecaja informacijsko-komunikacijskih tehnologija na inozemni turizam Republike Hrvatske*, Oeconomica Jadertina 1/2020., UDK / UDC: 338.48(497.5):[007:316.772.5]
3. Gabrilovich, E. (2020). *Using symptoms search trends to inform COVID-19 research, Google Health*, Published 02 Sep 2020, https://blog.google/technology/health/using-symptoms-search-trends-inform-covid-19-research, accessed 4. 01. 2021.
4. Ginsberg, J., Mohebbi, M., Patel, R. et al. *Detecting influenza epidemics using search engine query data*. Nature 457, 1012–1014 (2009). https://doi.org/10.1038/nature07634
5. Google: searchcovid19.com/, 2020.
6. GT: https://trends.google.com/trends/?geo=HR
7. Hantrais, L. Paul Allin , Mihalis Kritikos , Melita Sogomonjan , Prathivadi (2020). *Covid-19 and the digital revolution*. Contemporary Social Science: Journal of the Academy of Social Sciences
8. Hrvatska turistička zajednica (HTZ) (2020), *Informacija o statističkim pokazateljima - lipanj 2020*.
9. HTZ.hr, 18.08.2021., https://www.htz.hr/hr-HR/press/objave-za-medije/premasen-broj-nocenja-iz-cijele-2020-godine
10. HTZ.hr, https://www.htz.hr/hr-HR/informacije-o-trzistima/informacije-o-tijeku-sezone/arhiva-2020
11. HZJZ.hr, https://www.hzjz.hr/priopcenja-mediji/koronavirus-najnoviji-podatci/, access 20.01.2021]
12. Internet World Stats, 2020., https://www.internetworldstats.com/stats.htm
13. Önder, Irem, (2017). Forecasting Tourism Demand with Google Trends: *Accuracy Comparison of Countries vs. Cities*
14. Jurić, Tado, 2021, *Facebook i Google kao empirijska osnova za razvoj metode digitalnog praćenja vanjskih migracija hrvatskih građana*, Ekonomski pregled (in publishing);
15. Jurić, Tado, *Deep demographic aging of Croatia - predicting of natural population change with digital demography tools in: Strategic Approach to Aging Population: Experiences and Challenges*, Ekonomski fakultet u Osijeku, 341-366, https://www.ceeol.com. /search/chapter-detail?id=960442;
16. Jurić, Tado, „Gastarbeiter Millennials" Exploring the past, present and future of migration from *Southeast Europe to Germany and Austria with approaches to classical, historical and digital demography*, Hamburg, Verlag Dr. Kovač, ISBN: 978-3-339-12208-7.
17. Jurić, Tado, *Google Trends as a Method to Predict New COVID-19 Cases and Socio-Psychological Consequences of the Pandemic*, Athens Journal of Mediterranean Studies 2021, 7: 1-25, https://www.athensjournals.gr/mediterranean/2021-4210-AJMS-Juric-05.pdf;
18. Jurić, Tado, *Google Trends kao metoda za rano detektiranje pojave novih slučajeva COVID-a 19*, 2021, Medix, 147/148, https://medix.hr/google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19
19. Jurić, Tado, *Primjena analitičkih alata aplikacija YouTube, Google Photo i Google Web u predviđanju dolazaka turista u Republiku Hrvatsku s osvrtom na izazove*

zdravstvene sigurnosti, Medix, 2021, 147/148.

20. URL: https://www.medix.hr/index.php?p=pdf&pdf=google-trends-kao-metoda-za-rano-detektiranje-pojave-novih-slucajeva-covid-a-19;
21. Niiler, E. *An AI Epidemiologist Sent the First Warnings of the Wuhan Virus*. Available online: https://www.wired.com/story/ai-epidemiologist-wuhan-public-health-warnings/ (accessed on 29 January 2020).
22. Palloni, A. (1988). *On the Role of Crises in Historical Perspective: An Exchange: Comment*. Population and Development Review, 14(1)
23. Sobotka, T., Skirbekk, V. and Philipov D. (2011). *Economic recession and fertility in the developed world. Population and Development Review Vol. 37, No. 2* (JUNE 2011), pp. 267-306; Ullah, A., Moin, A. T., Araf Y., Bhuiyan, A., Griffiths, M., Gozal D. (2020). *Potential Effects of the COVID-19 Pandemic on Future Birth Rate*. Frontiers in Public Health 8
24. WHO, https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-COVID-19-final-report.pdf [accesses 10.01.2021]
25. Wilde, J., Chen, W., Lohmann, S. (2020). *COVID-19 and the future of US fertility: what can we learn from Google?*, IZA Discussion Papers, https://www.econstor.eu/bitstream/10419/227303/1/dp13776.pdf [accessed 10.01.2021]
26. Zhang, B, Anis Zaman, Vincent Silenzio, Henry Kautz, Ehsan Hoque. (2020) T*he Relationships of Deteriorating Depression and Anxiety with Longitudinal Behavioral Changes in Google and YouTube Use During COVID-19*: Observational Study. JMIR Mental Health 7:11, e24012.

prof.dr Aleksandra Labus[1]
doc.dr Miloš Radenković[2]
prof.dr Marijana Despotović-Zrakić[3]
prof.dr Zorica Bogdanović[4]
prof.dr Dušan Barać[5]

Keynote paper

CROWDSENSING SYSTEM FOR SMART CITIES

Abstract

This paper investigates the opportunities that crowdsensing, Internet of things and mobile technologies and services bring to improving life quality and healthcare ecosystem in smart cities. The main goal is to develop a crowdsensing system for smart cities that will encourage citizens to participate in collecting environmental data and solving problems related to ecology and healthcare. The proposed system will enable monitoring of air quality, allergens, level of noise and vibration caused by traffics. Intelligent devices such as mobile phones with embedded sensors, microcomputers, microcontrollers, and different sensors will be used for the monitoring. All the crowdsensing data collected from the smart city will be stored in the cloud, and used by different stakeholders via developed web and mobile applications. The crowdsensing data will be gathered in the city of Belgrade, Republic of Serbia. The proposed crowdsensing system and obtained results could serve as a good basis for adoption and implementation of crowdsensing smart city services in Serbia and other cities and governments. Furthermore, the proposed system can enhance citizens' e-participation and initiative to contribute to the detection of problems related to environmental pollution.

Keywords: crowdsensing, mobile crowdsensing, smart cities, IoT.

1 Associate professor, Faculty of organizational sciences, University of Belgrade, Serbia, E-mail: aleksandra@elab.rs
2 Assistant professor, School of Computing, Union University E-mail: mradenkovic@raf.rs
3 Full professor, Faculty of organizational sciences, University of Belgrade, Serbia, E-mail: maja@elab.rs
4 Full professor, Faculty of organizational sciences, University of Belgrade, Serbia, E-mail: zorica@elab.rs
5 Associate professor, Faculty of organizational sciences, University of Belgrade, Serbia, E-mail: dusan@elab.rs

1. Introduction

The migrations of population from rural to urban areas have been an ongoing process for many years (Heaton and Parlikad, 2019). According to UN, it is expected that by the year 2030, 70% of population will live in urban communities (United Nations Development Programme, 2016). The raising increase of population creates problems in the city's infrastructure, services and management, and requires new approaches regarding the healthcare, traffic environmental protection, and the quality of life in general (Alvear et al., 2018). These problems can be solved by applying modern information technologies such as Internet of Things, web and mobile technologies, cloud computing and big data. Implementation of these technologies in urban environments can improve the quality of citizens' life and enable the easier and more effective realization of everyday life activities.

For the development of the smart city, it is necessary to build adequate infrastructure based on the mentioned information technologies. This implies implementation of different kind of intelligent devices in the smart city application domains such as: smart houses and buildings, smart offices, smart classrooms, smart transportation, smart healthcare, etc. All intelligent devices, such as microcomputers, microcontrollers, modules, sensors, actuators, and mobile devices, should monitor environments where they are placed, and enable delivery of information and smart city services in real time. These data are important for different kind of smart city users such as: government, citizens, business users, providers of services. Besides the implementation of intelligent devices in the smart city infrastructure, important contribution can be given by citizens who participate in crowdsensing and collect data from the smart city. This usually means that citizen use their smart devices to measure parameters from the environment and to share data with aim to contribute to resolving problems in the city such as: air pollution, noise pollution, waste removal, traffic jams, monitoring patients with chronic diseases, etc.

This paper presents a crowdsensing system for smart cities that enables citizens to participate in collecting environmental data related to noise pollution, vibrations, air pollution, detection of allergens, and microclimate conditions. The proposed system could serve as a good basis for adoption and implementation of crowdsensing smart city services in Serbia and other cities.

The rest of the paper is organized as follows: section 2 gives the theoretical background on the smart city concepts, technologies and applications; section 3 considers the issues of crowdsourcing in smart cities; section 4 presents the developed crowdsensing system. Finally, we give conclusions and implications.

2. Smart cities

The concept of smart city relies on integration of human and social capital with modern information technologies, with the goal of solving the problems

of urban infrastructures and achieving a higher quality of life (Manville *et al.*, 2014). The specter of definitions of smart city is wide, some researcher are focusing on the application of information technology (Camero and Alba, 2019; Staletić, *et al.*, 2020; Jezdović et al., 2021), while others keep focus on social and human capital. According to (Schaffers *et al.,* 2011), "a city can be called smart when there are planned investments of human and social capital and where modern communication infrastructure comes to the fore, resulting in sustainable economic growth and high quality of life, with smart management of natural resources, based on management by citizens through e-participation". In addition, some authors use the terms such as intelligent city, future city, sustainable city, digital city, etc. (Ahvenniemi *et al*., 2017).

2.1 Smart city: application domains

A smart city is a geographical entity where digital services are applied in domains of everyday life, business, health, education, public utilities, transportation and public safety services to improve life quality and environmental protection (Sánchez et al., 2014; Kummitha and Crutzen, 2017; Staletić, *et al.*, 2020). In the smart city, the intelligent devices are implemented in any environment, in order to collect data and automate the processes in real time (Jin et al., 2014; Jezdovic et al., 2017). Intelligent devices can collect data about humidity, temperature, emissions of the harmful gases, air and noise pollution, parameters relevant for fire detection, public safety (Li et al., 2016). These data are used for detection, analysis and decisions about the different issues in the city.

Smart city application domains include (Radenković et al., 2017; Jezdovic et al., 2017):

1. Administration, participation programs and public safety. For improving quality of life in a smart city it is important to enable citizens' e-participation in problem detecting and solving, and decision-making (Estrada, Soto and D'Arminio, 2013).
2. Smart home and business environments. This domain refers to the automation systems within houses, buildings and offices (heating, water, electricity, waste, etc.) to achieve energy savings and reduced maintenance (Davidović and Labus, 2016), to built adequate conditions for life and make it safe and effective (Kim and Lavrova, 2013).
3. Smart healthcare. The primary is to improve the efficiency, quality of health services and treatment methods (Solanas, 2014), as well as to contribute to prevention and well-being in general (Rodić-Trmčić et al., 2017; Rodić-Trmčić et al., 2018).
4. Smart learning environments. These environments should improve realization of learning process, using advanced multimedia technologies that increase efficiency of the process of knowledge transfer (Simić et al., 2016).

5. Smart traffic. Using information and communication technologies and intelligent transport systems (ITS) for monitoring the traffic in the city, can increase safety, make traffic more effective, reduce delay and long period of travelling and reduce environmental pollution.
6. Smart grid. Smart grid is related to efficient and reliable delivery of electricity in smart environments, greater control over power consumption, increasing the number of electric vehicles, reduction of global emissions of carbon dioxide (Lukic et al., 2016)(Radenković et al., 2020).

2.2 Technologies for smart city development

Enabling technologies for smart city development are Internet of things (hereinafter: IoT), web and mobile technologies, cloud computing, and big data (Jezdović et al., 2017).

Internet of things is a global network infrastructure that enables the connection of physical and virtual objects on the Internet, where communication between objects is enabled using different protocols and intelligent interfaces (Ashton, 2009; Gubbi et al., 2013). Furthermore, IoT enables connecting a large numbers of various intelligent devices, such as microcomputers, microcontrollers, mobile devices, sensors, actuators, tags and readers, with services and applications on the Internet (Gubbi et al., 2013) with the aim to build the IoT infrastructure for smart city. Smart city IoT infrastructure enables the implementation of intelligent devices in homes, offices, classrooms, hospitals, in traffic, parking and roads, parks, and other public places in the city in aim to improve citizens' quality of life, business, education, delivering healthcare services, etc. (Gubbi et al., 2013; Jezdović et al., 2017).

Intelligent devices are placed in the lowest IoT infrastructure layer and have the role to collect data from smart environments such as fire detection, temperature, humidity, radiation, air and noise pollution, electricity and water consumption, traffic intensity, parking management, etc. The next IoT infrastructure layer is the network-centric layer, which provides a communication channel for intelligent devices. Smart city services are usually based on web and mobile technologies. These technologies enable receiving data from the smart environments in the city via wireless networks. Cloud-Centric IoT layer is responsible for storing, processing and distribution of the collected data. Finally, the application layer consists of applications that enable controlling and management of smart city services in real time.

With the increase in the number of intelligent devices connected to the Internet, the amount of collected data grows exponentially, which enables more detailed analyses for decision making in the smart city. Large amounts of data can be collected from intelligent devices placed in the smart environment and collected from mobile devices. In order to provide processing and analysis of collected data, big data technologies have to be used (Radenković et al., 2017).

3. Crowdsourcing in smart cities

Crowdsourcing represents the act of a company or an institution which outsources a function of the employees to an undefined (big in generally) network of people, connected via the Internet, in the form of a public call (Howe, 2006) (Staletić et al., 2020). It also represents a business model based on e-participation of individuals of various professional profiles to create, start and manage projects on interactive Internet platforms (Bogdanović et al., 2015; Staletić and Petrović, 2016). Participants in crowdsourcing projects usually do not know each other, so there may be different rules for participating.

The goal of applying crowdsourcing in smart cities is to encourage citizens to participate in resolving problems detected in a city and to propose innovative smart city services by applying their collective intelligence (Liao et al., 2019). In smart cities, crowdsourcing can be applied through the following models (Staletić et al., 2020):

- crowd wisdom or collective intelligence is a crowdsourcing model in which a "crowd" gathers and shares their knowledge via Internet (Surowiecki, 2005). Crowd wisdom in a smart city can be defined through the active participation of citizens in sharing knowledge, ideas, information and attitudes through various crowdsourcing platforms to improve the quality of life in a smart city (Prelec et al., 2017).
- crowd creation is an open call made through a crowdsourcing platform to gather new knowledge. The call contains a description of the project, the purpose, the qualifications to be possessed by the participants, the duration of the project and the compensation for the participation. The application of crowd creation in a smart city is reflected in the provision of creative solutions by citizens who are experts in a particular field (Radenković et al., 2017; Kittur et al., 2013, Liu et al., 2019).
- crowdvoting is based on voting by project participants. It is applied when it is necessary to gather the opinion of the audience ("crowds") through a crowdvoting platform on a particular issue. The application of crowdvoting in a smart city is most often reflected in the involvement of the public, through voting, in decision-making processes and creating priorities in the implementation of the smart city services (Maletić et al., 2019).
- crowdfunding is a special model of crowdsourcing that refers exclusively to financial contribution (Belleflamme et al., 2014). From the aspect of a smart city, crowdfunding is most often used to financially support projects that are important for a better life of citizens in the city.
- crowdsensing enables collecting data generated by sensors (Lau et al., 2017). Mobile crowdsensing enables ordinary citizens to provide data generated from their mobile devices, which are consolidated and used in the cloud to provide people-centric services (Staletić et al., 2020).

Crowdsourcing in a smart city is most often implemented through IoT crowdsourcing platforms (Mueller et al., 2018; Staletić et al., 2020). Citizens, legal entities and local governments can create or participate in projects on these platforms with aim to improve quality of life in the smart city (Mueller et al., 2018). Using applications and services citizens can participate in decision-making processes related to introducing new crowdsourcing services in the smart city, collect data from the environments and share information valuable for the solving problem in the smart city (Staletić et al., 2020).

4. Crowdsensing system for smart cities

In this article, we propose a comprehensive crowdsensing system for smart cities that integrates various services, including:

- A mobile crowdsensing system for measuring noise pollution and vibrations in traffic.
- An IoT crowdsensing system for monitoring air quality and allergens.
- An IoT crowdsensing system for monitoring microclimate conditions.

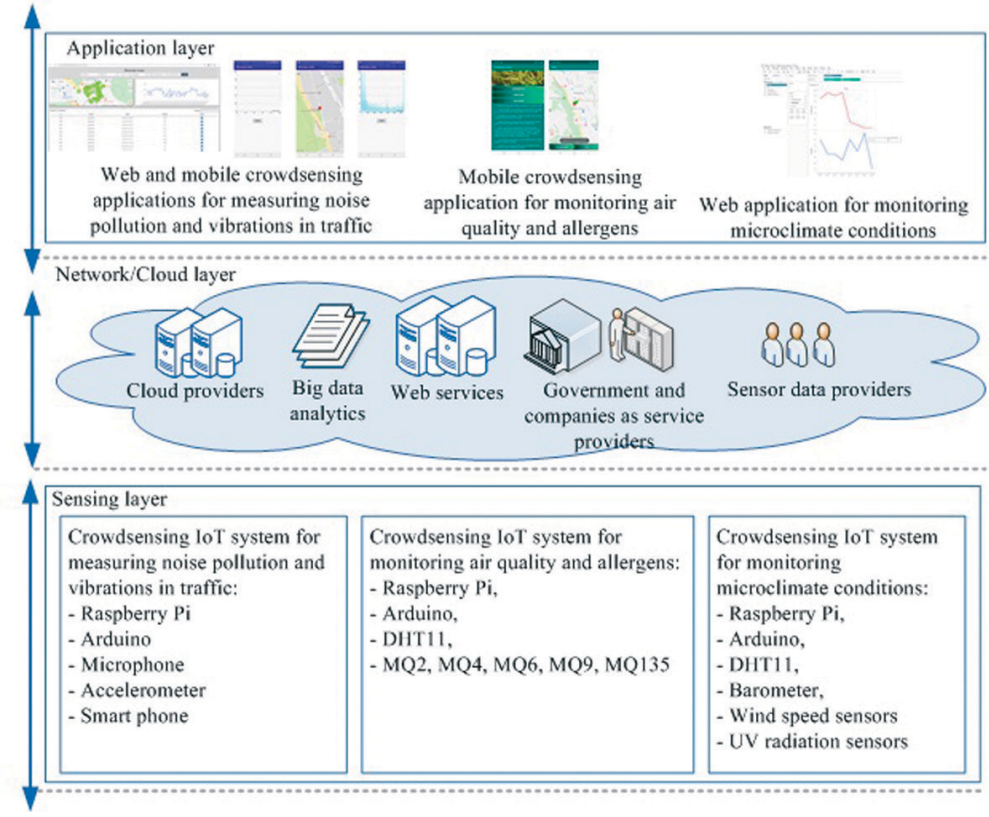


Figure 1. Crowdsensing system for smart cities
Source: Authors

The system is developed as an internal project of E-business Department, Faculty of Organizational Sciences, University of Belgrade. Although the system is developed in the academic environment, it allows ordinary citizens to participate in crowdsensing projects and become part of the crowdsensing network.

The architecture of the proposed system is shown in Figure 1. The cloud infrastructure of the system is developed within the private cloud of the E-business Department. In further text, we give more details about the three developed crowdsensing subsystems.

4.1 Mobile crowdsensing system for measuring noise pollution and vibrations in traffic

The mobile crowdsensing system for measuring noise pollution and vibrations in traffic is based on mainly on mobile technologies, but it includes IoT components as well. The developed system enables measuring noise and vibration using the smart phone, or an IoT system consisting of Raspberry Pi microcomputer, Arduino microcontroller, microphone and accelerometer. Intelligent devices can be placed in specific micro locations where the traffic intensity is high, or and in public transportation vehicles. The main scenario of usage is based on citizens' participation in the measuring of noise and vibrations in the city's micro locations using their mobile devices and during their rides in public transportation (bus, tram, train, etc.) (Baljak et al., 2019a; Baljak et al., 2019b; Jezdović et al., 2021). Citizen can measure noise and vibration using the developed mobile application that enables recording short audio recordings, and mapping the micro location using a GPS device. FFT (Fast Fourier Transform) data analysis is performed on recording devices immediately after measurement. All collected data are stored in the cloud infrastructure, then analyzed and finally compared with the prescribed norms. Due to the large amount of data, all data is stored in a MongoDB non-relational database: locations where audio recordings are made, location data, maximum and average volume in dB (A), as well as the complete result of FFT (Jezdović et al., 2021).

All measurements, in the form of a chart on an interactive map, are displayed on developed web application (Figure 2). Using web application citizen can further search and sort data, launch initiatives for solving problems related to noise pollution. Google maps were used to visualize geolocation data, and Google charts were used to display sound analysis. The main component of the system is the server, which hosts the API that communicates with all elements of the system: stations, mobile and web applications. The RESTful API was created using the Flight framework.

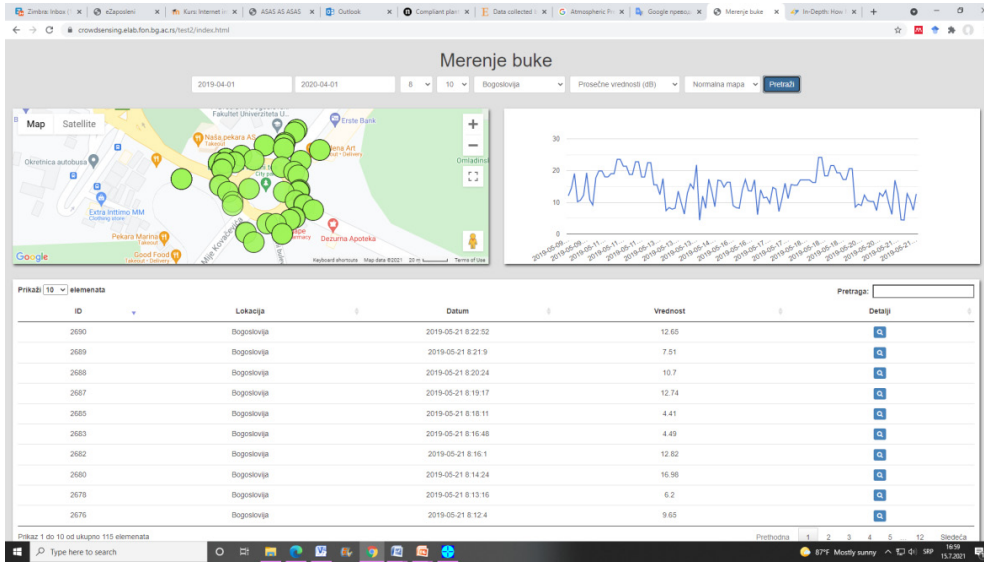


Figure 2. Web application for tracking noise pollution in the smart city
Source: Jezdović et al., 2021

The mobile application is made for the Android operating system. The application has the ability to measure noise levels, store noise and location data on the server application, as well as display a noise level map based on the collected data. The mobile application is shown in Figure 3.

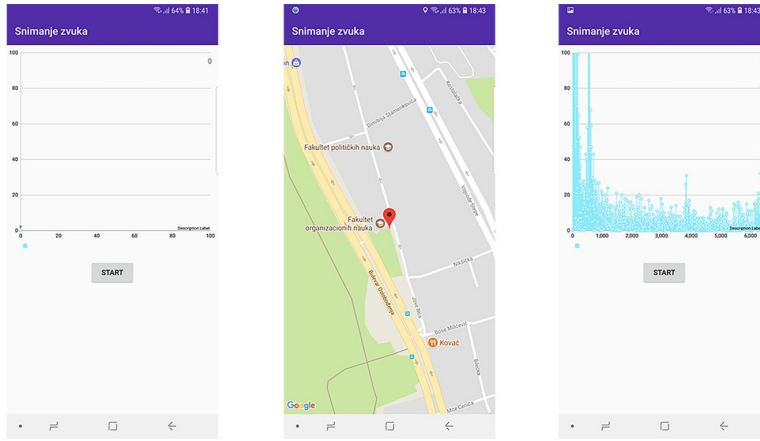


Figure 3. Crowdsensing mobile application for measuring noise pollution
Source: Jezdović et al., 2021

The same Android application enables measuring vibration manually or automatically (Figure 4). Users can manually measure vibrations in four type locations: at home, at work, on the bus, and in the car. After selecting location, the application enables recording vibrations and storing the location through the

Google Location API. Measured vibration in real-time are displayed via Graph-View. Users can record vibration automatically by selecting the time interval between the two measurements and the duration of the measurement. In both cases all recorded data are sent to the database by the web service.

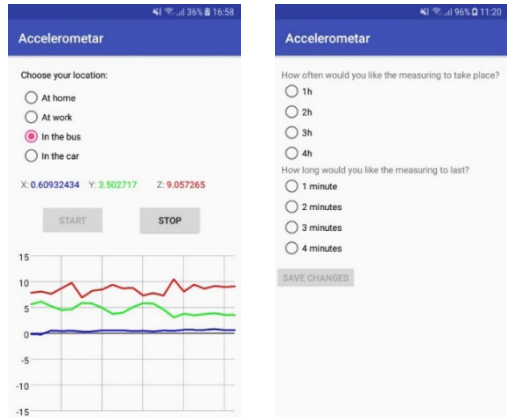


Figure 4. Mobile application for crowdsensing vibration
Source: Baljak et al., 2019a; Baljak et al., 2019b

Each smartphone has a set of sensors and services that can be used for gathering data from its surroundings such as:

- the accelerometer which can be used to determine direction of movement.
- the magnetometer which is used as a compass for detecting the position of the device in accordance to the 4 cardinal directions of the world.

GPS service that determines locations of the vibration measurements.

All data are stored in the cloud, and the format of data storing can be relational or non-relational, depending on the observed problem. For data visualization, a way of communicating with the cloud database is required. It can be done through direct requests from the database or through a previously developed API. Figure 5 shows the web application that enables preview of vibrations measured by locations and grouped into clusters.

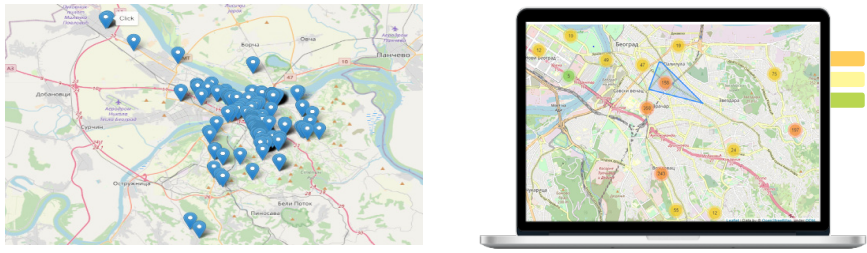


Figure 5. Web application: preview of the vibrations measured by locations
Source: Baljak et al., 2019a; Baljak et al., 2019b

Average values of intensity by frequencies and by type of vehicle are shown in Figure 6.

Figure 6. Average values of intensity by frequencies and by type of vehicle
Source: Baljak et al., 2019a; Baljak et al., 2019b

4.2 IoT crowdsensing system for monitoring air quality and allergens

The developed IoT crowdsensing system for monitoring air quality and allergens consists of (Figure 7) (Stefanović et al., 2021): Raspberry Pi, Arduino and sensors for monitoring air quality parameters MQ2, MQ4, MQ6, MQ9, MQ135, and DHT11. Sensors monitor various parameters in the air, such as: LPG (liquefied petroleum gas), temperature, humidity, flammable gases, carbon monoxide, harmful gases, and allergens particles etc.

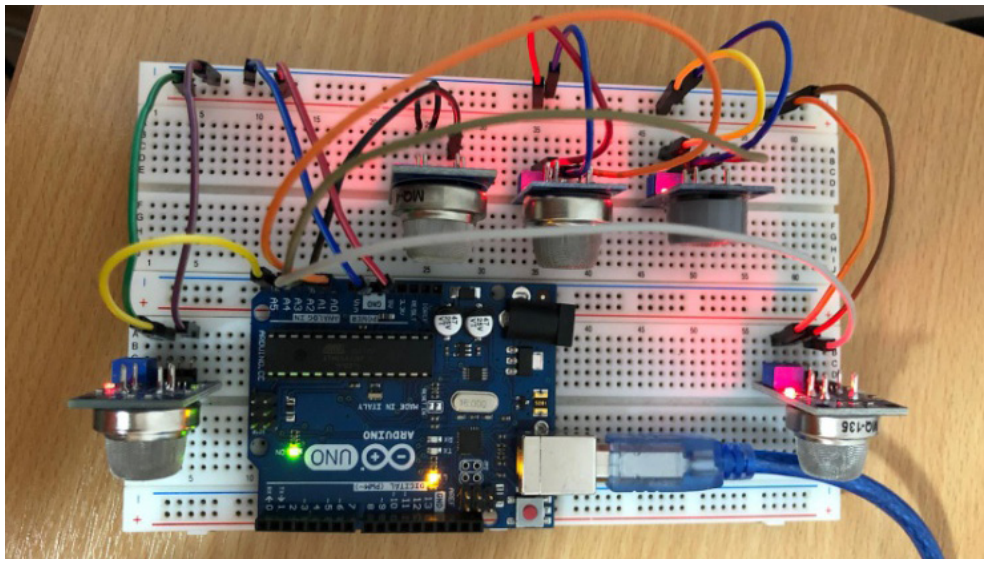


Figure 7. IoT crowdsensing system for monitoring air quality and allergens
Source:Stefanović at al., 2021

Sensors are connected to the Arduino and the measured values are processed using appropriate scripts, and then forwarded to the Raspberry Pi. Values from Raspberry Pi are forwarded to the mobile healthcare application via REST web service in JSON format. Measured values of the air quality parameters are displayed in real-time in the mobile healthcare application (Figure 8).

Mobile application enables users to mark location where they detect allergens like ambrosia. Collected data are stored in the cloud hosted database and mobile application displays locations in a custom Google Map embedded in the application. If users are located near one of the locations where allergens are detected, they will be notified accordingly and presented with useful information about the symptoms caused by the specific allergen and suggestions for appropriate treatment.

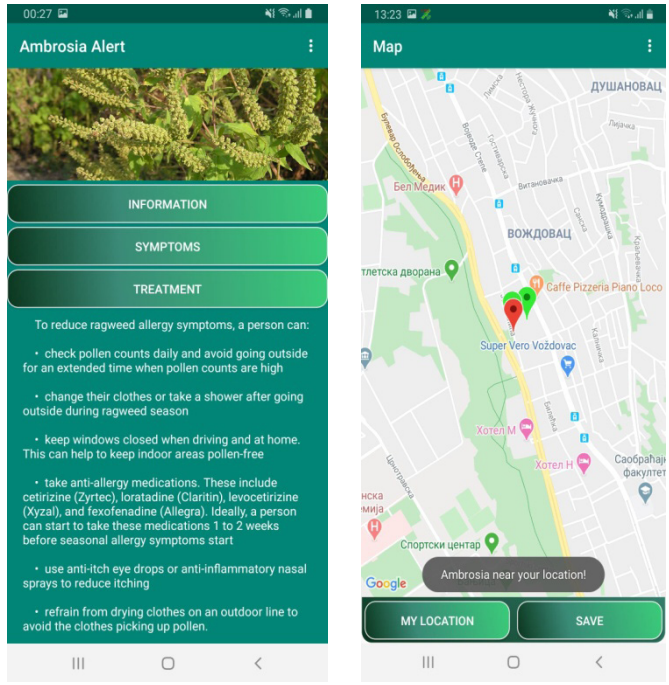


Figure 8. Crowdsensing mobile healthcare application
Source: Stefanović et al., 2020

4.3. IoT crowdsensing system for monitoring microclimate conditions

Crowdsensing IoT system for monitoring microclimate conditions consists of (Jezdović et al., 2017): Raspberry Pi, Arduino, DHT11 sensor that measures the temperature and humidity, and barometer that measures the air pressure. Raspberry Pi via web service sends the measured weather data to the cloud in database for further analysis and storage. Developed system is adaptable

so other sensor can be added for measuring wind speed and UV radiation, etc. System can be implemented in any micro location in the smart city and to provide citizens with real time information about the microclimate conditions with specific recommendation related to their health care. The system is shown in Figure 9.

Users can access weather data through web application (Figure 10). Analysis of the data is processed by using Hadoop (Figure 11) and the visualization of the data is enabled using Tableau Desktop tool.

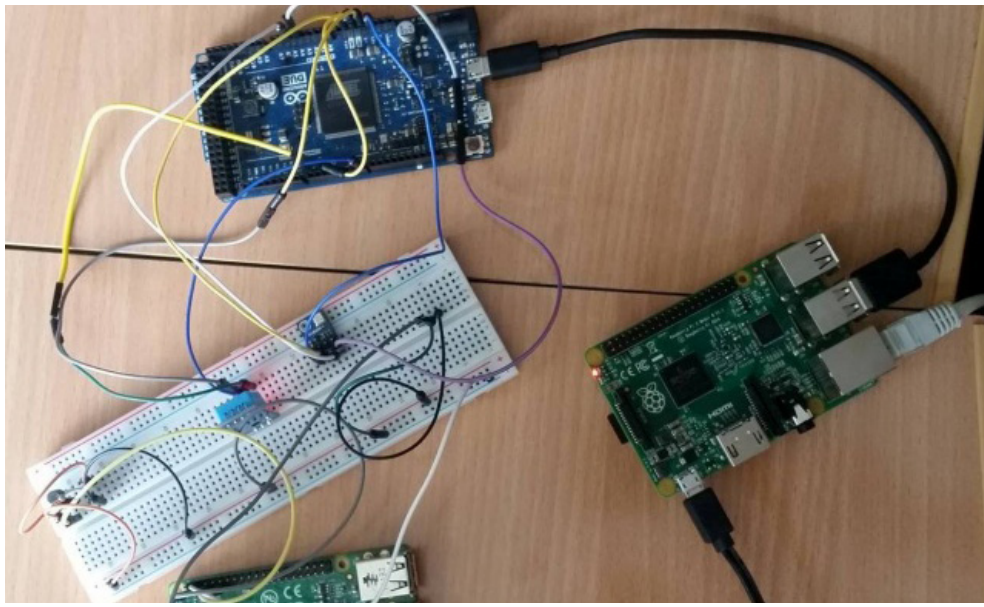


Figure 9. Crowdsensing IoT system for monitoring microclimate conditions
Source: Jezdović et al., 2017

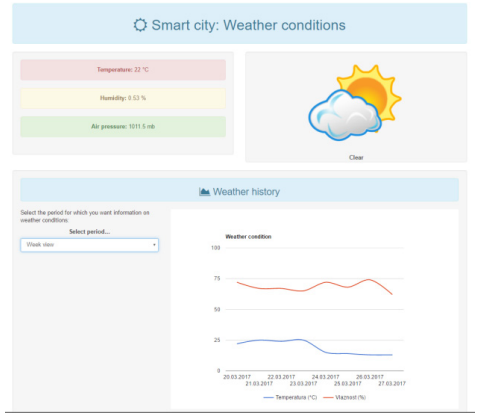


Figure 10. Web application
Source: Jezdović et al., 2017

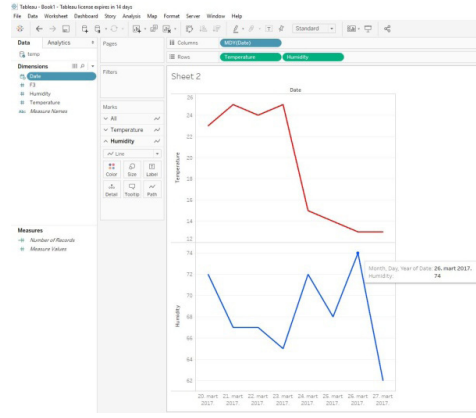


Figure 11. Data visualization in Tableau
Source: Jezdović et al., 2017

5. Conclusion

This paper presents a comprehensive crowdsensing system developed at the Faculty of Organizational Sciences, University of Belgrade, with three implemented subsystems: for crowdsensing noise and vibration in traffic, for crowdsensing the air quality, and for crowdsensing the microclimate conditions. The proposed approach enables citizens to connect their devices (IoT stations of mobile phones) and submit the measured data to the system, as well as to use the available data. Unlike the systems for official measurements, this system enables collecting data from various micro locations in a smart city, thus providing information from micro locations not covered by official measurements.

The web and mobile applications have been developed to provide users with various reports and analyses. The evaluation of each developed subsystems has been conducted, and the results point out to the usability of the developed services.

The proposed approach has some limitations that will be addressed in the future work. First of all, all crowdsensing systems face the problem of forged data and possible manipulation of the data. A possible solution can be realized by developing a blockchain based loyalty program of the smart city, where citizens who participate in the crowdsensing will be awarded with incentives, and will be trusted regarding the quality of the collected data. This will also contribute to solving the general problem of motivation of citizens to participate in crowdsensing projects. In addition, future work will be directed to further development of new business models that will provide sustainable and high-quality crowdsensing services to all the smart city stakeholders, including citizens, companies, local government, and others.

References:

1. Ahvenniemi, H., Huovila, A., Pinto-Seppä, I., & Airaksinen, M. (2017). What are the differences between sustainable and smart cities?. Cities, 60, 234–245.
2. Alvear, O., Calafate, C. T., Cano, J. C., & Manzoni, P. (2018). Crowdsensing in smart cities: Overview, platforms, and environment sensing issues. Sensors, 18(2), 460.
3. Ashton, K. (2009). That 'internet of things' thing. RFID journal, 22(7), 97-114.
4. Baljak, L., Bojkovic, N., Labus, A., Naumovic, T., & Maksimovic, A. (2019b). A system for crowdsensing vibration in public transportation. In 2019 International Conference on Artificial Intelligence: Applications and Innovations (IC-AIAI) (pp. 30-304). IEEE.
5. Baljak, L., Filipović, F., Jezdović, I., & Labus, A. (2019a). A system for Crowdsensing Vibration Comfort in Smart Traffic. IPSI Transactions on Advanced Research, Volume 15, Number 1, pp 16-23, ISSN 1820 – 4511
6. Belleflamme, P., Lambert, T., & Schwienbacher, A. (2014). Crowdfunding: Tapping the right crowd. Journal of business venturing, 29(5), 585–609.

7. Bogdanović, Z., Labus, A., Radenković, M., Popović, S., Mitorvić, S., Despotović-Zrakić, M. (2021). A Blockchain-based Loyalty Program for a Smart City, 9th World Conference on Information Systems and TechnologiesWorldCIST 2021, 30 March - 02 April 2021, Terceira, Portugal
8. Bogdanović, Z., Labus, A., Simić, K., Ratković-Živanović, V., & Milinović, S. (2015). Harnessing Crowdvoting to Support Students' Creativity. In EDULEARN15 Proceedings (pp. 4318-4326). IATED.
9. Camero, A., & Alba, E. (2019). Smart City and information technology: A review. Cities, 93, 84–94.
10. Davidovic, B. and Labus, A. (2015). A smart home system based on sensor technology. Facta Universitatis, Series: Electronics and Energetics, 29(3), pp.451-460.
11. Estrada, J.E.P., Soto, A.R.P. and D'Arminio, P. (2013). The new era of the smart cities Open Innovation based on human-centered computing methodologies applied in the PEOPLE project. In Information Systems and Technologies (CISTI), 2013 8th Iberian Conference on (pp. 1-6). IEEE.
12. Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. Future generation computer systems, 29(7), 1645-1660.
13. Heaton, J., & Parlikad, A. K. (2019). A conceptual framework for the alignment of infrastructure assets to citizen requirements within a Smart Cities framework. Cities, 90, 32–41.
14. Howe, J. (2006). The rise of crowdsourcing. Wired magazine, 14(6), 1–4.
15. Jezdovic, I., Nedeljkovic, N., Bogdanovic, Z., Labus, A., & Radenkovic, B. (2017). Smart Cities-System for Monitoring Microclimate Conditions based on Crowdsensing. In ICE-B (pp. 108-115).
16. Jezdović, I., Popović, S., Radenković, M., Labus, A., & Bogdanović, Z. (2021). A crowdsensing platform for real-time monitoring and analysis of noise pollution in smart cities. Sustainable Computing: Informatics and Systems, 100588.
17. Jin, J., Gubbi, J., Marusic, S. and Palaniswami, M. (2014). An information framework for creating a smart city through internet of things. IEEE Internet of Things Journal, 1(2), pp.112-121.
18. Kim, B. and Lavrova, O. (2013). Optimal power flow and energy-sharing among multi-agent smart buildings in the smart grid. In Energytech, 2013 IEEE (pp. 1-5). IEEE.
19. Kittur, A., Nickerson, J. V., Bernstein, M., Gerber, E., Shaw, A., Zimmerman, J., ... & Horton, J. (2013). The future of crowd work. In Proceedings of the 2013 conference on Computer supported cooperative work (pp. 1301-1318).
20. Kummitha, R. K. R., & Crutzen, N. (2017). How do we understand smart cities? An evolutionary perspective. Cities, 67, 43–52.
21. Li, C.M., Liu, B., Qin, R.F. and Yang, N. (2016). An urban mobile monitoring system integrating remote sensing and environmental sensors. In Design, Manufacturing and Mechatronics: Proceedings of the 2015 International Conference on Design, Manufacturing and Mechatronics (ICDMM2015) (pp. 510-519).
22. Liao, P., Wan, Y., Tang, P., Wu, C., Hu, Y., & Zhang, S. (2019). Applying crowdsourcing techniques in urban planning: A bibliometric analysis of research and practice prospects. Cities, 94, 33-43.
23. Liu, W., Moultrie, J., & Ye, S. (2019). The Customer-Dominated Innovation Process: Involving Customers as Designers and Decision-Makers in Developing New Product. The Design Journal, 22(3), 299–324.
24. Lukić, J., Radenković, M., Despotović-Zrakić, M., Labus, A. and Bogdanović, Z. (2016.) A hybrid approach to building a multi-dimensional business intelligence system for electricity grid operators. Utilities Policy, 41, pp.95-106.

25. Maletić, M., Barać, D., Naumović, T., Bogdanović, Z., & Radenković, B. (2019). Blending crowdvoting in modern e-learning environments. International Review of Research in Open and Distributed Learning, 20(2).
26. Manville, C., Cochrane, G., Cave, J., Millard, J., Pederson, J. K., Thaarup, R. K., ... & Kotterink, B. (2014). Mapping smart cities in the EU. Available via: https://www.rand.org/pubs/external_publications/EP50486.html (last access: 8. 4. 2018)
27. Mueller, J., Lu, H., Chirkin, A., Klein, B., & Schmitt, G. (2018). Citizen Design Science: A strategy for crowd-creative urban design. Cities, 72, 181–188.
28. Prelec, D., Seung, H. S., & McCoy, J. (2017). A solution to the single-question crowd wisdom problem. Nature, 541(7638), 532–535.
29. Radenković, B., Despotović-Zrakić, M., Bogdanović, Z., Barać, D., Labus, A. & Bojović Ž., (2017). Internet Inteligentnih uređaja. Fakultet organizacionih nauka. ISBN:978-86-7680-304-0.
30. Radenković, M., Bogdanović, Z., Despotović-Zrakić, M., Labus, A., & Lazarević, S. (2020). Assessing consumer readiness for participation in IoT-based demand response business models. Technological Forecasting and Social Change, 150, 119715.
31. Rodić-Trmčić, B., Labus, A., Bogdanović, Z., Babić, D. D., & Dacić-Pilčević, A. (2017). Usability of m-Health services: a health professional's perspective. Management: Journal of Sustainable Business and Management Solutions in Emerging Economies, 21(80), 45-54.
32. Sánchez, L., Elicegui, I., Cuesta, J. and Muñoz, L., (2014). On the energy savings achieved through an internet of things enabled smart city trial. In Communications (ICC), 2014 IEEE International Conference on (pp. 3836-3841). IEEE.
33. Schaffers, H., Komninos, N., Pallot, M., Trousse, B., Nilsson, M., & Oliveira, A. (2011). Smart cities and the future internet: Towards cooperation frameworks for open innovation. The future internet, 431–446.
34. Simić, K., Despotović-Zrakić, M., Bojović, Ž., Jovanić, B. and Knežević, Đ. (2016). A platform for a smart learning environment. Facta universitatis-series: Electronics and Energetics, 29(3), pp.407-417.
35. Solanas, A., Patsakis, C., Conti, M., Vlachos, I.S., Ramos, V., Falcone, F., Postolache, O., Pérez-Martínez, P.A., Di Pietro, R., Perrea, D.N. and Martinez-Balleste, A. (2014). Smart health: a context-aware health paradigm within smart cities. IEEE Communications Magazine, 52(8), pp.74-81.
36. Staletić, N., & Petrović, V. (2016) Implementation of the crowdfunding concept in higher education, in University of Belgrade, Faculty of Organizational Sciences proceeding XV International symposium Symorg 2016 in Zlatibor, Serbia, June 2016, 304–311.
37. Staletić, N., Labus, A., Bogdanović, Z., Despotović-Zrakić, M., & Radenković, B. (2020). Citizens' readiness to crowdsource smart city services: A developing country perspective. Cities, 107, 102883.
38. Stefanović, S., Milanović, S., Despotović-Zrakić, M. (2020). Crowdsensing mobile healthcare application for detection of ambrosia. XVII International Symposium Business and Artificial Intelligence, SYMORG Belgrade, September 7-9, pp. 513-519. ISBN 978-86-7680-385-9
39. Stefanović, S., Nešković, S., Rodić, B., Bjelica, A., Jovanić, B., Labus, A. (2021). Development of a crowdsensing IoT system for tracking air quality. E-business technologies conference, Faculty of Organizational Sciences, Belgrade, (pp. 117-119), ISBN 978-86-7680-390-3
40. Surowiecki, J. (2005). The wisdom of crowds. Anchor Books.
41. Trmčić, B. R., Labus, A., Mitrović, S., Buha, V., & Stanojević, G. (2018). Internet of things in E-health: an application of wearables in prevention and well-be-

ing. In Wearable Technologies: Concepts, Methodologies, Tools, and Applications (pp. 880-885). IGI global.
42. United Nations Development Programme (UNDP). (2016). Human Development Report 2016, Human Development for Everyone. Published for the United Nations Development Programme (UNDP). eISBN: 978-92-1-060036-1.
43. Wu, M., Lu, T. J., Ling, F. Y., Sun, J., & Du, H. Y. (2010). Research on the architecture of Internet of Things. In 2010 3rd international conference on advanced computer theory and engineering (ICACTE) (Vol. 5, pp. V5-484). IEEE.

Elma Šatrović, PhD[1] *Original scientific paper*

ECONOMIC FREEDOM AND ELECTRICITY CONSUMPTION THE IMPACT OF INTERNET USAGE ON ECONOMIC PERFORMANCE

Abstract

This study aims to investigate the relationship, if any, between economic freedom, human development, electricity consumption, internet usage and economic growth. The annual panel data are collected for eleven developing countries in the period of 1995-2017. In the light of methodology, this research employs the panel VAR methodology and the Granger causality test. Empirical findings outline two-way causal linkage between human development and economic growth; economic freedom and economic growth; internet usage and economic growth. However, results of this study display one-way causality spanning from electricity consumption to economic growth. Herein, the selected eleven countries should promote economic freedom by providing a legal structure and a law-enforcement system that protect the property rights of owners. In addition, governments should focus on improving the lives people lead rather than assuming that economic growth will lead, automatically, to greater wellbeing for all. Overall, this study argues that a better understanding of how everyday practices are shifting, in concert with the provision and design of online services, could provide a basis for the policies and initiatives needed to promote economic performance.

Keywords: Economic Growth, Economic Freedom, Electricity, Human Development, Internet usage.

1. Introduction

One of the most popular research topics in recent past has been the relationship between economic outcome and institutions. North (1990) defines institutions as: "the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction". He also emphasizes that institutions have a power to "structure incentives in human exchange, whether political, social, or economic". To mention a few, Acemoglu et al. (2005) and Sirowy and Inkeles (1990) highlight that economic institutions are of primary importance to economic outcome since they influence the economic incen-

1 Associate Professor, Department of Economics, University of Novi Pazar, Serbia, elma.satrovic@uninp.edu.rs

tives. Institutions are composed of rules and regulations that can be important catalysts to achieve sustainable development. Moreover, institutional malfunction can degrade the environment (Mehmood et al., 2021).

A smaller group of scholars (Doucouliagos and Ulubasoglu, 2006; Haan and Sturm, 2000 and Wu, 2011, to mention a few) has given empirical evidence on the relationship between economic freedom and economic output or human development. The recent research studies agree that economic freedom as a pillar of the institutional structure has an important role while explaining the human development of the country. However, researchers in general are far from the final consensus on the direct links between economic freedom and human development, and the channels through which they function.

In terms of economic freedom, one of the most challenging tasks is selecting appropriate proxy variable. One of the most commonly used measures is Index of Economic Freedom launched by The Heritage Foundation. For over twenty years the Index has delivered thoughtful analysis in a clear, friendly, and straight-forward format. This Index tends to measure the effects of the liberty and free markets worldwide for over two decades. The motivation for building this index arose from the heroic events that took place in Europe 25 years ago. People who used to live in poverty and fear have experienced modernization in terms of economy and rebirth of productivity thanks to economic freedom (Index of Economic Freedom, 2015).

North and Thomas (1973) indicate that economic freedom is not a novel concept in economic theory. Yet, this concept has been discussed ever since the time of Adam Smith addressing that the freedom to operate business, supply factors of production, trade and the protection of property rights are the basic concepts influencing the progress of an economy. Furthermore, David Ricardo has emphasized the great role of free trade in stimulating economic growth. Additionally, Gwartney and Lawson (1997) suggest that economic freedom has been more productive compared to any other methods that can potentially control the economic activity. As of economic freedom, it is of great importance to distinguish it from political freedom.

Moreover, the difference between civil liberties and economic freedom should be clearly emphasized. Economic freedom aims to protect the property of individuals, their freedom to make a choice and to exchange on voluntary basis. The important is the role of government that will provide the protection of economic freedom. In the light of political freedom, it covers the inclusion in the political processes. At last, civil liberty gives the right to establish organization and guarantees the freedom of the press.

In terms of human development, UNDP advocates that Human Development Index (HDI) summarizes the achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The health dimension is connected with life expectancy at birth; the education dimension is measured by mean of years of schooling. The standard of living dimension is measured by gross national income per capita. In terms of the time span covered in this research, it is important to emphasize

that in the last decades human development was progressing impressively. If we compare the last observed year (2017) with the 1995 for example, it will be easy to make a conclusion that people are living longer and healthier now, more children are in school and more people have access to basic social services (Human Development Report, 2016). Supplemented with the internet, information and communications technologies (ICT) have transformed production processes in most industries in many countries. Hence, there are obvious important effects of ICT on the economy and on society in general (Maurseth, 2018). Recently, many studies were conducted to examine the relationship between energy/electricity consumption and economic performance. The overall findings show that there is a strong relationship between energy /electricity consumption and economic growth (see, for example, Ozer and Mensah, 2015; Amin and Murshed, 2017; Incekara and Ogulata, 2017; Satrovic, 2018; Ahmad et al., 2021; Mujtaba and Jena, 2021).

In the context of this paper, economic freedom, electricity consumption, human development and internet usage are expected to drive the economic performance of developing countries (Abul et al., 2019; Muslija et al., 2020; Bese et al., 2020; Huskic and Satrovic, 2020; Kirikkaleli and Adebayo, 2021; Khan and Hou, 2021). However, there is no consensus on the direction of this relationship. Herein, this paper analyzes a multivariate link of interest while observing the sample of developing countries. After the introduction, this paper summarizes the recent literature on the linkage of interest. Furthermore, data and methodology is presented. Results section summarizes the most important findings of this paper together with the interpretation. At the end we present concluding remarks and policy implications.

2. Literature review

The linkage amid economic freedom, human development, internet usage, electricity consumption and economic performance has not been explored quite intensively to date in the case of developing countries. The paragraphs to follow summarize the most important findings of recent empirical work on the matter. Economic freedom has received much attention among research community nowadays since it can play a great role in economic performance. Moreover, it can provide a clear reason why do some countries have better performance than others. Additionally, economic freedom can provide the answers to the question: why do some economies have higher growth rates than the rest of the world? Due to the fact that economic freedom receives much attention among research community nowadays, there are many studies exploring the linkage amid economic freedom and economic growth in developed economies. For instance, Scully (1992) and Barro (1996) provide the empirical evidence suggesting the positive linkage amid the variables of interest. These authors claim that economic freedom represents an important driving factor of economic growth i.e. the restriction of economic freedom is expected to slow down economic growth. The increase in economic freedom on the globe level was the consequence of the improvements in freedom from corruption,

monetary freedom and trade freedom (Beach and Kane, 2008). In terms of other economic freedoms (business, labor, financial and property rights) small declines are registered worldwide. In terms of the overall observed period, it is important to emphasize that the growth in economic freedom has slowed over the past years.

Merely exploring the linkage amid economic freedom and economic growth is not enough. A critical concern nowadays is whether the improvements in economic growth lead also to the socio-economic progress of the society. Although some countries have experienced growth rates, the percentage of population living in poverty was rising. Thus, it is of critical importance to observe the linkage amid human development and economic growth. As in the case of economic freedom, it is hard to measure human development. Human Development Report (2016) indicates that: "human development is all about human freedoms: freedom to realize the full potential of every human life, not just of a few, nor of most, but of all lives in every corner of the world—now and in the future". Georgiou (2015) explores the impact of economic freedom on human development index. Panel data are collected over the period ranging between 2000 and 2012. Data are collected for European Union countries, Japan and USA. The results of the paper give an empirical support that economic freedom improves human development approximated using human development index. Moreover, author has also reported that HDI is more general than Gini coefficient. He suggests that economic freedom drives entrepreneurship and improves education, health and income that are considered to be the main dimensions of human development. Using the data for developing countries, Satrovic et al. (2020) strongly support these findings.

The incidence of human development, the perceived level of corruption and the economic freedom on economic and social environment is explored by Begu et al. (2013). They have collected panel data over the period 2005-2010 for 41 countries. The obtained results imply that economic freedom could influence the human development level, but it doesn't mean that in all the countries with a high level of economic freedom people live better, it only brings some advantages in the possibilities of development. Economic freedom is also recognized as a key determinant of tourism industry in Muslija et al. (2019).

Nikolaev (2014) provides some preliminary evidence on the relationship between economic freedom and indicators of quality of life. The results indicate that the strongest effect of economic freedom is associated with some of the nonmaterial dimensions of quality of life such as community, safety, and life satisfaction. In addition, the findings of this paper suggest that changes in economic freedom foster human development in both the short run (five years) and the long run (ten years). Using the sample of 34 countries, human capital is recognized as an important driver of economic performance in Satrovic (2019b).

Claessen and Bellavitis (n.d.) have explored the potential economic freedom-human development nexus. For the purpose of empirical evidence, they have collected the data in the time span ranging between 1998 and 2007 for the

sample of developing countries. As of proxy variables, they have utilized the Economic Freedom Index and Human Development Index. The findings of this research suggest positive relationship between the variables of interest. However, the major limitation of this finding is the fact that proposed models do not provide clear evidence on the link of interest due to the potential causality issue that is not addressed in the present research.

Madan (2002) aims to define the Economic Freedom Index and to investigate whether the improvement in economic freedom supports the economic performance. Addressing the fact that economic performance is a complex economic term, different determinants of economic performance are explored to see which of these determinants is most affected by the improvement in economic freedom. The empirical evidence presented in this paper suggests that improvements in trade freedom, protection of property rights and internal regulations have a significant positive impact on the economic performance.

Scully (2002) have explored the potential linkage amid economic freedom and economic growth. Moreover, the author has been interested to provide empirical evidence on the link between economic freedom and income distribution. The findings of this study suggest the increase in economic freedom to stimulate economic growth and to promote equity. Moreover, the model in reduced form served to investigate the effect of policy measures on growth performance and inequality of income. The findings of this paper suggest that more trade openness is positively correlated with economic growth as well as higher fiscal state. Anser et al. (2019), Abbasi et al. (2020) and Baye et al. (2020) have studied additional determinant of economic performance providing the strong evidence on the relationship between energy (electricity) consumption and economic growth. The relationship may very well run from electricity consumption to economic growth, and/or from economic growth to electricity consumption.

While most of the studies focus on the linkage between economic freedom and economic growth, Salahuddin and Gow (2016) suggest there are only a few studies analyzing the link between economic performance and internet usage. They use the case study of South Africa in the period of 1991-2013 to analyze the linkage amid internet usage, financial development, trade openness and economic performance. Empirical evidence highlights significantly positive impact of internet usage on economic performance. These findings strongly align with Maurseth (2018) who analyzes the relationship between internet usage and economic growth for the sample of 171 countries.

Medina-Moral and Montes-Gan (2018) have explored the role of institutions in the development process. The countries are grouped on "success" and enable the introduction of dynamics. The findings of this paper suggest that economic freedom is an important institution playing a crucial role in the growth process. Apart from the stage of development, entrepreneurial spirit is an engine of growth process in market economies. This is especially true in countries with the high level of economic freedom and favorable business environment that supports the entrepreneurial activity and consequently economic growth.

Mehmood et al. (2021) support these findings suggesting that in India and Bangladesh, the modifying role of institutional quality is evident to reducing pollutant emissions but in Pakistan, this interacting effect increases environmental degradation.

Aforementioned paragraphs reveal positive link between economic freedom and economic growth; human development and economic growth; internet usage and economic growth; electricity consumption and economic growth. However, the studies do not agree on the causality direction. Therefore, this paper employs panel VAR and Granger causality test to evaluate the causal association between economic freedom, human development, internet usage, electricity consumption and economic growth for a sample of developing countries.

3. Data, variables and methodology

This paper employs the panel VAR methodology. It has been used quite often in the recent empirical studies. The main assumption of the VAR model is the presence of the set of endogenous variables. Panel data received much attention among research community nowadays increasing the usage of panel VAR model. This is since it can control differences among units of interest (Abrigo and Love, 2016).

Additionally, panel VAR models can control for the interdependencies that change in time. Besides these, Satrovic and Muslija (2019) indicate that panel VAR can be easy transformed into structural form so that impulse-response function can be estimated. The methodology applied in this paper is based on the propositions described in Abrigo and Love (2016). Equation 1 formalizes the panel VAR model as following:

$$Y_{it} = Y_{it-1}A_1 + Y_{it-2}A_2 + \cdots + Y_{it-p+1}A_{p-1} + Y_{it-p}A_p + X_{it}B + u_{it} + \varepsilon_{it}. \quad (1)$$

Covariates are denoted by and have the dimension of outcome variables have the dimension of and is denoted by . Fixed effects are having the dimension of and are assumed to be endogenous. represents the individual effects. The units of interest can take the values from 1 to N whereas period of interest can range between 1 and Innovations are assumed to: and under the condition that t >s. To provide the value of regression parameters, this paper relies on the fact that GMM estimation provides the solution to the potential bias caused by the first lag of . The justification is given by Abrigo and Love (2016). The multivariate model to be estimated in this paper can be presented in general form as (Eq. 2):

Canova and Ciccarelli (2013) suggest that despite the fact that some authors criticize panel VAR models, these are still used intensively in the recent research. This is since panel VAR model controls for the individual heterogeneity

$$GDP_{it} = \sigma + \sum_{i=1}^{k} \beta_i \, GDP_{t-i} + \sum_{j=1}^{k} \theta_j \, HDI_{t-j} + \sum_{m=1}^{k} \varphi_m \, EFI_{t-m} + \sum_{n=1}^{k} \cap_n \, INT_{t-n} + \sum_{o=1}^{k} \emptyset_o \, ELC_{t-o} + u_{1t}$$

$$HDI_{it} = \alpha + \sum_{i=1}^{k} \beta_i \, GDP_{t-i} + \sum_{j=1}^{k} \theta_j \, HDI_{t-j} + \sum_{m=1}^{k} \varphi_m \, EFI_{t-m} + \sum_{n=1}^{k} \cap_n \, INT_{t-n} + \sum_{o=1}^{k} \emptyset_o \, ELC_{t-o} + u_{2t}$$

$$EFI_{it} = \tau + \sum_{i=1}^{k} \beta_i \, GDP_{t-i} + \sum_{j=1}^{k} \theta_j \, HDI_{t-j} + \sum_{m=1}^{k} \varphi_m \, EFI_{t-m} + \sum_{n=1}^{k} \cap_n \, INT_{t-n} + \sum_{o=1}^{k} \emptyset_o \, ELC_{t-o} + u_{3t}$$

$$INT_{it} = \omega + \sum_{i=1}^{k} \beta_i \, GDP_{t-i} + \sum_{j=1}^{k} \theta_j \, HDI_{t-j} + \sum_{m=1}^{k} \varphi_m \, EFI_{t-m} + \sum_{n=1}^{k} \cap_n \, INT_{t-n} + \sum_{o=1}^{k} \emptyset_o \, ELC_{t-o} + u_{4t}$$

$$ELC_{it} = \partial + \sum_{i=1}^{k} \beta_i \, GDP_{t-i} + \sum_{j=1}^{k} \theta_j \, HDI_{t-j} + \sum_{m=1}^{k} \varphi_m \, EFI_{t-m} + \sum_{n=1}^{k} \cap_n \, INT_{t-n} + \sum_{o=1}^{k} \emptyset_o \, ELC_{t-o} + u_{5t}. \quad (2)$$

and time interdependency. The methodology employed in this paper follows the propositions of Abrigo and Love (2016) and Love and Zicchino (2006).

To proceed to the empirical part, it is worth explaining the proxy variables of interest. GDP (GDP per capita (constant 2010 US$)) is proxy variable for economic performance. This variable is calculated by dividing gross domestic product by midyear population. Individuals using the Internet (% of population) – INT is the proxy for internet usage. These data are obtained from The World Bank. Electric power consumption (kWh per capita) – ELC is used to approximate electricity consumption. The data sources are The World Bank and International Energy Agency. HDI (Human Development Index) has been used as a proxy for human development. Data source is the United Nations Development Programme (UNDP). This index has been developed to emphasize not only the economic growth, but also the capabilities of people to evaluate the development performance of an economy. It includes three dimensions: health dimension, knowledge dimension and standard of living.

At last, EFI (Index of Economic Freedom) developed by The Heritage Foundation has been used as a proxy for economic freedom. Special attention is given to economic freedom in this paper due to the fact that it tends to have a positive impact on the majority of socio-economic objectives. Thus, it promotes human development, poverty reduction, environmental protection and healthier society. The use of these proxy variables has been justified in the studies to date (Ranis et al., 2000; Madan, 2002; Grzegorz and Krzysztof, 2011; Ozer and Mensah, 2015; Amin and Murshed, 2017; Incekara and Ogulata, 2017; Medina-Moral and Montes-Gan, 2018; Maurseth, 2018; Satrovic, 2019a; Huskic and Satrovic, 2020; Ahmad et al., 2021). To conclude the empirical findings, we used 500 Monte Carlo simulations to estimate the impulse-response function.

4. Results of the research and discussion

This paper starts by presenting measures of descriptive statistics in Table 1 for the eleven developing countries (Brazil, Russia, India, China, South Africa, Indonesia, Malaysia, Mexico, Philippines, Thailand and Turkey). The average value of GDP per capita (constant 2010 US$) is found to be 6160.06 for the eleven developing countries of interest. Brazil, Russia, South Africa, Malaysia, Mexico and Turkey record values that are above the group average. The maximum value of real GDP per capita is recorded in the case of Turkey in the last observed year, whereas India records the minimum value in 1995. As of Turkey, it has recorded a growth rate of 7.4% in 2017. This annual growth has been one of the fastest in the world. Exports have been supported by the depreciation in exchange rate. Moreover, domestic demand has been driven by fiscal stimulus based on the extension of credit scheme guaranteed by the government (OECD, 2018).

Table 1. Descriptive statistics

Stat	GDP	HDI	EFI	INT	ELC
mean	6160.06	68.10	58.91	21.62	2358.59
sd	3552.88	7.21	5.95	21.92	1704.37
max	14874.80	82.20	73.80	80.14	6810.17
min	674.62	46.30	45.10	0.00	263.62
skewness	0.103	-0.555	0.033	0.819	0.814
kurtosis	1.849	3.224	2.047	2.412	2.762

Source: Computed by the Author

In addition to the fiscal stimulation, the growth performance of Turkey has been driven by the well fragmented and diversified business sector. Investment sector is also strong but funded from the debt. Therefore the quality of investments is questionable as well as the allocation. Apart from this positive statistics, it is important to indicate the inflation above target that undermines the credibility of monetary policy. Starting from mid2016, macroeconomic policies have been directed to support growth performance. As a consequence, government expenditure increased significantly to grant the investment and employment incentives. In this regard, it is also important to emphasize the development of medium-size firms that tend to play an important role in the growth performance of less developed areas in Turkey. However, the further development of these firms requires better management and the development of technical skills but a foremost increased investment.

With regards to India, it has been a member of World Trade Organization (WTO) starting from 1995. It is important to indicate that the economic differentiation has been increased among the members of WTO organization starting from 1995. For instance, India has recorded 340% increase in GDP in the period

between 1995 and 2017. In 1995, India records 10% lower GDP compared to Sub-Saharan Africa. However, the statistics form 2017 suggests that GDP in India is 50% larger than the GDP of the aforementioned African countries. Despite the fact that India records the lowest GDP among the observed developing countries in the year 1995, it has rose from 10th to 5th largest at the global level in the period between 1995 and 2017 (WTO, 2019). World Bank (2019) indicates that sustainable growth performance in India is strongly linked with the reforms of public sector, education, better infrastructure, increased exports and investments as well as the public health. Moreover, this overview suggests that sustainable development of India will significantly impact the world performance since India's case represents the ambition of the world to eliminate extreme poverty and to support well-being.

Human development index mean value is found to be 68.10. Brazil, Russia, Malaysia, Mexico, Thailand and Turkey have recorded average HDI above the sample average with the maximum value recorded in Russia in 2017 and the minimum value recorded in India in 1995. All three dimension of human development recorded a significant progress. As a result, Russia records maximum value of HDI in 2017 among the developing countries of interest. This rank suggests that human development is very high in Russia. In terms of India, UNDP (2019) displays 50% increase in Human Development Index in the period between 1990 and 2018. All of the dimensions of human development recorded a significant progress.

In terms of the Index of Economic Freedom, mean value is found to be 58.91. Sample countries that record above average are: South Africa, Mexico, Thailand, Philippines and Turkey. Maximum value is recorded in Malaysia in 2017 whereas the minimum value is recorded in India in 1995. In terms of India, aforementioned paragraphs justify the minimum value. In Malaysia, it is worth noticing the fact that Prime Minister Mahathir Bin Mohamed has reduced the strong dependence of Malaysian economy on exports of raw materials; rather Malaysia economy started exporting service and manufacturing goods. Moreover, special attention has been made to the development of tourism and service sector. Maximum value of individuals using internet is reported for Malaysia in 2017 whereas China displays minimum value in 1995. Considering the electricity consumption, Indonesia reports minimum value in 1995 while Russia highlights the maximum value in 2017. Although our sample covers only developing countries, standard deviations suggest significant differences among these in all aspects of interest. After the description statistics, this empirical analysis moves toward exploration of the presence of unit root. For this purpose we have introduced the three most commonly used panel unit root tests namely: Levin–Lin–Chu (LLC) t* test, Im–Pesaran–Shin test, ADF – Fisher inverse chi square.

Table 2. Unit root tests

Trend included in the model		Method		
Variable	Test statistics	Levin-Lin-Chu (LLC) t* test	Im-Pesaran-Shin test	ADF – Fisher inverse chi square
LnGDP	Stat.	-0.91	0.71	33.33
	p-value	0.183	0.761	0.057*
D.lnGDP	Stat.	-6.80	-6.70	95.26
	p-value	0.000***	0.000***	0.000***
LnHDI	Stat.	-1.26	-0.14	22.83
	p-value	0.104	0.445	0.412
D.lnHDI	Stat.	-9.09	-8.20	86.97
	p-value	0.000***	0.000***	0.000***
LnEFI	Stat.	-0.39	0.65	16.41
	p-value	0.349	0.744	0.795
D.lnEFI	Stat.	-9.09	-9.10	95.76
	p-value	0.000***	0.000***	0.000***
LnINT	Stat.	-10.90	-7.39	153.30
	p-value	0.000***	0.000***	0.000***
D.lnINT	Stat.	-7.79	-6.78	45.17
	p-value	0.000***	0.000***	0.002***
LnELC	Stat.	-2.17	-1.57	31.27
	p-value	0.015**	0.059*	0.091*
D.lnELC	Stat.	-8.36	-8.39	102.92
	p-value	0.000***	0.000***	0.000***

Note: ***, **, * significant at 1%, 5% and 10% respectively.

Source: Computed by the Author

Panel unit root tests were performed for log level and first difference values. Table two summarizes the obtained results. The general conclusion from the Table 2 implies the non-stationary properties of log levels. However, all of the first differences were found to be stationary. All of the variables are integrated of the same order I(1) suggesting that assumptions of panel VAR have been justified. Moreover, we have detected the number of lags need in Table 3.

Table 3. Decision criteria

Order	CD	J	J p-value	MBIC	MAIC	MQIC
1	0.689797	57.35438	0.935333	-334.979	-92.6456	-190.839
2	0.904874	45.35702	0.659919	-216.198	-54.643	-120.105
3	0.752017	18.70601	0.810995	-112.072	-31.294	-64.0252

Source: Computed by the Author

In the next step of this empirical study, we have employed GMM estimator to investigate the multivariate model of interest. Table 4 summarizes the obtained findings.

Table 4. VAR models

Independent variables	Dependent variables				
	D.lnGDP	D.lnHDI	D.lnEFI	D.lnINT	D.lnELC
$D.lnGDP_{t-1}$	0.036 (0.123)	-0.059 (0.014)***	0.404 (0.128)***	-3.506 (0.564)***	0.248 (0.109)***
$D.lnHDI_{t-1}$	7.344 (0.805)***	1.380 (0.116)***	-11.442 (1.117)***	21.044 (2.584)***	7.664 (0.837)***
$D.lnEFI_{-1}$	0.324 (0.117)***	-0.014 (0.015)	0.293 (0.945)***	-0.202 (0.377)	-0.236 (0.111)**
$D.lnINT_{t-1}$	0.103 (0.007)***	-0.002 (0.001)***	0.028 (0.009)***	0.479 (0.046)***	-0.021 (0.007)***
$D.lnELC_{t-1}$	0.851 (0.040)***	-0.067 (0.017)***	0.534 (0.192)***	1.017 (0.526)**	-0.532 (0.174)***

Note: ***, **, * significant at 1%, 5% and 10% respectively.

Source: Computed by the Author

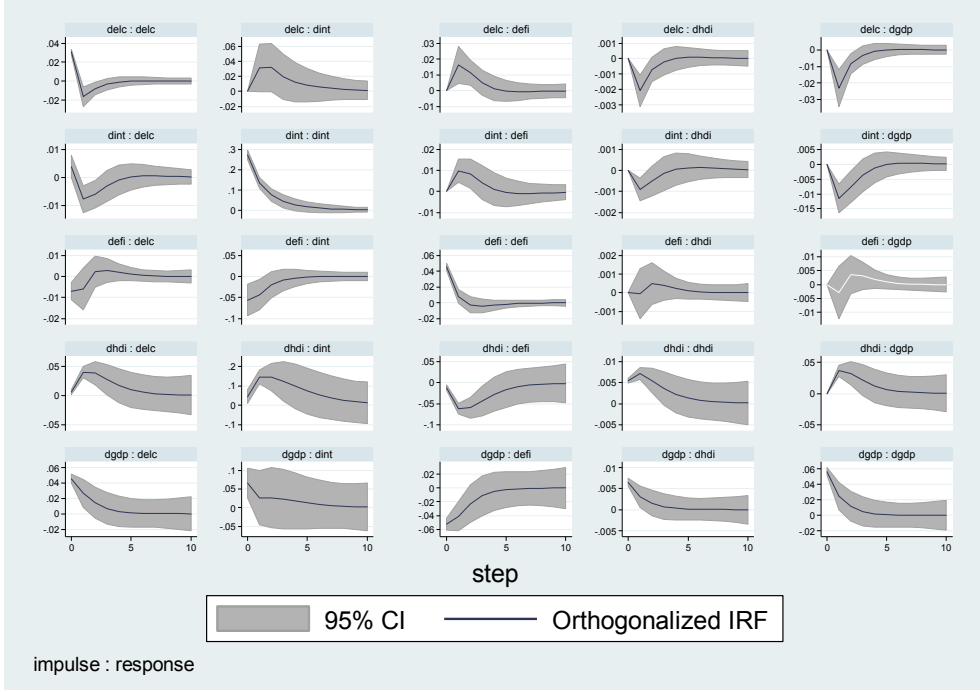
Panel VAR model suggests a positive response of economic growth on human development, internet usage, electricity consumption and economic freedom. Table 5 summarizes the evidence from the Granger causality test. Empirical findings outline two-way causal linkage between human development and economic growth; economic freedom and economic growth; internet usage and economic growth. However, results of this study display one-way causality spanning from electricity consumption to economic growth. It is also important to notice that joint impact of human development, internet usage, electricity consumption and economic freedom on economic growth is significant as well as the other joint impacts.

Table 5. Granger causality tests

Equation	Excluded				
	D.lnHDI	D.lnEFI	D.lnINT	D.lnELC	All
D.lnGDP	83.238 (0.000)*	4.640 (0.031)	19.933 (0.000)	15.399 (0.000)	92.988 (0.000)
	D.lnGDP	D.lnEFI	D.lnINT	D.lnELC	All
D.lnHDI	18.300 (0.000)	0.914 (0.339)	7.288 (0.007)	15.425 (0.000)	59.116 (0.000)
	D.lnGDP	D.lnHDI	D.lnINT	D.lnELC	All
D.lnEFI	10.032 (0.002)	104.794 (0.000)	9.370 (0.002)	7.751 (0.005)	110.875 (0.000)
	D.lnGDP	D.lnHDI	D.lnEFI	D.lnELC	All
D.lnINT	38.660 (0.000)	66.342 (0.000)	0.288 (0.592)	3.748 (0.053)	79.504 (0.000)
	D.lnGDP	D.lnHDI	D.lnEFI	D.lnINT	All
D.lnELC	1.977 (0.160)	83.758 (0.000)	4.497 (0.034)	7.584 (0.006)	86.423 (0.000)

Note: * p-value

Source: Computed by the Author



Graph 1. IRF plots
Source: Computed by the Author

At last, we have observed the linkage of interest by calculating the impulse-response functions. Human development index is found to react positively to economic freedom and internet usage, both in short- and the long-run, however short-run impact is found to be stronger. GDP is also found to react positively to economic freedom, human development, electricity consumption and internet usage in the long-run. Therefore, special attention should be paid to support human development, internet usage, and economic freedom in developing countries in order to foster the growth performance and consequently to achieve the sustainable economic growth.

5. Conclusion

Not many studies analyzed the relationship between economic freedom, electricity consumption, internet usage, economic growth and human development in the case of developing countries. Hence, this paper aims to fill in this gap in literature by collecting balanced panel data for eleven developing countries over the period ranging from 1995 to 2017.

Panel VAR model suggests that economic growth responds positively to the human development index, internet usage, electricity consumption and economic freedom. Granger causality tests outline two-way causal linkage between human development and economic growth; economic freedom and economic growth; internet usage and economic growth. However, results of this study display one-way causality spanning from electricity consumption to economic growth. Herein, economic freedom, internet usage, electricity consumption and human development stimulate economic growth due to the fact that proper government incentives would drive growth process since most of the key dimensions of sustainable development are determined rather by economic freedom, components of human development, internet usage or electricity consumption.

The obtained results indicate that economic freedom, internet usage, electricity consumption and human development have been rising impressively in recent past. Yet human development has been uneven. Some individuals have achieved only the basics of human development while some not even that. Therefore, the improvement in economic freedom, internet usage, electricity consumption and human development tend to contribute economic growth in both, short- and the long-run. Hence, this paper suggests that in order to increase the human development, policy makers need to create incentives for economic freedom in terms of property rights, government integrity, judicial effectiveness, tax burden, government spending, fiscal health, business, labor, monetary, trade, investment and financial freedom. Governments play a great role in this process by recognizing the benefits of improvements in economic freedom. Socio-economic development is strongly driven by the trade freedom as well as the protection of human rights. Special attention should also be paid to the fiscal freedom. Countries that support economic freedom may not see instance improvements in income equality. These improvements are expected

at a certain level of economic freedom. One of the limitations of this paper is the potential omitted bias. Hence, there is a great potential for future research. It will be of great importance to analyze the role of renewable energy in the inspected nexus.

References:

1. Abbasi, M.A., Parveen, S., Khan, S., Kamal, M.A. (2020). Urbanization and energy consumption effects on carbon dioxide emissions: evidence from Asian-8 countries using panel data analysis. Environmental Science and Pollution Research, 27, pp. 18029-18043
2. Abrigo, M., Love, I. (2016). Estimation of panel vector autoregression in Stata: A package of programs, Working Paper No. 16-2. University of Hawai. Retrieved October, 2020, from http://paneldataconference2015.ceu.hu/Program/Michael-Abrigo.pdf
3. Abul, S. J., Satrovic, E., Muslija, A. (2019). The link between energy consumption and economic growth in Gulf Cooperation Council countries. International Journal of Energy Economics and Policy, 9(5), pp. 38-45
4. Acemoglu, D., Johnson, S., Robinson, J.A. (2005). Institutions as the Fundamental Cause of Long-Run Growth. In: P. Aghion, & S. Durlauf (Eds.). Handbook of Economic Growth. Elsevier. Netherlands
5. Ahmad, M., Muslija, A., Satrovic, E. (2021). Does economic prosperity lead to environmental sustainability in developing economies? Environmental Kuznets curve theory. Environmental Science and Pollution Research
6. Amin, S.B., Murshed, M. (2017). An empirical analysis of multivariate causality between electricity consumption, economic growth and foreign aid: Evidence from Bangladesh. The Journal of Developing Areas, 51(2), pp. 369-380
7. Anser, M.K., Yousaf, Z., Usman, B., Nassani, A.A., Qazi Abro, M.M., & Zaman, K. (2019). Management of water, energy, and food resources: Go for green policies. Journal of Cleaner Production, 119662
8. Barro, R. J. (1996). Economics and growth. Journal of Economic Growth, 1, pp. 1-27
9. Baye, R.S., Olper, A., Ahenkan, A., Surugu, J. M., Anuga, S.W., Darkwah, S. (2020). Renewable energy consumption in Africa: Evidence from a bias corrected dynamic panel. Science of The Total Environment, 142583
10. Beach, W.W., Kane, T. (2008). Methodology: Measuring the 10 Economic Freedoms, in Heritage Foundation, 2008 Index of Economic Freedom. Retrieved January, 2021, from http://thf_media.s3.amazonaws.com/index/pdf/2008/Index2008_Chapter4.pdf
11. Begu, L.S., Davidescu, A.A., Dumitru, A.E. (2013). Economic freedom. The main factor in the human development. Alma Mater University journal, 6(1), pp. 1-5
12. Bese, E., Friday, H.S., Ozden, C. (2020). Coal consumption environmental Kuznets curve (EKC) in China and Australia: Evidence from ARDL model. Journal of Applied Business and Economics, 22(11)
13. Canova, F., Ciccarelli, M. (2013). Panel vector autoregressive models a survey, ECB Working Paper Series NO 1507. Retrieved March, 2021, from https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1507.pdf
14. Claessen, S., Bellavitis, N. (n.d.). Does economic freedom stimulate human development? An empirical study on how governments can affect the wellbeing of

developing countries. Retrieved December, 2020, from https://www.eur.nl/sites/corporate/files/387349_NiccoloBellavitis_380725_SebastiaanClaessen_FinalPaper.pdf

15. Doucouliagos, C., Ulubasoglu, M.A. (2006). Economic freedom and economic growth: Does specification make a difference? European Journal of Political Economy, 22, pp. 60-81
16. Georgiou, M.N. (2015). Economic freedom and human development index - a panel data analysis (2000-2012). Retrieved November, 2020, from https://ssrn.com/abstract=2601736
17. Grzegorz, C., Krzysztof, K. (2011). Degree of economic freedom and relationship to economic growth and human development, MPRA Paper No. 36712. Retrieved October, 2020, from https://mpra.ub.uni-muenchen.de/36712/
18. Gwartney, J., Lawson, R. (1997). Economic freedom of the World 1997. Retrieved October, 2020, from https://www.fraserinstitute.org/research/economic-freedom-of-the-world-1997-annual-report
19. Haan, J., Sturm, J.E. (2000). On the relationship between economic freedom and economic growth. European Journal of Political Economy, 16, pp. 215-241
20. Human Development Report, (2016). UNDP. Retrieved February, 2021, from http://hdr.undp.org/en/content/human-development-report-2016
21. Huskic, M., Satrovic, E. (2020). Human development- renewable energy-growth nexus in the top 10 energy gluttons. Uprava, 22, pp. 25-42
22. Incekara, C. O., Ogulata, S. N. (2017). Turkey's energy planning considering global environmental concerns. Ecological Engineering, 102, pp. 589-595
23. Index of Economic Freedom, (2015). Retrieved February, 2021, from: https://www.heritage.org/index/pdf/2015/book/index_2015.pdf
24. Khan, I., Hou, F. The dynamic links among energy consumption, tourism growth, and the ecological footprint: the role of environmental quality in 38 IEA countries. Environmental Science and Pollution Research, 28, pp. 5049-5062
25. Kirikkaleli, D., Adebayo, T.S. (2021). Do public-private partnerships in energy and renewable energy consumption matter for consumption-based carbon dioxide emissions in India? Environmental Science and Pollution Research
26. Love, I., Zicchino, L. (2006). Financial development and dynamic investment behavior: Evidence from panel VAR. The Quarterly Review of Economics and Finance, 46(2), pp. 190-210
27. Madan, A. (2002). The relationship between economic freedom and socio-economic development. Honors Projects, Paper 37. Retrieved March, 2021, from http://digitalcommons.iwu.edu/econ_honproj/37
28. Maurseth, P. B. (2018). The effect of the internet on economic growth: Counter-evidence from cross-country panel data. Economics Letters
29. Medina-Moral, E., Montes-Gan, V.J. (2018). Economic freedom, good governance and the dynamics of development. Journal of Applied Economics, 21(1), pp. 44-66
30. Mehmood, U., Tariq, S., Ul-Haq, Z., Meo, M.S. (2021). Does the modifying role of institutional quality remains homogeneous in GDP-CO2 emission nexus? New evidence from ARDL approach. Environmental Science and Pollution Research, 28, pp. 10167-10174
31. Mujtaba, A., Jena, P.K. (2021). Analyzing asymmetric impact of economic growth, energy use, FDI inflows, and oil prices on CO2 emissions through NARDL approach. Environmental Science and Pollution Research
32. Muslija, A., Satrovic, E., Colakovic, N. (2019). Dynamic panel data analysis of the relationship between economic freedom and tourism. Cankırı Karatekin Univer-

sity Journal of the Faculty of Economics and Administrative Sciences, 9(2), pp. 1-17Muslija, A., Satrovic, E., Colakovic, N. (2020). The causal link between electricity generation and CO2 emissions: Toda and Yamamoto approach. Economy and Market Communication Review, X(1), 27-41.

33. Nikolaev, B. (2014). Economic freedom and quality of life: Evidence from the OECD's your better life index. The Journal of Private Enterprise, 29(3), pp. 61-96
34. North, D., Thomas, R.P. (1973). The Rise of the Western World: a New Economic History. Cambridge Press. UK
35. OECD, (2018). OECD economic surveys: Turkey. Retrieved March, 2021, from http://www.oecd.org/economy/surveys/Turkey-2018-OECD-economic-survey-overview.pdf
36. Ozer, M., Mensah, C. (2015). A bivariate causality between energy consumption and economic growth in Ghana, 7th Annual American Business Research Conference, New York, 23-24 July, 2015
37. Ranis, G., Stewart, F., Ramirez, A. (2000). Economic growth and human development. World Development, 28(2), pp. 197-219
38. Salahuddin, M., Gow, J. (2016). The effects of internet usage, financial development and trade openness on economic growth in South Africa: A time series analysis. Telematics and Informatics, 33(4), pp. 1141-1154
39. Satrovic, E. (2018). The human development relies on renewable energy: Evidence from Turkey. 3rd International Energy and Engineering, in: Book of Proceedings, Gaziantep, Turkey, pp. 19-27
40. Satrovic, E. (2019a). Energy consumption, trade openness and growth nexus in Turkey: Evidence from VECM. Journal of Economics and Administrative Sciences, 20(1), pp. 1-12
41. Satrovic, E. (2019b). Moderating effect of economic freedom on the relationship between human capital and shadow economy. Trakya Üniversitesi Sosyal Bilimler Dergisi, 1(1), pp. 295-306
42. Satrovic, E., Muslija, A. (2019). The empirical evidence on tourism-urbanization-CO2 emissions nexus. Advances in Hospitality and Tourism Research (AHTR), 7(1), pp. 85-105
43. Satrovic, E., Muslija, A., Abul, S. J. (2020). Do innovation and entrepreneurship have dominant roles in economic growth? A new perspective of developed countries. Humanities & Social Sciences Reviews, 8(3), pp. 1056-1064
44. Scully, G.W. (1992). Constitutional Environments and Economic Growth. Princeton University Press. Princeton
45. Scully, G.W. (2002). Economic freedom, government policy and the trade-off between equity and economic growth. Public Choice, 113, pp. 77-96
46. Sirowy, L., Inkeles, A., (1990). The effects of democracy on economic growth and inequality: a review. Studies in Comparative International Development, 25, pp. 126-157
47. UNDP, (2019). Human Development Report 2019. Retrieved April, 2021, from http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/RUS.pdf
48. World Bank, (2019). India Country Overview. Retrieved April, 2021, from https://www.worldbank.org/en/country/india/overview
49. WTO, (2019). An Undifferentiated WTO: Self-Declared Development Status Risks Institutional Irrelevance Communication from the United States. Retrieved March, 2021, from https://www.tralac.org/news/article/13839-an-undifferentiated-wto-self-declared-development-status-risks-institutional-irrelevance.html
50. Wu, C. (2011). Economic freedom, economic growth, and China. The Chinese Economy, 44(5), pp. 104-119

Dr. sc. Siniša Franjić, dipl. iur.[1] *Professional paper*

THE IMPORTANCE OF INTELLECTUAL PROPERTY IN MODERN SOCIETY

Abstract

Intellectual property is a collective name for subjective rights in connection with intellectual creations as intangible goods. It includes copyright and related rights, as well as industrial property rights. The protection of intellectual property encourages creativity, but also economic activities. Intellectual property protection is one of the most harmonized areas of law. Intellectual property protection laws in most countries of the world follow the same principles and differ only in nuances. Several international treaties regulate interstate aspects in the protection of intellectual property. The importance of intellectual property in modern society is confirmed by the existence of the World Intellectual Property Organization (WIPO), which acts as a specialized agency of the United Nations. This means that modern society enables the quality implementation of intellectual property on a legal basis into national legislation. The aim of this paper is to raise the level of awareness of the importance of social implementation of intellectual property to a higher level.

Keywords: Intellectual Property, Good Idea, Piracy, Economics.

1. Introduction

Moral and economic rights of creators can be justified on several grounds (Kurr et al., 2013). Apart from the economic aspect to secure a dependable income to creators and their families, natural rights ideas also play a certain role. According to this view, the rights associated with IP are attributed to the inventor/creator because they 'belong' to him in some metaphysical justice-oriented sense, either because they are regarded – mainly with regard to copyright – as emanating from the creator's inalienable personality, or – more generally – as the fruit of his intellectual labour.

In contrast, the promotion of creativity and innovation, and as a consequence, of social welfare and consumer satisfaction, is largely economically motivated (Kurr et al., 2013). From this perspective, the aim is to incentivise and reward

1 sinisa_franjic@net.hr

investment made into creation and innovation. This is achieved by guaranteeing the first-mover a legally secured lead-time to recoup his investment made in order to come up with and market the invention or creation (including cost for unsuccessful research and cross-subsidies of the production of other less profitable, yet desirable goods). In achieving this, two important characteristics play a role which distinguish intangible from tangible goods. The first of these characteristics is their 'ubiquity'. In other words, an IP good is not confined to one particular place in time. Rather, it can be used and consumed at several places at the same time. The second of these characteristics is their 'non-rivalry'. In other words, use or consumption of an IP good does not exclude other users and consumers from using and consuming the same IP good at the same time, nor does it diminish its existence. This is markedly different from the rivalling consumption of – let's say – a non-ubiquitous apple.

In today's and tomorrow's "technology-driven" economy, the proper development of intellectual property assets is seen as crucial to business survival and advancement (Rockman, 2004). Just look around you and see how many items were not available just 50 years ago. Lately, many organizations have included intellectual property strategies in their business plans early on, rather than merely wait for a new development to emerge from their R&D Department, and then try to figure out how to best use and protect that new development. Also, in the past several years, different types of inventions have been added to the list of patentable subject matter that was not so considered before. These include computer software, methods of doing business, and biotechnology innovations. Along with the increase in patentable subject matter, many businesses have developed creative thinking in strategizing the development and use of their intellectual property. Today, intellectual property is on the radar scope of upper management, where patents, copyrights, trademarks, trade secrets, know-how, etc. are now part of strategic thinking, planning and implementation.

Although each country has its own procedures for obtaining intellectual property protection, the substance of the requirements for protectable subject matter are somewhat universal on this planet (Rockman, 2004). To obtain a patent, for example, practically every country requires that an invention be useful in a real-world environment, be novel or new (not previously publically known), and be non-obvious, or comprise an inventive step, over the relevant preceeding "prior art." The trademark laws of each country normally require that a mark you use in commerce cannot be overly descriptive, and does not confusingly conflict with a mark used on similar goods or services by another. Copyrights are broader in scope of enforceability, where the owner of a copyright in one country can normally enforce that copyright in another country, and copyrights are enforceable in most countries (except the United States) without seeking or obtaining government registration of the copyright.

2. Rules

Intellectual property is a form of property, such as real estate (Brougher, 2014). Similar to real estate, intellectual property can be owned, licensed, or transferred. Unlike real estate, however, intellectual property cannot be seen or touched. It is intangible. It is the result of a person's intellectual creative efforts. Intellectual property is an idea.

Ownership over intellectual property is essential to the development and growth of most technology companies (Brougher, 2014). Since ideas are the basis of commercially useful inventions and products, which, in turn, are the foundation of companies, the outcome of various business and financial opportunities depends upon whether or not those ideas are protected. Protection of intellectual property guarantees, to some extent, that certain assets belong to the company. Investors and potential partners often turn to a company's intellectual property portfolio in determining whether or not to pursue a partnership. As a result, successful companies and entrepreneurs place a high value on the ownership rights granted to intellectual property.

Intellectual property rules, by setting the terms of access to existing knowledge, necessarily shape the direction and content of future knowledge (Haggart, 2017). Granting current intellectual property holders full control over their works – the position of many intellectual property based industries and authors – would provide them with a veto over the future direction of economic and cultural change. Economically, such protection would allow firms to stave off competitors because they would set the terms on which newcomers would use existing knowledge to innovate and compete.

As a result, intellectual property law necessarily limits these rights in order to avoid just such monopolistic outcomes (Haggart, 2017). Copyright and patents, for example, are limited in time – generally, life of the author plus 70 years in the United States for copyright, and 20 years for patents, so that this knowledge can (eventually) be disseminated more widely, and copied, improved upon by others, and transformed into new knowledge. IP law also includes many rules allowing for knowledge to be used without seeking permission or requiring payment. For example, copyright laws often allow the copying of copyrighted works for the purposes of reporting, research or criticism, while drug patents can often be overruled to deal with pandemics. Because IP laws must encourage both protection and dissemination, these rules are not exceptions to IP rights, they are fundamental to a functioning IP regime and should be thought of as co-equal with IP's monopoly rights.

The role of rules is to stabilize expectations, by providing a framework within which certain 'proven' routines or 'solutions' evolve into rules of thumb that provide entrepreneurs with cognitive boundaries to what otherwise would be unfathomable (De Leon et al., 2017). These boundaries help them to focus their attention on the novel elements that the evolving reality brings about. Given the speculation that innovators engage in due to their endeavors to forecast future consumer needs, it clearly follows that the rules have a key role in eliminating

all possible sources of noise arising from speculation that is not strictly associated with the innovation or creation process, but rather from the activity of other economic agents with effects on the creative process, including the government. For this reason, entrepreneurial expectations are also constitutive of the system of rules, in the sense that these speculative interactions shape the set of rules that govern them; in other words, these rules are not external constraints imposed on their learning process, but rather the outcome of it. They create a filtering mechanism that conveys verified knowledge, thereby helping them to 'frame' their decision-making process.

3. Good Idea

The IP system is not always a major factor in the generation of good ideas, particularly at the early, revolutionary stages of new technological development (Leonnard, 2004). Many of the very best ideas came about with no regard for patent protection, for example. It is certain, however, that the patent system plays a vital part in the commercial exploitation of those ideas, and that patent protection has been necessary to grow the often major companies and industries that emerged from them. It is also certain that research to provide new and improved products and processes costs money, and that the investment necessary to provide for this could often not be made without the IP system, for a broad range of industries. The financial contribution from commercial sources (often IP-generated) to academic endeavour within the university sector should also be recognized.

Successful branded goods companies, of which the UK has a significant number, could not justify their major investment in brand creation and support (often much larger than the R&D investment in creating the product) without IP protection for their trade marks (Leonnard, 2004). Much of the creative industry sector, from Andrew Lloyd Webber musicals to computer games software companies, would not exist without copyright protection.

Innovation depends upon a number of interrelated factors, and optimizing the climate for innovation is complex (Leonnard, 2004). The existence of an effective IP system is an essential, but not sole, requirement for successful innovation. It will not necessarily spur an increase in innovative activity in isolation from other, equally important, provisions.

Innovation improves well-being and benefits future generations in several ways: biological innovation mitigates disease and hunger and thus contributes directly to health; innovation in communications and the organisation of information fosters educational, political and social development; innovation in smart grids leads to more efficient and sustainable energy consumption, etc (Granieri et al., 2012). And most importantly, innovation is the engine of economic growth, which is central to increasing well-being, particularly to the extent that the fruits of this economic growth flow in some measure to the least well-off.

At the same time, innovation is a very difficult subject for public policy: it is at once a pervasive and elusive subject (Granieri et al., 2012). It is pervasive since it entails both government and private investment; it is pervasive since it permeates all areas of public policy, from tax to labour, from telecoms to energy, from competition to industrial policy, from education to intellectual property, from immigration to health and agriculture, from supply-side to demand-side policies; and also, because it requires actions at global, European, national, regional and local levels. At the same time, innovation is a very elusive subject because it is hard to define; and also because there is no easy mix, no one-size-fits-all solution, no recipe bonne a tout faire ` to unleash the potential of innovation in a given country.

Fashion, food, football, and comedy are all industries in which creativity is vibrant and the patent and copyright laws are either absent or irrelevant (Raustiala et al., 2012). There are many similar examples. Few have been studied as a source of insights about innovation. The best known involves open-source software. The entire purpose of open source is to keep code "open"—to allow others freely to copy and modify what previous programmers have created. The use of copyright law to prevent copying or modification of the code is not permitted. And yet creativity flourishes and open-source software products, such as Linux and Firefox, have significant market shares. Others have explored the story of open source in depth.

There are many other fields in which IP plays little or no role in incentivizing innovation (Raustiala et al., 2012). Fonts are a vibrant creative area, with literally thousands available and many new fonts created every year. Copyright law does not eff ectively protect new fonts against copying. And the advent of digitization has made copying very easy. Rather than slow down the growth of new fonts, however, digital technology has actually accelerated it.

4. Modes

Intellectual property rights are legal entitlements that give their holders the ability to prevent others from copying or deploying the covered information in specific ways (Kapczynski, 2010). Patents, copyrights, and trademarks are the most familiar forms of intellectual property. Each regulates information in a different way. Patents typically cover forms of technological invention—once things such as machines and mousetraps and today things such as new molecules, plant varieties, and software. By describing his invention and showing that it is new, useful, and "nonobvious," an inventor can obtain a patent that gives him the right to prevent others from making, using, or selling the invention for a period of 20 years. Copyrights typically cover expressive or literary works—classically, maps, charts, and books, but today also things such as sound recordings and software. The holder of a copyright can prevent others from copying or performing the protected expression or creating "derivatives" of that expression (for example, creating a screenplay out of a novel) for upward of 100 years. Trademarks protect the use of a distinctive trade name in

commerce, permitting the holder of the mark (for example, Rolex™) to restrict its use, most centrally to ensure that consumers are not confused about the origin of a good.

The grouping of these different modes of regulation under the rubric of intellectual property is not uncontroversial (Kapczynski, 2010). Nonetheless, the rubric usefully helps us to identify a mode of legal regulation that applies to different areas of technology and commerce. In an alchemy that turns immaterial expressions and ideas into tradable commodities, intellectual property rights effectively give creators the ability to market information while also preventing it from being imitated and reproduced by others. These rights can, of course, lead to substantial revenues for those who hold them (and also to substantial economic costs for society, as I'll describe in a moment). Less obviously, but no less importantly, intellectual property doctrines that govern the ownership of creations made in the course of employment structure the distribution of benefits between corporations and employees. The so-called "work for hire" doctrine, for example, regulates whether the inventions or creations that a person makes at work belong to her or to her employer, and over the course of the nineteenth and early twentieth centuries, this doctrine became far more favorable to employers.

5. Extremes

From an economic standpoint, intellectual property protections, including patents, embody a balance between two extremes, each of which would hobble technological advance (Barfield et al., 2007). One would be to provide no property protections at all to inventors. Sometimes, secrecy can provide reasonable protection against copying of inventions by competitors, but this is often impossible in industries where regulators and users of new technology require detailed information about the products they endorse or use. Because nonsecret inventions typically can be copied at low cost (at least relative to the costs of discovery and development), competitors would quickly force market prices down toward the marginal costs of manufacturing. This would eliminate most of the expected profits that could compensate inventors for the costs and financial risks inherent to the inventive process, thus removing the most important incentive to undertake costly R&D. This "dynamic inefficiency" (so-called because it plays out over time) would inhibit innovation, so that many of the most valuable advances would be greatly delayed or perhaps not made at all.

The other extreme would be to provide inventors with permanent protection against appropriation of their inventions by competitors (Barfield et al., 2007). Patents and other intellectual property protections generate prices well above marginal costs, however. This "static inefficiency" would impede usage by buyers for whom the product is worth more than manufacturing and distribution costs but less than market prices. Perpetual patents would usually keep prices well above marginal costs until close substitutes could be brought to market, a process that might take many years.

6. Piracy

It became extremely challenging for legislators in the digital era to make new laws in medial usage because technology—particularly with the creation of mobile streaming apps for smart phones—was rapidly outpacing the rules and regulations even as they were being written (Pitt, 2015). Cynics have argued that many executives in the music industry assumed that "lost sales" from piracy could be easily recovered. The rationale was simple: If consumers weren't busy pirating content, they would be flocking to music stores to buy CDs, purchasing seats, merchandise and concession items at live concerts or listening to terrestrial radio to boost ratings and advertising revenue.

In point of fact, it was hard to quantify the real threats and opportunities that piracy and the disruption associated with digital technology presented—except for attorney fees—because some "pirates" eventually spent money on other music content, merchandise or concert tickets after discovering new music through piracy (Pitt, 2015). Still, others may have downloaded the pirated content because it was readily or easily available, but they had no intention of purchasing anything because it was too expensive to obtain it legitimately. The piracy argument would later strain credulity as technology; competition; innovation; economic and financial conditions; and consumer preferences would expose the structural problems in the music industry that led to the decline in revenue. Legitimate music and video services such as iTunes, Netflix, and Spotify would later demonstrate that some of the best methods to combat piracy—and its associated unmet consumer demand— was not copyright infringement lawsuits, but to use the right combination of price (singles versus bundles), aggregated inventory (combined music and video catalogs of copyright owners), technology (higher-quality streaming, smart phones, tablets and personal computers), and convenience (content available anytime or anyplace and binge-viewing).

7. Economic Discourse

The economic discourse of intellectual property (originating from both law and economics and pure economics studies) dominates lawmaking processes and policy debates related to the regulation of the information environment (Elkin-Koren et al., 2013). It has affected intellectual property laws in various junctures related to legislative processes and court litigation in the United States, Europe and elsewhere. This is especially surprising in Europe, where the foundations of IP law are deontological. Copyright, for example, has been viewed in Europe as protecting a set of natural entitlements of authors. In contrast, the US Constitution, which authorized Congress to legislate in the area of intellectual property, has taken a teleological-consequential approach. Congress was authorized to grant authors and inventors exclusive rights for a limited time, in order to promote the progress of science and useful art (Article 1, Section 8 of the US Constitution). Yet, the economic discourse has been explicitly applied by US courts to intellectual property law only from the mid 1980s. Despite

its deontological origins, economic arguments are playing an increasing role in the European intellectual property regimes and affecting law-making processes related to intellectual property both on the European Union level and on the national state level. It seems that the economic discourse of IP became dominant globally, mitigating the moral foundations' differences.

The economic approach to intellectual property is often described as a monolithic and coherent approach (Elkin-Koren et al., 2013). Yet, the growing literature of law and economics on intellectual property, and indeed pure economics writings in this field, do not speak in one voice. The economic discourse used in legal scholarship and in policy-making encompasses several strands, each reflecting a fundamentally different approach to the economics of informational works, and each grounded in a different ideology or methodological paradigm. Identifying the different economic approaches to intellectual property is critical for understanding the ramifications of using economic analysis of law in policy-making. Careful analysis of the underlying assumptions of these approaches is also necessary in order to appreciate the frameworks' limitations in confronting the challenges of the information revolution.

8. Conclusion

Intellectual property can be defined as the ownership of ideas and creative inventions based on a public will to grant property status. Intellectual property is a prerequisite for better identification, planning, commercialization, service provision, protection of inventions etc. Each industry needs to develop its own intellectual property rights policy. Intellectual property rights have become one of the most important issues raised in business negotiations. The content of intellectual property rights allows for better negotiating positions. The legal protection of intellectual property can be said to have a quality legal framework. In order for the protection of intellectual property to be as high quality as possible, it is necessary to improve it in a way that follows modern world trends. It is not worse to repeat that the existence of intellectual property in any form enables better negotiating positions in concluding business contracts. In this direction, it is necessary to conduct future scientific research because only in this way can be realized the benefits arising from intellectual property rights.

References:

1. Barfield, C., Calfee, J. E. (2007). Biotechnology and the Patent System - Balancing Innovation and Property Rights. American Enterprise Institute, Washington, USA, pp. 24 – 25
2. Brougher, J. T. (2014). Intellectual Property and Health Technologies - Balancing Innovation and the Public's Health. Springer Science + Business Media, New York, USA, pp. 1
3. De Leon, I., Donoso, J.F. (2017). Innovation, Startups and Intellectual Property Management - Strategies and Evidence from Latin America and other Regions. Springer International Publishing AG, Cham, Switzerland, pp. 5
4. Elkin-Koren, N., Salzberger, E. M. (2013). The Law and Economics of Intellectual Property in the Digital Age - The Limits of Analysis. Routledge, Abingdon, UK, pp. 4– 5
5. Granieri, M., Renda, A. (2012). Innovation Law and Policy in the European Union - Towards Horizon 2020. Springer-Verlag Italia, Milan, Italy, pp. 2
6. Haggart, B. (2017). What is Intellectual Property? in Callahan, M.; Rogers, J. (eds): A Critical Guide to Intellectual Property, Zed Books Ltd, London, UK, pp. 220
7. Kapczynski, A. (2010). Access to Knowledge: A Conceptual Genealogy in Krikorian, G.; Kapczynski, A. (eds): Access to Knowledge in the Age of Intellectual Property, Zone Books, New York, USA, pp. 23
8. Kurr, A., Dreier, T. (2013). European Intellectual Property Law - Text, Cases and Materials. Edward Elgar Publishing Limited, Cheltennham, UK, pp. 6
9. Leonnard, P. (2004). Innovation in Jolly, A.; Philpott, J. (eds): A Handbook of Intellectual Property Management - Protecting, Developing and Exploiting your IP Assets, Kogan Page Limited, London, UK, pp. 29– 30
10. Pitt, I. L. (2015). Direct Licensing and the Music Industry - How Technology, Innovation and Competition Reshaped Copyright Licensing. Springer International Publishing Switzerland, Cham, Switzerland, pp. 74 – 75
11. Raustiala, K., Sprigman, C. (2012). The Knockoff Economy - How Imitation Sparks Innovation. Oxford University Press, Oxford, UK, pp. 14
12. Rockman, H. B. (2004). Intellectual Property Law for Engineers and Scientists. Institute of Electrical and Electronics Engineers, John Wiley & Sons, Inc., Hoboken, USA, pp. 12

dr.sc. Haris Hamidović, dipl.ing.el.[1]
dr.sc. Jasmina Kabil-Hamidović, dipl. defektolog logoped[2]
mr. med. sc. dr. Maja Konrad Čustović[3]
Edina Šehić, dipl. ing. inf. teh.[4]

Professional paper

PERSONAL DATA PROCESSING - THE ISSUE OF LOGGING AND MONITORING

Abstract

According to Law on Protection of Personal Data in Bosnia and Herzegovina, the data controller and, within the scope of its competences, the data processor are required take care of data security and shall take all technical and organizational measures and develop rules of procedure required for the enforcement of this Law and other regulations concerning data protection. They also have an obligation to develop the data security plan, which shall specify technical and organizational measures for security of personal data. Pursuant to the bylaw Regulation on the manner of keeping and special measures of technical protection of personal data, the personal data security plan must contain technical and organizational measures that shall ensure, among other things, that it can be verified who processed the personal data: when, which personal data and in which manner – possibility of revision. In this paper, through the presentation of two case studies in the field of health services, we point out the importance of timely addressing the issue of fulfilling the obligation to keep appropriate records on the processing of a special category of personal data - health data.

Keywords: Personal Data, Health Data, Law on Protection of Personal Data, Information Security.

1 doc.dr., Visoka škola „Internacionalna poslovno-informaciona akademija" Tuzla, mr.haris.hamidovic@ieee.org
2 Klinika za bolesti uha, grla i nosa, Univerzitetski Klinički Centar Tuzla, jasminakabil@gmail.com
3 Poliklinika za laboratorijsku dijagnostiku, Zavod za patologiju ,Univerzitetski Klinički Centar Tuzla, maja.konrad-custovic@ukctuzla.ba
4 Visoka škola „Internacionalna poslovno-informaciona akademija" Tuzla, edina.salkanovic@gmail.com

1. Introduction

According to EU General Data Protection Regulation „personal data concerning health include all data pertaining to the health status of a data subject which reveal information relating to the past, current or future physical or mental health status of the data subject. This includes information about the natural person collected in the course of the registration for, or the provision of, health care services as referred to in Directive 2011/24/EU of the European Parliament and of the Council (1) to that natural person; a number, symbol or particular assigned to a natural person to uniquely identify the natural person for health purposes; information derived from the testing or examination of a body part or bodily substance, including from genetic data and biological samples; and any information on, for example, a disease, disability, disease risk, medical history, clinical treatment or the physiological or biomedical state of the data subject independent of its source, for example from a physician or other health professional, a hospital, a medical device or an in vitro diagnostic test" (Official Journal of the European Union, 2016).

Domestic legislation treats health data as a special category of personal data, for which Article 10 of the Law on Personal Data Protection states that "special category of personal data may not be automatically processed unless the appropriate protection has been provided for by law" (Official Gazette of Bosnia and Herzegovina, 2006). Based on the bylaw in Bosnia and Herzegovina, in addition to the mandatory organizational and technical measures required for all controllers and processors, additional measures are prescribed related to the protection for special categories of personal data (Official Gazette of Bosnia and Herzegovina, 2009).

„While the protection and security of personal information is important to all individuals, corporations, institutions and governments, there are special requirements in the health sector that need to be met to ensure the confidentiality, integrity, auditability and availability of personal health information. This type of information is regarded by many as being among the most confidential of all types of personal information. Protecting this confidentiality is essential if the privacy of subjects of care is to be maintained. The integrity of health information must be protected to ensure patient safety, and an important component of that protection is ensuring that the information's entire life cycle be fully auditable. The availability of health information is also critical to effective healthcare delivery", emphasizes the international standard ISO 27799 (ISO, 2016) (Hamidovic, Kabil, 2011).

COVID-19 provided fertile ground for attackers to sow confusion and take advantage of healthcare organizations on the front lines. Attacks against the healthcare sector demonstrate maliciousness on an unprecedented scale. While their methods vary, their goal is the same: grab sensitive data to steal, sell, or extort, indicates Varonis the 2021 Healthcare Data Risk Report.

However, the threat does not come only from the outside. Analyzing the case law of the European Court of Human Rights, the Personal Data Protection

Agency of Bosnia and Herzegovina states in one of its annual reports that due to the violation of the right to privacy guaranteed by Article 8 of the Convention, the European Court of Human Rights has issued a number of judgments against states. A larger group of verdicts concerns the responsibility of the state due to omissions in the protection of medical records of citizens and confidential data contained in them (AZLP, 2011).

According to Law on Protection of Personal Data in Bosnia and Herzegovina, the data controller and, within the scope of its competences, the data processor are required take care of data security and shall take all technical and organizational measures and develop rules of procedure required for the enforcement of this Law and other regulations concerning data protection. They also have an obligation to develop the data security plan, which shall specify technical and organizational measures for security of personal data. Pursuant to the bylaw Regulation on the manner of keeping and special measures of technical protection of personal data, the personal data security plan must contain technical and organizational measures that shall ensure, among other things, that it can be verified who processed the personal data: when, which personal data and in which manner – possibility of revision.

In this paper, through the presentation of two case studies in the field of health services, we point out the importance of timely addressing the issue of fulfilling the obligation to keep appropriate records on the processing of a special category of personal data - health data.

2. Case studies

2.1. Health Center S from Bosnia and Herzegovina

The Agency for Personal Data Protection of Bosnia and Herzegovina was approached by person A, who filed a complaint against Health Center S from Bosnia and Herzegovina due to unjustified access to her electronic health records. Acting upon the submitted complaint, the Agency found that Health Center S did not prove justification for 45 accesses to the electronic health records of the complainant, given that access to the electronic health records was performed by persons who did not participate in its treatment or persons employed in field clinics who did not have consent and were not required by law to do so.

In the reasoning of the judgment the Court of Bosnia and Herzegovina confirmed the decision of the Agency for Personal Data Protection of Bosnia and Herzegovina ordering the Health Center S to adopt and implement organizational and technical measures for personal data protection, and within them prescribes the obligation to record access grounds and conduct periodic internal control of access to personal data of the patient. The Court confirmed that the fact that in the disputed electronic information system all employees, including field clinics, are allowed to enter the health records of patients, does not release Health Center S as a controller from responsibility. In this case,

the personal data protection plan of Health Center S should include the part related to the information system. Health Center S, as a controller, was obliged to regulate the use of this information system, i.e. to limit and take measures in order to prevent the violation of the Law on Personal Data Protection of Bosnia and Herzegovina, which it did not do (Court of Bosnia and Herzegovina, 2019).

2.2. Polyclinic for eye diseases from Finland

Between 1989 and 1994 person B worked on fixed-term contracts as a nurse in the polyclinic for eye diseases in a Finland public hospital. From 1987 she paid regular visits to the polyclinic for infectious diseases of the same hospital, having been diagnosed as HIV-positive. Early in 1992 the person B began to suspect that her colleagues were aware of her illness. At that time hospital staff had free access to the patient register which contained information on patients' diagnoses and treating doctors. Having confided her suspicions to her doctor in summer 1992, the hospital's register was amended so that henceforth only the treating clinic's personnel had access to its patients' records.

On 25 November 1996, the person B complained to the County Administrative Board, requesting it to examine who had accessed her confidential patient record. Upon request, the director in charge of the hospital's archives filed a statement with the County Administrative Board, according to which it was not possible to find out who, if anyone, had accessed the applicant's patient record as the data system revealed only the five most recent consultations (by working unit and not by person) and even this information was deleted once the file was returned to the archives. Subsequently, in March 1998, the hospital's register was amended in that it became possible retrospectively to identify any person who had accessed a patient record.

The European Court of Human Rights notes that the person B lost her civil action because she was unable to prove on the facts a causal connection between the deficiencies in the access security rules and the dissemination of information about her medical condition. However, to place such a burden of proof on the person B - applicant before the Court is to overlook the acknowledged deficiencies in the hospital's record keeping at the material time.

"The protection of personal data, in particular medical data, is of fundamental importance to a person's enjoyment of his or her right to respect for private and family life as guaranteed by Article 8 of the Convention. Respecting the confidentiality of health data is a vital principle in the legal systems of all the Contracting Parties to the Convention. It is crucial not only to respect the sense of privacy of a patient but also to preserve his or her confidence in the medical profession and in the health services in general", stressed from the Court (ECHR, 2008).

3. Legally required technical protection measures

Based on Bosnia and Herzegovina domestic legislation, the personal data security plan should contain technical and organizational measures that shall ensure that (Official Gazette of Bosnia and Herzegovina, 2006):

a) *Only authorized persons can know the personal data - confidentiality;*
b) *During the processing the personal data remain unchanged, full and accurate - integrity;*
c) *That the data are always available and at disposal and can be properly processed - availability;*
d) *At any time, the origin of personal data can be determined - authenticity;*
e) *That it can be verified who processed the personal data: when, which personal data and in which manner – possibility of revision;*
f) *The procedure of personal data processing is complete, up-dated and correspondingly recorded - transparency.*

The bylaw of the Law on Personal Data Protection specifies specific organizational and technical measures that data controllers and processors should have implemented, such as (Official Gazette of Bosnia and Herzegovina, 2009):

Article 7 (Technical measures)

(1) Personal data automatic processing controller should ensure the technical measures of personal data protection such as:

a) *Unique user name and password containing combinations of a minimum of six characters, numbers or letters;*
b) *Automatic password change per agreed time period which may not be longer than six months;*
c) *The user name and the password shall allow access only to parts of the system necessary for the executer to carry out his/her work duties;*
d) *Automatic log-off from the system after agreed period of inactivity, not longer than 15 minutes, and re-activation of the system requires new log-in of the user name and password;*
e) *Automatic ban to the system access after three failed system log-ins with automatic warning to the executer to ask the personal data filing systems administrator for instructions;*
f) *Efficient and reliable antivirus protection system hat shall be continuously updated for prevention of unintended or unknown risks of new viruses;*
g) *Computer, software and other necessary equipment connected to electric power network by means of continuous power supply device.*

(2) In the case from the item (1) of this Article the personal data filing systems administrator grants further access to the system.

(3) The human resources officer shall report to the personal data filing systems administrator on the employment or engagement of each executive authorized to access the information system in order to be assigned user name and password, as well as on termination of employment or engagement in order to erase user name and password or delete to forbid further access.

(4) The reporting referred to in paragraph (3) of this Article is also done with any other change of working status of the executer that affects the level or extent of access to personal data filing systems.

Although Article 7 (c) of Regulation prescribes that controllers and processors should ensure the technical measures of personal data protection such as "the user name and the password shall allow access only to parts of the system necessary for the executer to carry out his/her work duties…", we are of the opinion that the court in Case study 1 correctly recognizes the specifics of work in health care institutions where it is not possible always to know in advance which doctor will provide health care to which patient and in which health care institution, but it must be known who accessed health care data and why and it to be subject to periodic audit to avoid abuse.

Separating responsibilities and enabling access only to those parts of the system and data that are necessary to perform business tasks is the preferred option, but this is not always possible, and is therefore necessary to introduce alternative controls. Information security good practices state that duties and areas of responsibility should be segregated to reduce the potential for unauthorized or unintentional modifications or misuse of an organization's assets. Separation of duties is method for reducing the risk of inadvertent or intentional misuse of the system. Care should be taken that no person can access, modify or use the property without authorization or detection. The initiation of an event should be separate from the authorization of that event. The possibility of collision should be considered when designing controls. However, it may be difficult for small organizations to achieve segregation of duties, but this principle should be applied as far as possible and practically. Wherever they are difficult to separate, other controls such as activity oversight, inspections, and management oversight should be considered. It is important that security control remain independent.

4. Information security management in health care institutions

Establishing an information security management system in health care institutions has a number of challenges, and therefore the International Organization for Standardization has developed specific guidelines for these types of environments - ISO 27799:2016 Health informatics — Information security management in health using ISO/IEC 27002.

Good practices presented by international standard ISO 27799 emphasize that "of all security requirements protecting personal health information, among the most important are those relating to audit and logging. These ensure

accountability for subjects of care entrusting their information to electronic health record systems and also provide a strong incentive to users of such systems to conform to the policies on the acceptable use of these systems. Effective audit and logging can help to uncover misuse of health information systems or of personal health information. These processes can also help organizations and subjects of care to obtain redress against users abusing their access privileges" (ISO, 2016).

ISO 27799 states the following guidance on implementation of controls identified as audit logging "in addition to following the guidance given by ISO/IEC 27002, health information systems processing personal health information should create a secure audit record each time a user accesses, creates, updates or archives personal health information via the system. The audit log should uniquely identify the user, uniquely identify the data subject (i.e. the subject of care), identify the function performed by the user (record creation, access, update, etc.), and note the time and date at which the function was performed. When personal health information is updated, a record of the former content of the data and the associated audit record (i.e. who entered the data on what date) should be retained" (ISO, 2016).

Furthermore, ISO 27799 indicates the need that the organization should carefully assess and determine the retention period for these audit logs, with particular reference to clinical professional standards and legal obligations, in order to enable investigations to be carried out when necessary and to provide evidence of misuse where necessary (ISO, 2016).

ISO 27799 good practices also require that health information systems containing personal health information should be provided with facilities for analyzing logs and audit trails that (ISO, 2016):

- allow the identification of all system users who have accessed or modified a given subject of care's record(s) over a given period of time;
- allow the identification of all subjects of care whose records have been accessed or modified by a given system user over a given period of time.

The ISO 27799 standard itself also states recommendations regarding:

- Protection of log information
- Clock synchronization

5. EU practices

Given the rapid technological development and new ways of data processing, there was a need for personal data protection reform in the European Union. The technology was much different about 20 years ago when Directive 95/46 / EC of 24.10.1995 was adopted. Today, with the widespread use of social media, applications and the Internet in general, personal data is shared and

transmitted across borders more than ever before. The directive was limited and represented the minimum legal standards that EU members had to incorporate into their national data protection laws, so each member drafted its own laws. The new Regulation has solved this problem. As a Regulation, a single data security law regime is directly imposed on all EU members. There is no need for Member States to adopt legislation in order for the new Regulation to become law in a Member State, because after the adoption of the GDPR it became law in every Member State, thus harmonizing data protection laws in all EU Member States. The regulation also creates clarity for companies by establishing a single EU-wide law, so it should simplify the legislative framework and facilitate harmonization for companies operating in more than one Member State. The new law gives users more control over the use of their data, creates trust, legal certainty and fairer competition (Hamidović, 2020).

When it comes to the impact of the General Regulation on the citizens of Bosnia and Herzegovina and domestic personal data controllers operating in the territory of the EU, the Regulation itself will have a certain impact on them, regardless of the harmonization of domestic legislation.

According to Article 3 of the Regulation, it follows that the same will apply to the processing of personal data within the activities of business entities established in the Union, regardless of whether the processing of personal data takes place in the Union or not. So, if the data controller based in the Union has business branches in Bosnia and Herzegovina or in any way provides services to citizens in Bosnia and Herzegovina, then these regulations will apply to the citizens of BiH.

On the other hand, according to the same article of the Regulation (paragraph 2), companies from Bosnia and Herzegovina operating in the Union or offering goods or services to citizens of the Union are obliged to apply the Regulation.

Therefore, even in the conditions that the domestic legislation is not harmonized with the European one, the new regulations for personal data protection, under certain conditions, will be applied to the citizens of Bosnia and Herzegovina, as well as to domestic controllers if they do business with the Union. It is therefore necessary to find a solution to bring data processing in line with both EU standards and current legislation in force in Bosnia and Herzegovina.

According to the European Union Agency for Cybersecurity (ENISA), the European Union's agency dedicated to achieving a high common level of cybersecurity across Europe, the use of log files is an essential security measure that enables identification and tracking of user actions (with regard to the processing of personal data), thus supporting accountability in case of an unauthorized disclosure, modification or destruction of personal data. Monitoring of log files is important for identifying potential internal or external attempts for system violation. ENISA on-line tool for the security of personal data processing - Risk level assessment - Security measures on the subject in question states the following (ENISA, 2021):

Table 1. Logging and monitoring security measures (ENISA, 2021)

MEASURE IDENTIFIER	MEASURE DESCRIPTION	RISK LEVEL
L.1	Log files should be activated for each system/ application used for the processing of personal data. They should include all types of access to data (view, modification, deletion).	
L.2	Log files should be timestamped and adequately protected against tampering and unauthorized access. Clocks should be synchronized to a single reference time source	
L.3	Actions of the system administrators and system operators, including addition/deletion/ change of user rights should be logged.	
L.4	There should be no possibility of deletion or modification of log files content. Access to the log files should also be logged in addition to monitoring for detecting unusual activity.	
L.5	A monitoring system should process the log files and produce reports on the status of the system and notify for potential alerts.	

The following risk level labels were used: low: green, medium: yellow, high: red.

The ENISA tool states that the measures mentioned above are related to ISO 27001:2013 - A.12.4 Logging and monitoring, which objective is to record events and generate evidence:

- A.12.4.1 Event logging Control: Event logs recording user activities, exceptions, faults and information security events shall be produced, kept and regularly reviewed.
- A.12.4.2 Protection of log in formation Control: Logging facilities and log information shall be protected against tampering and unauthorized access.
- A.12.4.3 Administrator and operator logs Control: System administrator and system operator activities shall be logged and the logs protected and regularly reviewed.
- A.12.4.4 Clock synchronization Control: The clocks of all relevant information processing systems within an organization or security domain shall be synchronized to a single reference time source.

6. The issue of access rights to system records

Access rights to system records for security administrators who need to perform their regular activities should be strictly controlled (Hamidović, 2021).

Computer security managers and system administrators should have access to review levels; however, security and / or administrative staff maintaining logical access functions may not need to access audit logs.

It is especially important to ensure the integrity of the audit trail data from any changes. This can be done using digital signatures, a one-time entry device, or a security information and event management system (SIEM). Audit trace files must be protected because intruders may try to conceal their traces by changing the audit trace records. Audit trail records should be protected by strong access controls to prevent unauthorized access. The integrity of audit trail information can be particularly important when legal issues arise, such as the use of audit trails as legal evidence (ISACA, 2015).

7. Conclusion

The protection of the rights and freedoms of individuals with regard to the processing of personal data requires that appropriate technical and organizational measures be taken. In order to demonstrate compliance with legal requirements, the controller should introduce internal policies and implement measures that particularly meet the principles of technical data protection and integrated data protection. Such measures consist, inter alia, of the use of log files that enables identification and tracking of user actions (with regard to the processing of personal data), thus supporting accountability in the case of an unauthorized disclosure, modification or destruction of personal data, and which is confirmed by the examples from case law cited in the paper.

The Law on Personal Data Protection of Bosnia and Herzegovina prescribes fines for controller up to 100,000 KM (about 50,000 euros) if fails to develop the data security plan, but also if it does not take all necessary measures and procedures against unauthorized or accidental access to personal data, their alteration, destruction or loss, unauthorized transfer, other forms of illegal data processing, as well as measures against misuse of personal data.

Establishing a Privacy Information Management System based on good practices from the ISO 27000 series can help healthcare organizations in the appropriate protection of special categories of personal data they process, but also demonstrable compliance with legal obligations, thus avoiding the risk of fines and lawsuits.

References:

1. AZLP. (2011). Izvještaj o zaštiti ličnih podataka u Bosni i Hercegovini za 2010. godinu
2. ECHR. (2008). Judgment in the case of I v. Finland, The European Court of Human Rights. https://www.cl.cam.ac.uk/~rja14/Papers/echr-finland.pdf (Date of access: 22.04.2021)
3. ENISA, (2021). On-line tool for the security of personal data processing, Risk level assessment - Security measures URL: https://www.enisa.europa.eu/risk-level-tool/help Date of access: 22.04.2021.
4. Hamidovic, H., Kabil, J. (2011). An Introduction to Information Security Management in Health Care Organizations. ISACA Journal
5. Hamidović, H. (2020). Tehničke i organizacijske mjere zaštite ličnih podataka. Repro-Karić, Tuzla
6. Hamidović, H. (2021). Pitanje izrade i upravljanja revizijski trag zapisima. Pravo i finansije, Maj 2021, pp. 89 – 92
7. ISACA. (2015). CISA Review Manual. 26th Edition
8. ISO. (2016). ISO 27799:2016 Health informatics — Information security management in health using ISO/IEC 27002. International Organization for Standardization
9. ISO/IEC. (2019). ISO/IEC 27701:2019 Security techniques — Extension to ISO/IEC 27001 and ISO/IEC 27002 for privacy information management — Requirements and guidelines
10. Official Gazette of Bosnia and Herzegovina. (2006). Law on Protection of Personal Data. Official Gazette of Bosnia and Herzegovina, 49/06, 76/11
11. Official Gazette of Bosnia and Herzegovina. (2009). Regulation on the manner of keeping and special measures of technical protection of personal data. Official Gazette of Bosnia and Herzegovina, 67/09
12. Official Journal of the European Union. (2016). Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). Official Journal of the European Union, L, 119/1
13. Court of Bosnia and Herzegovina. (2019). Judgment number: S1 3 U 031486 19 http://azlp.ba/upravni_sporovi/default.aspx?id=2784&langTag=bs-BA (Date of access: 22.04.2021)

Enaida Bejdić[1] *Review paper*

DIGITAL INTELLIGENCE

Abstract

According to DQ Institute, Digital Intelligence is a comprehensive set of technical, cognitive, meta-cognitive, and socio-emotional competencies grounded in universal moral values that enable individuals to face the challenges of digital life and adapt to its demands. Compared to the exponential speed of connectivity and technology advances, implementation of effective digital competency education, training programs, and policies occur at a far slower pace and this speed gap is increasingly growing. Such gaps have yielded serious, unintended negative consequences for individuals as well as for society as a whole – cyberbullying, technology addiction, online grooming, the spread of digital misinformation, privacy invasion, security threats, and many others. Until last year, there were no shared, global understanding of what terms such as digital literacy and digital skills mean. DQ Framework was created by Dr. Yuhyun Park and developed through an academically rigorous process by her research team. Framework is structured around two categories: areas and levels of digital intelligence. Eight broad areas have been identified: digital identity, digital use, digital safety, digital security, digital emotional intelligence, digital communication, digital literacy and digital rights. IEEE recognized the comprehensive and adaptive nature of the DQ Framework and decided to institutionalize the DQ Framework - standard for DQ IEEE 3527.1 was approved on 24 September 2020. This would be one of the steps in managing our digital reality which leaves us with the task of constantly measuring and reviewing of what has been achieved. This way, further negative and possibly even worse consequences can be prevented.

Keywords: digital intelligence, digital literacy, IEEE 3527.1 standard, digital skills.

1. Introduction

The focus of this paper is: we have invested a lot of effort and time in the digital transformation project, we have successfully implemented it, put the company in good market position, we are satisfied with the results. We made detailed plans and analyzes, educated ourselves, armed ourselves with knowledge,

1 Bachelor of Information Technology, email: enaida.bejdic@yahoo.com

tools and a well-thought-out strategy, we developed ecosystems and complied our business with legal regulations. We have selected the appropriate technologies, measured the development and success of the digital transformation, defined the goals and set performance indicators. We have empowered our employees and developed a digital culture. Workers are educated, aware of change and they are managing it successfully.

But important moment in the overall concept of digital transformation is that it is unsustainable without its primary and inseparable component - digital intelligence. For all of the above to be successful in the long run, we must not only develop digital intelligence but also standardize digital literacy. In order to master technology and the changes that accompany its application, we must raise our digital literacy to a level that gives us, the human race, an upper hand and a clear vision in directing our own development towards human centric intelligent society.

2. The Fourth Industrial Revolution

Professor Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, has been at the centre of global affairs for over four decades. He is convinced that we are at the beginning of a revolution that is fundamentally changing the way we live, work and relate to one another. Previous industrial revolutions liberated humankind from animal power, made mass production possible and brought digital capabilities to billions of people. This Fourth Industrial Revolution is, however, fundamentally different. It is characterized by a range of new technologies that are fusing the physical, digital and biological worlds, impacting all disciplines, economies and industries, and even challenging ideas about what it means to be human (Schwab, 2017).

Schwab puts the most recent changes into historical context, outlines the key technologies driving this revolution, discusses the major impacts on governments, businesses, civil society and individuals, and suggests ways to respond. At the heart of his analysis is the conviction that the Fourth Industrial Revolution is within the control of all of us as long as we are able to collaborate across geographies, sectors and disciplines to grasp the opportunities it presents.

In particular, Schwab calls for leaders and citizens to “together shape a future that works for all by putting people first, empowering them and constantly reminding ourselves that all of these new technologies are first and foremost tools made by people for people” (Schwab, 2017).

3. IQ, EQ and DQ (Digital Intelligence)

History tells us that every industrial revolution that brings new technological advances has also produced structural changes in societal and economic systems. When a society passes through a revolution and individuals in the society try to adapt to a new system, the focus of a human’s perceived worth

shifts as well. New forms of intelligence reflecting the evolving focus of a human's worth, have emerged after each industrial revolution, and have served as a framework for children's education, industry workforce development and related government policies (Park, 2019).

The First and Second Industrial Revolutions of the late 18th and late 19th centuries enabled mechanical means of production at mass scale with increasing levels of efficiency. With industrious machines, a human's physical skills became less important and mental strength - knowledge and skills - became a more valuable trait, thereby changing the focus of a human's worth: shifting from body to mind, especially knowledge. As a result, the concept of intelligence emerged and, in 1912, a German psychologist, William Stern, developed the concept of IQ, or "Intelligence Quotient", as a measure of human knowledge and "cognitive skills". Consequently, the current school-based education system has developed, with a focus on developing knowledge workers.

The Third Industrial Revolution of the late 20th century led to the proliferation of computers and the shift to a service-based economy. The rise of electronic devices and the Internet changed how we interact, work and play. This evolved society, with its heightened complexity, demanded that individuals have so-called "soft skills" that enable individuals to deal with multi-layered personal interactions, complex conflicts, and sophisticated negotiations, thereby again changing the focus of a human's worth: from knowledge to emotions and relationships. In 1964, Michael Beldoch developed the concept of EQ, or "Emotional Intelligence Quotient" that includes empathy, self-awareness, relationship management, and other soft skills. The EQ concept was later popularized and acknowledged by business leaders as a key component of individual skills development that led to business success beyond IQ alone.

Within the last decade, we have entered the Fourth Industrial Revolution, which is bringing together digital, physical, biological, and technological advances in an integrated fashion. Just as the Second Industrial Revolution triggered the replacement of human physical labor with machines, the Fourth Industrial Revolution is triggering the replacement of human mental labor with artificial intelligence, automation, and other digital innovations. It has been estimated that these technological advances will render over 75 million current jobs obsolete over the next four years while creating 133 million new ones over the same period. These new types of jobs will require new skills that allow humans to productively utilize technology – skills that go beyond physical, cognitive, and soft skills: "digital skills".

An important aspect to notice is that the Fourth Industrial Revolution has also yielded another shift in the focus of a human's worth - shifting from mind, including knowledge, emotions, and relationships, to spirit, including wisdom and values. This wisdom, together with contextual understanding and insights, has become more important than practical knowledge and skills, which can now be easily aggregated through the Internet. Universal moral values such as respect, kindness, and compassion make humans unique and distinguishable from machines. Such wisdom and values enable individuals to have a strong

identity as a "master of technology" who can fully capitalize on new technologies, and thrive in this fast-changing digital age. Individuals with such agency are encouraged to have agility, adaptability, and lifelong learning aptitude.

Just as IQ and EQ were born after the 2nd and 3rd Industrial Revolutions in the 19th and 20th centuries, respectively, now in the 21st century, we need a new form of intelligence called DQ or "Digital Intelligence Quotient" – Figure 1.

It is a comprehensive set of digital competencies rooted in universal moral values for individuals to use, control, and create technology to advance humanity. DQ aims to address the needs of educational systems, industries, and governments by providing a shared global blueprint to harness technology for a shared prosperous future during this 4th Industrial Revolution and far beyond.

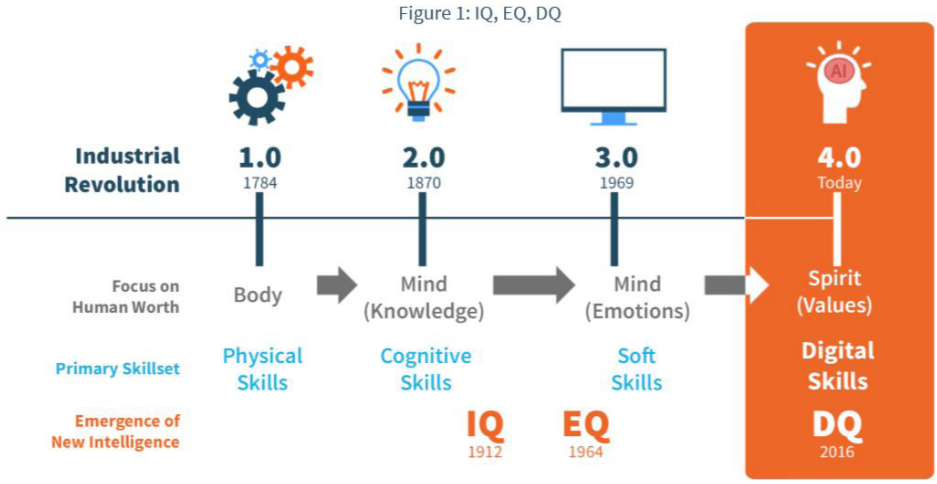


Figure 1. Development of intelligence forms through industrial revolutions
Source: DQ Global Standards Report 2019 (Park, DQ Institute, 2019)

4. Why Global Standards?

In an increasingly technology-oriented society, digital competencies such as digital literacy, digital skills, and digital readiness have become core requirements for the future- and job-readiness of individuals. The OECD (Organization for Economic Co-operation and Development), the World Economic Forum (WEF), the World Bank, and the United Nations have all identified these competencies as fundamental for our changing world (Park, 2019).

However, compared to the exponential speed of connectivity and technology advances, implementation of effective digital competency education, training programs, and policies occur at a far slower pace and this speed gap is increasingly growing. Such gaps have yielded serious, unintended negative con-

sequences for individuals as well as for society as a whole. One of the most serious issues is the worldwide, high prevalence of cyber-risks among children such as cyberbullying, technology addiction, online grooming, the spread of digital misinformation, privacy invasion, security threats, and many others.

According to the 2018 DQ Impact Report, more than 50% of 8- to 12-year-old children across 29 countries have been involved in at least one of the following cyber-risks: cyberbullying, video game addiction, offline meetings, and online sexual behavior. This report addressed the imperative to equip children with a holistic set of digital life skills to become ethical and discerning digital citizens who can proactively mitigate various cyber-risks, while maximizing the potential of technology.

On the other hand, the WEF's 2018 Future of Jobs report stressed an "upskilling imperative" for the workforce in an increasingly digitized world. Without a doubt, a workforce sufficiently equipped with a comprehensive set of digital competencies would have a greater chance of standing to gain from new job opportunities arising from technological advances.

However, a lack of digital competencies among adults is another big issue for industries and nations. Moreover, for communities already at the margins of society, the question of how digital inclusion and upskilling should be addressed cannot be underestimated. Evidence of an ever-widening digital competency gap among people in developing countries, underprivileged communities of low-socioeconomic status, women, seniors, and/or children changes the calculus in our understanding of where to channel resources for skill-building programs and initiatives: the socioeconomic and political implications of escalating economic and social inequalities are huge. Here, the imperative is immediate and requires scalable and sustainable efforts.

In order to address these digital competency gaps, today, governments, companies, and organizations are spending millions of dollars on digital competency education, and training. However, at present, there is no shared, global understanding of what terms such as "digital literacy," "digital skills," and "digital readiness" mean. Across sectors, for example, "digital skills," "digital literacy", "digital readiness", and "digital competency" are used interchangeably: technology developers often use the term "digital skills," where "skill" is a component of a "competency" used by educators and academia. In contrast, the term "digital literacy" as commonly used by the education community is categorized as one of many "skills" in the industry community.

This leads to the use of different - but overlapping - terminologies and initiatives across different sectors, communities, and nations. This predicament leads to current efforts lacking coordination, scalability, and comprehensive scope. At present, addressing how to sustain and improve best practices is difficult, if not impossible.

Moreover, it also makes meaningful monitoring and reporting difficult. In the absence of a common understanding of digital competencies including digital literacy, skills and readiness, we leave ourselves unequipped not only to un-

derstand the current progress of digital competency movements in the world today, but also to grapple with what forms of digital competency should be taught and to whom. For the world to build comprehensive digital competencies with speed, scalability, and sustainability, there is an urgent need for effective coordination and consensus towards building a common framework with a set of definitions, structure, and taxonomy.

To address these needs, the Coalition for Digital Intelligence (CDI), a platform created in association with the World Economic Forum (WEF) and formed jointly by the DQ Institute, Organization for Economic Co-operation and Development (OECD), and IEEE Standards Association (IEEE), was started on 26 September 2018 with the aim of establishing a global, common language and set of norms around digital competencies, and coordinating global actions.

As part of its efforts, this 2019 DQ Global Standards Report is the first attempt to define the DQ framework as the common framework of digital literacy, skills, and readiness that can be globally used as a reference framework across the education and technology sectors.

5. Definiton of DQ

Digital Intelligence (DQ) is a comprehensive set of technical, cognitive, metacognitive, and socio-emotional competencies grounded in universal moral values that enable individuals to face the challenges of digital life and adapt to its demands. Thus, individuals equipped with DQ become wise, competent, and future-ready digital citizens who successfully use, control, and create technology to enhance humanity (Park, 2019).

6. DQ Framework

The DQ framework was created by Dr. Yuhyun Park and developed through an academically rigorous process by her research team based at various universities including Nanyang Technological University, the National Institute of Education in Singapore, Iowa State University and many others (Park, 2019).

The DQ Framework offers a holistic set of digital competencies with a systematic structure as a reference framework. The aim is to enable any organization to adopt the DQ Framework, and to be able to practically tailor the framework to meet their needs. Any government, company, or school can easily adopt the DQ Framework and customize it to their own needs based on their educational aims and cultural background.

The DQ Framework has been designed to continuously update and evolve through further knowledge aggregation and feedback. It will continuously aggregate knowledge and best practices from around the world on digital literacy and skills education, training, and policies to ensure that the framework remains pedagogically and technically up-to-date.

DQ aims to cover all areas of individuals' digital life that range from personal and social identities of individuals to their use of technology including device and media, their online communication and collaboration at work or at leisure, their practical, operational and technical capabilities that are critical for daily digital lives and professional careers, potential safety and security issues related to technology, emotional and relational aspects and human rights in the digital age. Moreover, with "respect" being a fundamental moral principle of the Universal Declaration of Human Rights (UDHR), the guiding principles of an individual's digital life are: respect for human rights, dignity, and worth of the person in all area of their digital life.

Essentially, the goal is to inculcate digital intelligence in individuals, enabling them to move beyond just hard skills and harness the power of the digital world to shape their lives. These competencies are learnable, and once learned can help to maximize the benefits of technologies while minimizing the harms, both in our personal and work lives.

7. Three DQ Levels

Individuals can develop a deeper understanding and mastery of digital competencies, as well as progress their digital daily life, job, and professional careers throughout their lifetimes. Thus, DQ can be divided into three distinct levels - Table 1 (Park, 2019).

Table 1: 3 Levels of DQ
Source: DQ Global Standards Report 2019 (Park, DQ Institute, 2019)

Digital Citizenship is a set of fundamental digital life skills that everyone needs to have. We suggest that such educational opportunities should be free and compulsory, especially at early stages as basic human rights for individuals in the digital age.

Digital Creativity cover more advanced competencies of digital literacy, skills, and readiness as individuals become active members of the digital ecosystem and create economical and societal values through their participation, creation, and innovation.

Moreover, Digital Competitiveness is a higher-order capability for individuals to perform effectively as members of the digital economy who fuel entrepreneurship, create jobs, produce social impact, and spur economic growth.

8. 24 DQ Competencies

The DQ Framework is structured around two categories: areas and levels of digital intelligence. Eight broad areas of one's digital life have been identified: Digital Identity, Digital Use, Digital Safety, Digital Security, Digital Emotional Intelligence, Digital Communication, Digital Literacy, and Digital Rights. The competencies within these eight areas can be further differentiated by three different levels of maturity - Digital Citizenship, Digital Creativity, and Digital Competitiveness - allowing learning to proceed based on what may be most relevant to an individual's life at the present moment. In total, this creates an eight-by-three matrix of 24 competencies - Figure 2 and Figure 3.

Figure 2. The Matrix of 24 DQ Competencies
Source: DQ Global Standards Report 2019 (Park, DQ Institute, 2019)

1. **Digital Citizen Identity:** The ability to build and manage a healthy identity as a digital citizen with integrity.

2. **Balanced Use of Technology:** The ability to manage one's life both online and offline in a balanced way by exercising self-control to manage screen time, multitasking, and one's engagement with digital media and devices.

3. **Behavioral Cyber-Risk Management:** The ability to identify, mitigate, and manage cyber-risks (e.g., cyberbullying, harassment, and stalking) that relate to personal online behaviors.

4. **Personal Cyber Security Management:** The ability to detect cyber threats (e.g., hacking, scams, and malware) against personal data and device, and to use suitable security strategies and protection tools.

5. **Digital Empathy:** The ability to be aware of, be sensitive to, and be supportive of one's own and other's feelings, needs and concerns online.

6. **Digital Footprint Management:** The ability to understand the nature of digital footprints and their real-life consequences, to manage them responsibly, and to actively build a positive digital reputation.

7. **Media and Information Literacy:** The ability to find, organize, analyze, and evaluate media and information with critical reasoning.

8. **Privacy Management:** The ability to handle with discretion all personal information shared online to protect one's and others' privacy.

9. **Digital Co-Creator Identity:** The ability to identify and develop oneself as a co-creator of the digital ecosystem.

10. **Healthy Use of Technology:** The ability to understand the benefits and harms of technology on one's mental and physical health and to use technology use while prioritizing health and well-being.

11. **Content Cyber-Risk Management:** The ability to identify, mitigate, and manage content cyber-risks online (e.g., harmful user-generated content, racist/hateful content, image-based abuse).

12. **Network Security Management:** The ability to detect, avoid, and manage cyber threats to cloud-based collaborative digital environments.

Figure 3. 24 DQ Competencies
Source: DQ Global Standards Report 2019 (Park, DQ Institute, 2019)

9. Contribution to Well-Being, Sustainable Development Goals and Human Rights

The ultimate goal of the DQ Framework is to guide digital practices towards achieving individual and societal well-being across all aspects of one's life. The OECD's Better Life Initiative identified the following 11 areas of well-being: income, wealth, jobs, earnings, housing, quality of life, including health, civic engagement, social connections, education, security, life satisfaction, and the environment – Figure 4 (Park, 2019).

Figure 4. 11 OECD Well-Being Indicators
Source: OECD Better Life Initiative.
http://www.oecd.org/statistics/better-life-initiative.htm

These 11 areas of well-being, in turn, contribute to achieving the 17 UN Sustainable Development Goals (UN SDGs). The UN SDGs focus on 17 societal dimensions, including ending poverty and promoting prosperity, well-being, and protection of the planet – Figure 5.

Figure 5. 17 U.N. Sustainable Development Goals

Source: Sustainable Development Goals, United Nations. https://www.un.org/sustainabledevelopment/sustainable-development-goals/

10. IEEE's Standardization of DQ as Industry Standards for Digital Skills

As a key stakeholder and standards developer in the technology community, the IEEE recognized that the need to foster digital competencies and improve societal well-being, had yet to be ingrained within the industry as a whole. While it was not initially sure whether such goals would be achieved through technological development or through existing public product skills training, IEEE saw that the development of a comprehensive digital competency standard, in addition to technical product guides, was necessary (Park, 2019).

Alongside these concerns was the observation that various organizations and entities were already addressing digital upskilling, either by creating their own frameworks or by leveraging other frameworks. Nevertheless, by and large, these frameworks lacked a common set of indicators for more comprehensively and collectively understanding the existing challenges that digital skill-promoting efforts face. A common language was seen to be crucial to ensure that digital literacy and competency efforts are coordinated globally and moving in the right direction.

The IEEE's participation in the CDI thus grew out of efforts to address these needs. In December 2017, the IEEE Digital Literacy Industry Connections Group conducted a literature review of over 100 different literacy and skill-building resources to develop a set of collectively shared definitions of digital competencies. From this in-depth review, IEEE recognized the comprehensive and adaptive nature of the DQ Framework, noting the breadth and depth of the Digital Intelligence umbrella.

IEEE then decided to institutionalize the DQ Framework as a global standard in digital skill development and is taking additional steps to support the DQ Framework and its adoption by industry leaders, governments, and civil society organizations.

Embedded in the initiative is the recognition that digitization is making the world more complex and that individuals living in such a digital world must reconcile its contradictory tendencies - for example, the amplification of some voices and not others or the tension between an increasingly interconnected and knowable world and the rise of a "post-truth" culture built on the dissemination of misinformation. Addressing these tensions requires a digital intelligence rooted in human capabilities - a deep understanding of the digital world to make sense of the noise of online content.

The growing complexity of modern living calls for a deep understanding that integrates information, concepts, ideas, practical skills, and intuitions in a productive synthesis for real-life applications. In a structurally imbalanced world, reconciling diverse perspectives and interests requires people to become adept at handling tensions and dilemmas, striking a balance between competing demands such as equity and freedom, autonomy and community, or innovation and continuity.

People will need to think in integrated ways that recognize those interconnections, to deal with novelty, change, diversity, and ambiguity. The underlying premise is the assumption of independent thought and a willingness for collaboration: the ability to reflect on one's ethics in light of one's actions. Central to this reflexivity is the concept of self-regulation, which necessarily entails self-control, self-efficacy, responsibility, problem solving, and adaptability - all features that make digital intelligence crucial for education and future readiness.

11. Institutionalization and Adoption of the DQ Framework

The institutionalization and adoption of the DQ Framework with a broad consensus will be accomplished by synchronous movements within the CDI – Figure 6.

The CDI will also develop a common reporting framework for each group and hold summits to bring various stakeholders together to share progress updates and to identify needs that each community may have in relation to one another. These results will be looped back into the DQ Framework, which will be regularly updated in response to feedback from practitioners and ongoing technological advances.

The goal of institutionalizing the DQ Framework as a global standard is the development of a common understanding, structure, and taxonomy for digital literacy, skills, and readiness. This institutionalization will enable individuals, organizations, national ministries, and technology developers to communicate effectively and systematically in formulating essential digital competencies.

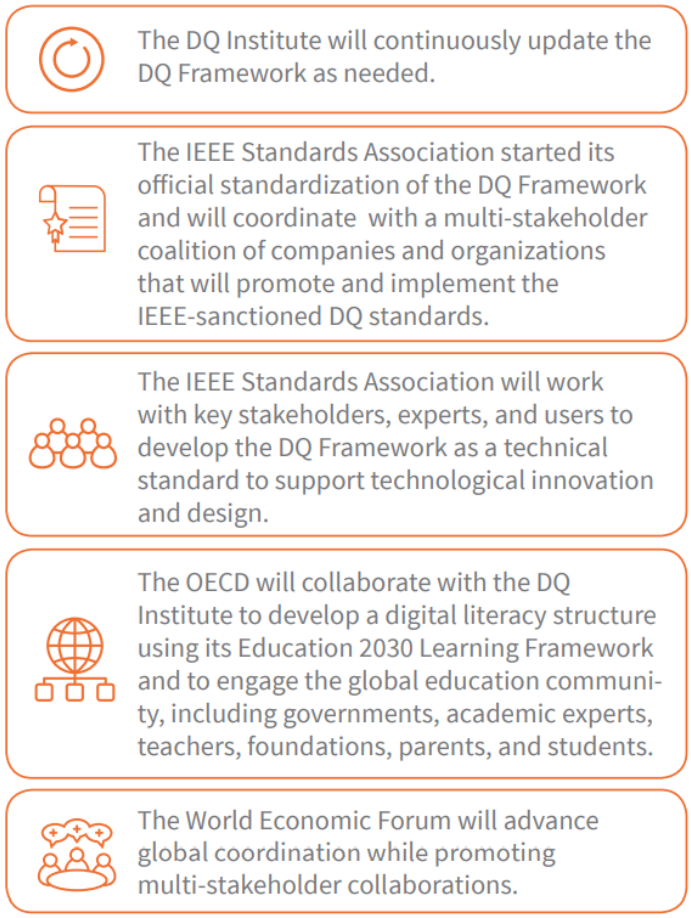


Figure 6. Institutionalization and Adoption of the DQ Framework
Source: DQ Global Standards Report 2019 (Park, DQ Institute, 2019)

12. World's First Global Standard for Digital Literacy and Digital Skills

Singapore, 10 October 2020 – marks the Digital Intelligence Day, which is part of a worldwide initiative to set global standards for digital intelligence. To celebrate DQ Day in 2020, the DQ Institute and Singtel (Asia's leading communications technology group) jointly announced the world's first global standard for digital literacy, digital skills and digital readiness – the IEEE 3527.1™ Standard for Digital Intelligence - which was approved by the IEEE Standards Board on 24 September 2020 (DQ Institute, 2020).

"The ongoing COVID-19 pandemic has made digital literacy and digital skills an even higher priority for educating and training people worldwide. Identified by the IEEE Industry Connections Program, adoption of the DQ Framework has

led to the publication of the IEEE 3527.1 Standard - *a holistic approach for helping people maximize the benefits of digital technology," said Konstantinos Karachalios, Managing Director of the IEEE SA. "The standard defines a reference framework that countries can leverage to develop skills agendas and empower citizens to pursue new job opportunities available in the digital economy, while minimising their risks and helping them to overcome challenges in their digital lives."*

13. Building a Framework for National-Level Digital Literacy and Skills

IEEE 3527.1 comes at an opportune time for nations around the world that are in urgent need of a reference framework to develop national-level digital skills agenda for citizens ranging from students and the workforce to seniors. The standard has multiple benefits for nations and industries as follows (IEEE SA Working Groups, 2020):

1. It will help nations and industries to effectively build their own curriculum and programs for digital literacy, digital skills, and/or digital readiness.
2. With a globally shared baseline understanding of what terms like digital skills and digital literacy mean, nations, nonprofits, and industry can coordinate digital skills efforts and effectively enhance the level of digital literacy and digital skills of their citizens in local communities and nationwide.
3. The common set of definitions and standards will enable monitoring and reporting that can help to strategically allocate resources to identify and bridge digital skills gaps.
4. The standard will help trigger globally accepted certification that can increase job opportunities and mobility across the world, which can yield billions of dollars of economic value to nations in the fast-expanding digital economy and help to overcome the economic challenges caused by COVID-19.

14. Conclusion

Every now and then the natural development of humanity and civilization imposes the need to turn to our intelligence for revision and development. Intelligence has metamorphosed over the centuries, never losing its previous forms, but shaping up the new dimensions. We are witnessing the emergence of a new form of intelligence: digital intelligence DQ. As technology changes our way of life, it is only natural for humans to manage the change in an intelligent way.

Until just a few years ago, due to the lack of standardization of digital competencies, companies and institutions around the world each developed, in their own way, best practices to overcome the challenges imposed by technological development. To address this problem, Dr. Park's research team spent sev-

eral years studying existing practices of world organizations to create the DQ Framework as a global baseline in digital skill development. The DQ framework is structured around two categories: areas and levels of digital intelligence. Eight broad areas have been identified: digital identity, digital use, digital security, digital security, digital emotional intelligence, digital communication, digital literacy, and digital rights. Efforts to institutionalize the DQ framework have resulted in adoption of the Digital Intelligence Standard - IEEE 3527.1.

DQ does not merely refer to the skills needed to use technology more effectively or being aware of potential harms. In today's technologically driven world it is crucial to develop a certain level of digital intelligence from an early age to suit personal, organizational, and community needs. As measureable and highly learnable, DQ is our strongest weapon for survival in this fast-changing digital age.

Our task is to do our homework: not only constantly develop and monitor, but also to anticipate the consequences of growing complexity of modern living - to use our experiences and build a holistic view of the world always taking into account the secondary effects of everything we do. All our efforts for digital transformations, progresses, innovations will be in vain if these processes are not intelligently directed for the benefit of humanity. An alternative would probably be some dystopian societies, which, so far, we have only seen in science fiction.

Where to start and where to direct future research? It is safe to start with an education system that will help students understand what awaits them in the digital world, and to prepare them to successfully manage all aspects of their lives in which technology has a major impact. Start focusing on dual education as well: merging medicine, economics, law and other sciences with information technology.

In data driven world, explore what the moral boundaries are in using data analysis or how to make algorithms more ethical. Tighten criteria of approving AI applications in the real world, and so on.

It would be interesting to see the results of research by human development experts: psychologists, doctors, sociologists, anthropologists, child life specialists, etc. - set their inputs as parameters for machine learning algorithms. And take the results as pointers for further research on human development, our intelligence and life on this planet.

References:

1. DQ Institute. (2020). World's First Global Standard for Digital Literacy and Digital Skills Is Born In Singapore. Available at: https://www.dqinstitute.org/news-post/worlds-first-global-standard-for-digital-literacy-and-digital-skills-is-born-in-singapore/ Date of access: 06.15.2021.
2. IEEE SA Working Groups. (2020). New Standard Will Help Nations Accelerate Digital Literacy and Digital Skills Building. Available at: https://beyondstandards.ieee.org/new-standard-will-help-nations-accelerate-digital-literacy-and-digital-skills-building/ Date of access: 06.15.2021.
3. Park, Y. (2019). DQ Global Standards Report 2019. DQ Institute. Available at: https://www.dqinstitute.org/wp-content/uploads/2019/03/DQGlobalStandardsReport2019.pdf Date of access: 06.15.2021.
4. Schwab, K. (2017). The Fourth Industrial Revolution, by Klaus Schwab. World Economic Forum. Available at: https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab Date of access: 06.15.2021.

Damir Bećirović, PhD[1]
Dino Arnaut, PhD[2]

Professional paper

BEHAVIORAL ECONOMICS IN THE DIGITAL AGE

Abstract

Behavioral economics is the link between psychological research and economics. The rise of behavioral economics is significant because people have ceased to be viewed as rational Homo Economicus. Behavioral economics gives people a role that is closer to reality, which shows that we are often irrational in our decision-making. We base our daily decisions on mental abbreviations or heuristics. In marketing, this has long been a well-known fact used to attract new customers. On the other hand, the concept of Nudge Theory means creating an environment that will use our irrationalities to make decisions that are in our best interests. In this paper, we have shown which are the most common heuristics by which people make everyday decisions. We have given examples of how these irrationalities are being used in today's digital age for marketing and other business purposes, but also how preferred digital technologies can be used to create a positive choice architecture. In today's digital age, when the amount of information and the speed of access to information is higher than ever before, it is increasingly difficult for people to make rational decisions. Therefore, understanding behavioral economics is very important in order to get to know and understand ourselves better and make better decisions. On the other hand, the choice architecture also raises several ethical issues, especially in the context of Digital Nudging, which need to be discussed so that the benefits of the idea of Choice Architecture in the digital age are not lost because of its abuse.

Keywords: Behavioral Economics, Choice Architecture, Digital Nudging, Digital Marketing, Ethics.

1. Introduction

Although the father of modern economics, Adam Smith, wrote the book *The Theory of Moral Sentiments* twenty years before his most famous book, *The Wealth of Nations*, the theory of observing man as a perfectly rational being, *Homo Economicus*, prevailed in economic theory. In the last two decades, we

1 Professor at International Business Information Academy Tuzla, damirbeci@hotmail.com
2 Professor at International Business Information Academy Tuzla, arnaut.dino@gmail.com

have witnessed the academic rise of behavioral economics. Behavioral economics deals with the research of emotional, cognitive, and social influences on individual decision-making. Researchers around the world publish papers that point to the *illogicalities* in the behavior of individuals when it comes to making not only economic decisions, but also when it comes to personal decisions, such as decisions about employment, marriage, etc. Research from behavioral economics shows that we are often not rational in our behavior and that we make irrational decisions. Thus, instead of rational *Homo Economicus* people show themselves as irrational *Homo Sapiens*. Today, in economics, through the rise of behavioral economics, this fact is increasingly recognized. Thaler (2000) argues that economics in the future will be increasingly associated with human behavior, that economists will pay more attention to human emotions and human consciousness, and that they will make a clearer distinction between normative and descriptive theories. Simply put, *classical economics* considers people to be rational in their decisions, while behavioral economics indicates a certain irrationality in decision-making.

Among other things, the aim of the paper is to provide a better understanding of the way we make decisions and an understanding of the bias that often guides us in the process. This is especially important in the context of digital age and the amount of information that is available to us, which makes it even more difficult for us to make the right decisions that are useful to us.

Starting from the fact that people are irrational in their decision-making, bearing in mind that this irrationality is often predictable (Ariely, 2008), Thaler and Sunstein (2008) developed the concept of choice architecture, which means that people are possible, through creating an appropriate environment in which they make decisions, to be encouraged to make decisions that are beneficial to them in a way that maximizes their well-being. By applying digital technology, Internet of things, Big Data Analysis and AI, it is possible to use the results of research in behavioral economics to provide significant benefits to individuals and companies by helping them make better financial decisions, develop trust and better customer experience, better manage humane resources, and assess risks, etc.

On the other hand, critics of choice architecture ask the question whether creating an environment that influences people's decision-making is ethical at all? Who has the right to decide on behalf of someone else what is good for that individual, or what if choice architecture is used in the interest of the government or some interest groups and not individuals? The digital age with the amount of information available and the potential of digital technologies in terms of their use in creating the choice architecture requires a clear answer to these ethical questions.

2. Decision-Making and Bias

Making completely rational decisions also requires having all the information needed to make decisions. However, it is exceedingly difficult to provide all the

necessary information because, on the other hand, it requires time and other resources, so the opportunity cost of making rational economic decisions is high, and therefore it is often not profitable.

Table 1. Some examples of heuristics

Type of heuristics	Explanation
Loss aversion	Kahneman and Tversky developed the Prospect theory where they showed that people do not experience equally equal gains and losses. They show aversion to losses (Kahneman and Tversky, 1979).
Scarcity	It is the kind of bias by which the subjective value of a good increases due to the very fact that it is scarce (Mittone and Savadori, 2009).
Anchoring effect	It is a cognitive bias when people use available information as an anchor, a starting point, when making a decision or assessment, whether or not that information is related to that task (Tversky and Kahneman, 1974).
Endowment effect	It is a bias by which people value things they own more than those they do not (Kahneman et al., 1991).
Framing effect	This effect shows that individuals' decisions are influenced by the way problems are presented. There is an unwarranted impact of problem formulation. (Tversky and Kahneman, 1981).
Decoy Effect	The decoy effect describes how, when we choose between two things, adding a third, less attractive option called bait, affects our perception of two basic choices (Ariely, 2008).
Status Quo Bias	Individuals tend to remain in the status quo, i.e., in the current state, because the disadvantages of giving up this state outweigh the advantages (Kahneman et al., 1991).
The Power of FREE	People are far more inclined to free compared to almost free. Offering something that is free significantly influences their choice compared to previous preferences (Ariely, 2008).
Herd bias	It is a psychological phenomenon where people observe other people's decisions when making decisions. They do what others do, instead of using their own information. This phenomenon is common in the capital market and is associated with the creation of market bubbles (Banerjee, 1992).

Source:Authors work

So, how do we make decisions? Individuals in the decision-making process use heuristics, which we can define as mental abbreviations, which allow us to make our decisions acceptable, but at the same time they are not always rational. Moreover, through experiments it has been confirmed that human behavior in the process of economic decision-making is often irrational and, more interestingly, predictably irrational. Heuristics are not a bad mechanism when making simple decisions, which do not have great potential harmful consequences, because the relationship between benefits and resource consumption is satisfactory. However, when it comes to complex decisions that require more information, irrationality can have significant negative consequences. At the heart of this way of decision-making are two systems of the human mind. System 1 operates automatically and quickly, intended for routine operations, while System 2 focuses on mental activities that require effort and attention. As most of our decisions are routine, they are made by System 1, because System 2 is inefficient and *slow*. Therefore, we often show biases in everyday behavior and decisions that are characteristic of the operation of intuitive System 1 (Kahneman, 2011).

3. Digital Nudging

In the decision-making process, people rely on available information. In addition to information, the decision-making process is also influenced by the way this information is presented, i.e., the design of the choice environment. Thaler and Sunstein (2008) define nudging as any element of the choice structure that influences a change in people's behavior in a way that is predictable, without prohibiting any other choice option or significantly changing their economic incentives.

Choice architecture can significantly improve people's quality of life by creating a user-friendly environment. Any factor that significantly changes people's behavior can be considered an incentive. By using incentives, it is possible not only to improve the lives of individuals, but to help solve significant social problems. Incentives, for example, of governments, aimed at solving social problems do not represent measures imposed by someone, freedom of choice has not been abolished, and this represents a special type of paternalism, so-called Libertarian paternalism (Thaler and Sunstein, 2008).

Arguments leading to the acceptance of nudging point to the following advantages of this concept (Schmidt and Engelen, 2020):

- Nudging is cost effective, relatively inexpensive, and relatively easy to implement.
- It usually respects freedom of choice, and it usually does not change or remove options.
- People are more inclined to accept nudging in relation to interventions and punishments.
- Even without nudging, decisions will always be influenced in one way

or another, because often a neutral decision-making framework is not possible.

Decision-making nudging in digital environments is defined as *digital nudging*. Given that people today carry out a significant part of their activities on the Internet and receive most of the information on which they make their decisions via the Internet, it is possible to create incentives to moderate their behavior in the digital environment via use of user-interface design elements. Digital nudging should not be viewed only in the context of the digital environment, because this type of nudging is used for behavioral changes in the real world as well. It does not just affect the decisions we make on the Internet but also how we behave after we turn off the digital device. With the increasing number of people making decisions through digital devices, user interface designers are becoming the architects of choice who consciously or unconsciously influence the decisions of an increasing number of people. The user interface is becoming the basic choice environment today (Schneider et al. 2018).

The ubiquitous digitization of private and professional life requires that digital nudging will inevitably spread to many areas of application, as people increasingly use digital devices for decision-making in different situations and areas, and the devices themselves will also change according to their form and function (Weinmann et al. 2016).

Table 2 shows some examples of the application of digital nudging and their effects.

Table 2. Example applications of digital nudging and their effects

Use case/IS field	Nudging example/behavior change intervention	Effect on organizational or societal level
Business process management	Structuring complex input screens	Organizational
E-business and e-commerce	Displaying limited room inventory during a hotel-booking process	Organizational
E-finance and insurance	Setting defaults for frequently selected insurance plan options	Societal
E-government	Setting defaults to opt in for organ donation	Societal
E-health	Step counter app that provides feedback on activity levels	Societal
E-learning	Reminder to learners to engage with course content	Organizational and/or societal

Green IS	Smart meters to encourage energy savings	Societal
Security and privacy	Displaying the strength of selected passwords	Organizational and/or societal
Social media	Giving incentives, such as badges, for sharing or other activities	Societal

Source: Weinmann et al. (2016)
Digital Nudging, Business & Information Systems Engineering. 58(6), p. 435

The question of the ethics of choice architecture arises, which is especially important in the digital age, when individuals create a huge amount of information online that can be used to create environments that will encourage people to make decisions that do not benefit them but benefit others. This is especially important given the possibilities and potential of using the Internet of Things and Big Data analysis. Especially the possibilities of Big Data analysis and AI are great and can be used to analyze and understand the patterns of behavior of people observed in real time to draw conclusions about users' personal characteristics, cognitive styles, or even emotional states (Hibeln et al. 2017).

The social media provider uses information shared by social network users, the so-called consumers-workers who share their information through communication with friends and the public. The social media provider reaps the surplus value by exchanging information between consumers and consumer workers on social networks, which results from nudging social network users (Puaschunder, 2017; 2018). For example, comments and likes on posts that people post on social networks have no economic value for users, but they give them satisfaction in terms of meaningful work and motivate them to continue posting and sharing information on those social networks.

Also, messaging apps give users the information that the person they are communicating with has seen their message and is currently replying to it, allowing you to stay on the app for as long as possible while waiting for a response. It is obvious that in these cases there is a nudge that is not focused on behavior that benefits people, but exclusively on social media providers.

Starting from the guidelines for the application of nudging in an offline environment, designers can create digital nudges by taking advantage of all the benefits offered by information systems. Schneider et al. (2018) believe that designing Digital nudging should follow the following cycle shown in Figure 1. This can help architects choose to achieve their organizational goals through understanding users and potential nudging effects, so that desired effects can be maximized and/or unintended effects minimized.

The user-interface design of any digital device influences choices, even unintentionally. However, in user-interface design, usability and aesthetics are often primarily considered, ignoring potential behavioral effects. Expanding the

field of computing through the acquisition of knowledge about digital nudging can help user-interface designers to create an environment of choice by taking advantage of digital nudging opportunities to common organizational goals (Schneider et al. 2018).

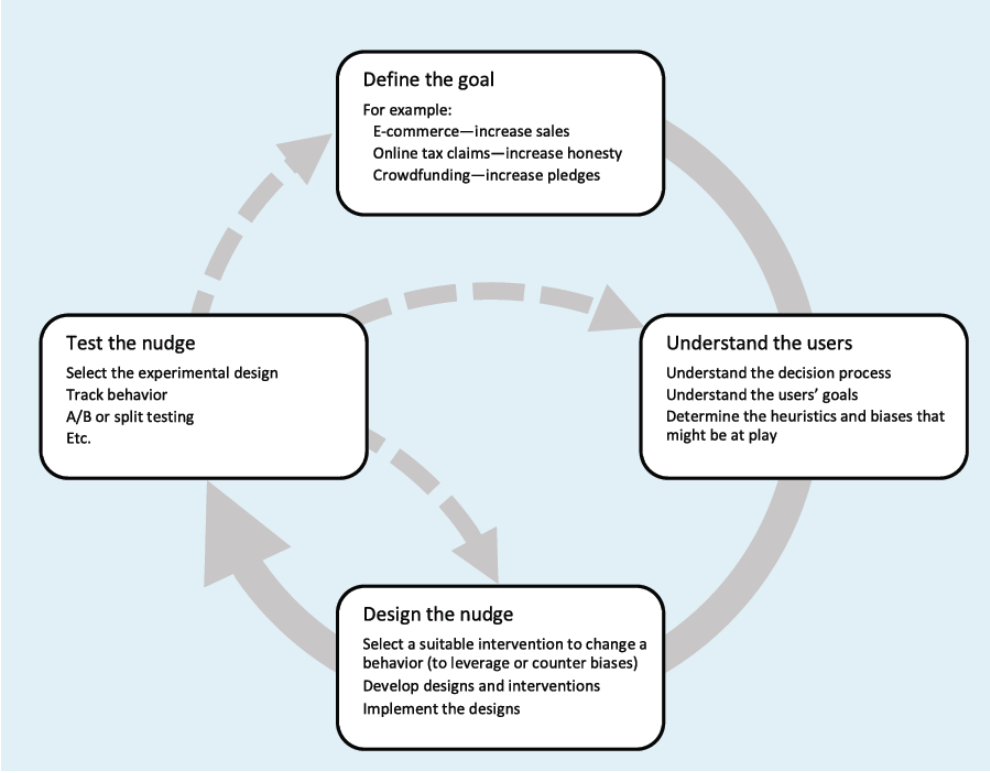


Figure 1. Designing digital nudges follows a cycle
Source: Schneider, C., Weinmann, M., Brocke, J.v.. (2018). Digital Nudging: Guiding Online User Choices through Interface Design. Communications of the ACM. 61(7), p. 69

4. Examples of Digital Nudging Applications

Although *classical economics* has long shown an underestimating attitude toward behavioral economists' research, marketers have long seen the potential to increase sales of products and services, through exploiting bias and irrationality in human behavior. As with other marketing tools, there is a fine line between using behavioral economics to improve the consumer experience and using it to manipulate consumers.

Customer manipulation or *Phishing for Phools* as Schiller and Akerlof (2015) call it is especially important to understand in the digital age, when the availability of content through digital media and the amount of information is incomparably greater than before.

In Figure 2 we can see on the example of the platform for offering accommodation, booking.com, how through interventions on the user-interface can influence consumer decision-making. Underlined are the user-interface design elements that focus on individual bias. These elements target three predictable behaviors, or the three heuristics we use in decision-making (Scarcity, The Power of Free and The Anchoring Effect).

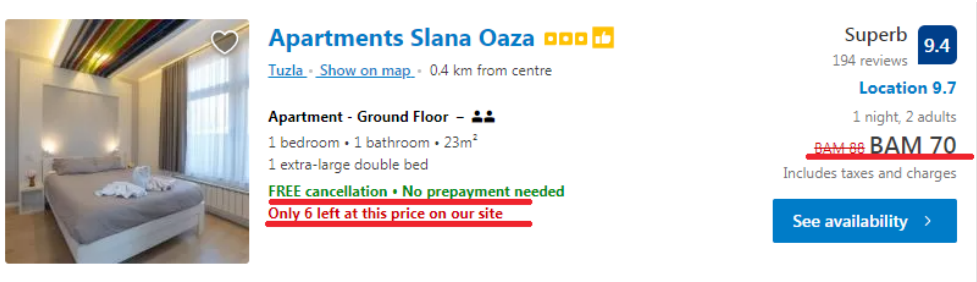


Figure 2. Application of digital nudging
Source: www.booking.com

Figure 3 shows how the online movie and series platform netflix.com uses in the design of user-interfaces that target individual bias. By offering a trial period of 30 days for free, *The Power of Free* heuristic is first activated, which leads to the acceptance of the application. After that, due to the action of the Endowment effect, people become reluctant to give it up

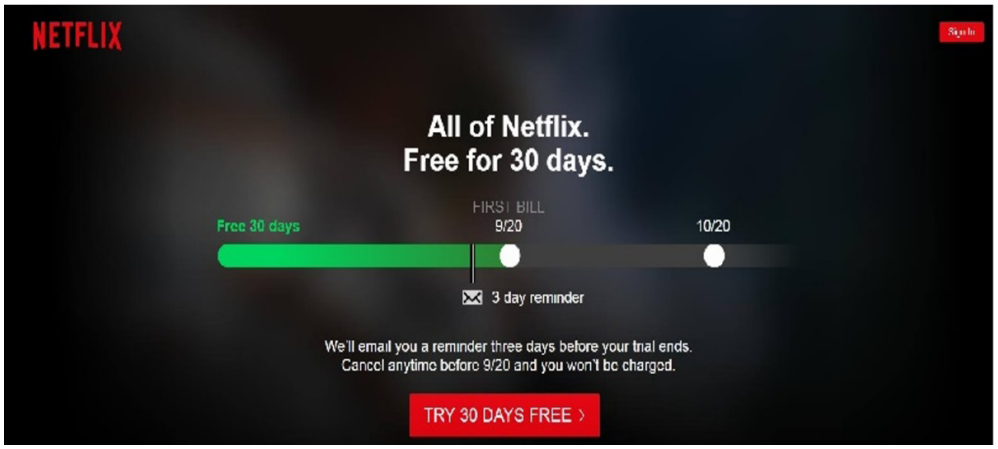


Figure 3. Application of digital nudging
Source: www.netflix.com

The strategy of Stitch Fix, an online styling service, is also based on the Endowment effect. The customer can try on clothes at home, keep what he likes and send back the rest. When a customer has received and tried items, he feels a sense of attachment and is likely to keep them.

We can see the Power of Free on the example of various applications such as You Tube and Viber if we compare their attractiveness. How attractive would these applications and social networks be if you paid even a minimum monthly amount of, e.g., $1?

It is said that in marketing, the line between improving the consumer experience and manipulation is very thin. In the case of sharing economy platforms or online sales platforms, the benefit to consumers cannot be disputed using these platforms. The user-interface of these platforms helps the customer to avoid the Decision paralysis that occurs when we are faced with too many choices, and we are not able to evaluate them all well. To help customers choose the right service these platforms offer a wide range of filters thus helping their customers to sort products and services. The experiences of previous users as well as their evaluation of the provided services help them in that, and today Big Data analysis and AI are increasingly used to make the choice even easier based on the previous behavior. It is also used by search engines like Google to provide the easiest and fastest way for consumers to access those websites and services they use most often.

Also, in the case of the model that uses Netflix shown in Figure 3, they notify customers of the date when the free usage period expires, thus ensuring that people, because of their tendency to be forgetful, are not *caught* using their service if they do not want it.

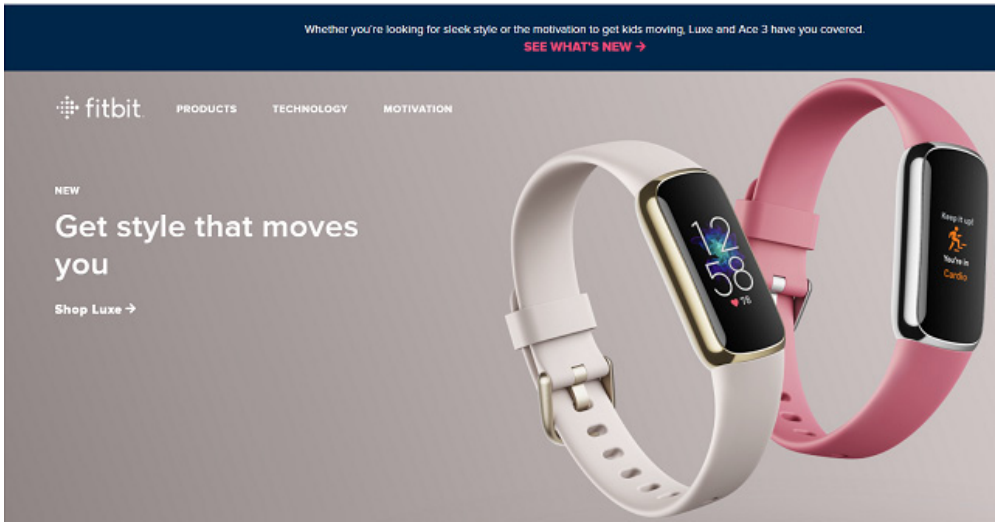


Figure 4. Primjena digital nudging
Source: www.fitbit.com

Fitbit watches, which are part of Google, have an effect in terms of encouraging healthier lifestyles, reminding users to become active by collecting data on their activity and health parameters. In this way, they benefit not only the users but also the whole society.

Applications such as Digit, Monzo or Capital help users to better manage their finances, with services created based on research results coming from behavioral economics. The concept of digital nudging refers not only to the current decision-making of consumers online, but also to various other contexts, from social media to organizational information systems. Although digital nudges influence the decisions of individuals at the time of decision-making (Miesler 2017), on the other hand presenting reviews, facilitating search and shopping, tagging has a strong effect on user behavior in general and it is important to observe this in general in terms of behavioral economics research in the digital age.

5. Ethical Questions Relating to Nudging

Bias and heuristics are present in both the online and offline worlds. From the very beginning, the concept of nudging had its followers, but also opponents. Critics are mostly concerned with the ethics of nudging. They believe that nudging is contrary to basic moral values, such as freedom, autonomy, respect, and dignity (Schmidt and Engelen, 2020).

In general, critics of the concept of nudging point out the following arguments (Renaud and Zimmermann, 2018):

- Nudges can jeopardize the autonomy of action and thus affect dignity.
- Nudge design often does not suit the intended purpose and can produce side effects.
- It is a questionable assumption that nudge developers know what is good for individuals or society given the complexity of social relationships and decision-making.
- There are concerns that not every intention that a nudger has is good, but that it is focused on making a profit for the one who creates the environment in which decisions are made.

The issue of ethics in the concept of nudging is especially important today in the digital age. The amount of information, the exposure to information through ubiquitous digital devices makes us exposed to different types of nudging. The development of Big Data and AI enables the application of nudging in a very sophisticated way, further influencing how people make decisions. Bias and heuristics are present in both the online and offline worlds.

The issue of ethics in the creation of the choice architecture is especially important in order to be able to take advantage of this way of helping people in making complex decisions. Otherwise, if governments or the private sector used the choice architecture to psychologically manipulate an interest that is not best for the people, this could lead to pressures that would lead to bans on this type of action. Responding to criticism, Thaler and Sunstein (2008) state that it is important to follow certain principles when creating choice architecture to keep its designers on the ethical path. Basically, the choice architecture should be created so that:

- Nudging must be useful, i.e., aimed at improving the well-being of those who are nudged.
- There must always be a choice.
- Be transparent, which means that those who seek to implement a particular policy through the choice architecture must be ready to make it public.
- In some issues, such as the appearance of ballots or encouraging private companies to have their employees buy their shares, the choice architecture must be neutral. This is important because there is always a certain choice environment that also imperceptibly influences our people's decisions.

If companies or governments follow these principles, the possibility of a real win-win situation is created for both users and those who create the environment of choice. The principles are especially important in the digital age when exposure to nudging is significantly higher than in the offline world. User-interface design influences choices, even unintentionally (Schneider et al. 2018), so it is particularly important to consider whether such a design causes negative side effects and efforts should be made to prevent this.

6. Conclusion

With the development of behavioral economics in the last two decades, the paradigm of man as a rational decision maker has been largely abandoned. Mostly experimentally, behavioral economists have discovered more and more situations in which people behave in a way that is not predicted by classical economics. Moreover, it seems that these irrationalities are predictable, and that people often use heuristics, i.e., mental abbreviations, in the decision-making process. Our decisions are largely determined by the design of the environment in which we make decisions. Considering the predictability of human irrationality and the influence of environmental design, it is possible to influence people's behavior by creating the choice architecture, helping them to make the right decisions. Of course, this also raises many ethical questions, and transparency, usefulness and freedom of choice are necessary preconditions for the use of nudging.

In the digital age, the amount of information, the development of Big Data and AI create the conditions for a much more pronounced application of nudging compared to the offline world. Each user-interface also unintentionally represents a choice architecture that can also have negative side effects. In this paper, we have shown some examples of the application of nudging in the digital world, especially in the context of companies' efforts to attract their customers. This paper represents a modest contribution to understanding the way we make decisions and how we are exposed on a daily basis to different decision-making designs that influence our decisions.

References:

1. Ariely. D. (2008). Predictably Irrational: The Hidden Forces That Shape Our Decisions. HarperCollins, New York.
2. Banerjee, A. (1992). A simple model of herd behavior. Quarterly Journal of Economics, 107(3), pp. 797-817.
3. Hibbeln, M., Jenkins, J.L., Schneider, C., Valacich, J.S., Weinmann, M. (2017). How is your user feeling? Inferring emotion through human-computer interaction devices. Management Information Systems Quarterly, 41(1),pp. 1–21.
4. Kahneman, D., Tversky, A. (1979). Prospect theory: An analysis of decision under risk. Econometrica, 47(2), pp. 263–291.
5. Kahneman, D., Knetsch, J.L., Thaler, R.H. (1991). Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias. The Journal of Economic Perspectives, 5(1), pp. 193-206,
6. Kahneman, D. (2011). Thinking, fast and slow. Farrar, Straus and Giroux, New York.
7. Miesler, L., Scherrer, C., Seiler, R., Bearth, A. (2017). Informational nudges as an effective approach inraising awareness among young adults about the riskof future disability. Journal of Consumer Behaviour, 16(1), pp. 15–22.
8. Mittone, L., Savadori, L. (2009). The Scarcity Bias. Applied Psychology, 58 (3), pp. 453–468.
9. Puaschunder, J. M. (2017). The nudging divide in the digital big data era. International Journal of Research in Business, Economics and Management, 4(11-12), pp. 49-53.
10. Puaschunder, J. M. (2018). Nudging in the digital big data era. European Journal of Economics, Law and Politics, 4(4), pp. 18-23.
11. Renaud, K., Zimmermann, V. (2018). Ethical guidelines for nudging in information security & privacy. International Journal of Human-Computer Studies, 120, pp. 22-35.
12. Schiller, R.J., Akerlof, A.A. (2015). Phishing for phools: the economics of manipulation and deception. Princeton University Press, Princeton, New Jersey.
13. Schmidt, A.T., Engelen, B. (2020). The ethics of nudging: An overview. Philosophy Compass, 15(4). pp. 1-13.
14. Schneider, C., Weinmann, M., Brocke, J.v.. (2018). Digital Nudging: Guiding Online User Choices through Interface Design. Communications of the ACM. 61(7), pp. 67-73
15. Thaler, R.H. (2000). From homo economicus to homo sapiens. Journal of Economic Perspectives, 14(1), pp. 133-141.
16. Thaler, R.H., Sunstein, C.R. (2008). Nudge: improving decisions about health, wealth, and happiness. Yale University Press, New Haven.
17. Tversky, A., Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. Science, 185, pp. 1124–1131.
18. Tversky, A., Kahneman, D. (1981). The framing of decisions and the psychology of choice. Science, 211, pp. 453–458.
19. Weinmann, M., Schneider, C., Brocke, J.v. (2016). Digital Nudging. Business & Information Systems Engineering, 58(6), pp. 433–436.

Websites

20. www.booking.com
21. www.fitbit.com
22. www.netflix.com

Aldin Brajić, MA oec.[1]
Saliha Brajić, MA oec.[2]
Kenan Kurić, PM&R physician[3]

Preliminary communication

QUALITY OF SERVICES AS A PRECONDITION FOR USER SATISFACTION OF JU DOM ZDRAVLJA ZENICA

Abstract

Improving the quality of healthcare in most countries is a major goal of health system reform and service delivery. All countries face challenges in seeking to ensure access, equity, security and user participation within available resources, and to develop evidence-based skills, technology and medicine. Quality is an essential and necessary component of healthcare and a feature of every activity we carry out in health and medicine. The subject of this paper is the research of theoretical, methodological and empirical characteristics of the quality concept in case of health services in the function of improving user satisfaction. The main goal of this research is to determine the importance of the perceived level of health services quality and the impact of expectations on the level of perceived quality in relation to the quality dimensions in the context of satisfaction of healthcare users of public institution JU Dom zdravlja Zenica. Data collection was performed on the basis of a controlled random sample, with 30 questionnaires adequately completed. The results of the research confirmed the central hypothesis, that there is a statistically significant difference between expectations and perceptions of service quality according to issues and dimensions that affect the satisfaction of healthcare users. Revising this topic imposes the need for public institution JU Dom zdravlja Zenica to constantly think about continuous improvement of the quality of health services in order to achieve user satisfaction.

Keywords: service quality, healthcare, user satisfaction, gap analysis.

1 Master of economics, IPI Academy, Kulina bana br. 2 Tuzla, brajicaldin@gmail.com
2 Master of economics, JP Elektroprivreda BiH d.d. – Sarajevo, ED Zenica, Safvet bega Bašagića br. 6 Zenica, saliha.cabro@yahoo.com
3 Physical Medicine and Rehabilitation physicians, JU Dom zdravlja Zenica, Fra Ivana Franje Jukića 2a, kenan.kuric@yahoo.com

1. Introduction

The healthcare system, together with the economic system, has a special significance for the state, society and individuals. This system is one of the pillars of the social system and a measure of its quality, achieved level and overall social perspective. In Bosnia and Herzegovina the healthcare system in the last few decades shares the fate of the overall economic system, which shows a tendency to stagnation, as a result of negative indicators in all areas of the economy, enormous budget deficit, age structure, wage cuts, pensions and the like. Quality improvement has different meanings for different actors in one health system. For physicians it most often refers to increasing medical effectiveness, for managers it represents an increase in efficiency, and healthcare users are usually concerned about their well-being. Satisfaction with healthcare is achieved by meeting the expectations of healthcare users. However, expectations vary from user to user, and based on that it is necessary to investigate what health service users expect.

In addition to the theoretical parts that represent the methodological and conceptual framework of research, which relate to the field of research, quality of health services and satisfaction of healthcare users, the results of the empirical research on service quality as prerequisites for user satisfaction of JU Dom zdravlja Zenica will be presented.

2. Literature Review

Babakus and Mangold (1992) are pioneers in measuring the quality of health services. Their empirical research examined the reliability and value of the instrument. Expectation and perception scales have resulted in one-dimensional constructs and have been shown to be successfully applied to estimate the size of the gap between user expectations and perception. It is for this reason that the authors assessed the model as a concise and practical instrument useful for assessing the quality of health services and suggested further research and evaluation of the instrument (Babakus E., Mangold W.G., 1992).

In their work, Ozretić Došen and his coleagues present the results of the conducted research on the quality of health services provided in primary healthcare institutions. The results showed that there is a significant gap between the perceptions and expectations of service users and that the gap is different depending on the dimensions. The largest gap was recorded for the dimensions of „responsibility", „security" and „reliability" (Ozretić D., Đ, et al., 2010).

Huseinspahić (2011) in his research on a sample of hospital users in Tuzla determined the perceived level of quality of health services and the impact of expectations on the level of perceived quality in relation to technical and functional dimensions of service quality and the impact of expectations on patient satisfaction. The research showed that there is a significant correlation between the level of non-confirmation / confirmation of expectations, ie perceived quality to the level of user satisfaction with both functional (rehabili-

tation services) and technical dimensions (surgical services). This connection has not been proven in other medical services (Huseinspahić N., 2011).

Mečev and Goleš Kardum (2015) in their research examined the user's perception of the quality of primary healthcare, ie whether there is a difference between the user's expectations and the level of satisfaction with the received medical service. They found a gap in all dimensions and that there is no difference in perception of service quality with regard to age and gender of users, but that there is a significant difference in satisfaction levels with regard to employment status and frequency of service use (Mečev D., Goleš KI, 2015).

Čakalić (2018) measured user satisfaction with the quality of healthcare with regard to age, gender, level of education, employment status and reason for hospitalization. The standardized Laschinger HCAHPS (*Hospital Consumer Assessment of Healthcare Providers and Systems*) questionnaire was used, as well as the NPSCC (Patient Satisfaction With Nursing Care Quality Questionnaire) questionnaire, in three thematic dimensions in relation to the Risser scale: interpersonal relationship and trust, education and information, and technical-professional competencies in nursing. The users rated the quality of healthcare as excellent. Slightly lower level of satisfaction is expressed by users in relation to the presentation of the nurse, admission on arrival at the hospital as well as the question of whether they received understandable answers to their questions. Beneficiaries are extremely satisfied with the quality of healthcare provided at the Clinical Institute for Nuclear Medicine and Radiation Protection in Osijek. They were also satisfied with the relationship with nurses and technicians. There is statistically significant difference with respect to age, employment status, vocational education, and reason for hospitalization. There is no significant statistical difference by gender (Čakalić S., 2018).

3. Quality of health services

The specific process of providing health services takes place through the primary activities of health institutions. Primary activities contain a distinct component of interaction with actual and potential healthcare users. They are focused on the sales market and directly participate in meeting user requirements. They can be divided into three phases: *the phase before the arrival of the user, the phase of providing the health service, and the phase after the provided health service* (Bieger, 2000). Behind the primary activities are supporting activities. They have the role of supplying primary activities with the necessary resources and infrastructure, and include processes in the areas of healthcare management, strategic marketing, human resource management, procurement management, finance and controlling.

In the first phase, *the phase before the arrival of the user*, there is an activity of defining the services and its elements. There are material and intangible parts of health services. The material part of health services refers to the appearance and all equipment, which can be divided into real estate, movable property and equipment, and machinery and apparatus. It is about the human

potentials of healthcare institutions that, in order to provide health services, enter into intensive communication, contacts and interaction with users of health services, and are, as well as the material part, an indispensable part of health services. In the first phase, users are provided with important information related to the material part of the primary healthcare service, which belongs to the dimension called *tangibility*, and the intangible part of the service related to the human factor, as an integral part of the dimension called *empathy*. Therefore, the dimension of tangibility implies physical, visible things in the process of providing health services: equipment, interior design, staff uniformity, accreditation, prospectuses, catalogs, etc. On the other hand, affection within this phase implies a willingness and willingness to provide assistance to health care users before their arrival.

In the second phase, *the phase of providing health services*, all activities of "production" of the service are included in the presence of users of health services. It involves intensive interaction between healthcare users and employees. Also, this phase is characterized by the connection of the material and intangible part of health services, because individuals and material goods are in interaction with each other. The healthcare delivery phase is actually the marketing of the potential of healthcare facilities. Given that in the second phase the process of providing health services takes place, it is necessary in addition to the dimension of *empathy*, to emphasize the dimensions of *reliability, identification, and expertise and trust*. Namely, the basic precondition for the success of any healthcare institution is that the users of health services consider it reliable, which means that it must provide consistent success of the service. Reliability is the core of services, that is, reliability is actually a prerequisite for the success of other dimensions. Reliability is assessed more according to the final outcome of the service received. If the mentioned dimension were to be applied to a healthcare institution, then in fact reliability means that the health care service should be provided at a pre-agreed time and without error. Unlike this dimension, which is influenced by the final result, other dimensions are more related to the service delivery process itself. Reliability is not a dimension that would significantly affect the satisfaction of healthcare users, because it goes without saying, it is promised in advance - its impact is much greater on dissatisfaction than on satisfaction. Identifying each user's problems or requirements implies an appropriate level of care and attention, while expertise and trust are in fact an impression of expertise and kindness as well as the ability of employees to create an image of confidentiality.

The third phase, the so-called phase after the provision of health services, includes all activities of maintaining contacts with health service users, which relate to advice and information on health and treatment costs, trust, providing information on check-ups, therapies, etc. Having in mind the fact that contacts should be maintained even after the provided health service, it is necessary to emphasize the reliability, expertise and trust, as well as the friendliness of the staff employed in healthcare institutions. Thus, the dimensions of the quality of health services that can be identified within the primary activities of the process of providing health services are observed through:

- Tangibles (physical appearance and overall assets of the health institution),
- Reliability (quality consistency),
- Responsiveness (providing sufficient time and attention to each individual user when providing health services),
- Competence and assurance (knowledge, abilities and skills of medical staff, which instill confidence in health care users),
- Empathy (individual attention, care and understanding of the specific needs of health care users).

4. User satisfaction with primary healthcare services

Grönroos' definition (Angelini A., 2006) according to which the quality of services is actually: "a product of the evaluation process, in which users compare their expectations with the service they received" identifies user satisfaction with the quality of service. Based on this definition, it can be concluded that we cannot talk about the quality of service, if we have not achieved the satisfaction of its users, or that there is no satisfaction without ensuring the quality of service. Although, at first it may seem confusing and reminiscent of the question of what is older, the point is that the quality of the service is assessed by consuming it, with the degree of satisfaction being subjective. In terms of the causal direction of quality and satisfaction, researchers have suggested in previous studies that satisfaction with a particular service over time results in global evolution, ie. type of attitude about quality (Bitner M. J., 1990), and that according to this way of reasoning, satisfaction would be an antecedent, ie it would precede quality. However, in recent times, the authors are increasingly advocating the reverse relationship, ie. that quality is the antecedent of pleasure (Oliver R. L., 1993). In order to opt for the first or second relation, the way we conceptualize satisfaction is crucial. In the search for an explanation of the concept of the same, we encounter numerous definitions, terminological inconsistencies, models and theories, which create a lack of clarity in the study of this part of the literature. The reason for such a large number of definitions should be sought in the fact that it is a very abstract concept.

Furthermore, it is necessary to emphasize that the term user satisfaction was mostly used in the 1970s in studies that primarily analyzed product satisfaction, while the term user satisfaction intensified only later, mainly in studies in the field of service quality research. Quality of service and user satisfaction are often used as indicators of competitiveness. However, as pointed out, their relationship with each other is relatively unclear. Namely, in some studies these two concepts have been seen as synonyms (Zeithaml V. A., Berry L. L. Parasuraman A., 1993), while in other studies a distinction has been made between these concepts (Cronin J. J., Taylor S. A., 1992). Although today the dominant concepts of satisfaction (disconfirmation paradigm) and service quality (gap

models) start from two different paradigms, both use expectations and perceptions as key determinants in their explanation, which is the reason why two comparative groups of satisfaction researchers have developed in the literature users and service quality researchers. Despite the obvious overlaps of the previously mentioned concepts, some important differences have been established between them. Very often, the subject of controversy is the question of what precedes what, user satisfaction with the quality of service or quality precedes satisfaction? According to a growing number of authors, these two concepts are largely related. Of course, they differ from each other in the duration of experience with the service, in the levels of expectations, the degree of affectivity and depending on the stability of the duration of the relationship between users and service providers (Snoj B., Savić V., 1999).

According to the integral approach, represented by Klaus (Snoj B., 1995), the quality of service could be understood as the value of the service for the user. It is thought to become more congruent with longer-term attitudes (Stafford M., Stafford T. F., Wells B. P., 1998). On the other hand, satisfaction is seen as a more emotional reaction to an experience with a product or service, quite similar to an individual's emotional state of deteriorating mood that forms the basis for a level of regret. Rust and Oliver (Rust R. T., Oliver R. L., 1994) point to the following differences between service quality and user satisfaction:

- the dimensions on the basis of which quality is assessed are more specific, while satisfaction can result from any dimension (which does not have to be exclusively related to quality),
- quality expectations are based on the ideal or perception of the best, while a number of issues not directly related to quality can help create satisfaction,
- quality perception does not require experience with services or service providers, while satisfaction does.

Cronin and Taylor conducted empirical testing of satisfaction and quality reciprocity in several service industries. Their research has resulted in the fact that the quality of services can be viewed as one of the determinants of user satisfaction, and satisfaction itself influences user's future purchasing decisions. Oliver points out in his studies that satisfaction is the result of the user's overall reaction, and that it can have a potential impact on future perceptions of quality (Oliver R. L., 1993). On the other hand, some authors in their research point out that satisfaction precedes the perceived quality of services (Bolton R. N., Drew J. H., 1991). However, regardless of the divided attitudes in the earlier period, today the prevailing opinion is that quality precedes satisfaction (Mikulić J., 2007).

5. Research of service quality as a precondition for user satisfaction of JU Dom zdravlja Zenica

The research was conducted based on the application of professional and scientific methods of secondary and primary research. As part of the secondary research, published scientific and professional papers dealing with this issue were used in the paper. Within the exploratory research secondary data were collected and as well as previous experiences. Secondary sources referred to the available relevant literature in the field of service quality management, healthcare and user satisfaction. Primary research collected data based on a survey method, using a survey questionnaire as a means of collecting data. The structured questionnaire was designed in accordance with the purpose of developing thorough and reliable measuring instruments with a clearly defined research goal to determine the importance of the perceived level of quality of health services and the impact of expectations on the level of perceived quality in terms of quality of health services by users of JU Dom zdravlja Zenica.

Within the elaboration of certain theoretical and methodological starting points of the observed problem and applied considerations, we used the method of analysis and synthesis, induction and deduction, hypothetical-deductive methods, comparative method and statistical method (univariate statistical analysis).

The central research question is: „*Is there a statistically significant difference (gap) between expectations and perceptions of service quality according to issues and dimensions that affect the satisfaction of healthcare users of the public institution JU Dom zdravlja Zenica*?" In addition to finding answers to this question, the paper will try to provide answers to a number of operational research questions:

- What are the expectations and perceptions of healthcare users?
- What is the evaluation of expectations and perceptions of healthcare users according to issues and dimensions?
- What are the dimensions of the quality of health services that determine the satisfaction of their users?

The subject of this paper is to investigate and determine all relevant theoretical, methodological and empirical characteristics of the concept of quality of health services in order to improve user satisfaction. The quality of services in healthcare institutions is measured from the point of user view. This conception is based on the gap between the expectations and the perception of the user. Each phase of the service quality measurement process requires appropriate research steps to diagnose, understand the problem in more detail, and implement solutions. The general goal of this research is to determine the importance of the perceived level of quality of health services and the impact of expectations on the level of perceived quality in relation to the dimensions of quality of health services in the context of satisfaction of healthcare users. In accordance with the aim of the research, we defined the central research hypothesis of the paper: „*There is a statistically significant difference (gap) be-*

tween expectations and perceptions of service quality according to issues and dimensions that affect satisfaction of healthcare users of JU Dom zdravlja Zenica."

The independent variable is *the quality of services*, and the dependent variable is *the satisfaction of the healthcare users of the public institution Dom zdravlja Zenica*.

Data collection was performed based on controlled random sample. The total number of distributed survey questionnaires was 50, with 30 questionnaires adequately completed. Thus, the return rate of the survey questionnaires was relatively high (60%). The survey was conducted in the public institution Dom zdravlja Zenica in June 2020, and the respondents were users of healthcare services. The collected data were first entered in excel, and later, for analysis, imported into SPSS Statistics 24.0. The processed data are presented descriptively and tabularly below.

The first part of the survey questionnaire included the socio-demographic characteristics of the users of healthcare services of public institution Dom zdravlja Zenica. A total of 30 healthcare users were surveyed. The gender structure includes 11 male and 19 female respondents, while the age structure is as follows: 20-29 years 3 respondents, 30-39 years 10 respondents, 40-49 years 6 respondents, 50-59 years 9 respondents and over 60 years 2 respondents. The completed level of formal education is as follows: 21 respondents completed high school, 3 respondents completed high school, 5 respondents successfully completed undergraduate studies, while 1 respondent completed doctoral studies. The occupation of healthcare users is as follows: 4 civil servants, 21 workers, 1 housewife and 6 unemployed persons. In the following, we will apply descriptive (univariate) statistical analysis in order to confirm (reject) the hypothesis.

Descriptive statistical analysis was used to provide an answer to the following central research hypothesis: „*There is a statistically significant difference (gap) between expectations and perceptions of service quality according to issues and dimensions that affect satisfaction of healthcare users of JU Dom zdravlja Zenica.*"

Table 1. Descriptive statistics of the healthcare users' expectations scale

Variables	Arithmetic mean	Median	Mode	Standard deviation
1. Healthcare institution should have modern equipment (equipment, instruments).	4.87	5	5	0.346
2. Facilities of healthcare institution should have attractive appearance (facility, lightning, signs, etc.).	4.47	5	5	0.681

3. Staff of the healthcare institution should be adequately trained (uniform, neat appearance, accreditation, etc.).	4.80	5	5	0.610
4. Materials related to health services such as prospects, catalogues, brochures should be visually attractive.	4.17	5	5	1.020
5. The healthcare institution needs to insist on providing health services without mistakes.	4.73	5	5	0.583
6. Health service users should be familiar with the ability and conditions under which team members make a home visit.	4.67	5	5	0.711
7. The healthcare staffs needs to help patients in solving their problems.	4.77	5	5	0.504
8. Health service should be provided in a pre-agreed term.	4.60	5	5	0.770
9. The provided health service should be flawlessly provided during first visit.	4.67	5	5	0.661
10. Medical staff should treat patients with respect.	4.90	5	5	0.403
11. The medical staff should, during the examination, dedicate enough time and attention to each patient.	4.77	5	5	0.568
12. Medical staff should always be ready to respond to the demands of healthcare users.	4.60	5	5	0.770
13. Patients should be asked for consent for a third person when a diagnostic or therapeutic procedure is performed.	4.37	5	5	0.999
14. Medical staff should provide the patient with the necessary advice, information on testing, treatments, therapies and treatment costs.	4.77	5	5	0.504
15. Medical staff should talk to the patient about health protection and disease prevention (e.g. quit smoking, weight loss, diet, exercise, etc.).	4.57	5	5	0.679

16. The healthcare staff needs to explain to the patient when they need to come to a check, therapy or other treatment.	4.80	5	5	0.407
17. Behaviour of healthcare staff should gave confidence to the users.	4.67	5	5	0.758
18. The healthcare staff should have the appropriate knowledge and skills to be able to meet the needs of the users.	4.83	5	5	0.379
19. Information that healthcare users own which are related to the health condition of the service user should be protected and not publicly disclosed.	4.90	5	5	0.403
20. Medical staff should provide information or advice regarding the user's (patient) or state of user.	4.57	5	5	0.679
21. All healthcare staff should be kind to healthcare users.	4.87	5	5	0.434
22. Healthcare users should be satisfied with waiting room conditions (e.g. hygiene, room warming, etc.).	4.77	5	5	0.504
23. When staying in a healthcare facility, service users need to feel safe (using lifts, medical equipment, violent behaviour and personal safety).	4.80	5	5	0.484
24. The prices of healthcare services should be reasonable.	4.77	5	5	0.568

Table 1 shows the average scores of all variables of health service users' expectations. Other statistical parameters are also presented: median, mode, and standard deviation. The most commonly used mean value during the research is the arithmetic mean. In everyday life, the term average or average value is used for this environment. It can be seen that the arithmetic mean on the scale of expectations of healthcare users ranges from 4.17 to 4.90 (on a scale of 1 to 5, 1 - I completely disagree, 5 - I completely agree), which implies to the conclusion that the expectations of health service users were very high. This is supported by the fact that the most common grade is 5 (mod). Mode represents the value of the quantitative or qualitative characteristic with the highest frequency. The median value in 24 questions is 5. The table also lists the values of the standard deviation that measures the scatter of the sample data. The table shows that the values of standard deviations are in the range between 0.346 and 1.020, which shows that the average deviations from the arithmetic mean are mostly statistically insignificant.

Table 2. Descriptive statistics of the healthcare users' perception scale

Variables	Arithmetic mean	Median	Mode	Standard deviation
1. Healthcare institution should have modern equipment (equipment, instruments).	3.80	4	4	0.805
2. Facilities of healthcare institution should have attractive appearance (facility, lightning, signs, etc.)	4.10	4	4	0.662
3. Staff of the healthcare institution should be adequately trained (uniform, neat appearance, accreditation, etc.).	4.07	4	4	0.828
4. Materials related to health services such as prospects, catalogues, brochures should be visually attractive.	4.00	4	4	0.830
5. The healthcare institution needs to insist on providing health services without mistakes.	4.27	4	4	0.785
6. Health service users should be familiar with the ability and conditions under which team members make a home visit.	3.83	4	4	0.913
7. The healthcare staffs needs to help patients in solving their problems.	4.13	4	4	0.629
8. Health service should be provided in a pre-agreed term.	4.33	5	5	0.844
9. The provided health service should be flawlessly provided during first visit.	4.33	5	5	0.844
10. Medical staff should treat patients with respect.	4.33	5	5	0.844
11. The medical staff should, during the examination, dedicate enough time and attention to each patient.	4.37	4.50	5	0.718
12. Medical staff should always be ready to respond to the demands of healthcare users.	4.13	4	4	0.730
13. Patients should be asked for consent for a third person when a diagnostic or therapeutic procedure is performed.	3.67	4	3	1.093

14. Medical staff should provide the patient with the necessary advice, information on testing, treatments, therapies and treatment costs.	4.10	4	4	0.712
15. Medical staff should talk to the patient about health protection and disease prevention (e.g. quit smoking, weight loss, diet, exercise, etc.).	4.03	4	4	0.850
16. The healthcare staff needs to explain to the patient when they need to come to a check, therapy or other treatment.	4.40	4.50	5	0.675
17. Behaviour of healthcare staff should gave confidence to the users.	4.20	4	4	0.761
18. The healthcare staff should have the appropriate knowledge and skills to be able to meet the needs of the users.	4.33	4	4	0.661
19. Information that healthcare users own which are related to the health condition of the service user should be protected and not publicly disclosed.	4.20	4	5	0.925
20. Medical staff should provide information or advice regarding the user's (patient) or state of user.	4.17	4	5	0.874
21. All healthcare staff should be kind to healthcare users.	3.93	4	4	0.828
22. Healthcare users should be satisfied with waiting room conditions (e.g. hygiene, room warming, etc.).	4.20	4	4	0.761
23. When staying in a healthcare facility, service users need to feel safe (using lifts, medical equipment, violent behaviour and personal safety).	4.13	4	5	0.900
24. The prices of healthcare services should be reasonable.	4.17	4	4	0.699

Table 2 shows the average scores of all variables of perceptions of healthcare users. Other statistical parameters are also presented: median, mode, and standard deviation. It can be seen that the arithmetic mean on the scale of perceptions of healthcare users ranges from 3.67 to 4.40 (on a scale of 1 to 5, 1 - I completely disagree, 5 - I completely agree), which implies to the conclusion that the perception of health service users was lower than their expectations. The most common grade is 4 (mod). Mode represents the value

of the quantitative or qualitative characteristic with the highest frequency. The median value is 4. The table also lists the values of the standard deviation that measures the dispersion of the sample data. It also shows that the values of the standard deviation are in the range between 0.629 and 1.093, which indicates that the average deviations from the arithmetic mean are more significant than the scale of expectations of users of primary healthcare services. In the following presentation, we compared the parameters from the previous two tables (Table 3).

Table 3. Comparison of expectations and perceptions of healthcare users according to dimensions and questions

Dimensions	Question number	Expectation			Percepcion		
		A.S.	Mode	S.D.	A.S.	Mode	A.M.
Tangibles	1	4.87	5	0.805	3.80	4	0.805
	2	4.47	5	0.662	4.10	4	0.662
	3	4.80	5	0.828	4.07	4	0.828
	4	4.17	5	0.830	4.00	4	0.830
Average		4.5775			3.9925		
Reliability	5	4.73	5	0.583	4.27	4	0.785
	6	4.67	5	0.711	3.83	4	0.913
	7	4.77	5	0.504	4.13	4	0.629
	8	4.60	5	0.770	4.33	5	0.844
	9	4.67	5	0.661	4.33	5	0.844
Average		4.6880			4.1780		
Responsiveness	10	4.90	5	0.403	4.33	5	0.844
	11	4.77	5	0.568	4.37	5	0.718
	12	4.60	5	0.770	4.13	4	0.730
	13	4.37	5	0.999	3.67	3	1.093
Average		4.6600			4.1250		
Competence and assurance	14	4.77	5	0.504	4.10	4	0.712
	15	4.57	5	0.679	4.03	4	0.850
	16	4.80	5	0.407	4.40	5	0.675
	17	4.67	5	0.758	4.20	4	0.761
	18	4.83	5	0.379	4.33	4	0.661
	19	4.90	5	0.403	4.20	5	0.925
Average		4.7566			4.2100		

Empathy	20	4.57	5	0.679	4.17	5	0.874
	21	4.87	5	0.434	3.93	4	0.828
	22	4.77	5	0.504	4.20	4	0.761
	23	4.80	5	0.484	4.13	5	0.900
	24	4.77	5	0.568	4.17	4	0.699
Average		4.7560			4.1200		

Table 3 shows that healthcare users services have higher expectations in all dimensions and in all issues in relation to perceptions. The highest expectations of healthcare users are related to the dimensions of „Competence and assurance" and „Empathy", which relates to ability of staff to create an image of confidentiality, and the lowest expectations are related to the dimension of „Tangibles". At the same time, when it comes to perceptions, healthcare users give the highest score to the dimensions of „Competence and assurance" and „Reliability", and the lowest perception is related to the dimension of „Tangibles". Based on the data from the previous table in Table 4, the average scores for both scales were calculated, in order to be able to evaluate the gap:

Gap = Perception (P) - Expectation (E)

The wider the gap, the greater the difference between the perception and expectations of healthcare users in the observed sample.

Table 4. Gap between perceptions and expectations of healthcare users

Dimensions	Perception	Expectation	Gap
Tangibles	3.9925	4.5775	-0.5850
Reliability	4.1780	4.6880	-0.5100
Responsiveness	4.1250	4.6600	-0.5350
Competence and assurance	4.2100	4.7566	-0.5466
Empathy	4.1200	4.7560	-0.6360
Total gap	4.1251	4.6876	-0.5625

Thus, the gap represents the difference between the average ratings of perceptions and expectations of healthcare users. The table shows us, primarily, that in all dimensions the average scores for expectations are higher than the average scores for perceptions, which resulted in a negative gap. The total gap is negative in the amount of (-0.5625). The widest gaps are gaps for the dimensions „Empathy" and „Tangibles", while the dimension „Reliability" represents the narrowest gap. Ultimately, the results show us the dissatisfaction of users

of primary healthcare services. However, this does not mean that the service is of poor quality, but that the expectations of users are not met, so dissatisfaction is created, and therefore better ways to provide health services must be found in the Public Institution JU Dom zdravlja Zenica.

6. Conclusion and discussion

Based on relevant theoretical sources and analysis of procedures and results of research using descriptive (univariate) statistical analysis, it can be concluded that the central research hypothesis is accepted: „*There is a statistically significant difference (gap) between expectations and perceptions of service quality according to issues and dimensions that affect satisfaction of healthcare users of JU Dom zdravlja Zenica.*"

The research showed that in all dimensions, the average scores for expectations are higher than the average scores for perceptions, which resulted in a negative gap. The total gap is negative in the amount of (-0.5625). The widest gaps are gaps for the dimensions „empathy" and „tangibles", while the dimension „reliability" represents the narrowest gap. Ultimately, the results show us the dissatisfaction of users of primary healthcare services. However, this does not mean that the service is of poor quality, but that the expectations of users are not met, so dissatisfaction is created, and therefore better ways to provide health services in the Public Health Center Zenica must be found.

Health service quality management aims to identify important business activities in order to continuously improve the satisfaction of health service users. In order to maximize the satisfaction of healthcare users, it is necessary to constantly increase the level of perceived quality of health services. In order to achieve the mentioned goal, it is necessary to: manage those dimensions that are of the greatest importance for the users of health services; develop and integrate mechanisms for regular examination of the level of satisfaction of health service users; act with preventive and corrective measures based on the principles of ISO 9001 and take strategic and operational activities to continuously improve the actual quality of health services.

References:

1. Angelini A. (2006). Customer relationship management e customer satisfaction. Franco Angeli. Milano
2. Babakus, E. 1., Mangold, W. G. (1992). Adapting the SERVQUAL Scale to Hospital Services: An Empirical Investigation. Available at: https://pubmed.ncbi.nlm.nih.gov/1737708/
3. Bieger, T. (2000). Dienstleistungsmanagement: Einführung in Strategien und Processe bei persönlichen Dienstleistungen. Bern/Stuttgart/Wien
4. Bolton, R. N., Drew, J. H. (1991). A Longitudinal analysis of the impact of service changes on customer attitudes. Journal of Marketing, 55, pp. 365-384
5. Cronin, J. J., Taylor, S. A. (1992). Measuring service quality: a Reexamination and

Extension. Journal of Marketing, 56(3), pp. 55–68
6. Čakalić, S. (2018). Zadovoljstvo bolesnika kvalitetom pruženih usluga zdravstvene skrbi u kliničkom zavodu za nuklearnu medicinu i zaštitu od zračenja. Diplomski rad
7. Huseinspahić, N. (2011). Kvalitet kao pretpostavka za zadovoljstvo pacijenata. South Eastern Europe Health Sciences Journal (SEEHSJ), 1(1), pp. 67–73
8. Mečev, D., Goleš, K. I. (2015). Primary healthcare service quality measurement: SERVQUAL scale. Ekonomski vjesnik, 28(1), pp. 161–177
9. Mikulić, J. (2007). Upravljanje kvalitetom usluga zračnih luka - analiza multifaktorske strukture zadovoljstva korisnika. Tržište, Ekonomski fakultet Zagreb, 19(1), pp. 25
10. Oliver, R. L. (1993). A conceptual model of service quality and service satisfaction: compatible goals, different concepts. Advances in Service Marketing and Management, 2, pp. 65-85
11. Ozretić, D. Đ., Škare, V., Škare, T. (2010). Mjerenje kvalitete usluge primarne zdravstvene zaštite SERVQUAL instrumentom. Rev soc polit. 2010, 17(1), pp. 27–44
12. Rust, R. T., Oliver, R. L. (1994). Service quality - new directions in theory and practice. Sage, London, pp. 1-19
13. Snoj, B., Savić, V., Rajtmajer, B. (1999). Merjenje zaznane kakovosti storitev družbe ISS servisystem iz Maribora (The measurement of perceived services quality in ISS Servisystem in traffic). Akademia MM, Slovenska znanstvena revya za trzvenje, 3(5), pp. 33-43
14. Snoj, B. (1995). The profiles of importance of service quality components in health spas. Der markt, 34(2)
15. Stafford, M., Stafford, T. F., Wells, B. P. (1998). Determinants of customer satisfaction in the auto casualty claims process. The Journal of Services Marketing, 12(6), pp. 426-440
16. Zeithaml, V. A., Berry, L. L., Parasuraman, A. (1993). The nature and determinants of customer expectations of service. Journal of the Academy of Marketing Science, 21(1), pp. 1-12

dr.sc. Haris Hamidović, dipl.ing.el.[1]
mag. iur. Amra Hamidović[2]

Review paper

ESCROW AGREEMENTS FOR APPLICATION SOFTWARE

Abstract

As a rule, commercial computer programs come exclusively in executable form, and the accompanying license agreement requires the user to refrain from actions that could violate the author's exclusive right to adapt, process and otherwise modify - if the user needs such changes, the author's it is in the interest of the user to contact him and pay a special fee for such a service. However, what happens if software vendors go bankrupt, abandon the software development business, or stop further development of their software in situations where it has not yet reached the end-use stage by the licensee, who has allocated significant funding to the license and plans to use it for a long period of time to achieve a return on investment. How companies that are legal users of software can continue to use and adapt the product to their needs in these situations is an important question to consider when entering into business arrangements to procure software products. The solution to such situations can be found in escrow agreements. In this paper, we briefly explain the concept of escrow software contracts for possible use by business entities in Bosnia and Herzegovina.

Keywords: Software, Escrow contracts, Protection of intellectual property rights, IPR.

1. Introduction

The copyright form was chosen as the legal framework for the protection of computer programs in Bosnia and Herzegovina, that is, the BiH legal system considers a computer program to be an author's work. Moral, property and other rights of authors and other copyright holders are regulated by the Law on Copyright and Related Rights of Bosnia and Herzegovina.

A computer program is protected as a written work if it represents the author's own intellectual creation. The term computer program according to the provi-

1 doc.dr., Visoka škola „Internacionalna poslovno-informaciona akademija" Tuzla, mr.haris.hamidovic@ieee.org
2 Pravna savjetnica u Misiji OSCE-a u BiH, amrahamidoviciur@gmail.com

sions of the Law on Copyright and Related Rights of Bosnia and Herzegovina includes a program in any form, including preparatory materials for its development. The ideas and principles on which any element of a computer program is based, including the elements that underlie its interface, are not protected. In other words, the law protects the specific copyright of a computer program, in any form (digital, printed, executive or original), but not the ideas or principles on which it is made - copyright does not protect ideas, but their concrete implementation in the form of an author's work.

The authors of a computer program are natural persons and, as a rule, enjoy the same copyright rights as the authors of other categories of copyrighted works. The content of copyright consists of the author's moral rights which protect the personal and spiritual (immaterial) ties of the author with his work, then the property rights which protect the author's property interests in relation to his work, and other authors' rights which protect other author's interests.

The Law on Copyright and Related Rights of Bosnia and Herzegovina in a special chapter (Part Four - Chapter I) makes special provisions for computer programs.

Computer programs can be protected in other ways than just copyright. Although computer programs themselves are not eligible for patent protection, a patent can protect computer-applied inventions. Furthermore, computer programs can be protected by a trade secret and their name by trademark. These forms of legal protection of computer programs are not mutually exclusive.

2. Software procurement options

International Standard IEEE Std 12207-2008 states that the acquirer should consider appropriate criteria when considering the possibility of procuring a software product, including consideration of the risks, costs and benefits of each of the following options:

a) Purchase an off-the-shelf software product that meets the business requirements of the organization.

b) Software product development or obtaining software services internally.

c) Software product development or obtaining software services through a software development contract.

d) A combination of A, B, and C, or

e) Improvement of an existing software product or service, if it already exists and needs improvement.

When it comes to the general classification of software products, Sommerville lists two categories (Sommerville, 2015):

- Generic products. These are stand-alone systems that are placed on the market and sold to any customer who wants to buy them. Examples are

the same: PC software, such as graphics programs, project management tools; CAD software; software for specific markets, such as dental appointment scheduling systems.

- Customized products. It is software ordered by a specific customer to meet his needs. Examples of these are; embedded control systems, air traffic control software, motion monitoring systems.

The main difference between these two categories is who controls the specification. For generic products, the specification of what the software should do is the property of the software developer and decisions to change the software are made by the developer, while for custom products the specification of what the software should do is owned by the software buyer and they decide on the necessary software changes.

When ordering the production of personalized software, the client and the contractor sign a special type of work contract - the Copyright Agreement, which is subject to the provisions of the law governing obligations and the provisions of regulations on copyright protection.

When it comes to software development contracts, the content of the contract mainly includes job description, programmer's fee, job deadlines and deadlines within which the client should submit its materials, respond to developer inquiries and test the program. In addition, the provisions regarding the license, ie the right of the client to use the program (on which number of computers or other devices, in which period, etc.), whether there is an obligation to update and what guarantees the programmer gives to the operation of the program and within period (whether the program is purchased as seen - "as is" clauses or guarantees of functionality are given), whether the developer has an obligation to train the client's staff to use the program, what are the obligations regarding software maintenance, bug fixes, whether the program has elements of open source software and under what conditions the use of such parts of the program is licensed. An important segment of regulating the rights and obligations of contractors are intellectual property rights.

Licensing is a basic way of using intellectual property. It consists of an agreement whereby the licensor authorizes the licensee to use the identified property under certain conditions.

If the software program is not delivered under the terms of the license, the copyright to the program is defined on the basis of the provisions of the Law on Copyright and Related Rights of Bosnia and Herzegovina, which states in Article 103:

Article 103

(Computer program created in employment or by order)

If the computer program was created by an employee in the performance of his duties or according to the instructions of the employer, or if it was created by the author on the basis of an order contract, all copyrights on such program

are considered exclusively and entirely transferred to the employer or client. otherwise determined.

3. Software escrow contracts

The software manages the computers and configures them in a specific way. The software programs the computer so that it can receive and respond to commands issued by the user or another program. What a specific program does to a computer can be described in three different ways:

- as an algorithm,
- in the source code and
- in object code.

Although outdated today in terms of computer terminology and the technology it deals with, the explanation provided by Gemignani in 1980 remains one of the most insightful: "Programs are the answers to problems that need to be solved. The given problem must first be clearly formulated. The solution must then be sketched. In order to be implemented in a computer, the solution needs to be expressed in a precise way, as a series of steps to be taken, where each individual step must be clearly defined. This is usually done in the form of a flowchart, a stylized diagram that shows the different steps in the algorithm and their interrelationships. Once a flowchart is created, it is used as a guide to express an algorithm in a "language" that a computer can "understand". This "coding" of a program will almost certainly involve the use of a "high-level" computer language: such as BASIC or FORTRAN. When the algorithm is "coded" into a high-level computer language, it is called source code. It is entered into a computer via input devices, such as a terminal or card reader. The source code "translates" the compiler, part of an operating system program, into a machine language - a language that bears no resemblance to everyday speech. is expressed in the language of a machine called object code. It is this program that drives the switch system that allows the computer to perform the initial algorithm and solve the problem.

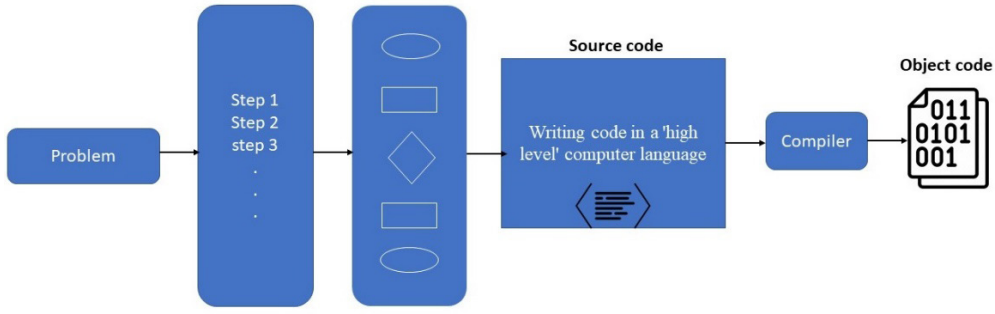


Figure 1 shows a simplified view of the steps in software development.

As a rule, commercial computer programs come exclusively in executive form, and the accompanying license agreement requires the user to refrain from actions that could violate the author's exclusive right to adapt, process and otherwise modify - if the user needs such changes, the author's it is in the interest of the user to contact him and pay a special fee for such a service.

However, what happens if software vendors go bankrupt, leave the software development business or stop further development of their software in situations where it has not yet reached the stage of final utilization by the licensee, who has allocated significant funds for the license and planned it is to use a long period of time to achieve a return on investment? How can companies that are legal users of the software continue to use and customize the product for their needs in these situations? The solution to such situations can be found in escrow agreements. Here, both parties - ie software users (licensed users) and software producers (licensors) - agree on an impartial third party - where the software source code will be stored. This additional guarantee option can generally be found in the procurement of software by contracting software development between the customer and the supplier, while it is unlikely in the procurement of generic software products such as Microsoft office suites and the like.

In general, a software escrow agreement involves three parties: the software vendor, the software user, and as an escrow agent acting as a neutral intermediary. Figure 2 shows an example of the first page of a draft of an escrow contract.

Figure 3 shows the general relationship of the parties in escrow arrangements.

The role of the escrow agent, who acts as a neutral intermediary, is to securely store the source code of the software during the contract period and make it available to the user under contract under certain conditions, for example in the event of bankruptcy of the software manufacturer. In this way, the user can continue to use, maintain and update important software programs.

Software escrow contracts offer significant benefits to both parties. Software users can be sure that the source code is securely deposited with the escrow agent code. Software vendors use the services of an internationally renowned broker for reliable documentation of their intellectual property, thus offering their customers clear security benefits.

Escrow agents point out that in the current legal situation, software escrow contracts offer special benefits. In some EU countries, the software source code is part of the bankruptcy assets and thus is not available to software users free of charge. However, storing source code with an independent third party is recommended not only for legal reasons, but also for very practical reasons. The Escrow agent subjects the data carrier it receives to incoming tests conducted by software experts and offers further optional tests. These tests ensure that all the necessary data stored on the data carrier is complete, up-to-date and error-free.

Escrow Agreement Dated:

Between:

(1) [Licensorname], a [STATE OF INCORPORATION] [TYPE OF ENTITY] whose principal place of business is at [Licensoraddress] (**"Licensor"**);

(2) [Licenseename] a [STATE OF INCORPORATION] [TYPE OF ENTITY] whose principal place of business is at [Licenseeaddress] (**"Licensee"**); and

(3) NCC Group Escrow Associates, LLC, a Georgia limited liability company whose principal place of business is at 123 Mission Street, Suite 900, San Francisco, CA 94105 (**"NCC Group"**).

Background:

(A) The Licensee has been granted a license to use the Software which comprises computer programs.

(B) Certain technical information and/or documentation relating to the Software is the confidential information and intellectual property of the Licensor or a third party.

(C) The Licensor acknowledges that in certain circumstances, such information and/or documentation would be required by the Licensee in order for it to continue to exercise its rights under the License Agreement.

(D) The parties therefore agree that such information and/or documentation should be placed with a trusted third party, NCC Group, so that such information and/or documentation can be released to the Licensee should certain circumstances arise.

Agreement:

In consideration of the mutual undertakings and obligations contained in this Agreement, the parties agree that:

1 Definitions and Interpretation

1.1 In this Agreement the following terms shall have the following meanings:

"Agreement" means the terms and conditions of this escrow agreement set out below, including the Schedule(s) hereto.

"Business Day" means a day other than a Saturday, Sunday or other day on which commercial banks in San Francisco are authorized or required by law to close.

"Confidential Information" means all technical and/or commercial information not in the public domain and which is designated in writing as confidential by any party together with all other information of any party which may reasonably be regarded as confidential information.

"Escrow Material" means the Source Code of the Software and such other material and documentation (including updates and upgrades thereto and new versions thereof) as are necessary to be delivered or deposited to comply with Section 2 of this Agreement.

"Intellectual Property Rights" mean any copyright, patents, design patents, registered designs, design rights, utility models, trademarks, service marks, trade secrets, know how, database rights, moral rights, confidential information, trade or business names, domain names, and any other rights of a similar nature including industrial and proprietary rights and other similar protected rights in any country or jurisdiction together with all registrations, applications to register and rights to apply for registration of any of the aforementioned rights and any licenses of or in respect of such rights.

"License Agreement" means the agreement under which the Licensee was granted a license to use the Software.

"Media Check" means the tests and processes forming NCC Group's Media Check service, in so far as they can be applied to the Escrow Material.

"Medium" means the media upon which the deposited Escrow Material is stored

Figure 1. Example of the first page of an escrow contract[3]

3 Source: https://www.nccgroup.com/ Accessed 21.06.2021.

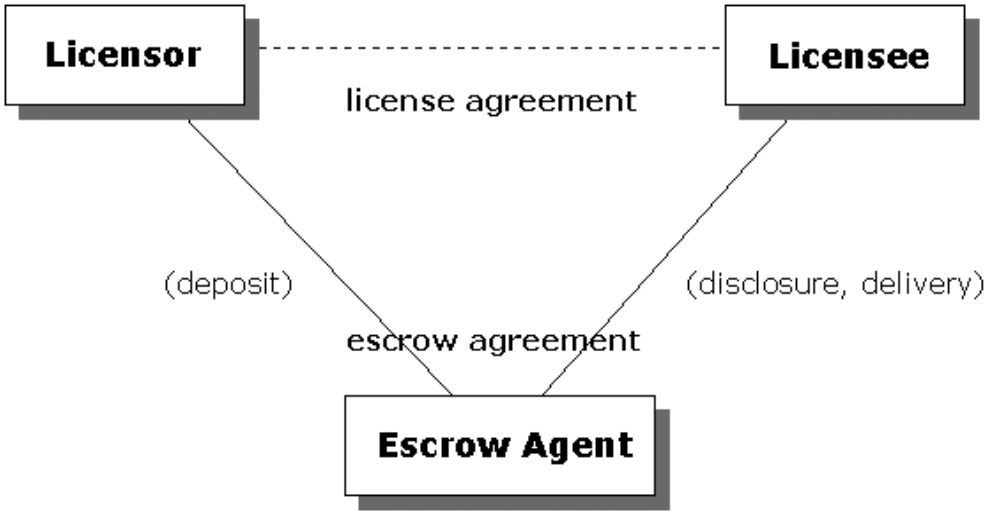


Figure 2. General relationship of parties in escrow arrangements[4]

After the verification process, an appropriate report is issued.

Figure 4 shows the verification process performed by the NCC Group, which offers escrow agent software services.

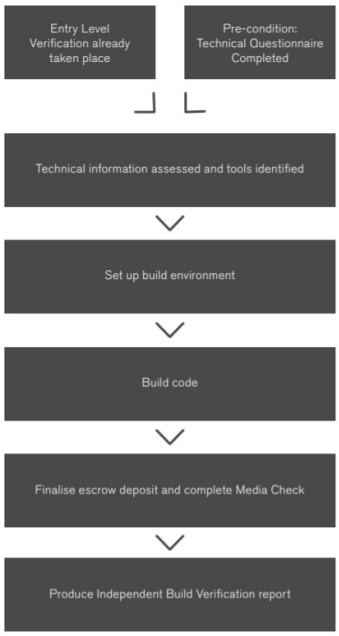


Figure 3. Example of software verification process[5]

4 Source: https://resources.infosecinstitute.com/topic/why-do-we-need-software-escrow/ Access date: 21.06.2021.

5 Source: https://www.nccgroup.com/uk/ Access date 16.07.2021.

Escrow agreements are typically entered into to protect the licensee by allowing access to the licensed software source code in the event of a release event or release terms, which means they need to define the conditions under which deposit materials will be released to the user under a deposit agreement.

The prudent licensor should ensure that the licensee does not have a unilateral right to announce the release event and initiate the release of the source code, but should instead have the right to request a release, but in accordance with a contract-defined procedure.

Escrow agreements should be negotiated in advance and executed, preferably at the same time as the license agreement.

The terms of the escrow are not an insignificant part of the transaction and must be considered before the parties agree to enter into a license agreement. A special issue is the cost of such an engagement, which can be a significant cost item of business software that needs to be considered in the context of cost / benefit analysis. For example, in the case of a Bosnian company, the ratio of the annual cost of the escrow arrangement to the cost of the initial development of the key business application and the annual cost of maintaining the same layout as in Figure 4.

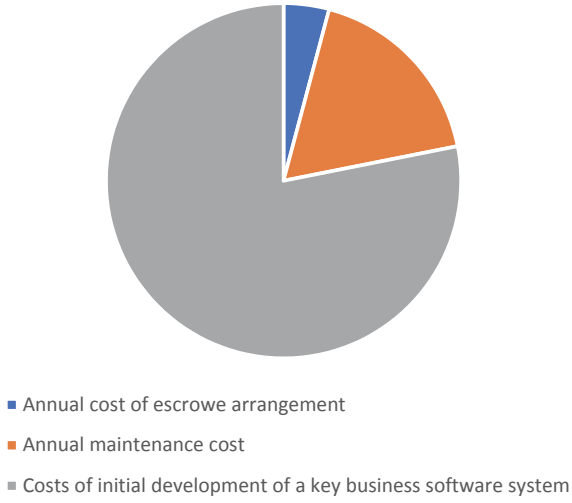


Figure 4. Example of the ratio of the annual cost of an escrow arrangement to the cost of initial development of a key business application and the annual cost of maintenance

4. Conclusion

For companies that develop critical software applications, customers of their products should be provided with some kind of guarantee that the software developer - or at least its source code - will always be available in case their

software needs maintenance, updating or reinstallation. The reputation of a software development firm can be great, but their customers require more than just words and verbal guarantees when purchasing key software.

Software escrow is a way to mitigate risk when two or more parties negotiate a software license. Under the escrow agreement, the software source code is placed in a secure escrow account controlled by a trusted independent third party. This means that if in the future the software developer is unable to support the software product for reasons stated in the agreement - such as bankruptcy, failure to maintain / support the software under the software agreement, non-performance of the software agreement, merger or acquisition - legal licensees remain will have access to the source code they need to carry out their mission and use critical software applications.

If the escrow arrangement is used for critical business software, and escrow deposits are monitored and tested, the escrow arrangement can be a key part of planning the business continuity of the client / customer of the software product. But if escrow deposits are not tracked or source code access events are not clear enough, these arrangements can be costly ventures and give a false sense of security.

References:

1. Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs, Official Journal of the European Union, L 111/16, 5.5.2009
2. Dragičević, D. et al. (2015). Visoke tehnologije i intelektualno vlasništvo. Narodne novine, Zagreb
3. Delić, E. (2021). Escrow ugovori za aplikativni softver. Završni rad, Visoka škola računarstva i poslovnih komunikacija eMPIRICA
4. Fishman, S. (2004). Web & Software Development: A Legal Guide. 4th edition, NOLO
5. Hamidović, H. (2016). Pitanje originalnosti u kontekstu autorskopravne zaštite kompjuterskih programa. Vještak, 2(1), pp. 100-104
6. Hamidović, H., Hamidović, A. (2017). Zaštita prava intelektualnog vlasništva – kompjuterskih programa. Vještak, 3-5(1-3), pp. 68-72
7. Krmić, F.N. (2009). Licencni ugovori za računalni software. Zbornik Hrvatskog društva za autorsko pravo, 10, pp. 123-132
8. Kunda, I. (2010). Raspolaganje autorskim pravom na računalnom programu – materijalnopravni i kolizijskopravni aspekti. Zbornik Pravnog fakulteta Sveučilišta u Rijeci, 31(1), Supplement, pp. 85-131
9. Sommerville, I. (2015). Software Engineering. (10th Edition), Pearson
10. Ward, C.H. (2017). A Practical Guide to Software Licensing for Licensees and Licensors. American Bar Association
11. Zakon o autorskom i srodnim pravima Bosne i Hercegovine. Službeni glasnik BiH, br. 63/10

Prof. Artur Bjelica, MD, PhD[1]
Daniel Bjelica, MSc[2]
Prof. Zorica Bogdanovic, PhD[3]
Prof. Svetlana Mitrović, PhD[4]
Prof. Božidar Radenković, PhD[5]

Original scientific paper

ASSESSMENT OF E-HEALTH LITERACY WITH THE AIM OF PROMOTING REPRODUCTIVE HEALTH OF WOMEN

Abstract

Digital marketing in healthcare should be primarily patient-centered. In order to be successful, its goals have to be clearly recognized, which assumes the production of pieces of relevant information that can be shared, and whose clearly defined focus is reflected in the goal – to cure people and improve the quality of their lives. E-healthcare consumers can benefit greatly from using Internet marketing. Ehealthcare literacy represents in fact a potential protection of the consumers against possible harms, and encourages them to fully participate in the making informed health-related decisions. The persons with a high level of e-health literacy are aware of the risk that the Internet information are sometimes unreliable. To get an insight into the possibilities offered by new information-communication technologies, that is the application of the Internet and social networks aimed at promoting reproductive health of women, a poll was conducted among 610 women of reproductive age (15-50 years). The questionnaire, created with the aim to get information about the e-healthcare literacy, was placed on the Internet. It contained the questions related to the age, education, partnership status, residence place, self-assessment of personal general health, way of obtaining health information, and an adapted five-degree Likert-type scale, created according to the eHEALS questionnaire. The analysis of the obtained results showed that a great majority of polled women

1 Full professor, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia, artur.bjelica@mf.uns.ac.rs
2 Faculty of Organizational Sciencies, University of Belgrade, Belgrade, Serbia, daniel.bjelica@gmail.com
3 Associate professor, Faculty of Organizational Sciencies, University of Belgrade, Belgrade, Serbia, zorica@elab.rs
4 Assistant professor, Faculty of innovation and project management, Educons University, Belgrade, Serbia, svmitrovic@mts.rs
5 Full professor, Faculty of Organizational Sciencies, University of Belgrade, Belgrade, Serbia, boza@elab.rs

consider the Internet useful in making health-related decisions and are well aware of the importance of the Internet-provided healthcare information. The survey participants showed a satisfactory degree of e-healthcare literacy, but it should be pointed out that their trust in the Internet information is lower when making decisions concerning their own health. No connection was observed between the e-healthcare literacy of the participants and their age, residence place, employment, civil relationship, level of physical activity, use of tobacco products, and the own self-assessed health state. On the other hand, a significant association was found between the participants' education level and the level of e-healthcare literacy.

Keywords: e-health, e-health literacy, digital marketing, healthcare strategy.

1. Introduction

The main advantages of using the Internet in marketing is the precise targeting, interactivity, potent media, costs reduction, efficiency, and attraction of the clients (Moorman, van Heerde, Moreau, and Palma Tier, 2019). Up to now, the Internet has been the fastest growing communication medium. Almost from the very beginning, one of its most important possibilities, compared to the previous technologies of mass communication, is the two-way functioning, making access to the website easier, which is important for building up and maintaining relations among the users. Besides, social media have strengthened the clients' intercommunication processes, which enables a client to communicate with numerous other clients in a fast and relatively easy way. Still, the companies can have a direct control of such communications (Mangold and Faulds, 2009).

The Internet is a very important channel for communication between companies, and marketing experts should use it in a wise way in order to attract new clients and retain the existing ones. Nowadays, practically all companies use the Internet as a new and very efficient way of marketing communication. Chaffey and Ellis-Chadwick (2012) mention that there are three main operative processes in e-marketing: 1. attracting new clients (attracting site visitors), 2. conversion (engagement of the web-location visitors), and 3. retaining (encouraging further use of digital channels).

Internet marketing does not only mean only simple posting of ads on the Internet, since it includes some more complex, coordinated and planned communication activities. A company can have a dynamic and attractive design of its Internet page, with the excellent content, but the client is not aware of the existence of that web page only because of a wrong or inappropriate Internet marketing. For these reasons, the online marketing is focused on the attraction of visitors to the website.

The Internet marketing communication is defined as a technique of online communication with the aim of attaining the awareness of the brand, stimulating the users of digital technologies to visit the web page, and thus play a sig-

nificant role in the marketing mix, which is presently experiencing development in a planned and continuous way.

2. Specificities of the Internet marketing in healthcare

Internet marketing of healthcare institutions is rather specific, and has changed with time. In the middle of the 90ties of the 20th century, the web pages included educational contents, graphical design, and original photos, aimed at informing public about healthcare services offered by physicians and pharmaceutical companies. In the course of years, the web pages have become more complex and more sophisticated. Today, the Internet healthcare marketing involves well-developed web pages, as a means for all advertising activities.

Digital healthcare marketing should be patient-centered, and the tendency is to relate its efficiency to clearly recognizable marketing goals. This assumes, first of all, production of relevant information which may be shareable, with a clearly defined focus, which is reflected in the approach – to cure people and improve quality of their lives.

It should be always kept in mind that each patient is a special case, that there are differences between patients, and that is necessary to insist on an personalized approach to each individual, so that the strategy *one-size-fits-all* is not good for a successful communication. Of essential importance is to emphasize empathy, which represents a key aspect in advancing experience of the patients/clients.

Normally, healthcare institutions want to have satisfied patients, and to initiate this goal it is necessary to target personal problems of the patient, induce him to show his inner desires, and reveal his personality using visual metaphors. All this suggests that one should not focus on general key words of advertising campaigns, since this will generalize the target population, whereas the essence is hidden in the details. The recommendation is to use key phrases, and not key words (Evolve, n.d.).

3. E-health literacy

E-health literacy is defined as the ability of searching, finding, understanding, and assessing the healthcare information from electronic sources, and application of the acquired knowledge to solve the health problems (Norman and Skinner, 2006). According to this definition, e-healthcare literacy encompasses six kinds of literacy: traditional literacy (general and numerical literacy), information literacy, media-related literacy, health literacy, computer literacy, and scientific literacy. Media-related e-health literacy is the literacy that assumes consciousness of the existence of biases concerning media perspectives and of the ability to make distinction between the explicit and implicit meanings of media messages, as well as to understand meaning of the media messages. Healthcare consumers may have positive results from the use of the Internet

for healthcare purposes. Ehealth literacy, in fact, represents a potential to protect the consumers from harms, and strengthen them to fully participate in making informed decisions concerning their health. Persons with a high level of e-health literacy are more conscious the risk of finding sometimes unreliable information on the Internet. It is important to recognize that e-health literacy does not depend on the skill in accessing the technology, but of the skill to use the given knowledge (Neter and Brainin, 2012). Also, of essential importance is to point out that e-health literacy is an essential element of the application of healthcare. In Europe and in developed countries, a great portion of population does not have sufficient knowledge and skills to trace, understand, and assess online information, and apply them in making decision concerning their own health (Del Giudice, 2017).

4. Study design

In order to get an insight into the possibilities offered by new information-communication technologies, that is into application of the Internet and social networks to promote reproductive health of women, a specially-designed questionnaire was handed out to a sample of 610 women in their reproductive age (15-50 years).

The questionnaire, created with the aim to get information about the level of e-health literacy, was uploaded on the Internet. It contained questions related to participants' age, education level, residence place, self-assessment of the own general health state, way of obtaining health information, and an adapted five-degree Likert scale related to e-health literacy, created according to the eHEALS (eHealth Literacy Scale (Norman and Skinner, 2006).

In order to have a survey sample representative to the selected population, its number was determined in the following way:

- According to the estimates of the Statistical Office of the Republic of Serbia, the number of women of the age 15-50 on December 31 of 2018 was 1,510,363 (Statistical Office of the Republic of Serbia, 2021).
- Using the calculator for sample size (CheckMarket, n.d.), at the confidence level of 95% and a confidence interval of 4%, it was calculated that the number of 600 responses makes a representative sample of woman population aged 15-50 in the Republic of Serbia.

The total number of filled in questionnaires when the polling was actual on the Internet was 610. Some of the participants did not answer some of the questions, but there was a minimum of 600 responses to each question.

Statistical analysis was performed using the software package IBM SPSS 27.0.

5. Results

The survey sample was 610 women of the age from 15 to 50. The results showed that: 65.7% lived in a larger town, 55.9% had university education, 60.9% were married, 56.4% practiced regularly physical activities, 56.4% were non-smokers, and finally, 58.9% mentioned that they cared sufficiently about their health. The ways of obtaining information, presented in Figure 1, mention the Internet as the dominant source of information about health issues.

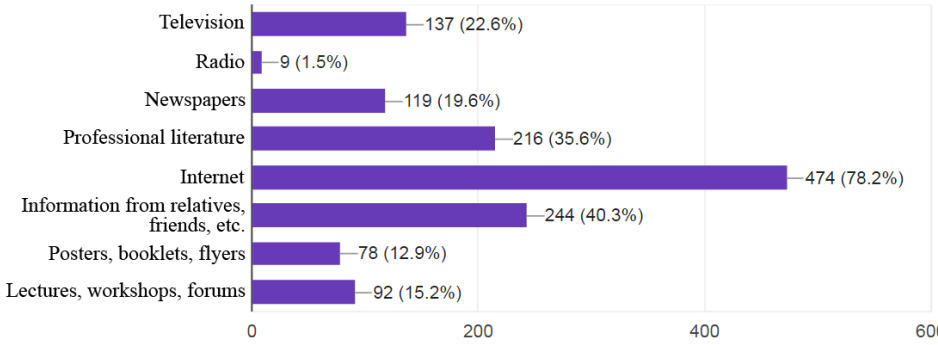


Figure 1. Ways of obtaining information about health

Table 1 presents the descriptive statistics of the results obtained on the modified e-health literacy scale.

Table 1. Descriptive statistics of the results on e-health literacy scale

		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
N	Valid	609	607	608	608	608	607	610	606	609	609
	Missing	1	3	2	2	2	3	0	4	1	1
Mean		3.28	3.65	3.36	3.50	3.66	3.67	3.55	3.56	3.74	2.67
Median		3.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00
Std. Deviation		1.04	1.08	1.02	1.10	1.05	1.09	1.11	1.13	1.10	1.09
Minimum		1	1	1	1	1	1	1	1	1	1
Maximum		5	5	5	5	5	5	5	5	5	5

The average scores on all questions from the e-health literacy scale, with the exception of the item 10, are above 3, which implies the following conclusions: the possibility of getting health-related information from the Internet is of great importance; the Internet is very useful in making decisions concerning the respondents' own health; the respondents showed a satisfactory e-health literacy. The item 10 from the scale (I have confidence in the Internet-provided information about health when I am to make decision about my own health) indicates a lower appreciation of the Internet information when the respondent's own health is concerned.

Table 2 shows the correlation between the items consisting the e-health literacy scale.

Table 2. Pearson's correlation between variables in the e-health literacy scale

		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
V1	Pearson correlation	1	.723**	.529**	.441**	.462**	.491**	.513**	.321**	.324**	.561**
	Sig. (2tailed)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	609	606	607	607	607	606	609	605	608	608
V2	Pearson Correlation	.723**	1	.555**	.454**	.478**	.509**	.543**	.393**	.414**	.487**
	Sig. (2tailed)	.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	606	607	605	605	605	604	607	603	606	606
V3	Pearson correlation	.529**	.555**	1	.712**	.682**	.626**	.632**	.493**	.509**	.473**
	Sig. (2tailed)	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	607	605	608	606	606	605	608	604	607	607

V4	Pearson correlation	.441**	.454**	.712**	1	.862**	.709**	.667**	.576**	.550**	.444**
	Sig. (2tailed)	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000
	N	607	605	606	608	606	605	608	604	607	607
V5	Pearson correlation	.462**	.478**	.682**	.862**	1	.824**	.726**	.594**	.576**	.424**
	Sig. (2tailed)	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000
	N	607	605	606	606	608	605	608	604	607	607
V6	Pearson correlation	.491**	.509**	.626**	.709**	.824**	1	.806**	.581**	.542**	.451**
	Sig. (2tailed)	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
	N	606	604	605	605	605	607	607	603	606	606
V7	Pearson correlation	.513**	.543**	.632**	.667**	.726**	.806**	1	.631**	.580**	.526**
	Sig. (2tailed)	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000
	N	609	607	608	608	608	607	610	606	609	609
V8	Pearson correlation	.321**	.393**	.493**	.576**	.594**	.581**	.631**	1	.757**	.434**
	Sig. (2tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000
	N	605	603	604	604	604	603	606	606	605	605

V9	Pearson correlation	.324**	.414**	.509**	.550**	.576**	.542**	.580**	.757**	1	.397**
	Sig. (2tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
	N	608	606	607	607	607	606	609	605	609	608
V10	Pearson correlation	.561**	.487**	.473**	.444**	.424**	.451**	.526**	.434**	.397**	1
	Sig. (2tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	N	608	606	607	607	607	606	609	605	608	609
** Correlation is significant at the 0.01 level (2-tailed).											

All obtained correlations are moderately high, and all are statistically significant. The correlation between the particular variables – V1 and V2, V4 and V5, V5 and V6, V5 and V7, are somewhat higher.

The correlations in question are between the following variables:

1. How do you experience the use of the Internet as a help in making decisions about your health and how important is to you the possibility of accessing health-related information via the Internet?
2. I know where to find health-related on the Internet, and I know how to find them.
3. I know how to find health-related information on the Internet and how to use the Internet to find the answers to the questions concerning my health.
4. I know how to find health-related information on the Internet, and how to use them with the aim to help me to care about my own health state.

Such results point out to a consistency in the participants' responses related to the following issues:

1. utility of accessing the Internet when the health is concerned,
2. site and way of finding health-related information on the Internet,
3. way of how to use the Internet in respect of getting health-related information,
4. finding health-related information that are important for assessing the own health state.

The questions of the e-health literacy scale were analyzed using factor analysis by principale components method extraction. Tables 3-6 show the results of the factor analysis of the questionnaire.

Table 3. Results of e-health literacy scale factor analysis

Component Characteristics			
	Eigenvalue	Proportion var.	Cumulative
PC1	6.054	0.605	0.605
PC2	1.126	0.113	0.718

The analysis of the file data isolated two components with characteristic roots higher than unity. It should be pointed out that the first principal component explains about 6 times more of the variance compared to the second one.

All variables have a very high correlation with the first principal component (all measure a similar construct), which is presented in Table 4.

Table 4. Component matrix

	Component
	1
V1	0.680
V2	0.703
V3	0.805
V4	0.840
V5	0.870
V6	0.856
V7	0.862
V8	0.746
V9	0.727
V10	0.652
Extraction method: Principal Component Analysis.	
a. 1 component extracted.	

The parallel factor analysis, comparing the coverages of the variance of isolated factors (solid line) and of the simulated factors (broken line) suggests the existence of one rather than two factors.

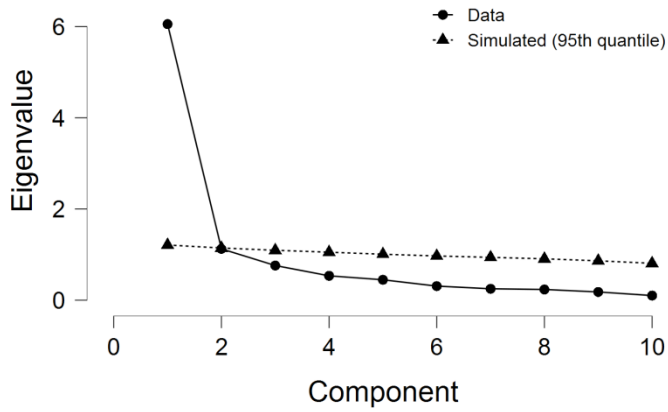


Figure 2. Scree plot

Realibility of the scale, evaluated as the internal consistency of the items expressed by Cronbach's alpha is high (**α** = 0.93).

Table 5. Realiability analysis

Scale Reliability Statistics	
Cronbach's α scale	0.926
Note. Of the observations, 593 were used, 18 were excluded listwise, and 611 were provided.	

Distribution of the contacted variable
of the average score on the e-health literacy scale

The respondents' results are presented as their average score on the scale items, so that the maximum score on this variable is 5. The arithmetic mean is 3.5, and the distribution of the scores is mildly skewed (Skewness = -0.57), meaning that higher results are somewhat more frequent, which is also indicated by the histogram of scores.

Table 6. Summary results on the modified eHEALS scale

Statistics		
E-health literacy_MEAN		
N	Valid	593
	Missing	18
Mean		3.4690
Median		3.5000
Std. Deviation		0.83854
Skewness		-0.566
Std. Error of Skewness		0.100
Kurtosis		0.379
Std. Error of Kurtosis		0.200
Minimum		1.00
Maximum		5.00

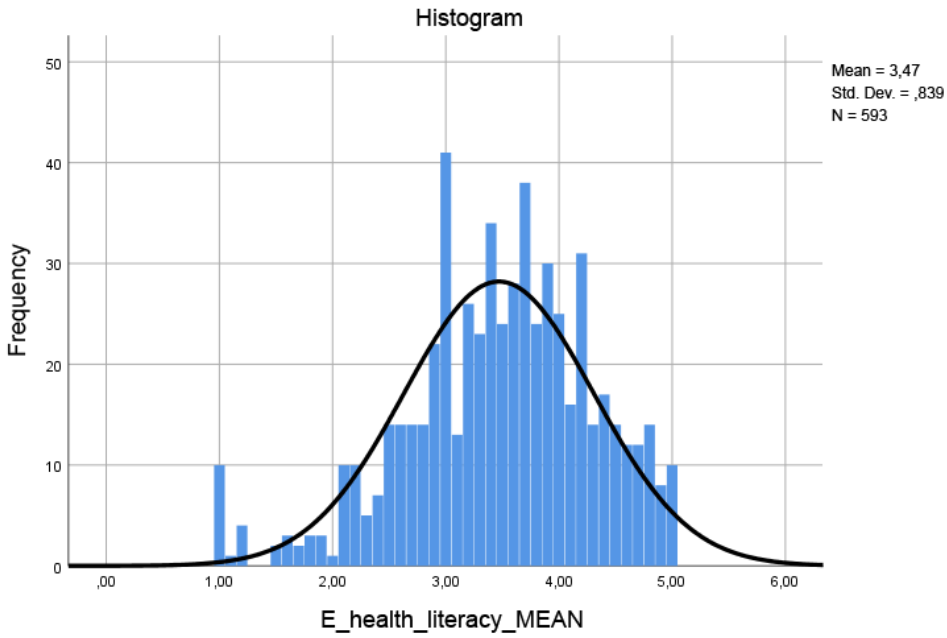


Figure 3. Graphical presentation of the responses on a modified eHEALS scale

Differences in respect of categorical variables

One-way variance analysis was used to test differences between participant groups in respect of different classification criteria (age, residence place, education level, partnership status, employment, level of physical activity, use of tobacco, and care for own health). Each analysis involved the following:

a) Descriptive indicators,

b) Levene's Test of Equality of Error Variances,

c) F-test to evaluate differences between the groups (*Tests of Between Subjects Effects*). Besides the F-test, the effect magnitutes are also presented (*Partial Eta Squared*),

d) Post-hoc tests to evaluate differences between group pairs are shown for the results in which F-test showed previously significant differences between groups (*Multiple Comparison*),

e) Kruskal-Wallis H test for testing differences between the groups, based on the ranges, non-parametric surrogates for the variance analysis,

f) Graphical presentation of avearage values per groups (*Profile plots*).

No association was found between the e-health literacy and age of the respondents in respect of their age, residence place, employment, partnership status, level of physical activity, use of tobacco products, as well as the assessed care for the own health. The testing results are presented in the subsequent tables.

The results for the groups formed in respect of education have different variability (*Levin test*). But, in addition to the F-test, the Kruskal-Wallis test too, indicates significant differences between the respondent groups in respect of the score concerning e-health lieracy – the participants with university education and doctorate showed somewhat higher scores compared to those with college degree, and with vocational school and secondary school. The differences between the arithmetic means are not high, and the effect assessed via the partial eta coefficient is relatively low (partial h = 0.03).

Table 7. Descriptive statistics of results on modified eHEALS scale

Dependent Variable: E_health_literacy_MEAN			
Education	Mean	Std. Deviation	N
Secondary school + Elementary school	3.3511	0.90348	184
College/ Vocational school	3.2038	0.95151	53
University degree	3.5506	0.77125	332
Doctorate	3.8292	0.70123	24
Total	3.4690	0.83854	593

Table 8. Testing of statistical significance

Levene's Test of Equality of Error Variances[a,b]					
		Levene Statistics	df1	df2	Sig.
E_health _literacy_ MEAN	Based on Mean	4.134	3	589	0.006
	Based on Median	3.765	3	589	0.011
	Based on Median and with adjusted df	3.765	3	574.95	0.011
	Based on trimmed mean	4.068	3	589	0.007
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.					
a. Dependent variable: E_health_literacy_MEAN					
b. Design: Intercept + Education					

Table 9. Testing of intersubject effects

Dependent Variable: E_health_literacy_MEAN						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial sq. eta
Corrected Model	11,611[a]	3	3.870	5.633	0.001	0.028
Intercept	2814.872	1	2814.872	4097.183	0.000	0.874
Education	11.611	3	3.870	5.633	0.001	0.028
Error	404.658	589	0.687			
Total	7552.290	593				
Corrected Total	416.269	592				
R Squared = 0.028 (Adjusted R Squared = 0.023)						

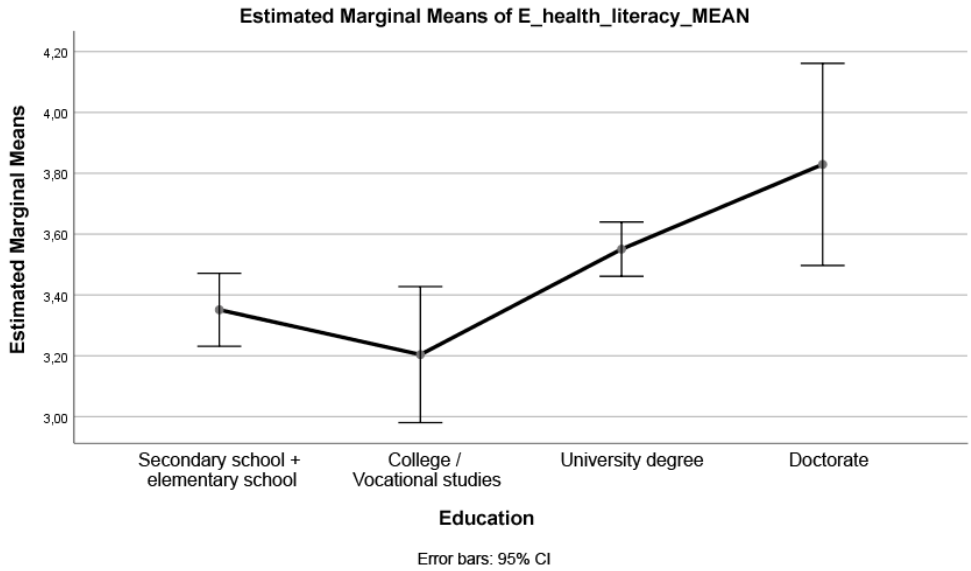
Table 10. Multiple comparison between variables

Dependent Variable: E_health_literacy_MEAN						
Tukey HSD						
(I) Education	(J) Education	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Secondary school + Elementary school	College/ Vocational school	0.1473	0.12922	0.665	-0.1856	0.4802
	University degree	-0.1995*	.07618	0.045	-0.3958	-0.0033
	Doctorate	-0.4781*	.17989	0.040	-0.9415	-0.0146
College/ Vocation. studies	Secondary school + Elementary s.	-0.1473	.12922	0.665	-0.4802	0.1856
	University degree	-0.3468*	.12261	0.025	-0.6627	-0.0310
	Doctorate	-0.6254*	.20393	0.012	-1.1508	-0.1000
University degree	Secondary school + Elementary s.	0.1995*	.07618	0.045	0.0033	0.3958
	College/ Vocational school	0.3468*	.12261	0.025	0.0310	0.6627
	Doctorate	-0.2786	.17520	0.385	-0.7299	0.1728
Doctorate	Secondary school + Elementary school	0.4781*	.17989	0.040	0.0146	0.9415
	College/Voca-tion.studues	0.6254*	.20393	0.012	0.1000	1.1508
	University degree	0.2786	.17520	0.385	-0.1728	0.7299
Based on observed means. The error term is Mean Square (Error) = 0.687.						
*. The mean difference is significant at the 0.05 level.						

Table 11. Testing of statistical significance

Test Statistics[a,b]	
	E_health_literacy_MEAN
Kruskal-Wallis H	13,301
Df	3
Asymp. Sig.	,004
a. Kruskal Wallis test	
b. Grouping variable: Education	

Figure 4. Graphical presentation of the correlation of education level and e-health literacy



6. Conclusion

An Internet survey was conducted on a representative sample of women in fertile age, with the aim to assess their e-literacy and plan the strategy for promoting reproductive health using digital channels. The adapted e-health literacy scale showed good characteristics in measuring the given construct.

The analysis of the obtained survey results indicate that the great majority of respondents experience the Internet useful in making decisions about their

own health, and consider the Internet as a very significant means for providing health-related information. The respondents showed a satisfactory level of e-health literacy, although it is neccessary to point out that the trust into the Internet health-related information is lower when decisions about the own health are to be made. No association was observed between the e-health literacy of the respondents in respect of their age, residence place, employment, partnership status, level of physical activity, use of tobacco products, and care about the own health. A significant correlation was found in respect of educational level and assessed level of e-health literacy.

References:

1. Chaffey, D., Ellis-Chadwick, F. (2012). Digital Marketing: Strategy, Implementation and Practice. 5th Edition, Pearson Education Limited, London
2. CheckMarket (n.d.). Sample size calculator. Available at https://www.checkmarket.com/sample-size-calculator/
3. Del Giudice, P. (2017). The IC-Health project: improving digital health literacy in Europe. European Journal of Public Health, 27(3), 1 ckx187.
4. Evolve (n.d.). The Future of Medical Healthcare Marketing. Available at https://evolvedigitallabs.com/future-medical-healthcare-marketing/
5. Mangold, W., Faulds, D. (2009). Social media: The new hybrid element of the promotion mix. Business Horizons, 52, pp. 357-365
6. Moorman, C., van Heerde, H.J., Moreau, C.P., Palmatier, R.W. (2019). Challenging the Boundaries of Marketing. Journal of Marketing, 83(5), pp. 1-4
7. Neter, E., Brainin, E. (2012). eHealth literacy: extending the digital divide to the realm of health information. Journal of Medical Internet Research, 14 (1), e19
8. Norman, C.D., Skinner, H.A. (2006). eHEALS: The eHealth Literacy Scale. Journal of Medical Internet Research, 8(4), e27
9. Statistical Office of the Republic of Serbia (2019, June 26). Estimated number of inhabitants in 2018. Available at https://www.stat.gov.rs/sr-latn/vesti/20190628-procenjen-broj-stanovnika-2018/

Daniel Bjelica, MSc[1]
Prof. Artur Bjelica, MD, PhD[2]
Prof. Marijana Despotović Zrakić, PhD[3]
Prof. Dušan Barać, PhD[4]
Tamara Naumović, MSc[5]

Original scientific paper

USERS' ACCEPTANCE OF A MOBILE APPLICATION TO FOLLOW THE COURSE OF PREGNANCY

Abstract

In order to ensure a better insight into the course of pregnancy, a mobile Android application, named *Future Mom*, has been developed and handed to its users – patients and physicians. After a three-month trial period, an evaluation was made of the application's acceptance, and of the factors influencing it. The evaluation was carried out based on the Benefits Evaluation Model, involving the polling of 420 pregnant women and 75 physicians. Implementation of the application went well, and the poll results indicated that both groups of participants showed a high degree of acceptance of the application, as well as the readiness for its further use. The obtained results for both groups can be considered as rather positive in respect of readiness of the respondents to use mobile technologies and mobile applications. In order to improve further use of this mobile application, a wider digital marketing campaign would be needed, first of all based on the *omnichannel* strategy, in a continuous form, and with the accent on the three crucial time points: before use, after one-month use, and after a three-month use of the application, as well as in the post-implementation period. The campaign should promote the following aspects: technical characteristics of the mobile application (factors of expected performance), easiness of use (factor of expected efforts), influence of the satisfied users (including physicians, reporting their positive experience in using the application (factor of social influence), and through some other incentives (factor of mitigating circumstances).

Keywords: e-business, m-healthcare, mobile application, acceptance assessment.

1 Faculty of Organizational Sciencies, University of Belgrade, Belgrade, Serbia, daniel.bjelica@gmail.com
2 Full professor, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia, artur.bjelica@gmf.uns.ac.rs
3 Full professor, Faculty of Organizational Sciencies, University of Belgrade, Belgrade, Serbia, maja@elab.rs
4 Associate professor, Faculty of Organizational Sciencies, University of Belgrade, Belgrade, Serbia, dusan@elab.rs
5 Teaching assistant, Faculty of Organizational Sciencies, University of Belgrade, Belgrade, Serbia, tamara@elab.rs

1. Development of the application for following the course of pregnancy

In the domain of promoting communication between the physicians and their female patients a need arises for developing new systems which will facilitate the communication processes (Weiner, 2021). To achieve a better control of the pregnancy, a mobile application, named *Future Mom*, has been developed and implemented. The application is intended to enable pregnant women to get efficient, prompt, simple, and clear insight into the results of all the examinations, and provide communication with the physician attending her pregnancy. In the everyday practice, there are cases of changing the appointment date without informing the pregnant woman, or the attempts of doing it were unsuccessful (wrongly written phone number or email address, etc). On the other hand, the medical examination is normally time-limited, so that the amount of information that the pregnant woman obtains about progress of the pregnancy is not sufficient. Also, the physician's report, given in the classic paper form is susceptible to forgetting or losing. The developed application can provide the physician a simple and efficient way of controlling the state of all his pregnant patients (Goetz M, Müller M, Matthies LM, et al., 2017).

2. Technologies used in the development of the mobile application

The application *Future Mom* was created for the Android operative system by using the Android Studio environment. In view of the fact that the application requires storage of the data for both patients and physicians, the Firebase Database service was used as a *cloud* database solution. The focus of this application is to provide information about all the examinations taking place during the pregnancy. This enables input of the overall data about the all the examinations. The main advantage is the possibility of synchronization of the ultrasound examinations. The idea is to send independently the ultrasound data to API, while loading of the examination data should be automatic.

3. Methodology used to assess the user's readiness to employ the created mobile application

The mobile application was evaluated based on the Benefits Evaluation Model, developed by the Canada Health Infoway (Canada Health Infoway, 2012), specially adapted to the healthcare environment. This model was created on the basis of the Model of Information Systems Success: A Ten-Year Update described by DeLone and McLean (2003). The key performance indicators of the developed application are presented in Table 1.

Table 1. Key performance indicators of the developed mobile application

Category and Subcategory	Domain/Sub-domain Benefits	Indicator/Type of the Survey Question
System		
Functionality	General quality	Likert scale
Functionality	Simplicity of use	Likert scale
Functionality	Effect on work performances	Likert scale
Performance	Response time	Likert scale
Performance	Integration into everyday practice	Likert scale
Performance	Reliability	Likert scale
Security	Security	Likert scale
Information		
Content	Completeness	Likert scale
Content	Precision	Likert scale
Content	Relevance	Likert scale
Accessibility	Information supply rate	Likert scale
Accessibility	Availability when needed	Likert scale
Accessibility	Information frame format	Likert scale
Service		
Responsivity	System's general quality	Likert scale
Responsivity	Implementation process	Likert scale
Responsivity	Training level	Likert scale
Responsivity	Continuous support level	Likert scale
Usage data	Usage level	Likert scale
Usage intention	Recommendation level	Likert scale
Usage intention	Further usage of the system	Likert scale
Satisfaction		
User's satisfaction	General satisfaction	Likert scale
User's satisfaction	Productivity	Likert scale
User's satisfaction	Healthcare service quality	Likert scale
User's satisfaction	Significance for everyday practice	Likert scale
User's satisfaction	Quality of the provided information	Likert scale
User's satisfaction	Proposition for advancement	Open type

The usage of the developed mobile application was assessed based on a questionnaire whose items were created according to the defined performance indicators given in the five-level Likert-type scale. The questions concerning the propositions of the application promotion were of the open type, while those related to social-demographic data were of closed type. In the evaluation of the application usage use was also made of the Technology Acceptance Model (TAM), that is a theoretical construct lying behind TAM and its further modifications – Unified Theory of Acceptance and Use of Technology (UTAUT). Some particular questions were adapted to these theoretical concepts (Cimperman, Brencic, Trkman, 2016; Kalayou, Endehabtu, Tilahun, 2017).

The questionnaire was filled in on-line by the physicians and pregnant women, who had used the developed mobile application for following the pregnancy. The survey's sample consisted of 420 pregnant women and 75 physicians from the territory of the Republic of Serbia, mainly from Vojvodina.

4. Results

Based on the obtained results by grouping the responses of the physicians and pregnant women it was possible to extract two key indicators that are significant for the use of the developed mobile application (Table 2):

1. Readiness to use mobile applications,
2. Acceptance of the mobile application developed for following the pregnancy.

Table 2. Key indicators extracted from the questionnaire, significant for the use of the mobile application

Indicator	Mean value	Standard deviation	Confidence level (alpha = 0.05)
Readiness to use mobile applications – pregnant women/physicians			
How often do you use mobile devices?	4.45	0.66	0.42
	4.55	0.53	1.02
How often do you install applications?	3.46	1.25	0.33
	3.70	0.98	0.84
I am familiar with the IoT concept and omnipresent technologies for measuring the organism parameters	4.15	1.34	0.39
	4.37	0.97	0.99
Healthcare institutions should use mobile services in the communication with patients	4.75	0.61	0.45
	4.69	0.73	1.09

Acceptance of the application – pregnant women/physicians			
The application is very useful	4.76	0.63	0.45
	4.66	0.66	1.05
I would use the application	4.24	0,94	0,40
	4.54	0.76	1.03
I think that this application would improve the process of communication with the gynecologist	4.79	0.65	0.45
	4.89	0.49	1.09
The application allows easy finding information and functionalities	4.71	0.67	0.45
	4.78	0.55	1.08
The application would provide me the possibility of tracing data about examination in a simple way	4.68	0.80	0.41
	4.77	0.53	1.08
I think that the information about examinations are structured in the application in a right way	4.64	0.71	0.44
	4.70	0.56	1.06
I think that the IoT component would improve the application	4.66	0.75	0.43
	4.71	0.65	1.06
The application and the way of its usage suit my needs	4.53	0.90	0.43
	4.73	0.57	1.07
I would recommend the application to other pregnant women	4.21	0.94	0.45
	4.79	0.52	1.08
I think that the application would make pregnancy easier	4.66	0.75	0.44
	4.78	0.50	1.08
The application would enable a faster and more efficient treatment of patients	4.75	0.64	0.45
	4.73	0.58	1.08
I think that the application encompasses all essential parameters related to the pregnant woman examinations (D)	4.74	0.57	1.07
The application would enrich the existing electronic data about patients (D)	4.87	0.48	1.10

Generally, the results for both groups of survey participants are rather positive in respect of their readiness to use mobile technologies and mobile applications. Mobile devices are often used – mean scores are 4.45 (pregnant women) and 4.55 (physicians), which means that the answer to the question concerning the frequency of using mobile devices is "many times a day". Accordingly, these findings support strongly the healthcare institutions in their intention to use mobile services in the communication with their patients (4.75 – pregnant women and 4.69 – physicians). Still, the results concerning the

frequency of downloading and installing mobile applications are significantly below this level, as the average scores are 3.46 (pregnant women) and 3.70 (physicians). It is interesting to note that the great majority of respondents are familiar with the concept of using Internet, mobile technologies, and different sensors for measuring body parameters. At the same time, the standard deviation of 1.34 for the participating women indicates that there exist rather significant differences.

The results associated with the questions of Technology Assessment Model (TAM) show that the quality, usability, and usefulness of the developed application are at a rather high level. The majority of responses are above 4.60, with small deviations (mainly below 0.70). However, the women are intended to further use the application and recommend it, which is seen from the score of 4.21, and small deviations of 0.94, which is significantly less than for the other responses. Such finding is in correspondence with the response to the question related to the readiness to install new applications.

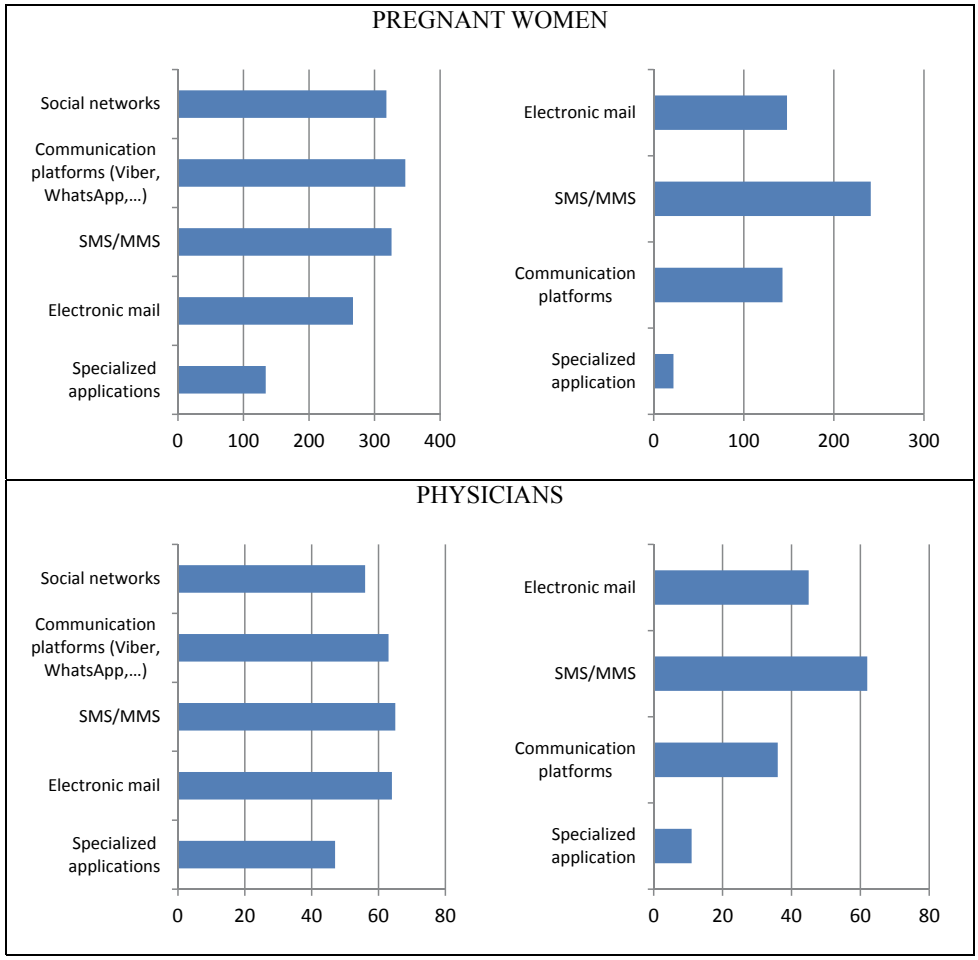


Figure 1. Frequency of using mobile technologies

Based on the graph given in Figure 1, showing a summary of the findings for the groups of women and physicians, reflecting the frequency of using mobile technologies and services and their liking for different types of communication channels, a further analysis makes it possible to draw certain conclusions. Evidently, the level of using usual channels of mobile communication such as SMS, applications for exchanging messages, mobile social networks, and e-mail is, expectedly, rather high. However, the usage of a specialized mobile application is at a low level. Hence, there is a significant room for using mobile applications that encompass all common tools and channels for mobile communication.

In the light of TAM (Technology Acceptance Model), that is the UTAUT theory (Unified Theory of Acceptance and Use of Technology), it can be concluded that the implementation of the developed mobile application has been realized well, with a high degree of acceptance, and with the intention of its further usage.

With the aim of achieving better effects of the campaign, an analysis has been done of the effects of the factors that influenced most the acceptance of the application by both groups of respondents. This was done by using the regression model with categorical predictors, based on the statistical software package SPSS (Statistical Package for the Social Sciences), version 25.0.

Results of the regression analysis for the sample of pregnant women

The regression model was formed in four steps (*enter* method). In the regression analyses, the criterion variable was the average score on the questionnaire, while the predictor variables were category variables standing for: 1. woman's age, 2. the ordinal number of pregnancy (1–4 and more), and 3. education level. In addition to these variables, the analysis included also three variables (treated as numerical), serving to assess the level of readiness to accept new technologies.

The first model indicates that the age of pregnant women does not influence the acceptance of the application, since all of the respondents gave similar marks (in average 4.67 out of 5). If the variables related to the ordinal number of pregnancy were included into the model, the probability of its significance shows a mild increase ($p = 0.039$). However, the regression coefficient in Table 4 does not show significantly different results for some of the categories. Only it is possible to notice a mild tendency that the women in the fourth and higher pregnancy gave somewhat lower marks, especially compared to those in the third pregnancy. The education level, included in the third model, increases the possibility of predicting the application mark ($R^2 = 0.05$, $p = 0.010$) – the more educated women rated the application higher. Finally, the variable "readiness for acceptance of new technologies" increases significantly predictive power of the fourth model (21% of the criterion explanation), in the sense that more frequent use of technologies is an essential predictor of the probability for rating the application higher. However, more frequent installation of applications

has no significant influence on the frequency of using mobile devices and familiarity with the IoT.

Table 3. Level of explanation of the average questionnaire rate by the models -- sample of pregnant women

Model	R	R^2	Corrected R^2	Assessment standard error
1	0.127[a]	0.016	0.007	0.53332079943
2	0.187[b]	0.035	0.019	0.53009252097
3	0.233[c]	0.054	0.031	0.52661969012
4	0.454[d]	0.206	0.180	0.48441184273

a. Predictor: Age
b. Predictors: Age, Number of pregnancies
c. Predictors: Age, Number of pregnancies, Education
d. Predictors: Age, Number of pregnancies, Education; responses to the items: How often do you use mobile devices?, How often do you install applications?, I am familiar with the IoT concept

Table 4. Significance of the model – sample of pregnant women

ANOVA[a] Model		Sum of squares	Degree of freedom	Mean square	F	Significance
1	Regression	1.924	4	0.481	0.691	0.151[b]
	Residual	118.039	415	0.284		
	Total	119.963	419			
2	Regression	4.192	7	0.599	2.131	0.039[c]
	Residual	115.771	412	0.281		
	Total	119.963	419			
3	Regression	6.536	10	0.654	2.357	0.010[d]
	Residual	113.427	409	0.277		
	Total	119.963	419			
4	Regression	24.693	13	1.899	8.0.95	0.000[e]
	Residual	95.270	406	0.235		
	Total	119.963	419			

a. Dependent variable: Mean of the qustionnaire score
b. Predictor: Age
c. Predictors: Age, Number of pregnancies
d. Predictors: Age, Number of pregnancies, Education
e. Predictors: Age, Number of pregnancies, Education; responses to the items: How often do you use mobile devices?, How often do you install applications?, I am familiar with the IoT concept

Table 5. Contribution of particular variables – sample of pregnant women

Coefficients[a]		Unstandardized beta coefficient	Standard error	Standardized beta coefficient	T	Significance
Model						
1	(Constant)	4.584	0.067		68.764	0.000
	25-30 years	-0.002	0.089	-0.002	-0.027	0.979
	31-35 years	0.137	0.083	0.115	1.654	0.099
	36-40 years	0.161	0.087	0.124	1.853	0.065
	41+ years	0.078	0.093	0.054	0.836	0.404
2	(Constant)	4.589	0.070		65,694	0.000
	25-30 years	-0.051	0.091	-0.038	-0.563	0.574
	31-35 years	0.080	0.087	0.067	0.917	0.360
	36-40 years	0.102	0.091	0.079	1.122	0.263
	41+ years	0.085	0.096	0.059	0.888	0.375
	Second pregnancy	0.073	0.067	0.063	1.085	0.278
	Third pregnancy	0.094	0.071	0.077	1.318	0.188
	Fourth + pregn.	-0.195	0.106	-0.101	-1.847	0.065
3	(Constant)	4.535	0.072		62.819	0.000
	25-30 years	-0/124	0.096	-0.091	-1.301	0.194
	31-35 years	-0.014	0.094	-0.012	-0.154	0.878
	36-40 years	-0.013	0.100	-0.010	-0.126	0.900
	41+ years	-0.042	0.106	-0.029	-0.399	0.690
	Second pregnancy	0.052	0.068	0.045	0.761	0.447
	Third pregnacy	0.108	0.072	0.089	1.513	0.131
	Fourth + pregn.	-0.112	0.110	-0.058	-1.021	0.308
	Higher school	0.151	0.081	0.116	1.860	0.064
	University educ.	0.188	0.074	0.175	2.548	0.011
	Doctorate	0.289	0.124	0.133	2.335	0.020

4	(Constant)	3.515	0.166		21.149	0.000
	25-30 years	-0.045	0.089	-0.033	-0.509	0.611
	31-35 years	-0.014	0.087	-0.011	-0.158	0.874
	36-40 years	-0.010	0.093	-0.007	-0.103	0.918
	41+ years	-0.062	0.098	-0.043	-0.637	0.525
	Second pregnancy	0.037	0.064	0.032	0.584	0.559
	Third pregnancy	0.056	0.067	0.046	0.839	0.402
	Fourth+ pregnan.	0.036	0.103	0.019	0.354	0.724
	Higher school	0.103	0.077	0.079	1.332	0.184
	University educ.	0.107	0.069	0.100	1.544	0.123
	Doctorate	0.168	0.117	0.077	1.445	0.149
	How often do you use mobile devices?	0.110	0.032	162	3.443	0.001
	How often do you install applications?	-0.004	0.017	-0.011	-0.220	0.826
	I am familiar with the IoT concept	0.149	0.021	0.374	7.219	0.000
a. Dependent variable: Mean value of the questionnaire score						

The regression analyses were also performed on the sample of physicians, where the questionnaire average mark was the criterion variable, whereas the predictor variables were: 1. Age, 2. Years of working experience, and 3. Readiness of acceptance of new technologies.

Regresion analysis was performed by forming three models using *enter* method. In the first model the mobile application evaluation was explained in terms of physcian's age, the second model included additionally working experience, while the third model encompassed also the variables to measure the readiness to use new technologies.

The results presented in Tables 6-8 indicate that phycian's age does not have a significant effect on evaluation of the developed application ($p = 0.90$; $R^2 = 0.003$). The second model explains somewhat more of the response variance (about 16%), but its significance does not exceed the level $p < 0.05$. Still, based on the values of the regression coefficients, it is possible to notice a mild tendency that the physicians with more working experience (over 20 years) are somewhat less prone to accept mobile applications. It is likely that this tendency would be more pronounced in the case of a larger number of respondents. The third model revealed a dominant effect of the readiness to use new technologies on the acceptance of the application. However, among the variables from this domain, only familiarity with the IoT concept has a predictive value, whose inclusion into the model increases the possibility of predicting the application rating to 56%.

Table 6. Level of explanation of the average questionnaire rate by the models – sample of physicians

Model	R	R^2	Corrected R^2	Standard error of estimation
1	0.055[a]	0.003	-0.025	0.45844555304
2	0.400[b]	0.160	0.086	0.43303073353
3	0.750[c]	0.563	0.502	0.31953014950

a. Predictor: Age
b. Predictors: Age, Years of working experience
c. Predictors: Age, Working experience; responses to the items: How often do you use mobile devices?, How often do you install applications?, I am familiar with the IoT concept

Table 7. Significance of the model – sample of physicians

ANOVA[a]		Sum of squares	Degree of freedom	Average square	F	Significance
Model						
1	Regression	0.045	2	0.023	0.108	0.898[b]
	Residual	15.132	72	0.210		
	Total	15.178	74			
2	Regression	2.427	6	0.404	2.157	0.058[c]
	Residual	12,751	68	0.188		
	Total	15.178	74			
3	Regression	8.541	9	0.949	9.295	0.000[d]
	Residual	6.636	65	0.102		
	Total	15.178	74			

a. Dependent variable: Mean value of the score on the questionnaire
b. Predictor: Age
c. Predictors: Age, Working experience
d. Predictors: Age, Working experience; responses to the items: How often do you use mobile devices?, How often do you install applications?, I am familiar with the IoT concept

Table 8. Contributions of particular variables – Sample of physicians

Coefficients[a]		Unstandardized beta coefficient	Standard error	Standardized beta coefficient	T	Significance
Model						
1	(Constant)	4.789	0.084		57.215	0.000
	41-50 years	-0.047	0.126	-0.049	-0.376	0.708
	51+ years	0.011	0.130	0.011	0.085	0.932
2	(Constant)	4.805	0.116		41.516	0.000
	41-50 years	0.071	0.181	0.074	0.394	0.695
	51+ years	0.474	0.231	0.473	2,056	0.044
	5-10 y. of w. exper.	0.010	0.186	0.007	0.051	0.959
	10-15 y. of w. exper.	-0.070	0.188	-0.064	-0.373	0.711
	15-20 y. of w. exper.	-0.062	0.231	-0.059	-0.267	0.790
	Over 20 years	-0.645	0.264	-0.612	-2.440	0.017
3	(Constant)	3.351	0.270		12.414	0.000
	41-30 years	0.012	0.134	0.013	0.092	0.927
	51+ years	0.116	0.177	0.116	0.655	0.514
	5-10 y. of w. exper.	0.070	0.139	0.050	0.501	0.618
	10-15 y. of w. exper.	-0.016	0.147	-0.015	-0.109	0.914
	15-20 y. of w. exper.	0.061	0.175	0.058	0.348	0.729
	Over 20 years	-0.173	0.212	-0.164	-0.816	0.417
	How often do you use mobile devices?	0.003	0.077	0.004	0.042	0.966
	How often do you install applications?	0.001	0.042	0.003	0.033	0.974
	I am familiar with the IoT concept	0.320	0.047	0.685	6.844	0.000
a. Dependent variable: Mean value of the score on the questionnaire						

Bearing in mind the results of the regression analyses it is possible to draw the following conclusions:

- Pregnant women in the first and second pregnancies accept most readily mobile application for pregnancy management,
- Pregnant women with higher education level are more ready to use such mobile application,
- Those pregnant women who use more mobile devices, irrespective of frequency of installing new applications and familiarity with the IoT con-

cept, are to a greater extent willing to use the developed mobile application,

- Physicians with a working experience over 20 years are to a lesser degree ready to use the mobile application to follow pregnancies of their patients,
- Those physicians who are familiar with the IoT concept are more prone to use this application.

These conclusions suggest guidelines for a further marketing strategy for promoting the use of the developed mobile application. The target should be women with a higher level of education in their first or second pregnancy, as well as the physicians with a shorter working experience as specialists, and who endeavor to be informed about novelties in the use of mobile technologies and the Internet in medicine.

5. Conclusion

The results concerning the acceptance of the developed mobile application to follow the course of pregnancy are rather positive for both groups of respondents in respect of their readiness for using mobile technologies and mobile applications. In the frame of the TAM model, that is the UTAUT theory, it can be concluded that the implementation of the developed mobile application has been performed well, with a high degree of acceptance and readiness for its further use. Bearing in mind the survey results, with the aim of promoting the use of the developed application (and of, possibly, some new ones), it would be necessary to undertake a comprehensive digital marketing campaign. The campaign should be primarily based on the omnichannel strategy, performed in continuous way, but with an accent on three crucial time points: before using the application, one-month after its implementation, and a three-month post-implementation. The campaign should promote the following: technical characteristics of the mobile application (factor of expected performance), easiness of use (factor of expected efforts), influence of satisfied users of the application, both from the sample of pregnant women and physicians (factor of social influence), and through some other forms of promotion (factor of mitigating circumstances).

Also, a more detailed analysis of the questionnaire survey suggests additional directions for a marketing strategy to promote the developed mobile application by targeting the pregnant women with higher level of education who are in the first or second pregnancy. As far as physicians are concerned, the target should be on those with a shorter working experience as specialists, since it is expected that they are more interested in the actual achievements and possibilities of using the Internet and mobile technologies in medicine.

References:

1. Canada Health InfowaY. (2012). Canada Health Infoway Benefits Evaluation Indicators - Techical Report. Version 2.0, Toronto-Montreal-Halifax-Vancouver: Canada Health Infoway in collaboration with University of Victoria
2. Cimperman, M., Brencic, M.M., Trkman, P. (2016). Analyzing older users' home telehealth services acceptance behavior—applying an extended UTAUT model. International Journal of Medical Informatics, 90, pp. 22–31
3. Goetz, M., Müller, M., Matthies, L.M., et al. (2017). Perceptions of Patient Engagement Applications During Pregnancy: A Qualitative Assessment of the Patient's Perspective. JMIR Mhealth Uhealth, 5(5), e73
4. Kalayou, M.H., Endehabtu, B.F., Tilahun, B. (2020). The Applicability of the Modified Technology Acceptance Model (TAM) on the Sustainable Adoption of eHealth Systems in Resource-Limited Settings. J Multidiscip Healthc, 13, pp. 1827-1837
5. Weiner, Jonathan. (2012). Doctor-patient communication in the e-health era. Israel journal of health policy research, 1. 33. 10.1186/2045-4015-1-33

doc.dr.sc. Kasim Bajramović, dipl.ing.rudarstva[1]
Irhad Bajramović,[2]
Irfan Bajramović,[3]

Professional paper

APPLICATION OF INFORMATION TECHNOLOGIES AND AUTOMATION IN RMU "KAKANJ"

Abstract

The use of informatics and automation in the process of underground and surface exploitation of mineral resources is increasingly obliging experts in this field, to give priority to this flow, which covers the entire technique and technology.

Modern approaches in underground and surface exploitation imply a much greater participation of experts in the pits and in the surface mines in the research, which should enable greater efficiency of the exploitation process, and thus, higher profits. Knowledge of world technology, modern mining techniques and the quality of human resources must give a new impetus to underground and surface exploitation in terms of mass creativity, which will later take over new technological solutions.

The real possibilities in the realization of these development tasks are provided by informatics. The starting point for the use of informatics is a quality database. The traditional approach to the database mainly represents a centralized database for underground exploitation as well as the entire surface mine, as a recurrence of centralized computer centers and information systems. The introduction of personal computers, however, is increasingly changing the creative attitude towards relational databases, which enable faster development of application programs, intended to solve very specific problems. In pits as well as in surface mines, a distributed database is necessary for the deposit (geology, hydrogeology, hydrology, geodesy, geomechanics, etc.), for equipment (harvesters, loaders, methanometric power plants, pumps, transformer stations, excavators, trucks, drills, conveyors, auxiliary equipment) and for economics (production costs, ore price, etc.).

1 PhD in Mining Engineering; ZD RMU Kakanj d.o.o. Kakanj (Kakanj Coal Mine) and Docent at Faculty of Mechanical Engineering, University of Zenica; kasim.bajramovic@mf.unze.ba
2 Bachelor-Information Technology Engineer; irhadbajramovicbajra@gmail.com
3 Bachelor road traffic Engineer; irfanbajramovic@gmail.com

This paper aims to show how automation and information technology can improve safety in the mines, improve measures and actions to prevent injuries at work, occupational diseases, other work-related diseases and the protection of the working environment.

Keywords: Automation, information technology, computer programs, mining.

1. Introduction

The process of automation in mining is not old. Only in the eighties, remote control of machines was introduced, in the nineties, machines were automated under the supervision of the operator, and in the last ten years, new, conceptual machines were created (Vujić, 2012). In mining, we distinguish several technologies related to the modernization of production processes: automation, introduction of remote control and robotization. This paper deals with various aspects of the introduction of automation and information technology in mining. The working conditions of mining machines are very different. The existing mining machinery is of the hydraulic type, it is powered by diesel or electric motors and the working parts of the equipment are often far from the operator and energy source. Equipment loads are high and equipment is expensive. In terms of robotics, the equipment is heavy, aligned and mobile. Working conditions can be very difficult, in terms of temperature, salinity and acidity of the water and exposure to rock falls and robust handling. In terms of safety, equipment can be very dangerous to people. The current mining robots are mostly custom mining machines, but over time they will evolve into purpose-built robots. Automation and the introduction of information technology is not easily applicable in mining. The reason for that, unlike factory plants and other process plants, is that the mining environment is not permanent, but is constantly evolving. Machines and people must be adaptable and flexible in order to adapt to the terrain they encounter. There is no easy way to apply automation and information technology in such an environment. On the other hand, mine financing has very little tolerance, so it is difficult to accept the risk posed by the introduction of untested technology. Data and experiences are taken from existing successful operations, new methods are introduced gradually with minimal changes to existing production. Many in the mining industry are not familiar with automation and the potential it carries. Mining engineering is a combination of mathematics, mechanical engineering, geomechanics, geology, electrical engineering, finance and management. It is necessary for these disciplines to jointly determine the possibility of increasing production and improving the working conditions that automation brings to the production process. So far, automation has found the widest application in wide-end handling vehicles, drills and transport vehicles. Currently, only a few manufacturers produce this specialized equipment and have a demand significantly higher than their production capabilities. Many machines exist in the form of concepts such as automated (robotic) installation of supports, placement of explosives and others. Robotics finds its chance in increasing production through the continuity of equipment, ie. reducing downtime, as it is usually un-

able to achieve the performance of experienced operators. The time lost in the process due to shift changes is no longer a problem, as automated equipment is operational both during eating breaks and shift changes. Typically, this can save two to three hours per shift, especially if the equipment is centrally operated and monitored.

When looking at safety at work, the obvious benefit is the ability to keep people away from hazardous environments and thus prevent injuries due to explosive atmospheres, noise, dust, landslides and moving parts of equipment. The first mining machines appeared 4-5 thousand years ago in ancient Egypt, in the extraction of stone blocks and gold ores. Originally it was a hand tool, and later the energy of animals and hydropower began to be used. The turning point in the use of mining machines arises with the use of steam as a source of energy, which enabled the development of mining, ie. use of natural resources to unimaginable proportions. In the XIX. century, the development of industrialized countries has led to a demand for industrial raw materials: coal, iron ore, oil and the rapid development of mining, which passes from manufacturing to industrial intensive development. The twentieth century means machines designed and intended for certain technological activities: cutting, scraping, loading, transport, etc. Dedicated machines are being perfected, automated, robotized and as such become highly efficient. They ensure the receipt of relatively cheap raw materials and energy, which enables the rapid progress of humanity. Mining science strives to develop mining machines, unmanned, robots. In the middle of XX. century, the introduction of electronics and automation in the application of mining machines, which leads to mass production of mineral resources, resulting in a fall in market prices. Given the working conditions, mining is one of the most difficult jobs for a person. Workers in such conditions are exposed to all weather conditions. Mineral raw materials are largely in areas where the adverse impact of working conditions on the human body is pronounced. The richest raw materials are at depths greater than 1000 m. Working at these depths requires special conditions required by the human body, and for these reasons the use of robots is a necessary need of modern times. The increase in efficiency increases drastically, so that in the pit exploitation (coal thermal power lessof 15000 kJ/kg) efficiency below 1000 t per year per employee does not allow profitable production, and in surface exploitation this threshold has already exceeded the efficiency of 3000 t per year per employee. Mining machines are extremely robust in their efficiency, they work in difficult natural conditions and must be fully adapted to the working environment. The evolution of mining machines is very fast, their development is such that the machine from the eighties of this century is already obsolete today.

2. Automation at the “Haljinići» plant

Modern mining implies the obligatory introduction of information technologies at a certain level, primarily for the reason of increasing the level of safety at work, personal and collective, but also achieving the best possible production effects. Here, information technologies appear in the role of supporting the

technological process of coal exploitation and production. In the pits of the "Haljinići» plant, RMU «Kakanj» d.o.o. Kakanj, with the introduction of automation and information technology to a certain extent, the following positive effects can be expected:

- increasing safety at work;
- increase production and productivity;
- large economic savings in the operation of equipment and devices;
- better coordination of working groups, professional services and business structures.

These effects can be achieved by introducing automation of certain technological processes in the pits of the «Haljinići» plant, which would enable continuous monitoring and control of all significant production processes, and the establishment of management capabilities on the technological process of coal production, as well as supporting activities. (This primarily refers to transport and drainage systems, and pit ventilation system). When developing the concept of the structure of the information - management system, which is the basis for the automation of technological processes, we started from the minimum technical requirements that it should meet:

1. Continuous measurement and monitoring of cave atmosphere parameters;
2. Automatic shutdown of electricity in the part of the pit that is endangered by explosive and flammable concentrations of methane;
3. Continuous monitoring and automatic control of parts of the technological process;
4. Centralized review of information based on processed data from the pit;
5. Realization in explosion-proof design.

These requirements stipulate that such a system should be distributed more hierarchically, with the necessary hardware and software in the pit, and in the control and management center. Special attention should be paid to the processing, display and printing of alarms, protection of data from unauthorized access, as well as the way information is displayed in normal and during alarm conditions in the pit.

In the pits of the «Haljinići» plant, it is possible to perform the following division of production and accompanying processes:

1. Extraction (exploitation) of coal, by wide-head excavation method;
2. Opening and preparation of new pit rooms;
3. Ventilation (ventilation) of the pit of the «Haljinići» plant;
4. Drainage of the pits of the «Haljinići» plant;

5. Transport system;
6. Electricity supply to the pits of the «Haljinići» plant.

As part of the automation of a part of the transport system (7 conveyors with a rubber belt), the following is envisaged:

1. Conveyor speed control with rubber belt;
2. Conveyor rubber belt break control;
3. Control (detection) of coal accumulation at the transfer points of the conveyor;
4. Control of the conveyor operation (control of the EMP conveyor operation);
5. Control of horizontal movement of the rubber belt of the conveyor;
6. Measurement of weight of transported material (scales mounted on GT-1);
7. Emergency conveyor stop switch;
8. Mode selector switch (manual / automatic);
9. Video surveillance of spillways.

For control and remote monitoring of the main pumping station at elevation K + 300.00 m, the following is envisaged:

1. Control of centrifugal pumps;
2. Water level control in the reservoir;
3. Centrifugal pump housing temperature;
4. Video surveillance.

3. Structure of the information system for the needs of drainage of the surface mine PK "Vrtlište"

Practical solutions in modern conditions of surface exploitation clearly show that the application of information systems can be expected in all areas of management, production organization, design and management. used drainage techniques and technologies, can be strongly integrated in terms of information, which provides new moments in the field of optimal use of these systems. The information system for the needs of surface mine drainage consists of five basic zones: data preparation zones, data processing zones, data and zones for the use of data and appropriate software, final results processing zones and monitoring and management zones.

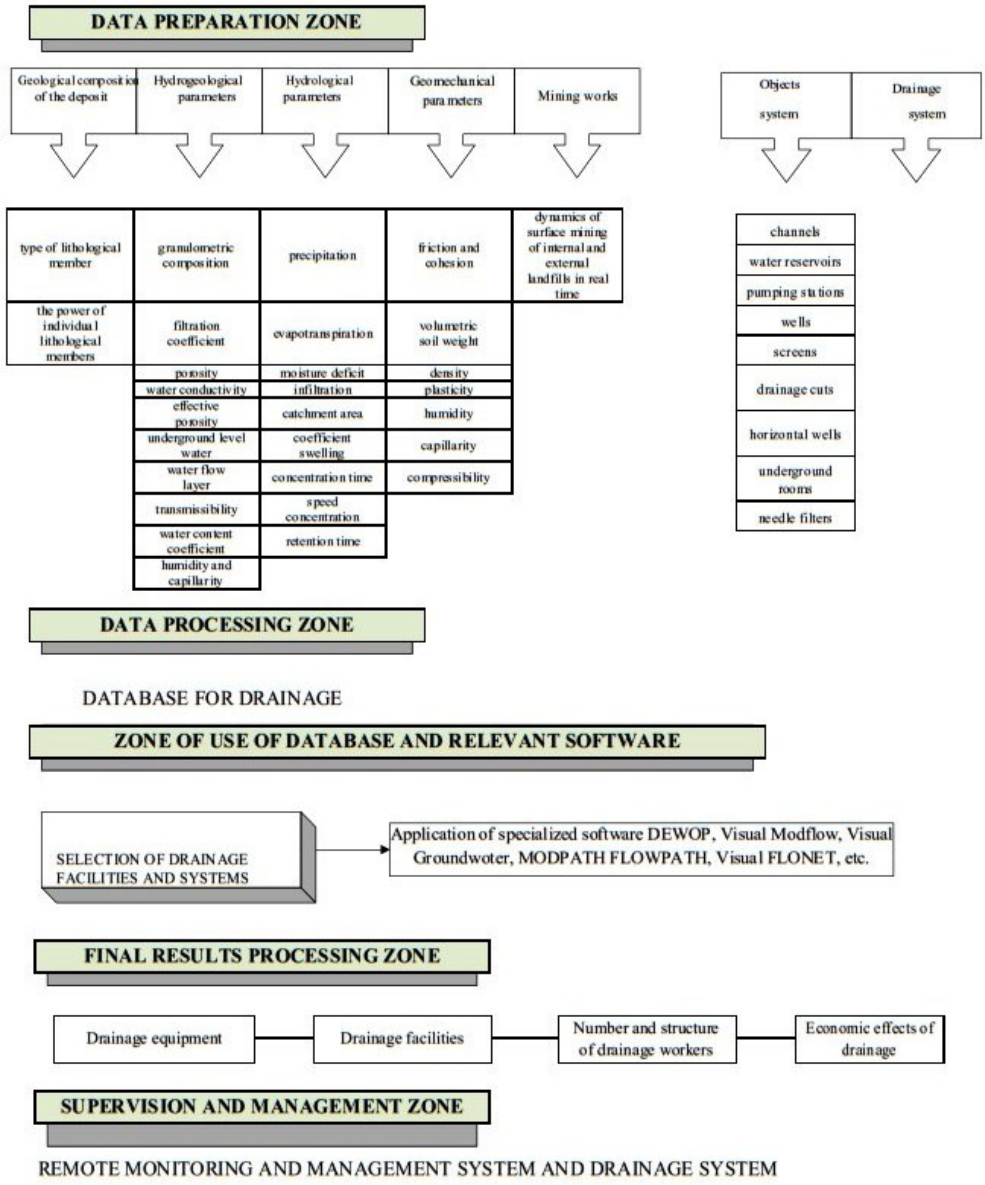


Figure 1. Basic zones of information systems for the needs of surface mine drainage Source: STUDY "Establishment of the Central Dispatching System" for the needs of ZD RMU "Kakanj" d.o.o. Kakanj; Kakanj, August 2015; (Elaborat, 2015)

The final results processing zone provides data on drainage equipment and facilities, then on the number and structure of the drainage workforce, as well as on the immediate economic effects of the drainage process itself.

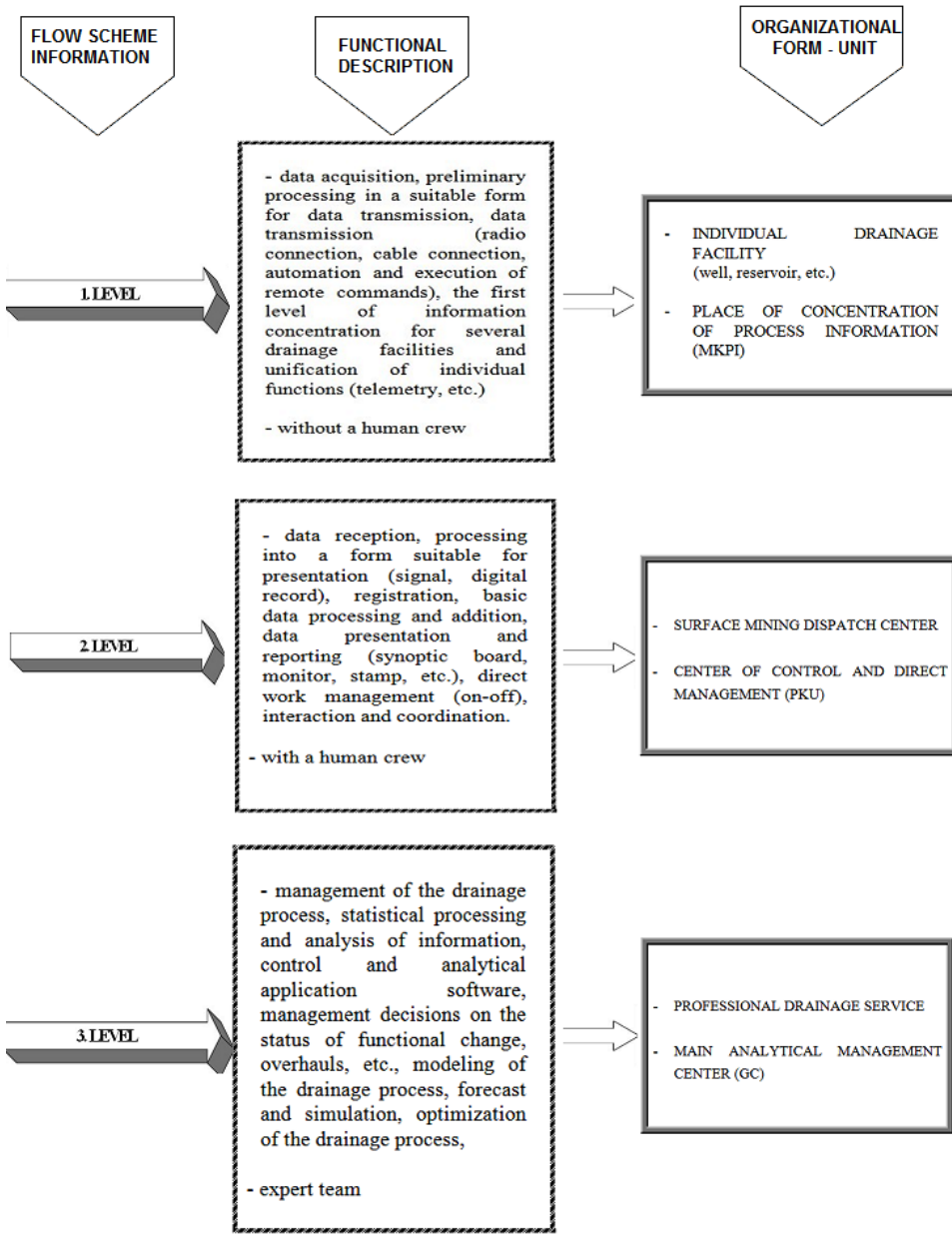


Figure 2. Information flow diagram
Source: STUDY "Establishment of the Central Dispatching System" for the needs of ZD RMU "Kakanj" d.o.o. Kakanj; Kakanj, August 2015; (Elaborat, 2015)

Drainage of surface mines includes consideration of initial hydrogeological, geological, geomechanical and mining technological parameters, then quality

selection and dimensioning of drainage facilities and especially selection of location of drainage facilities. Depending on the dynamics of the development of mining works, the mentioned complex issues are integrated by the system of drainage of surface mines.

The separation of special zones in the information system is especially conditioned by the anticipated dynamics of the research. The entire information system is a kind of long-term scientific research program in the field of surface coal drainage, which is realized in theoretical terms, through master's and doctoral dissertations, while in practical terms, its implementation is done through specific research on surface mines.

4. Introduction of a system of records of attendance and working hours in ZD ZD RMU "Kakanj" d.o.o. Kakanj

Expected production effects

Access control and time attendance facilitate the work of employee records, maximize the accuracy of recording, which is done automatically and updated instantly, which means that overall discipline and productivity increase with maximum protection of business systems.

Expected effects of the investment

Access control and time attendance will consist of a card reader that will be located at all access points, where you want to perform control and records. Time and attendance is an application that is related to card readers, and this record records all communication with the device, performs analysis and creates a record of each employee who spent time in the business system. At any time, it is possible to know how many people are in the company where they are, who enters and who leaves, what is the frequency of entries and exits, how long someone stayed at work, and how long he is out of the company. For each employee it is possible to get information on how much time he spent at his workplace, where he moved, whether there are delays at work as well as whether there is an early justified or unjustified departure from work.

5. Computer network at the plant "Održavanje" in ZD ZD RMU "Kakanj" d.o.o. Kakanj

The very idea of wireless networks is probably old since the discovery of electromagnetic waves in the early twentieth century, or the first connection of computers to local networks in the middle of the same century. The principle is very simple and is based on the idea that the computer uses air instead of wire as a physical medium of communication. Data packets are sent by electromagnetic waves in the radio (3 KHz - 500 GHz) or infrared spectrum (500 GHz - 400 GHz).

The advantages of wireless networks over wired ones are very obvious:

- They are usually simpler and cheaper to implement and subsequently expand,
- Physical infrastructure is significantly smaller than wired,
- Maintenance is less demanding.

The rapid popularization started a few years ago and hardware manufacturers have found an interesting market there and it is currently one of the highest growth rates in the IT industry. Wireless devices are becoming more powerful and powerful, more reliable and cheaper. The result is the massive opening of amateur and commercial wireless networks around the world. The above indicators also show the justification of this investment, for the purpose of building a wireless LAN network within the Administration Building (Directorate) and the "Održavanje" plant.

6. Radio connection of remote LAN networks of Directorate 1 with LAN networks with repeater RMU "Kakanj" d.o.o. Kakanj

There is a need for the implementation of a system for connecting remote LAN networks - Directorate 1 with the networks of other plants and economic units of ZD RMU "Kakanj". These systems will be the basis for further development of the company in modern business. This system will be the basis for further development in terms of the use of accounting software, video surveillance systems, both sectoral and centralized, attendance and working time recording systems, Voice over Internet Protocol telephony and the like. As such, the system itself will justify its existence in a very short period of time.

The investment will include all plants and economic units of RMU "Kakanj" d.o.o. Kakanj, and will be a single system for connecting all LAN networks, individual plants and economic units and LAN networks of Directions 1 and 2 into a single network system. The technical-technological description includes solutions that will apply to each location individually. Given the existence of local computer networks (Local Area Network-LAN) within the building of Directorates 1 and 2 and in the administrative buildings of plants and economic units of RMU "Kakanj" d.o.o. Kakanj there is a need to interconnect them into a single network system, a single computer network. The investment would unite remote LANs into one larger metropolitan area network (MAN). The main goal of such an investment is to provide conditions for the full functioning of closely related investments such as: card registration of employees, video surveillance, video conferencing, Voice over Internet Protocol telephony. In this way, the conditions for the creation of unique databases, centralized and sectoral management of card registration of employees and video surveillance would be achieved. These investments (video surveillance and video conferencing) a large amount of sub-act traffic. Namely, if the services of third parties were used as Internet service providers, large amounts of intersegmental sub-act traffic would be realized, which would result in a high price of Internet

connection services, which, despite the high price, represents a constant cost. Therefore, in order to avoid fixed costs, it is necessary to invest in connecting to the LAN network of Directions 1 and 2 and to form unique WAN networks. The investment itself aims to reduce intersegmental sub-act traffic at the expense of increasing intersegment traffic within the private computer network. In this way, there would be no need to pay for Internet connection services to third parties, which is the economic viability of this investment. Internet connections of individual LAN users would be made through the Internet connection of Directorates 1 and 2, which leaves the possibility of controlling the consumption of individual users. Another advantage of this investment is that it leaves the possibility of using the same connection to install a local telephone exchange based on Voice over Internet Protocol telephony or in free translation "Telephony over the Internet".

7. Connection of remote LAN networks of the plant "Haljinići» with the Directorate of ZD RMU «Kakanj» d.o.o. Kakanj

Since RMU "Kakanj" has a telecommunications infrastructure, ie telecommunications lines (twisted pairs) there is a possibility of using it to connect remote LAN networks. Connecting remote LAN networks via parallel pairs is accomplished using G.SHDSL pairs, one at each end of the line. These modems have, among other things, RJ and RJ45 ports, so there is the possibility of connecting remote LAN. Since there is a telecommunication infrastructure between the management of the plant "Haljinići» and Directorates 1 and 2, there is a possibility of connecting the LAN network of the same. As the line is outdated, and thus the amplified noise, as well as the distance that is significantly greater than allowed, it is necessary to install a signal amplifier-repeater. The signal repeater requires power supply, so it would be best to install them in existing facilities such as the service garage in „Obrima" and the facility at the plant «Separation». The «Haljinići» plant is the most remote location of RMU «Kakanj» d.o.o. Kakanj, so the solution for connecting this plant is the most demanding. When the optimal solution for connecting this plant is selected, the same solution is applicable to other facilities of RMU «Kakanj» d.o.o. Kakanj, because connecting them is technically less demanding, ie. Optical visibility can be achieved and the distance is much smaller (Elaborat, 2015).

8. Realization of communication and voice connection at the plant "Haljinići» ZD RMU «Kakanj» d.o.o. Kakanj

For a long time at the plant "Haljinići» RMU «Kakanj» d.o.o. Kakanj is a problem of difficult telephone communication between certain locations, in the pit and outside. The reason for this is, first of all, the dilapidated bad telephone exchange, as well as communication lines and pit telephones. At the «Haljinići» plant, there is an automatic telephone exchange (ATC) - relay telephone exchange, manufactured by «Nikola Tesla» Zagreb, type Tesla ACK-K 120/12,

with appropriate communication lines and telephones, intended for work in methanometric pits. The reasons that led to the fact that the existing system for communication at the «Haljinići» plant is no longer able to respond to the needs of underground exploitation in a quality and reliable way are reflected, primarily in the lack of authorized service, inability to procure quality spare parts and obsolete technology. Given that this branch of electrical engineering has developed rapidly in recent decades, new technologies have emerged, which have completely suppressed the production and use of relay telephone exchanges, so that it is currently impossible to find spare parts for exchanges of this type. There has also been a change in the principles of operation of telephones, which are produced today, in relation to the time when the telephone exchange «Nikola Tesla» was procured and put into operation, and therefore

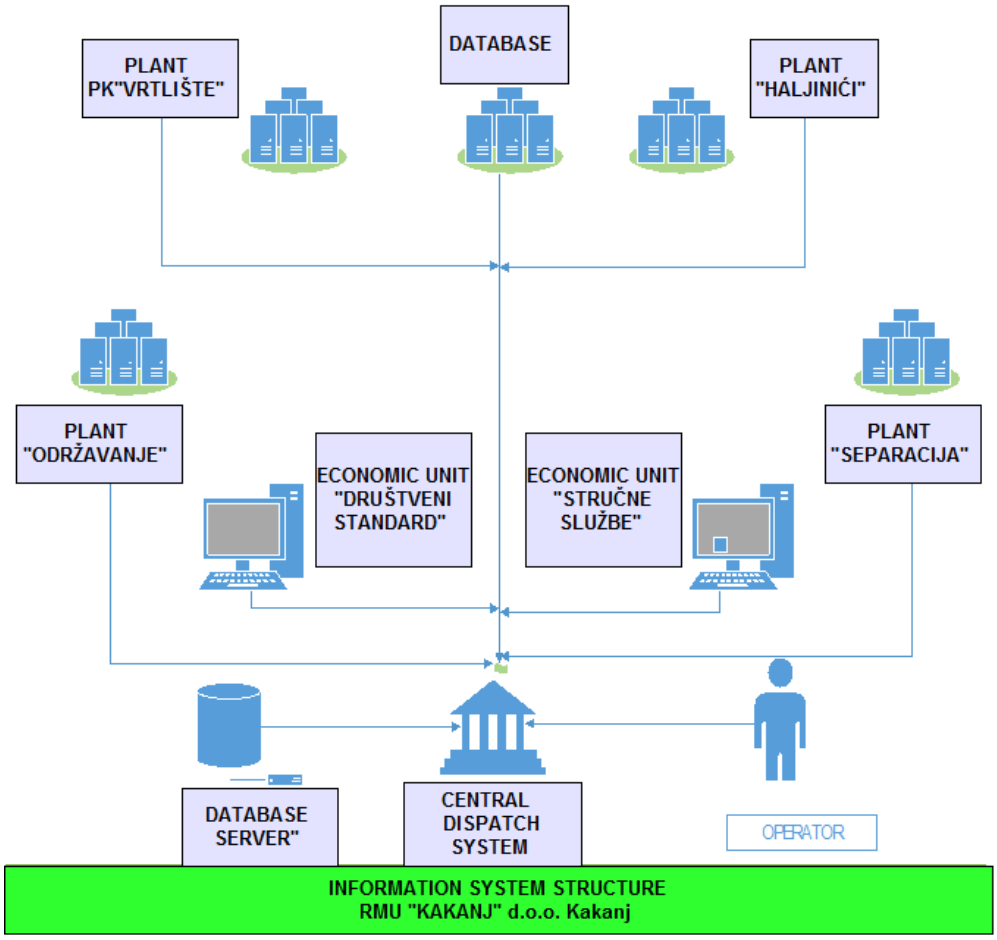


Figure 3. Structure of information systems and automation of RMU Kakanj
Source: STUDY "Establishment of the Central Dispatching System" for the needs of ZD RMU "Kakanj" d.o.o. Kakanj; Kakanj, August 2015 (Elaborat, 2015)

we have a situation that telephones currently available, or which can be found on the market, they are not compatible with the existing telephone exchange. The needs of modern mining, which are primarily reflected in the requirements for increased production, which results in increased requirements for the application of occupational safety, fire protection and health protection of employees, are such that at the plant «Haljinići» it is necessary to install a system communications, which will provide quality, fast and reliable transmission of information. Today, there are systems on the market that can meet the requirements for fast, reliable and secure communication, when performing mining works in pits endangered by methane and hazardous coal dust. A modern system for monitoring the ventilation and gas parameters of the cave atmosphere was previously installed at the «Haljinići» plant, and a project of remote monitoring and automation of the transport system and drainage system was implemented, thus creating preconditions for the formation of a modern control and dispatch center. part should be a system for communication and voice communication.

9. Voice radio communication system ZD RMU "Kakanj" d.o.o. Kakanj

A radio communication system was put into operation at the "Maintenance" plant, with its dispatch center, which has fixed and portable radio receivers installed on three plants ("Maintenance", "Separation" and PK "Vrtlište») and which has the ability to monitor the location of the radio. receiver. The Voice Radio Communication System (SGRV) of RMU Kakanj is designed as a voice radio communication system used by a radio repeater at the Vrana location, for certain groups of users from RMU Kakanj. The voice radio communication system (SGRV) of RMU Kakanj is conceived as one closed group in which all users can communicate with each other. It is envisaged that logical channel 1 (semiduplex - time frame 1) would be used for speech transmission, and logical channel 2 (semiduplex - time frame 2) would be used by all participants in the data transmission system (short messages, GPS information, telemetry, etc.) .

10. Automation and remote control of the fan plant "Begići»

Remote control of the operation of the fan plant "Begići» is also enabled through the SCADA System installed on a PC in the dispatch center. Communication with the fan station was established via ETERNET connection. Remote mode control is only enabled when the mode selector switch is set to position 2 - AUTOMATIC for the selected system. The PC is powered via a UPS device that allows autonomy of 5-10 minutes. Figure 4 shows a block diagram of the control of a fan plant (Elaborat, 2015).

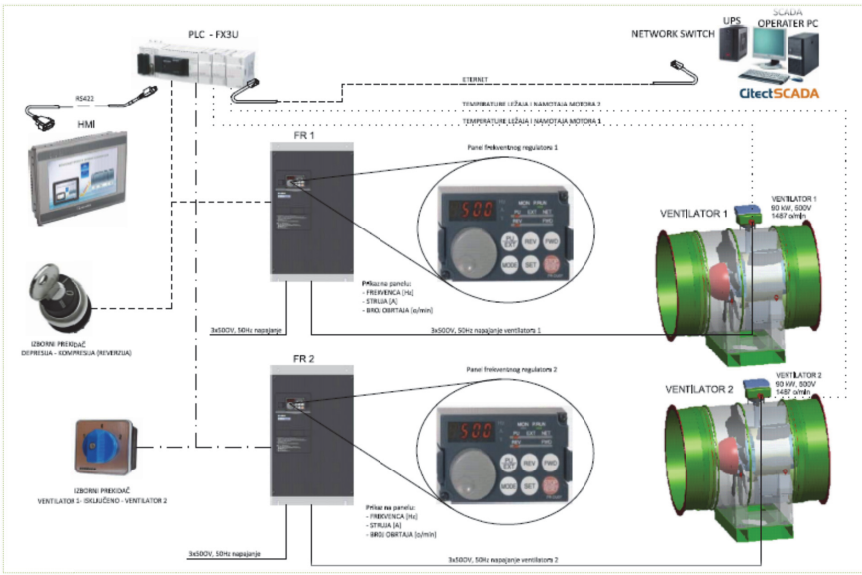


Figure 4. Block diagram of the fan plant control
Source: STUDY "Establishment of the Central Dispatching System" for the needs of ZD RMU "Kakanj" d.o.o. Kakanj; Kakanj, August 2015 (Elaborat, 2015)

11. Conclusion

Investing in the modernization and development of production capacities of ZD Rudnik "Kakanj" is directly related to the development and modernization of capacities for the production of electricity in the Thermal Power Plant "Kakanj". Investing in the development of mining production capacities means ensuring long-term stability in electricity production. With the entry of rudnik into JP "Elektroprivreda BiH", the recapitalization procedure began, in which funds were invested for the development of mine production capacities. The mine is also making new strides in modernizing coal production with its own investments.

With the introduction of the most modern automatic systems for control, transport and drainage in underground coal mining, the system of safety at work has been significantly improved, especially in the segment of preventive action. The metanometric power plant is a modern system with great IT support and digital indicators for pit gases and air movement. Automation with remote monitoring of transport and drainage in underground exploitation achieves optimal utilization and higher productivity in the technological process.

The goal is to achieve long-term successful business, based on a constant increase in energy demand, the existence of a sufficient amount of ore deposits, modernization of equipment, possession of the necessary knowledge and experience, as well as the constant acquisition of new knowledge.

For devices that are not easy to access, pre-created error procedures (failures, which are monitored using information technology) will help us get to know our machines better. This allows these faults to be quickly diagnosed as soon as they occur, significantly reducing machine downtime. These scenarios can be reproduced and recorded for the training of machine operators, maintenance technicians and engineers.

With the help of information technology and automation, the hydraulic, pneumatic and electrical functions of all mining machines can be partially, or completely designed, modeled, validated and integrated.

References:

1. Kowalski, A., Mirek, G., Wojtas, M. (2013). Paszportyzacja jako system ewidencji sieci teleinformatycznych eksploatowanych w zakładach górniczych. Zakopane, Polska
2. Krauze, K. (2020). Mechanizacja, automatyzacja i robotyzacja w górnictwie. Wiśle, Polska
3. Wilkins, R. (2004). Mining with Robots. (Point of Beginning, Oktobar 2004)
4. Vujić, S. (2012). Automatizacija i upravljanje procesima u rudarstvu. Akademija inženjerskih nauka Srbije
5. ELABORAT. (2015). Uspostava Centralnog dispečerskog sistema za potrebe ZD RMU Kakanj d.o.o. Kakanj
6. https://www.famictech.com/de/Produkte/Automation-Studio/Professional-Edition/Industries/Bergbau, Date of access: 01.04.2021.
7. https://www.wydawnictwoagh.pl/MECHANIZACJA--AUTOMATYZACJAI-ROBOTYZACJA-W-GORNICTWIE-2020;s,karta,id,1422
8. http://www.miningandconstruction.sandvik.com

Amina Duraković, MA[1] *Preliminary communication*

HOW DID THE COVID-19 PANDEMIC CHANGE OUR ONLINE BEHAVIOR?

Abstract

Around the globe, the COVID-19 pandemic and measures that were taken against the spread of the virus drastically changed the lives of billions of people. Work and education were forced into online space overnight, pushing people into learning new skills. COVID-19 changed the way we make and spend money, interact with others and spend our free time. But how? This paper aims to review relevant literature on this topic and give a holistic view of this phenomenon. Issues of interest that will be explored in this paper are teaching and learning, shopping, gambling, gaming, social interactions, and leisure activities. In the light of new social norms, internet addiction will be also discussed. An unparalleled event like this brings unparalleled opportunities. The world will never be the same again, but the changes brought by the deadly virus don't have to be negative. This pandemic gave us a glimpse of our digital future and lessons we learned from it should be used to improve it.

Keywords: COVID-19, online behavior, human behavior, internet addiction.

1. Introduction

The beginning of 2020 shook the world as we knew it to the core. Highly infectious SARS-CoV-2 virus with high fatality rates spread from Wuhan, China to the rest of the world (Xu et al., 2020). Data from the World Health Organization (WHO) Guidelines tell us that on January 13th the first case of COVID-19 was confirmed outside of China and that by January 14th, 2020, only 41 cases were confirmed (World Health Organization [WHO], 2020). An epidemic quickly turned into a pandemic. From the beginning of 2020 to mid-2021 almost 180 million cases of COVID-19 infections are confirmed worldwide, with almost 4 million fatalities (World Health Organization [WHO], 2021). Global response to the pandemic was partial or total lock-downs, practicing social distancing/isolation, and wearing protective gear. All of those preventive measures had a profound effect on every aspect of human life. Businesses shut down,

1 Magistrica psihologije', aminadurakovic3@gmail.com

economies weakened, families were torn apart, schools closed and traveling was banned. The existing theoretical basis for researching human response to mass-scale infections relies heavily on work done during the epidemics of Ebola (Gamma et al., 2019) and influenza A H1N1 (Rubin et al., 2009; Seale et al., 2009). However, this is the first pandemic to occur in the era where we are hyper-connected. With unprecedented disruptions in the daily activities of billions of people around the world, the pandemic has also strengthened the importance of communication to generate an adequate public response (Hanafiah and Wan, 2020).

2. Methods

Data were obtained by the author who carried out a comprehensive and non-systematic search in the PubMed, ResearchGate, Frontiers, and Google Scholar databases. Search strategies included terms as: "COVID-19," and "psychology," "pandemic," "habits,", "behavior changes", "consumer behavior", "social interactions", "online behavior", "social media", "internet addiction", "teaching", "learning", "gambling", "gaming". The search was conducted between June 22nd and July 15th. The author critically analyzed and chose recent publications, dissertations, thesis, published case series, consensus statements, guidelines, meta-analyses, systematic reviews, and prospective cohort studies. In addition, research was conducted in the public domains of informational official websites as well as the references contained in the previously acquired material.

3. Psychology of pandemics

Throughout history, human beings had to deal with a variety of infectious diseases. Infections on a mass scale are one of the most influential events in the making and shaping of human history, culture, and society. One of the earliest recorded pandemics happened during the Peloponnesian War around 430 B.C. Then came Justinian Plague, the Black Death, the Spanish Flu, HIV Pandemic (Huremović, 2019), and the currently present COVID-19 pandemic. There were other outbreaks in the different parts of the world, however, documents and research consider these to be the major ones. Since the sixteenth century, influenza (or flu) pandemics have occurred three times in a one-hundred-year period, or about every 10-50 years. There were three influenza pandemics in the twentieth century and each pandemic had a huge impact on human life and economic growth (WHO, 2011).

Previous research on large-scale disruptive events, such as various kinds of natural disasters (earthquakes, floods, etc.), shows that these types of tragic events are strongly linked to negative mental health outcomes, with posttraumatic stress disorder (PTSD) being the most common, followed by mood disorders (depression), anxiety, and other behavioral and psychological disorder (Makwana, 2019). Le and Nguyen (2020) researched the psychological well-being of Americans during the COVID-19 pandemic and found that their results

are comparable to Henriksen et al. (2010) who investigated the effects of terrorist attacks. According to Henriksen et al. (2010), those who were exposed to the 9/11 terrorist attacks are at least 42 % more likely to experience anxiety than those who were not. Similarly, Le and Nguyen (2020) found that individuals are 3.9, 4.4, 4.5, and 3.2 percent more likely to feel nervous, worried, unhappy, and depressed daily when the number of weekly COVID-19 death rate increases by 0.01 percent. The current pandemic poses a great risk of damaging one's mental health as various variables occurring in its duration are considered to have a negative impact on overall well-being.

Fear and uncertainty play a crucial role in human behavioral and emotional responses to the pandemic (Perdosa et al., 2020). Unlike the human immunodeficiency virus (HIV) which spreads through bodily fluids (sperm, blood, vaginal secretions, and breast milk) and is relatively difficult to get, the coronavirus spreads rapidly. One does not need to have risky sexual intercourse with an individual who carries the virus to get infected, all you need to do is be in the same room with them. At the same time, coronavirus is not very selective, as it does not occur more frequently in a particular age group, lifestyle choices, or any other category. Anyone can get it. Naturally, this produces the emotion of fear, which is a tool that helps human beings deal with threats coming from the environment. LaDoux (2014) explains how people respond to environmental threats. Defensive behaviors are instantaneous, driven by activity in survival circuits that identify dangers, and followed by the subjective experience of fear. Fear brought about by the COVID-19 pandemic is multifaceted and multilayered. People fear that they will get infected or that they will infect someone, that individual and community economic resources may become scarce or that they will not be able to recover shortly, they fear people coming from other countries (xenophobia) (Coelho et al., 2020). Fear could also have desirable consequences in the context of the COVID-19 pandemic because it pushes people toward preventive behaviors like hand-washing and social distancing/isolation (Harper et al., 2020). When fear becomes overwhelming, it has the potential to be dysfunctional, resulting in high amounts of distress and irrational behavior in both individuals and populations (Han, Mahendran & Yu, 2021).

Along with fear comes the inability to tolerate uncertainty. Uncertainty is characterized as the presence of ambiguous, complicated, or unpredictable stimuli or circumstances, as well as a lack of or inconsistent knowledge to deal with them (Toro, Avendao-Prieto, & Vargas 2019). The distress caused by the uncertainty is described as a subjective and personal unpleasant reaction to unknown aspects of the event (Freeston, Tiplady, Mawn, Bottesi, & Thwaites, 2020). In the light of the current pandemic, uncertainty can be seen as not having the ability to predict the course of disease-related events (Mishel, 1988; Kuang & Wilson, 2017). This includes doubts about whether we are already infected or not, will our loved ones become sick, whether there will be a shortage of supplies, whether the national economy will be impacted, whether our earnings will decrease, and so on.

4. Consumer behavior

As mentioned earlier the current research is based on investigations of people's reactions and changes in consumer behavior as a result of the Ebola (Gamma et al., 2019) and influenza A H1N1 epidemics (Rubin et al., 2009; Seale et al.,2009). Behavioral changes during epidemics and pandemics have previously been related to individual motives and government-enforced regulations (Wen et al., 2005). In new and confusing settings, individual and government decision-making is prone to mistakes and biases (Weinstein, 1988). The coronavirus prompted swift responses from governments, stock markets, and consumers. Almost every nation affected by the virus imposed travel restrictions, quarantined individuals, closed public places such as schools, and canceled or banned big public gatherings, among other things. (Anderson et al., 2020; Farooq et al., 2020). Researchers look at how ambiguity, product shortages, hoarding, manufactured obsolescence, isolation, increased use of internet channels, trust, and fear, and other variables affect how customers purchase and use products and services in the short and long term (Laato et al., 2020). While many of the unusual habits witnessed at the peak of the pandemic are expected to go away as the epidemiological situation improves (e.g., buying odd items and self-isolation), consumers' long-term behavior and tastes will be shaped by their experiences (Sheth, 2020). In the latest Euromonitor (2020, as cited in Berezka, Rebiazina, and Muravskaia, 2021) poll, nearly three-quarters of respondents think that the shift to e-commerce will be permanent, and 45 percent now anticipate the drop in in-store shopping to be permanent, up from 28 percent in April 2020. All of the restrictive measures taken by the governments forced businesses and consumers to go online. Despite having a favorable overall influence on the acceptance and development of disruptive technological prospects, researchers are becoming greatly worried about the regulatory aspect of the industry's expansion. Online entertainment and e-commerce can result in major setbacks when it comes to commitment, trust, and readiness to use technology after the pandemic threat has passed (Septianto & Chiew, 2021; Sheth, 2020).

Manss, Kurze & Bornschein (2020) define four types of consumers in the digital or omnichannel era:

1. Pure offline shoppers - They represent the population of people who carry out their shopping processes entirely through traditional media. They seek needed information in physical stores and also buy products at physical stores
2. Pure online shoppers - Much like pure offline shoppers they utilize only one type of media in their shopping process. Both information seeking and shopping happen in the digital space.
3. Webroomers - This subcategory of people who does research online before going into the store for a final evaluation and purchase.
4. Showroomers - These shoppers visit a store to seek information and examine the product and then purchase the product online.

Khan and Nedera (2021) from UNICEF bring a report from Bosnia and Herzegovina. Since the beginning of the pandemic, 13% of households have reported an increase in internet use and online transactions, such as online shopping, e-commerce, and e-banking. All this is especially prevalent among young people (aged 18 to 30) in urban areas and households with a net income of 1,500 BAM and more. Toploko Herceg (2020) explored the impact of COVID-19 on online consumer behavior in Croatia. She found significant growth in online purchases of food and beverages as more consumers have resorted to online grocery shopping. Interestingly, a lot of them were forced to do it for the first time due to the circumstances. That shows that consumers› adaption to internet purchasing has been accelerated by the corona epidemic.

On the other hand, Sayyida et al. (2021) explored the impact of the COVID-19 pandemic on online retail sales and concluded that the effect is quite small. He reports that before the COVID-19 epidemic, the rise in worldwide online retail sales was less than 10% of overall retail sales or 10% to 15% of online retail sales. During the pandemic, the most significant surge in online retail sales happened in the second quarter of 2020, before declining in the third quarter. During the pandemic, internet retail sales accounted for no more than 35% of overall retail sales. He proposes that buyers sought information online before buying the actual product (webrooming) despite the social distancing rules. This could be explained by the consumer's need to feel the product before making the final purchase.

5. Teaching and learning

Much like any other public service, the government closed down schools and universities and imposed an online model of working. Closures influence approximately 90% of the world›s students as of March 29, 2020 (UNESCO, 2020). Online education has its roots in nineteenth-century correspondence education. The way people learn has been changing since the turn of the century, thanks to advances in communication technology, and the Internet and open-source learning have created an atmosphere conducive to large-scale distance education (Volery, 2001).

Online learning can be divided into categories based on different parameters such as modality (totally online, blended, and web-enabled face-to-face), tempo (self-paced or class-paced), assumed student roles, and synchronicity (Means et al., 2014). Authors define two types of online teaching methods: synchronous and asynchronous. Synchronous refers to teachers and students meeting at a pre-determined time for interactive learning classes, whereas asynchronous refers to the teachers giving the course without interaction with the students. This proposes no interaction between the professors and the pupils. However, students can access online content anytime they choose with asynchronous types of online learning. During the pandemic majority of global teaching institutions chose to work with both methods (EasyLMS, 2021). According to Stec et al. (2020), there are three primary ways of online teaching: enhanced,

blended learning, and online approach. To ensure creative and dynamic education, enhanced learning makes extensive use of technology. Blended learning combines classroom and online learning. The online method denotes that the course material is given over the internet. However, because students were exposed to a variety of e-learning schemes at the start of the COVID-19 pandemic, this type of online learning could not be categorized in any existing concepts (Naujoks et al.,2021). As a result, the events of the spring semester of 2020 can be classified as a new form of online learning called emergency remote teaching or emergency remote education (Bozkurt et al., 2020; Hodges et al., 2020).

Different technologies are available and are being used on online platforms to assist in running online interactive lessons and reducing student loss. They are created to share knowledge and organize class activities (Martin-Blas & Serrano-Fernánde, 2009). According to UNESCO (2020b) report, the most used platforms to assist the online teaching are Hangouts Meet (video calls), Teams (chat, interactive meetings, video, and audio calls), Skype (video and audio calls), WhatsApp (video and audio calls, chat, and content share), and Zoom (video and audio calls, and collaboration features). In their meta-analysis, Camargo and her colleagues (2020) found that Zoom and Google platforms are the most popular online learning platforms.

There are some advantages to online learning. For example, Davletova et al. (2016) emphasized its flexibility and affordability. This proposes that students can choose the pace they want and need at that moment during the learning process. When students study at their own pace, learning becomes more flexible and convenient for them. It also decreases stress and increases pleasure and self-motivation, as opposed to the conventional classroom environment, when students have no choice but to learn at the pace of the teacher. The efficacy of online learning is dependent on adequate planning and instruction to increase learning quality and overall student outcomes. Both active and passive learners can benefit from online learning. Its goal is to give students comprehensive information that can be accessible at any time and from any location. This approach to learning and teaching extends beyond the classroom, allowing students to hone their critical thinking and research abilities while also acquiring new information that may be applied to new ideas (Songkram, 2012).

UNESCO (2020c) warns about a slew of difficulties brought on by closing schools down and restricting their work to the online domain. The consequent disruptions aggravate previously existing inequalities not just inside the educational system, but also in other aspects of student's life.

Some of them are:

- For some students schools are the only educational opportunity they have, so their learning became interrupted.
- Marginalized and underprivileged students relied on free or cheaper meals which school provided and the closure threatened their nutrition.

- Transition to online learning platforms proved to be stressful and confusing to both teachers and students
- Parents were unprepared for distance learning, especially those who have a restricted level of education and financial means.
- Without schools children become more vulnerable to violence and exploitation such as sexual and military exploitation. Similarly, peer pressure, substance abuse, and teenage pregnancies become more prevalent.
- Children's social skills were greatly affected by social isolation and the inability to interact with their peers.
- Teachers faced great challenges in measuring and validating learning

We are yet to see the real consequences of online education. The problem is that it is not only the educational process that affects learning. Ongoing stress due to fear of contagion and illness, worry about the economy, social issues, and the future, and overall mental health conditions are all impacting both teaching and learning processes. Studies have shown that the transition between face-to-face and online teaching poses an unprecedented challenge even for teaching staff who are well-versed in using information and communication technology (ICT) in their classrooms. Teachers have had to adjust to this fast-changing new paradigm while juggling their difficulties, such as stress, loneliness, sickness, and family caregiving (Gorman, 2020). Whenever a human element is involved researchers have to keep in mind psychological processes that happen in the background when they evaluate the efficacy and efficiency. However, the COVID-19 pandemic served as a push towards the development of new teaching technologies and methods.

6. Addictions

According to Beard and Wolf (2001), Internet addiction (IA) is the misuse of the Internet that causes a person's psychological condition (both cognitive and emotional) to deteriorate, as well as their academic or work-related and social communications. Young et al. (1999) see IA as a hypernym encompassing a wide range of behaviors and difficulties related to impulse control that may be divided into five categories based on evidence from experimental research:

1. Cybersexual addiction
2. Cyber-relationship addiction
3. Net compulsions (gambling, shopping, and stock trading)
4. Information overload
5. Obsessive computer game playing

News reports (BBC, The Washington Post) tell us that in the first three months of 2020, BBC and Netflix acquired 16 million new members, about 100 percent more than in the last few months of 2019. Microsoft's game servers had ten

million users in April, demonstrating how the internet gaming business has flourished despite the global epidemic.

Drug use and other potentially addictive behaviors such as gambling, gaming, watching TV shows and pornography, using social media, and surfing the Web have all been used to relieve stress and anxiety or lift a low mood, according to the existing body of literature (Király, Potenza and Stein, 2020). The problem with this behavior is that they can get out of hand quickly. Since COVID-19 is considered to be a highly stressful period for most people it is expected to see a rise in these unhealthy coping strategies which have a high potential of becoming extremely difficult to give up. This is all connected to the physical isolation caused by the lockdowns, resulting in people wasting time online for no apparent reason, spending longer, abnormally long periods online when bored (Koyuncu, Unsal, Arslantas, 2014). In summary, when individuals are feeling bad or bored, they frequently resort to unhealthy coping mechanisms for brief solace. King et al. report that Internet use has grown significantly during the lockdown, particularly in terms of access to websites related to pornography and video games. Internet addiction (particularly when it comes to social networking), online sex, and gaming addiction are among the most common behavioral addictions.

PornHub, one of the leading pornographic websites, published reports on traffic statistics during COVID-19 and they note that it became clear that as people spent more time at home, in self-isolation or distant working, PornHub traffic had increased. On March 17th, 2020, worldwide traffic to Pornhub increased by 11.6 percent. It is worth noting that Pornhub got 42 billion visitors in 2019 and the epidemic appears to have resulted in an even more dramatic and visible increase in visits to pornographic websites. One of the most interesting statistics is related to the search for coronavirus-themed pornography. The report states that the search for "coronavirus" and "coronavirus" began on January 25th and has since grown in popularity. The number of searches reached 1.5 million on March 5th. The problem with pornography is that it changes the brain structure (Kühn and Gallinat, 2014; Gola et al., 2017). Furthermore, due to an individual's desire for greater reward, newer, more extraordinary, and pathological content is sought (Love et al. 2015), which could explain the search for corona-related porn content.

Studies also focused on gaming, especially on its online form. Reports from Korea state that 24% of the participants spent more time online gaming after COVID-19 restrictive measures (Korean Addiction Forum, 2020). Another study from the same country says that 70.5% of the respondents reported an increase in time spent playing digital games, which is 4.8% more than in the year 2019 (Korea Creative Content Agency, 2020). In Iran, Fazeli et al. (2020), found that Internet gaming disorder, insomnia, and the life quality among adolescents during the COVID-19 pandemic are mediated by depression, anxiety, and stress.

Over the last decade, the use of social media has expanded astonishingly. People now use it for a wide variety of reasons from gathering information to

entertainment. The top five platforms are Facebook (2.2 billion users), YouTube (1.9 billion), WeChat (around 1 billion), Instagram (1 billion), and TikTok (500 million) (Hauer & Sood, 2020). At the very beginning of the pandemic, strict preventive measures were taken by most governments, which left people heavily dependant on social media for contact and information update. Also, fear of the unknown prevented people from taking any risks and meeting with friends and family members. Zhao and Zhou (2020) point out that social media in the time of the COVID-19 pandemic played both positive and negative roles. Among the positive ones are the spread of information regarding the pandemics, promotion of preventive measures, and substitution of real-life social contact. Panic due to rumors and conspiracy theories which spread as fast as any other news is considered to be detrimental to one's mental health. Their study confirmed previous findings that heightened social media consumption is positively correlated with the high odds of anxiety and depression (Gao et al., 2020). Social media have a high potential to become addictive since they promote constant user engagement through endless scrolling, resulting in people spending hours and hours consuming their content. Prikhidko, Long & Wheaton (2020), report on a phenomenon called digital emotion contagion which can be defined as the transmission of emotional experience from one person to another in digital space. Given the fact that people spent a lot of time on social media either actively or passively communicating with others, it became easy to get 'infected' with other people's negative emotions. The level at which emotions of other people, even on social media platforms will affect, an individual depends on a personal susceptibility to emotion contagion (Wheaton, Prikhidko & Messner, 2021).

7. Conclusion

COVID-19 has given us a glimpse of our near future where most of the daily tasks can be digitized. Jobs, shopping, learning, and teaching as well as basic human communication are now transferred into an online realm. COVID-19 pandemic just sped up a train that carries us into the golden era of the digital world. We are still a long way from a complete digital transformation but this pandemic has forced people to be innovative in their use of technological advances. No one sane will deny that it has brought us many positive changes; it has revolutionized many aspects of our lives. However, the danger is always lurking beneath the shiny and attractive exterior. Many scientists are worried that our bodies and our brains are not designed to deal with such changes, meaning that the world is changing too fast, and our brains are lacking behind. Science fiction novels/TV shows/movies, as well as futurists, tend to somewhat forget how human psychology works. Many studies have shown that overuse of the internet in particular leads to significant mental impairment (mainly depression and anxiety). Studies have shown that it also disrupts our focus and concentration . This article would have been finished earlier if the author hasn't checked her social media accounts and messaged her friends. The Internet also offers us cheap and unhealthy stress coping mechanisms

which have a huge potential to overpower us. It is interesting to look at the (over)use of the Internet in the days of the pandemic. Many people spent hours online chatting and playing games or just scrolling endlessly through their social media feeds. The time they spent engaged in those activities and negative consequences that it had on their minds or bodies could indicate the problem with overuse of the Internet. Can we categorize them as addicted to the Internet? For the majority, the answer is no. We could view it as a normal response to an abnormal situation. Although, scholars and medical professionals should keep track of this kind of behavior even after the pandemic to see how much COVID-19 has changed our online behavior and definitions of normality. To some extent, the digitization because of the COVID-19 pandemic has highlighted the stark differences between classes, where the poor have been prevented from getting the education and the rich got the best possible experience. This global calamity has thought us a valuable lesson; we still have a lot of work to do before we advance any further in technology. Growth is possible, as many individuals have shown us, but always with a healthy dose of caution.

References:

1. Anderson, R. M., Heesterbeek, H., Klinkenberg, D., & Hollingsworth, T. D. (2020). How will country-based mitigation measures influence the course of the COVID-19 epidemic?. Lancet (London, England), 395(10228), 931–934.
2. Beard, K. W., & Wolf, E. M. (2001). Modification in the proposed diagnostic criteria for Internet addiction. Cyberpsychology & behavior, 4 (3), 377-383.
3. Berezka, S., Rebiazina, V., & Muravskaia, S. (2021). Changes in consumer behavior in the BRICS countries during the COVID-19 pandemic: The role of trust and anxiety. BRICS Journal of Economics, 2 (1), 53–73.
4. Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., Egorov, G., ... & Paskevicius, M. (2020). A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. Asian Journal of Distance Education, 15 (1), 1-126.
5. Camargo, C.P., Tempski, P.Z., Busnardo, F.F., Martins, M.A., & Gemperli, R. (2020). Online learning and COVID-19: a meta-synthesis analysis. Clinics,75, e228
6. Coelho, C. M., Suttiwan, P., Arato, N., & Zsido, A. N. (2020). On the nature of fear and anxiety triggered by COVID-19. Frontiers in Psychology, 11, 3109.
7. Davletova, A. K., Maykibayeva, E. K., Rakhimzhanova, M. B., Kasymova, A. K., & Kusainov, A. A. (2016). Didactic Potential of Multimedia-Technology in the Development of Students 'Information Culture. Indian Journal of Science and Technology, 9 (12), 32-63.
8. EasyLMS (2021). Difference Synchronous vs Asynchronous Learning | Easy LMS. Available online at:https://www.easy-lms.com/knowledge-center/lms-knowledge-center/synchronous-vs-asynchronous-learning/item10387 Accessed : 09/07/2021
9. Farooq, A., Laato, S., & Islam, A. N. (2020). Impact of online information on self-isolation intention during the COVID-19 pandemic: cross-sectional study. Journal of Medical Internet research, 22 (5), e19128.
10. Fazeli, S., Zeidi, I. M., Lin, C. Y., Namdar, P., Griffiths, M. D., Ahorsu, D. K., & Pakpour, A. H. (2020). Depression, anxiety, and stress mediate the associations between internet gaming disorder, insomnia, and quality of life during the COVID--19 outbreak. Addictive Behaviors Reports, 12, 100307.

11. Freeston, M., Tiplady, A., Mawn, L., Bottesi, G., & Thwaites, S. (2020). Towards a model of uncertainty distress in the context of Coronavirus (COVID-19). The Cognitive Behavior Therapist, 13.
12. Gamma, A. E., Slekiene, J., & Mosler, H.-J. (2019). The impact of various promotional activities on Ebola prevention behaviors and psychosocial factors predicting Ebola prevention behaviors in the Gambia evaluation of Ebola prevention promotions. International Journal of Environmental,
13. Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., ... Dai, J. (2020). Mental health problems and social media exposure during COVID-19 outbreak. PLoS One, 15 (4), e0231924.
14. Gola, M., Wordecha, M., Sescousse, G., Lew-Starowicz, M., Kossowski, B., Wypych, M., et al. (2017). Can pornography be addictive? An fMRI study of men seeking treatment for problematic pornography use. Neuropsychopharmacology, 42, 2021–31.
15. Gorman, G. (2020). Teachers working through the coronavirus pandemic need our support more than ever. ABC Life. Available at: https://www.abc.net.au/life/teachers-working-through-coronaviruspandemic-need-kindness/12075544 Accessed: 09/07/2021
16. Han, M. F., Mahendran, R., & Yu, J. (2021). Associations between fear of COVID-19, affective symptoms and risk perception among community-dwelling older adults during a COVID-19 lockdown. Frontiers in Psychology, 12, 961.
17. Harper, C. A., Satchell, L. P., Fido, D., & Latzman, R. D. (2020). Functional fear predicts public health compliance in the COVID-19 pandemic. International journal of mental health and addiction, 1-14.
18. Hauer, M.K. & Sood, S. (2020). Using Social Media to Communicate Sustainable Preventive Measures and Curtail Misinformation. Frontiers in Psychology, 11, 568324
19. Henriksen, C. A., Bolton, J. M., & Sareen, J. (2010). The psychological impact of terrorist attacks: examining a dose-response relationship between exposure to 9/11 and Axis I mental disorders. Depression and Anxiety, 27 (11), 993-1000.
20. Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., and Bond, A. (2020). The difference between emergency distance teaching and online learning. Educause Review. Available at: https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning Visited: 09/07/2021
21. Huremović, D. (2019). Brief history of pandemics (pandemics throughout history). In Psychiatry of pandemics (pp. 7-35). Springer, Cham.
22. Khan, R. & Nedera, S. (2021). Procjena socijalnog utjecaja pandemije bolesti COVID-19 u Bosni i Hercegovini. Available at: https://www.unicef.org/bih/pri%C4%8De/procjena-socijalnog-utjecaja-pandemije-bolesti-covid-19-u-bosni-i-hercegovini Accessed: 05/07/2021
23. Király, O., Potenza, M. N., Stein, D. J., King, D. L., Hodgins, D. C., Saunders, J. B., ... & Demetrovics, Z. (2020). Preventing problematic internet use during the COVID-19 pandemic: Consensus guidance. Comprehensive psychiatry, 100, 152180.
24. Korea Creative Content Agency (KOCCA), (2020). The 7th survey report of the game users in Korea. Available at: https://www.kocca.kr/cop/bbs/view/B0000147/1842858.do?menuNo=201825 Accessed: 07/07/2021
25. Korean Addiction Forum (KAF), (2020). Republic of Korea: COVID-19 Pandemic & Change in Addictive Behaviors. Available at: http://www.addictionfr.org/2020/bbs/board.php?bo_table=sub06_1&wr_id=33&page=1 Accessed: 07/07/2021
26. Koyuncu, T., Unsal, A., & Arslantas, D. (2014). Assessment of internet addiction and loneliness in secondary and high school students. Journal of Pakistan Medical Association, 64 (9), 998-1002.

27. Kuang, K., & Wilson, S. R. (2017). A meta-analysis of uncertainty and information management in illness contexts. Journal of Communication, 67(3), 378-401.
28. Kühn, S. & Gallinat, J. (2014). Brain structure and functional connectivity associated with pornography consumption: the brain on porn. JAMA Psychiatry, 71, 827–34.
29. Laato, S., Islam, A. N., Farooq, A., & Dhir, A. (2020). Unusual purchasing behavior during the early stages of the COVID-19 pandemic: The stimulus-organism-response approach. Journal of Retailing and Consumer Services, 57, 102224.
30. LeDoux, J. E. (2014). Coming to terms with fear. Proceedings of the National Academy of Sciences, 111 (8), 2871-2878.
31. Love, T., Laier, C., Brand, M., Hatch, L. & Hajela, R. (2015). Neuroscience of internet pornography addiction: a review and update. Behavioral Sciences (5), 388–433.
32. MacIntyre, C. R. (2009). The community's attitude towards swine flu and pandemic influenza.
33. Makwana, N (2019). Disaster and its impact on mental health: A narrative review. Journal of family medicine and primary care, 8(10), 3090.
34. Manss, R., Kurze, K., & Bornschein, R. (2020). What drives competitive webrooming? The roles of channel and retailer aspects. The International Review of Retail, Distribution and Consumer Research, 30 (3), 233-265.
35. Martín-Blas, T., & Serrano-Fernández, A. (2009). The role of new technologies in the learning process: Moodle as a teaching tool in Physics. Computers & Education, 52, 35-44.
36. Means, B., Bakia, M. and Murphy, R. (2014). Learning Online: What Research Tells Us about Whether, When and How. Routledge Taylor & Frances, New York.
37. Mishel, M. H. (1988). Uncertainty in illness. Image: The Journal of Nursing Scholarship, 20(4), 225-232.
38. Mohd Hanafiah, K., & Wan, C. D. (2020). Public knowledge, perception and communication behavior surrounding COVID-19 in Malaysia.
39. Naujoks, N., Bedenlier, S., Gläser-Zikuda, M., Kammerl, R., Kopp, B., Ziegler, A., & Händel, M. (2021). Self-Regulated Resource Management in Emergency Remote Higher Education: Status Quo and Predictors. Frontiers in Psychology, 12.
40. Pedrosa, A. L., Bitencourt, L., Fróes, A. C. F., Cazumbá, M. L. B., Campos, R. G. B., de Brito, S. B. C. S., & e Silva, A. C. S. (2020). Emotional, behavioral, and psychological impact of the COVID-19 pandemic. Frontiers in Psychology, 11.
41. Pornhub (2020). Coronavirus Insights. Available at: https://www.pornhub.com/insights/corona-virus Accessed: 07/07/2021
42. Prikhidko, A., Long, H. & Wheaton, M.G. (2020). The Effect of Concerns About COVID-19 on Anxiety, Stress, Parental Burnout, and Emotion Regulation: The Role of Susceptibility to Digital Emotion Contagion. Frontiers in Public Health, 8, 567250.
43. Rubin, G. J., Amlot, R., Page, L., & Wessely, S. (2009). Public perceptions, anxiety, and behavior change in relation to the swine flu outbreak: Cross sectional telephone survey. BMJ, 339, b2651–b2651.
44. Sayyida, S., Hartini, S., Gunawan, S., & Husin, S. (2021). The Impact of the Covid-19 Pandemic on Retail Consumer Behavior. Aptisi Transactions on Management (ATM), 5 (1), 79-88.
45. Seale, H., McLaws, M. L., Heywood, A. E., Ward, K. F., Lowbridge, C. P., Van, D., ... & MacIntyre, C. R. (2009). The community's attitude towards swine flu and pandemic influenza. Medical Journal of Australia, 191(5), 267-269.

46. Septianto, F., & Chiew, T. M. (2021). Perceived Threat of COVID-19 Influences Product Preferences: The Moderating Role of Consumers 'Mindset. Australasian Marketing Journal, 29 (1), 78-86.
47. Sheth, J. (2020). Impact of Covid-19 on consumer behavior: Will the old habits return or die?. Journal of Business Research, 117, 280-283.
48. Smith, N. (2020). The Giants of the Video Game Industry Have Thrived in the Pandemic. Can the Success Continue? Available online at: https://www.washingtonpost.com/video-games/2020/05/12/video-game-industry-coronavirus/ Accessed: 19/07/2021
49. Songkram, N. (2017). Online course design for creativity and innovative skills in virtual cultural ASEAN community: from research to empirical practice. International Journal of Emerging Technologies in Learning, 12 (1), 4-20.
50. Stec, M., Smith, C., and Jacox, E. (2020). Technology enhanced teaching and learning: exploration of faculty adaptation to iPad delivered curriculum. Technology, Knowledge and Learning, 25 (3), 651-665
51. Thomas, Z (2020). Netflix Gets 16 Million New Sign-Ups Thanks to Lockdown. Available online at: https://www.bbc.com/news/business-52376022 Accessed: 19/07/2021
52. Topolko Herceg, K. (2021). IMPACT OF COVID-19 PANDEMIC ON ONLINE CONSUMER BEHAVIOR IN CROATIA. CroDiM, 4 (1), 131-140.
53. Toro, R. A., Avendaño-Prieto, B. L., & Vargas, N. (2020). Transdiagnostic model of anxiety and depression according to the relationship with affect, uncertainly intolerance, and anxiety sensitivity. Rev. CES psicologia, 13 (1), 140-152.
54. UNESCO (2020). Education: From disruption to recovery. Available at: https://en.unesco.org/covid19/educationresponse Accessed: 19/07/2021
55. UNESCO (2020b). Distance Learning Tools. Available at: https://en.unesco.org/covid19/educationresponse/support Accessed: 09/07/2021
56. UNESCO (2020c). Adverse consequences of school closures. Available at: https://en.unesco.org/covid19/educationresponse/consequences Accessed: 05/07/2021
57. Volery, T. (2001). Online education: An exploratory study into success factors. Journal of educational computing research, 24 (1), 77-92.
58. Weinstein, N. D. (1988). The precaution adoption process. Health psychology, 7 (4), 355.
59. Wen, Z., Huimin, G., Kavanaugh, R.R. (2005). The impacts of SARS on the consumer behavior of Chinese domestic tourists. Current Issues in Tourism, 8 (1), 22–38.
60. Wheaton, M.G., Prikhidko, A. & Messner, G.R. (2021). Is Fear of COVID-19 Contagious? The Effects of Emotion Contagion and Social Media Use on Anxiety in Response to the Coronavirus Pandemic. Frontiers in Psychology 11, 567379.
61. World Health Organization (2020). Timeline: WHO's COVID-19 response. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline#! Visited: 09/07/2021
62. World Health Organization (2011b). Comparative Analysis of National Pandemic Influenza Preparedness Plan. Geneva-Switzerland: WHO.
63. Xu, Z., Shi, L., Wang, Y., Zhang, J., Huang, L., Zhang, C., ... & Wang, F. S. (2020). Pathological findings of COVID-19 associated with acute respiratory distress syndrome. The Lancet respiratory medicine, 8 (4), 420-422.
64. Young, K.S., Pistner, M., O'Mara, J., & Buchanan. J. (1999). Cyberdisorders: The mental health concern for the new millennium. CyberPsychology & Behavior, 2, 475-479.

65. Zhao, N. & Zhou, G. (2020). Social Media Use and Mental Health during the COVID-19 Pandemic: Moderator Role of Disaster Stressor and Mediator Role of Negative Affect. Applied Psychology: Health and Well-being, 12(4), 1019-1038.

Robert Andrejaš, M.Sc. art.[1] *Preliminary comunication*

CHANGES IN THE WORK OF BOSNIA AND HERZEGOVINA'S CANTONAL RADIO AND TELEVISION STATIONS, RADIO TELEVISION HERCEG BOSNA AND FACE TV DURING THE COVID 19 PANDEMIC, UNTIL JUNE 2020

Abstract

After five decades of existence, television in Bosnia and Herzegovina stands how it found itself, not of its own volition, nearly thirty years ago. Even today, there are "state media" that unquestioningly broadcast the approved thoughts of the ruling structures and private tv stations, some of which may carry the epithet "independent", but only in a certain territory of Bosnia and Herzegovina. In fact, there is no universal independence in BiH.

All the media that were observed in this research have a war past, if not direct then through the founders. This wartime past helped to prevent a collapse in reporting at the time the special measures were announced, but on the contrary, this experience was used to quickly adapt to the new working conditions. In addition, the experience helped to quickly identify the needs of the public, and find opportunities to meet these emerging needs.

However, the experience gained during the war did not help in reporting the bad decisions of the founders who represent the government in a certain area. A large number of scandals that marked the time of the pandemic, passed "under the radar" of these media. In fact, self-censorship has prevented the publication of even already known facts. This lack of BH public media was compensated by independent media, and this form of concealment became even more visible in the cantonal media.

At the time of the pandemic, there was a rapid development of online communication, and "thanks" to the coronavirus, there was an increase in digital competencies among all media workers, their audiences, but also the general public. It is the television websites that have become the place where, at the time when it suits the audience the most, content of the audience's choice is found. Some tv stations have used this form of work to the greatest extent, while some have not fully recognized the benefits of such published news.

Keywords: Television, Media, corona, pandemic, online journalism.

1 Josip Juraj Strossmayer University of Osijek, Croatia

1. Introductory considerations

B&H television first appeared as a medium between viewers and events five decades ago. At the time of the one-party system, television was entirely focused on meeting the needs of the audience... as long as they were in line with the wishes of the political party. It has been operating in a completely monopoly position for almost two full decades, only to gain competition in the early 1990s in the form of a larger number of private TV stations. Different tones began to come from the television, not always to the liking of the rulers.

The war that soon began polarized the media market to such an extent that media workers, who again mostly became transmitters of only "approved" news, this time of different political options, became true enemies of each other. War reporting is certainly not a time in which forms of honest reporting are developed, but it is a period in which methods of working in special circumstances, such as the state of war, are found. At that time, all public tv stations whose work was researched in this paper were founded, but at and before that time, the founder of the only private media house whose work is the focus of this research grew into a well-known media worker. Common to all tv stations that are the focus of this research is that they are located in the Federation of Bosnia and Herzegovina. The reason for this is that in the Republika Srpska, which is part of the other part of Bosnia and Herzegovina, there are no cantons, and therefore no cantonal tv stations.

All cantonal public tv stations of Bosnia and Herzegovina operate outside the Public Broadcasting System of Bosnia and Herzegovina and their founders are the assemblies of the canton in which they operate. Radio Television of Herceg Bosna was founded by the Croatian Community of Herceg-Bosna Mostar and is funded by all municipalities with a Croat majority in the Federation of BiH. Face TV is a commercial independent television station founded by Senad Hadžifejzović, a well-known Bosnian journalist. The aim of this research is to show the changes in the work of public broadcasters outside the Public Broadcasting System of Bosnia and Herzegovina, and to compare their work with the work of private, independent and commercial tv station "Face TV" in the first six months of 2020. It is a time of special circumstances caused by the Covid 19 pandemic, and the focus of the research are the reactions of these televisions to environmental stimuli and change in order to meet the new needs of the public in such circumstances.

This paper compares the public media, which in Bosnia and Herzegovina are often identified with the governing structures with a private, independent, commercial television company. Common to all these media is the program commitment that emphasizes them primarily as information media. The importance of public information for the local community was also observed, as well as the "differences in the settings" of these and one (their "only") independent tv station. However, this "independence" is accepted in Bosnia and Herzegovina only if it fully agrees with the views of viewers in a particular BH entity and a particular political option, because universal independence in Bosnia and Herzegovina does not exist.

Although created in different circumstances or at different times, often the work of all these media houses, and in the case of private Face Television, the work of its founder, is associated with war reporting and work in war circumstances. These experiences proved to be crucial for the reaction of this media in the new circumstances, because the coronavirus pandemic in the world, and even in Bosnia and Herzegovina, produced the situation closest to the state of war. The question that arises when it comes to the work of these media is the current readiness of these media to provide true uncensored and timely information in special circumstances, and to provide all possible support in the segment of public reporting in such a situation.

2. Pandemic

On New Year's Eve 2019, "the World Health Organization office in China was informed about a pneumonia of unknown origin that was discovered in the city of Wuhan, Hubei Province. According to officials, some of the patients were vendors at the Hunan Seafood Market."[2].In the preparations for the celebratory programs of local tv stations in Bosnia and Herzegovina before the New 2020, this was not news that deserved attention. The unexplained cases of pneumonia in the city of Wuhan, which began to appear on December 12[3], were not interesting to anyone in BiH on New Year's Eve, because the New Year was near, while China was very far away. A disease that did not even have a name could in no way spoil the prepared celebrations and find its place in the programs. Two weeks later and three days after the first death from the new virus was confirmed on January 11, 2020[4], the World Health Organization warns of a possible epidemic of the Chinese corona virus[5]. "There may have been limited human-to-human transmission of the new corona virus (corona) in China, and there may be a wider epidemic," the World Health Organization (WHO) said on January 14[6], after the virus was first detected outside China in Thailand on January 13[7].

In the first two weeks, the virus, which belongs to a group of viruses with a characteristic corona shape visible under an electron microscope, also got its name, which in the following year will be one of the most commonly cited terms in the world. Three days later, another victim was confirmed in Wuhan[8].

2 Čilić, Una: (2020). 100 dana koji su promijenili svijet, Radio Slobodna Evropa, 2020., available at: https://www.slobodnaevropa.org/a/korona-virus-pandemija/30544700.html, date quoted: 8. 2. 2021.
3 Cf. Joseph, Andrew: (2020). First death from Wuhan pneumonia outbreak reported as scientists release DNA sequence of virus, STAT, 11. 1. 2020., available at: https://www.statnews.com/2020/01/11/first-death-from-wuhan-pneumonia-outbreak-reported-as-scientists-release-dna-sequence-of-virus/, date quoted: 8. 2. 2021.
4 Cf. Law, Elizabeth: (2020). China reports first death in Wuhan pneumonia outbreak, The Straits Times-Asia, 4. 2. 2020., Singapore Press Holding, available at: https://www.straitstimes.com/asia/east-asia/china-reports-first-death-in-wuhan-pneumonia-outbreak, date quoted: 8. 2. 2021.
5 Amplius. Čilić, loc. cit.
6 RSE: (2020). WHO upozorava na moguću epidemiju novog kineskog korona virusa, Radio Slobodna Evropa, 2020., available at: https://www.slobodnaevropa.org/a/30376907.html, date quoted: 8. 2. 2021.
7 Cf. Ibid.
8 Cf. GardaWorld: (2020): China: Officials confirm second death from pneumoniain Wuhan, January 16 / update 5, 17. 1. 2020., available at: https://www.garda.com/crisis24/news-alerts/305746/china-officials-confirm-second-death-from-pneumonia-in-wuhan-january-16-update-5, date quoted: 8. 2. 2021.

News from China were becoming extremely bad, but it was not a signal to attract attention in the cantonal and commercial media in BiH. The assessments did not show any greater danger of the arrival of coronavirus in BiH.

3. Pandemic on TV stations in B&H

Three weeks after New Year 2020 celebration, Face Television, an independent Bosnian media house, published six articles on its portal on January 22, 2020, about the coronavirus, in which it brings the latest world news about the epidemic that has spread to China and spread to other In the show Vjestnik[9], on the same day on Face TV program, a report longer than 3 minutes was dedicated to this topic, while RTV Herceg Bosna devotes only a little less time to the same problem, in its Dnevnik[10].

Only a day later and two days before Chinese New Year on January 23, 2020, the city of Wuhan found itself in one of the strictest "lockdowns" the world had ever seen[11]. The city will remain completely separate from the rest of the country until June with strict restrictions and strict implementation of measures. Radio-Television of Tuzla Canton in Bosnia and Herzegovina, in its central news program "Dnevnik", reports that "There is still no fear of spreading a new type of corona virus to the Balkans.[12]".

Face television continuously, for a full 161 days of the observed period, brought new news about the spreading global contagion on its portal and in the program. On January 24, 2020, in the most important show of that television, *Centralni Dnevnik sa Senadom Hadžifejzovićem*, the topic of coronavirus takes up close to 5 minutes of the show[13,14,15].

The report states that "26 people have died from the coronavirus so far, more than eight hundred have become ill and hundreds of people have been infected with the coronavirus." The news that China, due to the lack of hospital capacities, has started the construction of a new hospital with a thousand beds, which will be completed in five days, already announces a great danger that is already spreading around the world and has already affected a large number of countries.[16]Finally, it is emphasized that "the risk of coronavirus in Bosnia and Herzegovina is low, but it cannot be ruled out."[17]

9 Face TV-Vjestnik, 22. 01. 2020. 0:21:50 – 0:25:00
10 Ćorić, Valerija: RTV HB Dnevnik, 22. 01. 2020., report: 0:21:14 – 0:23:21
11 Cf. Illmer, Andreas; Wang, Yitsing; Wong, Tessa: (2020)., Wuhan lockdown: A year of China's fight against the Covid pandemic, BBC News, 22. 1. 2020., available at: https://www.bbc.com/news/world-asia-china-55628488, date quoted: 8. 2. 2021.
12 Cf. Prof. dr. Nijaz Tihić u prilogu Ferković Pašić, Ivana, Dnevnik RTV TK 23. 01. 2020. 0:14:26 – 0:15:11/ https://www.youtube.com/watch?v=FTcEjKiOAGQ&t=118s / https://rtvtk.ba/jos-nema-bojazni-za-sirenje-novog-tipa-korona-virusa-na-prostor-balkana/
13 Cf. Hadžifejzović Senad: Emisija Centralni dnevnik, TV Face, 24. 01. 2020., Show announcement 0:00:00 – 0:00:26.
14 Ibid. Introductory announcement. 0:04:45 – 0:06:17.
15 Ibid. Report – Corona, 0:06:26 – 0:09:12.
16 Ibid., 0:06:26 – 0:09:12.
17 Ibid. Report – Corona, 0:06:26 – 0:09:12.

RTV Herceg Bosna dedicated the most airtime to the coronavirus which in more than six minutes, through two articles in its *Dnevnik*[18,19], also introduced its viewers to all new knowledge about the spread of the virus and measures taken in Bosnia and Herzegovina.

Out of cantonal BH tv stations, RTV of Una-Sana Canton reacted the fastest and produced content that problematized this disease. On January 23, 2020, it brings two news about the coronavirus on its website, and the day after, on January 24, 2020, Dnevnik of that tv station ended with warnings related to the new virus[20]. During the observed period, on its website, this tv station produced a total of 158 content about this disease in 158 days. This commitment was partly influenced by the proximity of the western Bosnian border with Croatia, and on January 26, 2020, in Dnevnik, regarding the coronavirus, it was pointed out that a group of tourists from Wuhan province, from Croatia, visited the national park " Plitvice ", entered Bosnia and Herzegovina, and headed towards Medjugorje and further to Bosnia and Herzegovina.[21]News of the spread of the virus and the increase in the number of dead and infected, as well as new findings, were followed by 12 repetitions of tickers[22] (crawls) during the show. The announcement of the daily report from January 30 already said that "the possibility of its occurrence in Bosnia and Herzegovina is not excluded, but it is moderately probable."[23]On the same day, a press conference was held at the Institute of Public Health of the FBIH, at which the participants who will become the most frequent participants in all news programs in the country in the coming period spoke.

By the end of the first month, January 28, 2020, Radio-Television of the Bosnian-Podrinje Canton will produce and publish a report on coronavirus, while similar content will appear on the portals of the two remaining cantonal televisions in the first half (RTV TK) and at the end (TV SA) of the second month.

4. Pandemic in Europe and B&H

A day after the first Chinese lockdown, on January 24, France confirmed the first three cases of the coronavirus in Europe[24], and only a day later a case of coronavirus was confirmed in Croatia[25], while Italy confirmed two cases on its territory on January 30. Situation development in Italy will show how dev-

18 Bliznac, Damir: RTV HB Dnevnik, 24. 01. 2020., report: 0:10:21 – 0:12:34 (announcement, editor Šutalo Milan)
19 Jukić, Branka: RTV HB Dnevnik, 24. 01. 2020., report: 0:12:34 – 0:16:51 (announcement, editor Šutalo Milan)
20 Cf. Hadžić, Darmin: Dnevnik, RTV USK, 24. 01. 2020., report, 0:23:30 – 0:24:22
21 Cf. Štilić, Aida: Dnevnik, RTV USK, 26. 01. 2020., report, 0:12:06 – 0:13:05
22 RTV USK: Dnevnik, RTV USK, 26. 01. 2020., ticker at the screen bottom, 12 times during the show
23 Softić, Klara: Dnevnik, RTV USK, 30. 01. 2020., news announcement, 0:14:07 – 0:14:37
24 Reuters: (2020). France confirms first three cases of Wuhan coronavirus in Europe, France 24, 24. 1. 2020., available at: https://www.france24.com/en/20200124-france-confirms-first-two-cases-of-wuhan-coronavirus-china-bordeaux-paris, date quoted: 8. 2. 2020.
25 Al Jazeera (2020)., Potvrđen prvi slučaj korona virusa u Hrvatskoj, Al Jazeera Balkan, 25. 2. 2020., available at: https://balkans.aljazeera.net/news/balkan/2020/2/25/potvrden-prvi-slucaj-korona-virusa-u-hrvatskoj, date quoted: 8. 2. 2020.

astating the disease can be, where in the province of Bergamo in the region of Lombardy, mostly at the end of the second, and during the third and early fourth months, there was a dramatic increase in confirmed cases and later a huge number of coronavirus victims.

After two cases of coronavirus infection were confirmed on March 5 in the city of Banja Luka in Bosnia and Herzegovina, the adoption of recommendations by the crisis headquarters of the Ministry of Health was intensified in order to prevent the spread of the epidemic in Bosnia and Herzegovina. News about the spread of the corona virus is beginning to occupy an increasingly important place in the news programs of the Bosnian media.

Coronavirus was the first news item in the news programs of all local televisions after the discovery of the first case of coronavirus infection on March 9th in Zenica, in the federal part of BiH. After the outbreak of the disease in Posavina County (March 15), Una-Sana Canton (March 17), Mostar (March 18), Goražde and Konjic (March 19), where a massive spread of the epidemic was recorded, and Sarajevo and again in Konjic (March 20).), public and intercity traffic in the Federation of BiH was suspended[26], and movement for the people under the age of 18 and over the age of 65 was prohibited[27].The first death from the consequences of coronavirus infection in BiH was recorded in Bihać[28], on March 21, 2020, after which all other cantons were affected.

The case of coronavirus infection on March 27, 2020, in Lukavac (Tuzla Canton) showed how much fear the coronavirus causes among citizens, and how much stigma the infected face. The girl Sandra Šahat, about whose experiences from the isolation the documentary „Pozitivna"[29]was made, said for the radio "Kameleon" "I get threats because I have a coronavirus"[30].

5. Pandemic on public tv stations

The first, uncertain stage of the fight against the completely unknown Covid 19 pandemic was beginning. In vague rules of conduct, public cantonal tv stations responded really well. A number of employees of these televisions had experience in war reporting, and those experiences were significant in times of contagion, cluster, restriction, and curfew. The tv stations reacted very quickly to the interruption of school, and with their potentials they ensured the continuation

26 Maksimović, Dejan: Federalni štab civilne zaštite: Obustavljen javni prevoz u Federaciji BiH, Anadoly Agency, 19. 03. 2020., available at: https://www.aa.com.tr/ba/balkan/federalni-%C5%A1tab-civilne-za%C5%A1tite-obustavljen-javni-prevoz-u-federaciji-bih/1772329

27 Maksimović, Dejan: Na području Federacije BiH zabranjeno kretanje mlađima od 18 i starijima od 65 godina, Anadoly Agency, 20. 03. 2020., available at: https://www.aa.com.tr/ba/balkan/na-podru%C4%8Dju-federacije-bih-zabranjeno-kretanje-mla%C4%91ima-od-18-i-starijima-od-65-godina/1773418

28 Hodžić, Aldijana: Prvi smrtni slučaj od posljedica zaraze koronavirusom u BiH, Anadoly Agency, 21. 03. 2020., available at: https://www.aa.com.tr/ba/balkan/prvi-smrtni-slu%C4%8Daj-od-posljedica-zaraze-koronavirusom-u-bih/1774252

29 Ekmečić, Amra; Čolaković, Vladimir: Pozitivna – documentary, O-kanal, 2020.

30 Amplius. Demirović, Elma: Prvooboljela djevojka iz Lukavca Sandra Šahat: "Dobijam prijetnje zato što imam COVID-19", Radio Kameleon, 29. 03. 2020., available at: https://radiokameleon.ba/2020/03/29/prvooboljela-djevojka-iz-luvca-sandra-sahat-dobijam-prijetnje-zato-sto-imam-covid-19/, date quoted 24. 6. 2020.

of schooling on television. (Table 1.) Radio-Television of Una-Sana Canton and Radio-Television of Tuzla Canton, in cooperation with educational institutes and ministries, and Radio-Television of Herceg-Bosna in cooperation with the University of Mostar and ministries in Croat-majority counties in the Federation of BiH, produced a completely new products that provided lower primary school students with the opportunity to continue attending classes. These were new, replacement television schools that replaced teaching in schools in Tuzla Canton and Una-Sana Canton, and were recommended in some other areas as a supplement to online teaching. The TV school RTV HB / SUM has replaced classical teaching in the counties where the curricula are conducted in the Croatian language[31], while it has been recommended by the Posavina County Government "as additional help to students in times of crisis"[32]

Table 1. TV School

TV School			
	RTV TK	RTV USK	RTV HB
TV show	TV škola[33]	TV škola[34]	RTV HB SUM TV škola[35]
Broadcast period	23. 03. 2020. 29. 05. 2020.	18. 03. 2020. 19. 06. 2020.	24. 03. 2020. 14. 05. 2020.
	240 shows[36] 200 hours of the program + religion and English language	68 shows, 304 contents[37]	RTV HB | SUM TV ŠKOLA[38]

Other cantonal tv stations have also adapted their content to the new situation. TV Sarajevo broadcast previously produced content with teaching material in 21 episode of the show "Školica" and 22 episodes of "TVSA Škola". The broadcasting of "Školica" started on March 18, 2020, while the broadcasting of the show "TVSA Škola" started on March 24, 2020, in support of the online teaching system applied in the Sarajevo Canton. (Table 2.)

31 Čolak, Ivo: Obavijest HNS, Glavno vijeće – Odjel za znanost i obrazovanje, Mostar, 23. 03. 2020.
32 Governmentof Posavina County: Online nastava na Tv programu, Vijesti Vlade ŽP, 24. 03. 2020., available at: https://www.zupanijaposavska.ba/online-nastava-na-tv-programu/
33 Fazlić, Edina: Report RTVTK
34 Data verified thanks to the courtesy of Halilagić Anela, editor in chief of RTV Una-Sana Canton
35 Data verified thanks to the courtesy of Bliznac Damir, editor of TV program of RTV Herceg Bosna
36 RTV TK-TV škola – YouTube kanal, available at: https://www.youtube.com/c/RTVTKTuzla/search?query=tv%20%C5%A1kola
37 RTV USK TV škola – YouTube kanal, available at: https://www.youtube.com/channel/UCt9b3KRT0n7fr-ZpIggzrvjQ/search?query=TV%20%C5%A1kola
38 RTV HB | SUM TV ŠKOLA – YouTube kanal, available at: https://www.youtube.com/c/RadiotelevizijaHercegBosne/search?query=tv%20%C5%A1kola

Table 2. Shows for school

Shows for school		
	RTV BPK	TV SA
Broadcasting	In cooperation with TV SA, shows "Školica" and „Školokrečina" were broadcasted	18. 03. 2020. –
Show		21 episodes of "Školica"[39]
Broadcasting		24. 03. 2020. –
Show		22 episodes of "TVSA Škola"[40]

At the beginning of the pandemic, cantonal tv stations launched special shows in which the topic of Covid 19 was viewed from the angle of scientists, doctors, but also artists or educators. RTV Tuzla Canton and RTV Una-Sana Canton had special televisions that made all important decisions and changes important for citizens in one place, while other tv stations treated these topics within their, primarily news programs. The peculiarity of these programs compared to the previous period is reflected in the use of online audio-video communication with show participants. (Table 3.)

Table 3. Special TV shows-Covid 19/coronavirus in B&H

Special shows Covid 19/coronavirus in B&H				
RTV BPK	TV SA	RTV TK	RTV USK	RTV HB
		Otvoreni program - COVID 19 16. 03. 2020. – 22. 04. 2020.	Koronavirus u BiH 06.04.2020. 29.05.2020.	

Although some institutions and individuals have made extraordinary efforts to stabilize the situation caused by the pandemic, "the weaknesses of the political system in BiH have been shown, where there was virtually no coordinated action at the state level, so decisions were made at lower levels of government, often contrary with each other, and sometimes with delays, which, unfortunately, were paid for with lives"[41]. The scandals that have been raging in Bosnia and Herzegovina since the proclamation of the pandemic on March 11, 2020, have also shown the shortcomings of tv stations dependent on the ruling poli-

39 Data received thanks to the courtesy of editor in chief of TV SA Amela Hubijar Hatić and Maida Drinjaković

40 Ibid.

41 Huseinović, Samir: 2020. u BiH, godina skandala i afera, Deutsche Welle, 01. 01. 2021., available at: https://www.dw.com/bs/2020-u-bih-godina-skandala-i-afera/a-56086160, date quoted: 02. 01. 2021.

cies. The success of these stations was reflected in the implemented projects which in some cantons / counties compensated, and in other cantons helped part of the teaching for primary schools, as well as the success in performing the function of public broadcasters which in special circumstances regularly and timely reports on all new decisions and restrictions. Yet cantonal tv stations did not show much interest in reporting on the negativities that ensued and whose actors were individuals from political life. The difference in reporting on the biggest scandals exists in the program of the Radio Television of Herceg Bosna, which has shown considerable interest in topics related to corruption scandals. The reason for this may be that the actors in these scandals were, as a rule, political opponents of the option that is the founder of television, but also in the fact that most employees of that television have a lot of experience working in commercial media. The reasons why in Bosnia and Herzegovina the public segment of reporting only with independent, private and commercial TV stations can form a whole in informing citizens lies precisely in the dependence of these media on political decisions. Face TV was chosen for comparison because the largest and most famous part of the production of that television is the news program, and "Centralni dnevnik" has a large audience in the field of broadcasting covered by all cantonal tv stations and Radio Television of Herceg Bosna.

6. Online life of Media in B&H

If there is anything positive that the pandemic has produced, it is the development of online journalism, the development of digital competencies for most citizens, the establishment of an online education system, but also pointing to the importance of portals that until then were seen only as a necessary companion or sometimes even as a nuisance to other media. However, this type of journalism also carries great risks and requires special attention.Media coverage of "The Bizarre Case of Zdravko Bumbulović",[42]which was a very popular topic in two neighboring countries, Bosnia and Herzegovina and Serbia, shows how carefully the media must approach the treatment of topics in online journalism. Prolonged treatment of completely false confessions shows all the shortcomings of this kind of communication, precisely in this case.

The second stage of the "fight" against the negativity caused by the coronavirus was not aimed at suppressing the virus, but it was an effort in which all the scandals that arose during the "real" effort to control the impact of the pandemic should be clarified. Reporting on these efforts belonged entirely to certain "free media", to which all the credit for revealing these scandals belongs. In the Federation of BiH, this was mostly done by the independent "Face" television, which invested its greatest potential in reporting on the coronavirus in BiH.

42 Krupalija, Rašid, Bizarni slučaj Zdravka Bumbulovića: mediji nasjeli na laži o boravku u karantinu i povratku kući, Raskrinkavanje.ba, 26. 02. 2020. available at: https://raskrinkavanje.ba/analiza/bizarni-slucaj-zdravka-bumbulovica-mediji-nasjeli-na-lazi-o-boravku-u-karantinu-i-povratku-kuci, date quoted: 14. 02. 2021.

7. Keyword: "CORONA"

It was the time when information was very valuable that made that information easily accessible. It was no longer possible to plan the daily schedule according to the time of broadcasting on television, but these media had to be transformed in order to be constantly available, and here Internet portals were a solution that already existed in all observed media. However, not all tv stations paid equal attention to these types of announcements, and research showed that private independent tv station had a significant advantage in the number of announcements/posts on the Internet, and that the number of announcements/posts was in line with the "popularity" of the "corona" topic.

The results of the search for announcements by the keyword "corona" on the portals of the observed television companies showed that smaller, private, independent and commercial Face television reacts the fastest to stimuli from the environment and attaches the greatest importance to news announcements on the Internet. The number of announcements reflects the current interest of the audience. The word crown in the news content becomes the most significant topic in the third and fourth months of 2020, as shown in the attached chart 1. and 3.

Table 4. News with keyword "Corona"

News with keyword "corona", published on the web pages of cantonal tv stations, RTV Herceg Bosna and Face TV						
month	RTV BPK	TV SA	RTV TK	RTV USK	RTV HB[43]	Face TV
I	1			18		104
II	9	2	7	80	38	275
III	264	119	204	371	249	1093
IV	331	251	206	460	225	709
V	154	208	139	400	120	334
VI	119	152	125	248	100	259
I-VI	878	732	681	1577	732	2774

Recognition the importance of the topic of "corona" for the audience of Face TV station appeared earlier than other televisions, and with a significantly larg-

43 Keyword search is not an option when reviewing the RTV HB website, and the result was obtained by simply counting the announcements, with the oldest publication (due to the renewal of the page) dated 18 February 2020.

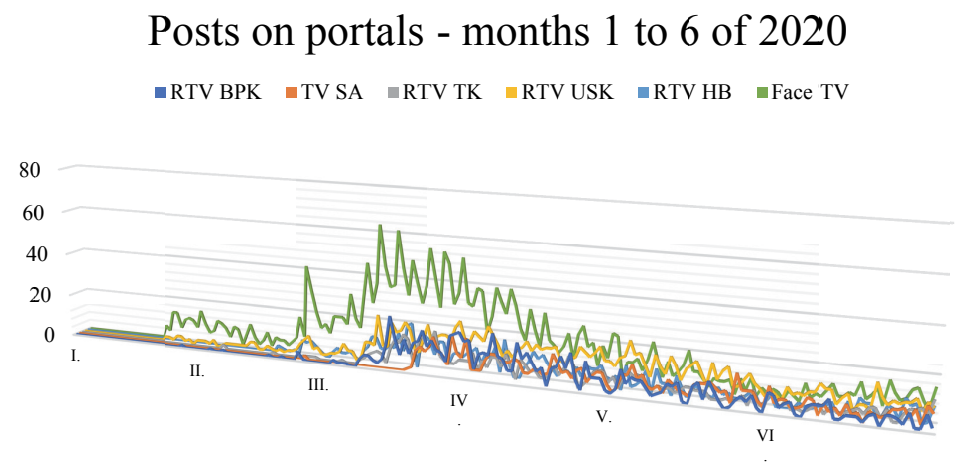


Chart 1. Posts on portals – months 1 to 6 of 2020

er number of announcements, the editors of this television slowly introduced the entire audience to a topic that showed its importance in the coming period. Slightly earlier and more intensive activity on the portals, during the entire observed period, is shown by RTV Una-Sana Canton, which thus shows how it recognizes the importance of online communication in special circumstances. A step forward in this field was also made by RTV BPK, a significantly smaller media house in terms of the number of employees, which recorded a larger number of published news than televisions with a significantly larger number of employees. (Chart 1. and 2.)

The chart shows the ratio of the number of announcements of four cantonal BH tv stations and one private commercial TV company in the first and second month of 2020.

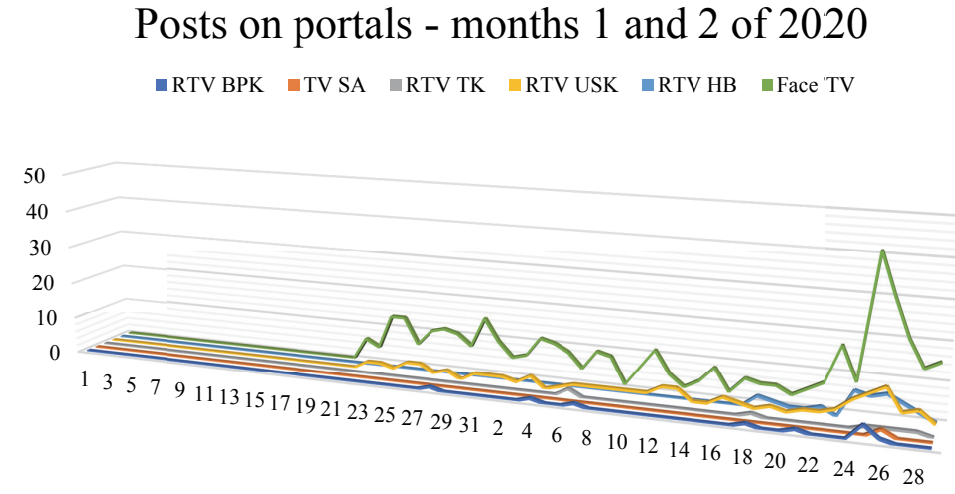
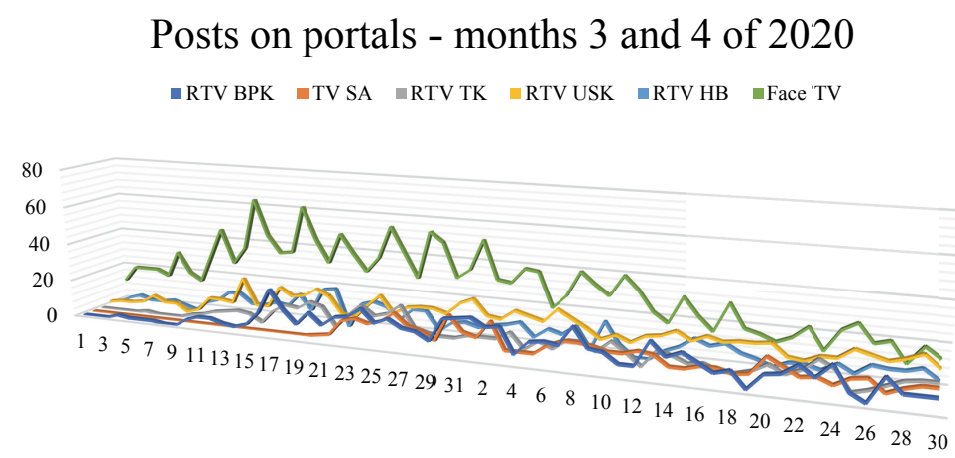


Chart 2. Posts on portals- months 1 and 2 of 2020

The number of announcements with the keyword "corona" is significantly higher on the portal of Face TV during the first four months of the observed period, but also on the portal of RTV Una-Sana Canton in the first two months of 2020, than the number of announcements on portals of other public cantonal tv stations. (Charts 1. and 2.)

Chart 3. Posts on portals – months 3 and 4 of 2020



At the time of the increase in the number of patients and the time of "special measures" that were prescribed in the Federation of Bosnia and Herzegovina during the third and fourth months of 2020, the largest number of publications with the keyword "corona" was recorded and reached 63 news in one day (March 14, 2020, Face TV). (Chart 3.)

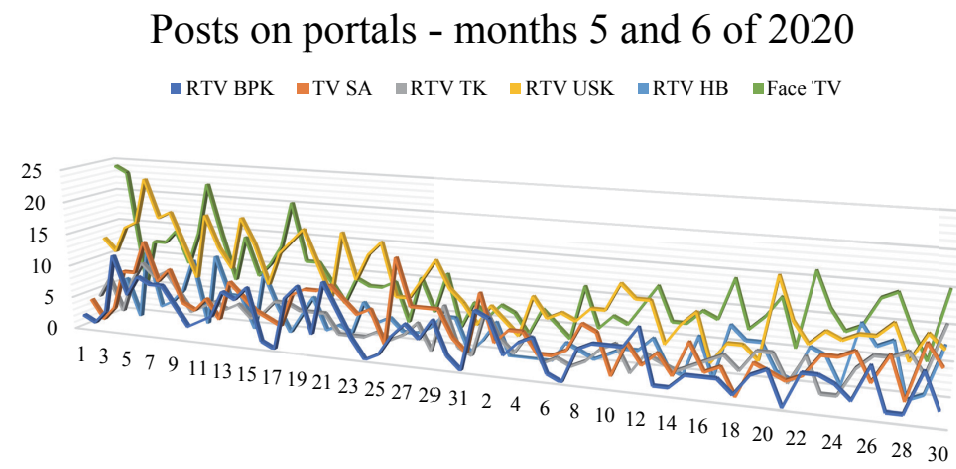


Chart 4. Posts on portals – months 5 and 6 of 2020

At a time of declining numbers and declining interest in the topic of the epidemic during the fifth and sixth months of 2020, private, commercial Face TV produced significantly fewer broadcasts, while interest from public cantonal tv stations was largely retained. This is the reason for the approximate number of publications produced by all tv stations in that period. (Chart 4.) Flexibility in reporting and adaptation to incentives from the environment is greater in the observed commercial private tv station than in public cantonal tv station. As the number of publications does not have to correspond to the number of broadcast content, the data on the number of publications should be viewed as a whole of the relationship with the media audience. In addition, as the first half of 2020, due to the opportunities caused by the COVID-19 pandemic, is the time of development of online work, online schools and online journalism in BiH, the number of publications must reflect the attitude towards this increasingly important segment of communication. This is especially true for public media, whose purpose and task is to "guarantee citizens their need for fair, objective, timely, balanced information, and provide them with a free platform for their participation in public space and social dialogue."[44], as Lejla Turčilo and Belma Buljubašić write in the book „Medijska stvarnost".

The media market in Bosnia and Herzegovina is very numerous, but due to the division of Bosnia and Herzegovina into Entities and cantons in the Federation of Bosnia and Herzegovina, the division of media into public and commercial, municipal, city, cantonal, entity or state, divided in this way do not provide one informative unit to the media audience. The audience must create its own truth from the multitude of received, often contradictory information, and the media do not provide enough help in that.

The media in Bosnia and Herzegovina still operate in a kind of post-war setting, which only occasionally results in quality strides. For further progress, the whole community must emerge from the post-war period and adapt to new ways of communicating, and this adaptation is sometimes driven by major disasters, such as the Covid 19 pandemic.

8. Conclusion

After the analysis, the question arises as to what extent the cantonal / county tv stations have justified their existence. A significant part of the mission of these televisions has been fulfilled in the new circumstances. The problem in this assessment arises when the public interest is shifted to the actions of some political actors who have found themselves in the focus of the activities of judicial institutions. In these topics, public television most often ceases to represent the public and voluntarily leaves reporting to private independent media. At the same time, no relation can be established that would ensure that the "larger" media necessarily communicates more and more often with its audience on increasingly influential Internet sites than the "smaller" media.

44 Turčilo, Lejla; Buljubašić, Belma: Medijska stvarnost – Eseji o korištenju medija u BiH, Sarajevo, BiH, 2020., p. 10.

For all these reasons, even collectively, all these media do not fulfill all the set tasks in which "it should guarantee citizens the satisfaction of their need for fair, objective, timely, balanced information, as well as provide them with a free platform for their participation in public space and social dialogue"[45]. To meet all these needs, it is necessary to join the operation of public television and the operation of independent, private television.

The Covid 19 pandemic, which by some estimates is already in the third phase, has opened many questions and still has open questions from the first phase, and those questions have been opened precisely in the independent media. For this reason, despite the exceptional efforts of public television, their existence without independent private media does not form a whole that every media outlet would have to fulfill.

Special thanks:

1. Amela Hubijar Hatić, editor in chief of TV Sarajevo
2. Anela Halilagić, executive director of TV USK
3. Edina Fazlić, editor of documentary-educational program of RTV TK
4. Elvira Aganović, editor in chief of RTV BPK
5. Maida Drinjaković, TV Sarajevo

Notice:

1. Data on the number of announcements with the keyword "Corona" on RTV Tuzla Canton, RTV Una-Sana Canton, TV Canton Sarajevo and Face TV are extracted by counting these announcements published in the period 01.01. 2020. - 30.06.2020., because there was no possibility of automatically obtaining information about their number on any of the selected pages.
2. Data on the number of announcements at RTV Herceg Bosna were obtained by extracting the content that treated the crown from all announcements, because there is no possibility of searching either by date or by term. After extracting these publications, the final result was obtained by counting.
3. With the creation of a new page on February 18, 2020, all announcements of RTV Herceg Bosna that are older than that date have become unavailable, so this information is not part of the total sum.

45 Ibid.

References:

1. Turčilo, L., Buljubašić, B. (2020). Medijska stvarnost – Eseji o korištenj umedija u BiH. Sarajevo, BiH, p. 10.
2. Al Jazeera (2020)., Potvrđen prvi slučaj korona virusa u Hrvatskoj, Al Jazeera Balkan, 25. 2. 2020., available at: https://balkans.aljazeera.net/news/balkan/2020/2/25/potvrden-prvi-slucaj-korona-virusa-u-hrvatskoj, date quoted: 8. 2. 2020.
3. Demirović, E. (2020). Prvooboljela djevojka iz Lukavca Sandra Šahat: "Dobijam prijetnje zato što imam COVID-19". Radio Kameleon, 29. 03. 2020., available at: https://radiokameleon.ba/2020/03/29/prvooboljela-djevojka-iz-luvca-sandra-sahat-dobijam-prijetnje-zato-sto-imam-covid-19/, date quoted 24. 6. 2020.
4. Čilić, U. (2020). 100 dana koji su promijenili svijet. Radio Slobodna Evropa, available at: https://www.slobodnaevropa.org/a/korona-virus-pandemija/30544700.html, date quoted: 8. 2. 2021.
5. Garda World (2020). China: Officials confirm second death from pneumoniain Wuhan. January 16 /update 5, 17. 1. 2020., available at: https://www.garda.com/crisis24/news-alerts/305746/china-officials-confirm-second-death-from-pneumonia-in-wuhan-january-16-update-5, date quoted: 8. 2. 2021.
6. Hodžić, A.(2020). Prvi smrtni slučaj od posljedica zaraze koronavirusom u BiH. Anadoly Agency, 21. 03. 2020., available at: https://www.aa.com.tr/ba/balkan/prvi-smrtni-slu%C4%8Daj-od-posljedica-zaraze-koronavirusom-u-bih/1774252
7. Huseinović, S.(2021). 2020. u BiH, godina skandala i afera. Deutsche Welle, 01. 01. 2021., available at: https://www.dw.com/bs/2020-u-bih-godina-skandala-i-afera/a-56086160, date quoted: 02. 01. 2021.
8. Illmer, A., Wang, Y., Wong, T. (2020). Wuhan lockdown - A year of China's fight against the Covidpandemic. BBC News, 22. 1. 2020., available at: https://www.bbc.com/news/world-asia-china-55628488, date quoted: 8. 2. 2021.
9. Joseph, A. (2020). First death from Wuhan pneumonia outbreak reported as scientists release DNA sequence of virus, STAT, 11. 1. 2020., dostupno na: https://www.statnews.com/2020/01/11/first-death-from-wuhan-pneumonia-outbreak-reported-as-scientists-release-dna-sequence-of-virus/, date quoted: 8. 2. 2021.
10. Krupalija, R.(2020). Bizarni slučaj Zdravka Bumbulovića: mediji nasjeli na laži o boravku u karantinu i povratku kući. Raskrinkavanje.ba, 26. 02. 2020. available at: https://raskrinkavanje.ba/analiza/bizarni-slucaj-zdravka-bumbulovica-mediji-nasjeli-na-lazi-o-boravku-u-karantinu-i-povratku-kuci, date quoted: 14. 02. 2021.
11. Law, Elizabeth: (2020). China reports first death in Wuhan pneumonia outbreak. The Straits Times - Asia, 4. 2. 2020., Singapore Press Holding, available at: https://www.straitstimes.com/asia/east-asia/china-reports-first-death-in-wuhan-pneumonia-outbreak, date quoted: 8. 2. 2021.
12. Maksimović, D.(2020). Federalni štab civilne zaštite: Obustavljen javni prevoz u Federaciji BiH. Anadoly Agency, 19. 03. 2020., available at: https://www.aa.com.tr/ba/balkan/federalni-%C5%A1tab-civilne-za%C5%A1tite-obustavljen-javni-prevoz-u-federaciji-bih/1772329
13. Maksimović, D.(2020). Na području Federacije BiH zabranjeno kretanje mlađima od 18 i starijima od 65 godina. Anadoly Agency, 20. 03. 2020., available at: https://www.aa.com.tr/ba/balkan/na-podru%C4%8Dju-federacije-bih-zabranjeno-kretanje-mla%C4%91ima-od-18-i-starijima-od-65-godina/1773418
14. Reuters: (2020). France confirms first three cases of Wuhan coronavirus in Europe. France 24, 24. 1. 2020., available at: https://www.france24.com/en/20200124-france-confirms-first-two-cases-of-wuhan-coronavirus-china-

bordeaux-paris, date quoted: 8. 2. 2020.
15. RSE: (2020). WHO upozorava na moguću epidemiju novog kineskog korona virusa. Radio Slobodna Evropa, available at: https://www.slobodnaevropa.org/a/30376907.html, date quoted: 8. 2. 2021.
16. From:RTVTK(korona)page205availableat:https://rtvtk.ba/page/205/?s=korona
17. To: RTVTK page 276 available at: https://rtvtk.ba/page/276/?s=korona
18. From: RTV USK (korona) page 144, available at: https://www.rtvusk.ba/pretraga?q=korona&stranica=144 –
19. To: RTV USK (korona) page 250, available at: https://www.rtvusk.ba/pretraga?q=korona&stranica=250
20. RTV SA (korona) page 144, available at: https://www.tvsa.ba/?s=korona
21. RTV HB extracted news from categories:
22. Bosna i Hercegovina, available at: https://rtv-hb.com/category/bih/
23. Hrvatska, available at: https://rtv-hb.com/category/hrvatska/
24. Svijet, available at: https://rtv-hb.com/category/svijet/
25. HNS available at: https://rtv-hb.com/category/hns/
26. Crna kronika, available at: https://rtv-hb.com/category/crna-kronika/
27. From: Face TV (korona) page 95, available at: https://www.face.ba/pretraga?search_keyword=korona&page=95
28. To: Face TV (korona) page 212, available at: https://www.face.ba/pretraga?search_keyword=korona&page=212#

TV shows

1. Face TV-Vjestnik, 22. 01. 2020.
2. RTV HB Dnevnik, 22. 01. 2020.
3. Dnevnik RTV TK 23. 01. 2020.
4. Centralni dnevnik, TV Face, 24. 01. 2020.
5. RTV HB Dnevnik, 24. 01. 2020., report
6. Dnevnik, RTV USK, 26. 01. 2020.
7. Dnevnik, RTV USK, 30. 01. 2020.

Youtube

1. RTV USK-TV škola – YouTube channel, available at: https://www.youtube.com/channel/UCt9b3KRT0n7frZpIggzrvjQ/search?query=TV%20%C5%A1kola
2. RTV TK-TV škola – YouTube channel, available at: https://www.youtube.com/c/RTVTKTuzla/search?query=tv%20%C5%A1kola
3. RTV HB | SUM TV ŠKOLA – YouTube channel, available at: https://www.youtube.com/c/RadiotelevizijaHercegBosne/search?query=tv%20%C5%A1kola

Documentary

1. Ekmečić, Amra; Čolaković, Vladimir: Pozitivna – documentary, O-kanal, 2020.
2. Reports - decreets
3. Čolak, Ivo: Obavijest HNS, Glavno vijeće – Odjel za znanost I obrazovanje, Mostar, 23. 03. 2020.
4. Vlada županije posavske: Online nastavana Tv programu, Vijesti Vlade ŽP, 24. 03. 2020.
5. Fazlić, Edina: Izvještaj RTVTK 2020.

PhD, Anida Zahirović Suhonjić[1]
Adnana Beganlić, MA[2]

Original scientific paper

CROWDSOURCING MODELS IN HIGHER EDUCATION

Abstract

Crowdsourcing refers to the distribution of tasks between a group of people with the aim of solving a problem or completing a task. It is a collaborative model that uses different technologies to connect thpe "crowd" involved in the problem solving. This model was originally developed as an innovative business model, however, it later found its use in various fields including education. The aim of this paper is to determine which models of crowdsourcing can be used in education and which models are suitable for higher education. In addition, the aim is to determine the benefits of applying the crowdsourcing models in higher education for all participants in this process. Some of the models are crowdteaching, crowdlearning, crowdsensing, etc. Some of these models are intended for students, some are for teaching staff. There are also models that seek to use the crowd to raise funds to support a particular educational goal. Innovative approach to applying crowdsourcing in education include smart technologies.

Keywords: crowdsourcing, higher education, crowdteaching, crowdlearning, crowdfunding, crowdsensing.

1. Introduction

The impact of globalization and the development of the information society has set new demands in all aspects of social life, including higher education, so that e-learning has become a significant instrument in the new digital environment of higher education that encourages centered learning for students and new educational practices resulting in more flexible learning methods (Shopova, 2012).

1 Professor, International business-information academy Tuzla, Bosnia and Herzegovina, e-mail: anida@ipi-akademija.ba
2 Lecturer, International business-information academy Tuzla, Bosnia and Herzegovina, e-mail: adnana@ipi-akademija.ba

E-education of new generation is aimed at students exchanging their experiences through interaction, and creating new knowledge (Orehovački, Konecki & Radošević, 2007).

In this new learning environment, students are no longer just consumers of static content created by professionals, but they themselves are involved in the processes of designing and creating content (Tabot, Oyibo & Hamada, 2013). This way of education puts students in an active role and emphasizes their individual development, and all learning activities are organized with the aim of improving students' knowledge, skills and competencies (Palacious & Evans, 2013).

The aim of this paper is to determine which models of crowdsourcing can be used in education and which models are suitable for higher education. In addition, the aim is to determine the benefits of applying the crowdsourcing models in higher education for all participants in this process. The following models are presented: crowdteaching, crowdlearning, crowdfunding, crowdtuitition, crowdwoting and crowdsensing.

2. Crowdsourcing

Crowdsourcing is a collaborative model that is enabled through people-centered web technologies to solve individual, organizational and social problems using a dynamically formed group of people who respond to the invitation to participate (Pedersen, Kocsis, Tripathi, Tarrell, Weerakoon, Tahmasbi, Xiong, Deng, Oh & deVreede, 2013). Crowdsourcing "is a combination of the efforts of a group of people, usually volunteers, in a job in which each individual makes a small contribution in order to achieve a greater result and group goal" (Injac-Malbaša, 2013). Community-based crowdsourcing takes place in an environment that connects different individuals based on common interest, social group, nationality (Puah, Bakar & Ching, 2011).

The key elements of a crowdsourcing process are (Niu, Qin, Vines, Wong & Lu, 2018):

- the crowdsourcer (requester) – institution or an individual seeking help from the crowd
- the crowd – group of people working on crowdsourcing task
- the task – needs to be well defined
- the platform – web platform that allowes the crowdsourcer to access the crowd.

A simplified crowdsourcing process is presented in Figure 1.

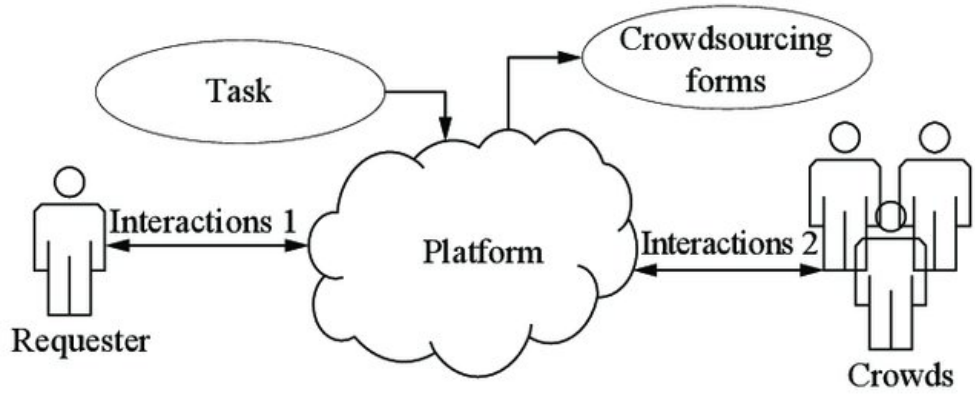


Figure 1. Crowdsourcing process
Source: (Niu et al.,, 2018)

Authors (Pan & Blevis, 2011) singles out the application of crowdsourcing in three basic forms. These three forms are crowdsourcing in an academic, business, and social environment. When it comes to the academic environment, the following values of crwdsourcing stand out:

- The number of contributing individuals is increasing;
- Leads to innovation and discovery;
- Maintaining diversity and supporting fundamental research.

3. Crowdsourcing models in higher education

Crowdsourcing can be used in several different domains to take advantage of wisdom of the crowdsuch as business and marketing, medicine, education, sociology, ect (Hosseini et al., 2014). Collective intelligence and crowdsourcing are also used in education to use knowledge and ideas, as well as solutions to problems from different users connected ICT (Heusler & Spann, 2014). Numerous applications take advantage of these approaches, some examples are: forecasting the future (eg predictive markets), design of new products (npr. Jovoto), funding initiatives (eg Kickstarter), solving crowdsourcing tasks (eg Amazon Mechanical Turk) (Heusler & Spann, 2014).

The paper (Llorente & Morant, 2015) lists four key models of crowdsourcing in higher education: crowdteaching, crowdlearning, crowdfunding and crowdtuition. This can be extended to the increasingly prevalent crowdvoting, as well as crowdsensing which is especially important for smart educational environments.

The most important models of crowdsourcing in higher education are presented in Figure 2.

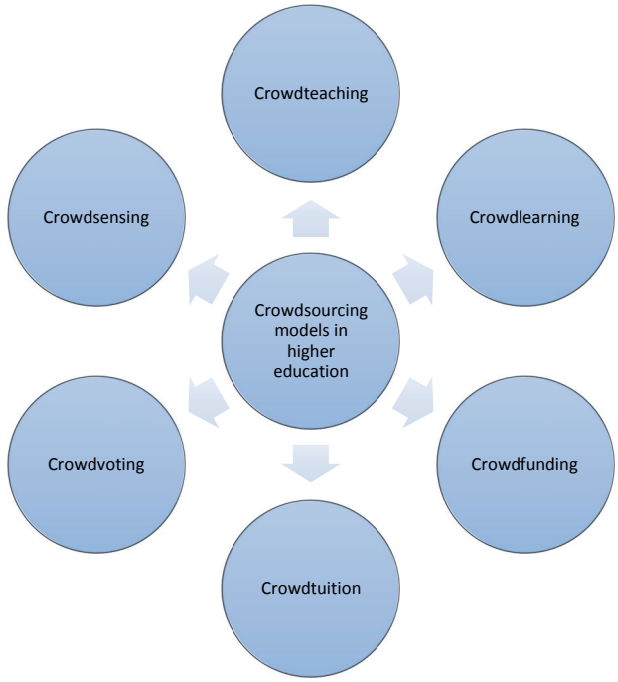


Figure 2. Crowdsourcing models in higher education
Source: Llorente & Morant, 2015

3.1. Crowdteaching

Crowdteaching serves to optimize lectures and exercises through the sharing and exchange of educational materials. Through crowdteaching, teachers share and compose teaching materials together, following the university curriculum (Llorente & Morant, 2015). Crowdteaching provides new potential to teachers as designers of curricula and teaching activities. When the possibilities of today's participatory web culture and infrastructure are added to the concept of crowdteaching, then teachers can take full advantage of the collective intelligence or crowdsourcing community (Recker, Yuan & Ye, 2014). Crowdteaching can take place through an ad hoc platform that will allow the exchange of content (Llorente & Morant, 2015) or existing web tools for crowdteaching, such as Instructional Architect. This tool allows teachers to create projects, and to find, create and share educational materials (Recker, Yuan & Ye, 2014).

Crowdsourcing is often used in universities through the sharing of educational materials, because professors look for materials that are of good quality and that correspond to the field they teach (Llorente & Morant, 2015). Professors use crowdteaching to communicate formally and informally, with the goal of gathering, developing, and sharing information and resources (Kramer, Ocenar & Yamasaki, 2016). However, special attention must be paid to the source of

these materials, and this is a problem that students often face. Eg. The Uclass application allows professors to access the best lecture materials through crowdsourcing, which also saves them the time needed to prepare lectures. Also, Uclass allows students to work together on collaborative projects (Llorente & Morant, 2015).

3.2. Crowdlearning

The concept of crowdsourcing can be applied in learning (Dontcheva, Morris, Brandt & Gerber, 2014) and in that case it is about crowdlearning. Crowdlearning is the learning of a group of students through work on real projects (Llorente, Morant & Garrigos-Simon, 2015). This type of learning mostly refers to collaborative projects in which students have certain skills, and share information and learn from each other, which is a good preparation for their career (Llorente & Morant, 2015). Through crowdlearning, groups of students from the same or different educational institutions can work together on collaborative projects, which are coordinated by teachers (Llorente, Morant & Garrigos-Simon, 2015). In order for the project to be successfully realized, each student contributes his / her own skills. The results of the paper (Dontcheva et al., 2014) showed that crowdsourcing can be combined with learning with the aim of improving the learning and performance of individuals. Also, it has been shown that users are more motivated when a real problem that needs to be solved is added to the process itself.

Crowdlearning is based on project-based learning and has been successfully implemented in universities around the world. In this approach, the knowledge building process is based on collaborative projects where different students share knowledge, teach each other and learn together to successfully solve the project. An example of crowdlearning is the Skillshare educational platform, which brings together the online learning community to acquire real skills through project-based classes. The advantage of this technique is that each student can use the skill they already have, which is needed to successfully complete the project (Llorente & Morant, 2015). Various crowdlearning tools, especially the use of massive open online courses - MOOC, can reduce the pressure on teachers, and at the same time create a global learning audience (Llorente, Morant & Garrigos-Simon, 2015).

3.3. Crowdfunding

Crowdsourcing can be used to raise funds for a specific purpose (Llorente & Morant, 2015). It is mainly implemented online to support various educational projects (Solemon, Ariffin, Din & Anwar, 2013). The subject of crowdfunding can be anything that will support education, and most often it is laboratories and the necessary technical equipment. Laboratory equipment at higher education institutions can be particularly expensive, especially in the case of engineering studies, where in addition to the necessary equipment, appropriate

materials are often required. Thus crowdfunding can be used to form laboratories for exercises and lectures that will be socially useful, e.g. for research on certain diseases (Llorente & Morant, 2015). The paper (Llorente, Morant & Garrigos-Simon, 2015) identified four types of crowdfunding: donations, rewards, equality and credit.

As education has become more expensive around the world in the last ten years, crowdfunding has emerged as an interesting option that can help students raise money for tuition. Some examples of crowdfunding sites for students are Upstart or Scolaris, which allow students and donors to connect. Although a large number of students still rely on other sources in such cases (eg government, companies, families, etc.), crowdfunding platforms have proven to be effective in connecting those in need of funds with those willing to give (Dron & Anderson, 2014). Also, one of the trends in crowdfunding is raising funds for the implementation of scientific research projects (Solemon et al., 2013).

3.4. Crowdtuition

Since crowdsourcing has a significant impact on social benefits, the crowdtuition technique can be used to enable the best students to have their tuition paid through crowdsourcing methods (Llorente & Morant, 2015).

Crowdtuition as a model of crowdsourcing in educational environments, belongs to the broader concept of crowdfunding, and is a type of crowdfunding. The difference is that crowdtuition refers exclusively to student tuition, while in crowdfunding funds can be raised for various purposes.

There are numerous websites dedicated to crowdtuition, e.g. ScholarMatch. Crowdtuition can be conducted as a fundraising campaign through crowdfunding platforms (Llorente, Morant & Garrigos-Simon, 2015).

3.5. Crowdvoting

Crowdvoting refers to a situation where the crowd is asked to vote on certain points of interest (Araman & Caldentey, 2016). Subjective responses of the crowd are collected in order to make a specific decision (Prpić, Shukla, Keitzmann & McCarthy, 2015). These subjective responses may relate to opinions, ideas, and decisions by the public (Solemon et al., 2013). When conducting crowdvoting, the duration of voting is mostly predetermined (Araman & Caldentey, 2016).

This concept is increasingly becoming a practice of a different companies when they are in the phase of designing or placing new products on the market (Araman & Caldentey, 2016). Crowdvoting is applied in higher education mainly within the framework of competition-based initiatives, most often in order to enable students to make decisions (Solemon et al., 2013).

In higher education, crowdvoting can be conducted in different ways, e.g. through social networks in order to support student creative projects (Bogdanović, Labus, Simić, Ratković-Živanović & Milinović, 2015). Within education, the crowdvoting strategy can also be used for innovation, since through such initiatives large groups of participants can be engaged for various competitions or problem solving (Solemon et al., 2013).

3.6. Crowdsensing

When it comes to crowdsensing, it mostly refers to mobile crowdsensing. It is a new paradigm that takes advantage of mobile devices that have the role of efficiently collecting data and enabling the use of numerous applications (Ma, Zhao & Yuan, 2014). Viewed in the context of education, mobile devices are effective tools that allow students to actively participate and collaborate on large-scale applications because they are equipped with a large number of different sensors (Longo, Zappatore & Bochicchio, 2015).

Unlike typical IoT objects, which often lack computing capabilities, mobile devices have many sensors, as well as computing and communication capabilities, and as such can serve as a link to everyday objects or as a means of generating environmental information (Ganti, Ye & Lei , 2011).

Mobile crowdsensing provides ways for continious learning of students through the experience of participating in practical activities, which also results in the development of skills for students (Longo, Zappatore & Bochicchio, 2015). In addition, mobile crowdsensing in education enables the implementation of various applications and devices of a smart educational environment, because it enables the collection of sensory data that can relate to information about the institutions' environment, students' location, attendance control, classroom occupancy, noise detection, temperature , pressure, etc.

4. Conclusion

Crowdsourcing as a collaborative and business model provides the possibility of implementation within higher education to harness the power of a networked group (the crowd). This can be reflected in the creation and sharing of educational content between teaching staff or students, problem solving, fundraising etc.

In relation to the goal of the crowdsourcing process, various models of crowdsourcing have been developed that can be applied within education. The paper presents the most important models of crowdsourcing that can be applied in higher education. Those models are crowdteaching, crowdlearning, crowdfunding, crowdtuitition, crowdvoting and crowdsensing. This provides opportunities for further research in the context of combining crowdsourcing and higher education environment.

References:

1. Araman, V. & Caldentey, R. (2016). Crowdvoting the Timing of New Product Introduction. Retrieved from: https://ssrn.com/abstract=2723515 (last visited: 09.11.2017.)
2. Bogdanović, Z., Labus, A., Simić, K., Ratković-Živanović, V. & Milinović, S. (2015). Harnessing crowdvoting to support students' creativity. In Proceedings of the 7th International Conference on Education and New Learning Technologies, (pp. 4318-4326), Barcelona, Spain.
3. Dontcheva, M., Morris, R., Brandt, J. & Gerber, E. M. (2014). Combining Crowdsourcing and Learning to Improve Engagement and Performance. In Proceedings of the Computer Supported Cooperative Work Conference (CSCW '14) (pp.3379-3388), Toronto, Canada. DOI: http://dx.doi.org/10.1145/2556288.2557217
4. Dron, J. & Anderson, T. (2014). Teaching Crowds – learning and social media. AU Press: Athabasca University.
5. Ganti, R. K., Fan, Y. & Hui, L. (2011). Mobile Crowdsensing: Current State and Future Challenges. IEEE Communications Magazine, 49, 11, 32–39.
6. Heusler, A. & Spann, M. (2014). Knowledge Stock Exchanges: A Coopetitive Crowdsourcing Mechanism For E-Learning. In Proceedings of the European Conference on Information Systems (ECIS) 2014, Tel Aviv, Israel.
7. Hosseini, M., Phalp, K., Taylor, J. & Ali, R. (2014). The four pillars of crowdsourcing: A reference model. The IEEE Eight International Conference on Research Challenges in Information Sciences (pp. 1-12), Marrakesh, Marocco. DOI: 10.1109/RCIS.2014.6861072
8. Injac-Malbaša, V. (2013). Crowdsourcing – određenje pojma, tipologija i srodni termini. Glasnik Narodne biblioteke Srbije, 2012/2013, 239-255.
9. Kramer, J., Ocenar, J. & Yamasaki, J. (2016). Crowdteaching: Online Crowdsourcing in Education. Retrieved from: https://tccpapers.coe.hawaii.edu/index.php/tcc/article/view/8 (last visited: 20.10.2017.)
10. Llorente, R., Morant, M. & Garrigos-Simon, F. J. (2015). Crowdlearning, Applying Social Collaboration in Higher Education. International Conference – New perspectives in science education. Retrieved from website: http://conference.pixel-online.net/NPSE/files/npse/ed0004/FP/1550-SERA935- FP-NPSE4.pdf (last visited: 08.08.2017.).
11. Longo, A., Zappatore, M. & Bochicchio, M. A. (2015). Collaborative learning from Mobile Crowd Sensing: A case study in electromagnetic monitoring. In Proceedings of the IEEE Global Engineering Education Conference (EDUCON). Tallinn, Estonia.
12. Ma, H., Zhao, D. & Yuan, P. (2014). Opportunities in mobile crowd sensing. IEEE Communications Magazine, 52, 8, 29–35.
13. Niu, X. J., Qin, S. F.,Vines, J., Wong, R. & Lu, H. (2018). Key Crowdsourcing Technologies for Product Design and Development. International Journal of Automation and Computing. DOI: 10.1007/s11633-018-1138-7
14. Orehovački, T., Bubas, G. & Kermek, D. (2007). Razvoj kvalitete u eobrazovanju. 9. CARNetova korisnička konferencija: Korisnik u fokusu. Retrieved from website: https://cuc.carnet.hr/cuc2007/program/radovi/pdf/g2- 1-rad.pdf (last visited: 28.11.2017.)
15. Palacious, L. & Evans, C. (2013). The Effect of Interactivity in E-learning Systems. Newcastle upon Tyne: Cambridge Scholars
16. Pan, Y. & Blevis, E. (2011). A Survey of Crowdsourcing as a means of Collaboration and the Implications of Crowdsourcing for Interaction Design. In Proceedings of the 2011 International Conference on Collaboration Technologies and Systems

(CTS), (pp. 397-403). Philadelphia, PA, USA. DOI:10.1109/CTS.2011.5928716

17. Pedersen, J., Kocsis, D., Tripathi, A., Tarrell, A., Weerakoon, A., Tahmasbi, N., Xiong, J., Deng, W., Oh, O. & deVreede, G. J. (2013). Conceptual Foundations of Crowdsourcing: A Review of IS Research. In Proceedings of the 46th Hawaii International Conference on System Sciences (pp. 579-588). Wailea, Maui, HI USA. DOI: 10.1109/HICSS.2013.143
18. Prpić, J., Melton, J., Taeihagh, A. & Anderson, T. (2015). MOOCs and crowdsourcing: Massive courses and massive resourcer. First Monday, 20, 12. doi:http://dx.doi.org/10.5210/fm.v20i12.6143
19. Puah, C., Bakar, A., Zaki, A., Ching, C.W. (2011). Strategies for community based crowdsourcing. In Proceedings of the International Conference On Research and Innovation in Information Systems (ICRIIS), (pp. 1–4), Kuala Lumpur, Malaysia
20. Recker, M., Yuan, M. & Ye, L. (2014). Crowdteaching: Supporting Teaching as Designing in Collective Intelligence Communities. International Review of Research in Open and Distributed Learning, 15, 4, 138-159.
21. Shopova, T. (2012). E-learning in higher education environment. In Proceedings of International Conference the Future of Education, Florence, Italy.
22. Solemon, B., Ariffin, I., Din, M. M. & Anwar, R. M. (2013). A review of the uses of crowdsourcing in higher education. International Journal of Asian Social Science, 3, 9, 2066-2073.
23. Tabot, A., Oyibo, K. & Hamada, M. (2013). Chapter I: E-Learning Evolution: Past, Present and Future. In: E-Learning: New technology, applications and future trends. Editor: Homada, M. Nova Science Publishers: New York.

Milan Puvača, Ph.D.[1] *Review paper*

BLOCKCHAIN AS A BASE FOR CONTEMPORARY EDUCATION

Abstract

Businesses in global environment are constantly adapted and new employees are expected to possess fresh "workers of tomorrow" skills and knowledge. Situation got even more rough when almost overnight COVID-19 influenced everyday lifestyle.

On the other side, it became clear that education systems are to be changed in near future. Some institutions already started to work of that process. Others are aware that need is here, but deciding about optimal approach. Dynamic times are expecting flexible models of teaching and learning so finding best solution is a must for all contemporary teaching institutions.

Blockchain as a new and disruptive technology has been perceived as a basis for cryptocurrency. However, its abilities and benefits could be utilized in different aspects of life, work and learning. New implementation of this technology could announce different point of view in education process, no matter if we are talking about studying as formal or learning on work as informal process.

This paper has a goal to explain blockchain fundamentals and research on how it could be implemented in learning process. Also, any possible usage of such technology in lifelong learning and certification process is another outcome which paper should summarize. Current market situation and expectations for wider blockchain usage will be discussed and researched in detail.

Keywords: information and communication technology, blockchain, education management, career development.

1. Introduction

In todays' world it is clear that new paradigms are constantly introduced in everyday lives. Maybe the best example is COVID-19 pandemic which caused major transformation of every segment in just couple of months. Being able to

1 doc. dr. sc. Milan Puvača, lecturer, College of Applied Sciences Lavoslav Ružička, Vukovar, Croatia
E-mail: mpuvaca@vevu.hr

adapt and adjust to new environment became not just a buzz word in media and social networks, but new normal which is obviously here to stay for some time.

Business sector is always changing (Shemesh Jesse, 2021). Numerous articles and web content is proving that more then ever companies are influenced with globalization, new technology and fresh customer-oriented approaches. On the other side, huge gap in label market needs and offer is causing in finding new trends of remote work (even before pandemic) in fields where that is possible. If we are considering business sectors as tourism or construction it is almost impossible o find a good worker no matter on salary or corresponding perks (Nenad Ivanović, 2021). Tech and high skilled industries as IT is has even worse situation. Even though some predictions about IT expert needs which EU provided, became overestimated (Peter Teffer, 2021) it is definite that skilled information and communication individuals are able to choose company and working environment. (S. Paparella, 2021).

It's old news that education system should be adapted as it must provide better "worker of tomorrow" pool. The rapid changes in new normal are just putting new demands on education system (Miriam Bar-Yam, 2002). Again, other side of this medal is resistance to change which is known in educational system. There are some common resistances in modernization, but also specific reasons for the rejection or obstructing the introduction of new solutions to education (Puvača & Zdrilić, 2012). World wide pandemic and health issues placed a lot of countries in so called "lock downs". E-learning came to spot light in minutes and every IT enhanced education which is available at least in last ten years, became a must in kindergartens, schools and faculties. A lot of challenges during pandemic online education were pointed out in recent studies (ex. lack of student engagement, interactions or attendance and distractions) but also a highlight of at least 40 different pedagogies which were successfully implements in virtual classrooms (Kundu, 2021).

Another current problem in domestic surrounding is public or private school system. Private school institutions are seen as "pay and pass" systems where student will surely finish it. However, it is obvious that such schools are able to work with smaller groups and provide more recent knowledge (Sara Šokić, 2019). Also, there has been an increase of faculties and study programs in last decade which provides additional issue in quality and employability recognition among freshmen. At the top of this facts, business sector simply cannot track nor understand different titles of graduates (ex. baccalaureate or graduate in various fields).

Quality recognition together with standardization is occurring in education (Ivković, 2009). However, that process is taking for some time and still not providing optimal results. Information and communication together with contemporary technologies definitely cannot solve all mentioned issues, but maybe can provide a good base for its wider and faster solving.

2. Blockchain

New technology called blockchain took first place in media coverages in last 6-7 years even though it was introduced by a person (or group of people) using an alias Satoshi Nakamoto in 2008. Some experiments with predecessors of this technology were noted in 1990's but insufficient computer power made it impossible for development. Its name is consisted from technology structure – a chain of blocks. Each block is linked to previous block with cryptographic hash and making it that way almost impossible to interfere with chain structure, order or values[2]. A block has own data structure which enables value storing and securing. Main idea was to handle financial data – transactions but via blockchain further development it is seen that numerous data types (use cases) can be stored:

- Images (Koptyra, 2020),
- Full user / company backup (Storj, 2015),
- Database BigchainDB (BigchainDB, 2016),
- Automatized (smart) contracts execution (Ethereum.org, 2021),
- …and a lot more.

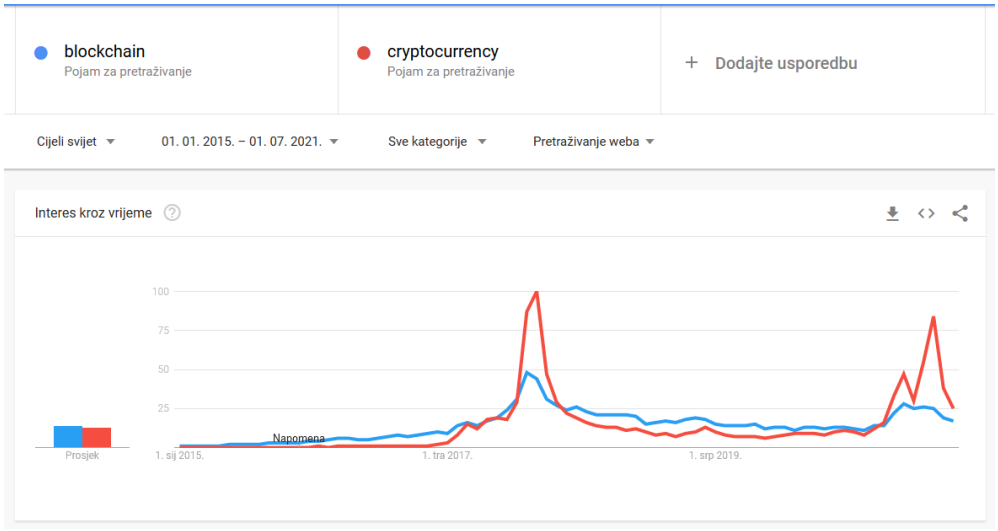


Figure 1. Blockchain and Cryptocurrency trends in searching on Google
Source: Author work on Google trends[3]

2 Of course, there are articles about blockchain vulnerability (Cipher LTD, 2020) however as technology is growing it is expected to be more secure and adapted.

3 The Google trends service analyses user searches on Google platform. In the case of a larger number, it easily defines trends or keywords that record an increase. The graphs show the relative interest on a scale of 0-100 in relation to the nominal number of searches on a particular topic, content or similar. More details on https://support.google.com/trends/answer/4365533.

Mentioned hype about blockchain has started mainly because of cryptocurrencies. As it can be seen on Figure 1. main amplitudes were in search terms when crypto had highest values. Similar interest (up and down) was followed by blockchain term. Cryptocurrency is a form of digital asset based on a network that is distributed across a large number of computers (Frankefield, 2021). Global idea is to replace classical fiat currency and enable transactions without the need of "middle man" (banks, credit institutions etc.). However, cryptocurrency value is highly volatile making it risky investment and making it difficult to implement in wider usage. Since no central or trusted party has an ability to control it, values can rise or drop in just couple of seconds. Just because of its fluid prices, cryptocurrencies made a room for wide range of scams and frauds. Technology enhanced speculations and investments reminds on situation before dot-com bubble in 1990s. More likely (as it was back then), some of main players (among 11.183 current cryptocurrencies) will survive plus remain active and allow more active usage of blockchain technology (similar to Amazon and Google staying after dot-com bubble).

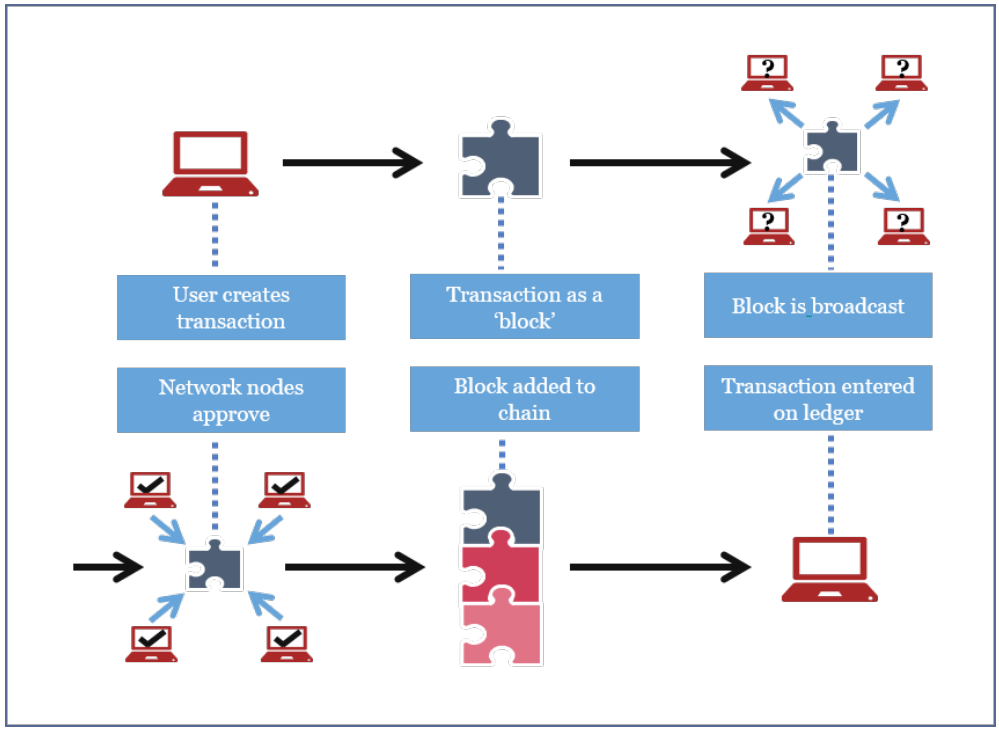


Figure 2: Blockchain technology flow
Source: PwC Digital Services

Blockchain flow as shown in Figure 2. has ending base in main - distributed ledger where all "transactions" are stored and can be shared in an environment. Members of "ecosystem" has own copy of information which must be

validated collectively upon any updates. This solution is allowing blockchain to be secure, reliable and trustworthy platform. Some main advantages could be pointed out:

- Verifiability / traceability – in case of distributed ledger each transaction is approved by verifiers (ex. miners in Bitcoin). Any member of the platform may verify the correctness of the system state. All actions are stored and easily traced.
- Privacy – no user can be discovered within blockchain network only its transactions / actions.
- Integrity – data is secured and protected from unauthorized modifications (close connection with verifiability).
- Transparency – depending on role in environment data is seen and is required for confirmation.
- Redundancy – provided by replications to verifiers.

3. Blockchain and education

From everything mentioned main question arises – how blockchain can be implemented or used in education? It is obvious that current situation with blockchain usage is not suitable and simple for end user. Average user identifies blockchain as Bitcoin or maybe altcoins[4] and its values. User experience still assumes considerable skills in terms of adjusting wallet or using cloud solutions as CEX (Bitcoin & Cryptocurrency Exchange | Best Bitcoin Trading Platform - CEX.IO, 2021).MetaMask (MetaMask, 2021) as browser / mobile application is maybe more user friendly however still not simple and understandable as Facebook login process. It seems that whatever company makes blockchain usage simple as today's web/mobile applications will get enormous popularity and users.

Earlier stated challenges in education as standardization, verification and trust could be solved within blockchain technology. Included stakeholders in education process:

- students,
- teachers,
- administration staff,
- business sector,
- NGO,
- government, accreditations, testers,

… would be able to participate in controlled chain of information. Verifiability of student skills and knowledge could be done in seconds as well as diploma check with corresponding university. Administration staff would be able to

4 Term related to all cryptocurrencies other than Bitcoin.

trace previous student grades (ex. high school) before enrollment and have a proof of each study year as hash value in education blockchain.

Of course, cons of this setup would be complicated user experience and customized applications tailored for stakeholders. Question of main authority (as Ministry or Central academic IT provider is) is also open issue. Since blockchain is available for certain time now, it is notable that some institutions are experimenting with this orientation. European union provides wide report (Grech & Camilleri, 2017) on more than 100 pages in 2017. about possibilities and current pioneers in this tech field. Different aspects of certificates, security, infrastructure and acceptance are considered as well as best practices back then described via interviews with responsible institutions.

Since blockchain is new technology and grows rapidly it is interesting to see that some institutions are providing rewards for new prototypes and solutions. One example is (Office of Educational Technology - Department of education USA, 2020) where it "explores novel applications of distributed ledger technologies like blockchain to address complex challenges in education. EBI focuses particular attention on understanding how blockchain technology can facilitate the secure, traceable, and verifiable exchange of educational data among institutions in the learning and employment ecosystem.". Almost one million dollars is given to applicants and it would be interesting to see solutions they will be coming up with (by the end of 2021).

Some papers are also oriented in research on practical cases of blockchain implementation. There's notable increase in articles and reviews of such approach (Raimundo & Rosário, 2021). However, in 2019. (A. Alammary, 2019) states "although the volume of literature on the application of blockchain to education has been increasing in the last few years, it is still fragmented, and no systematic review has yet been conducted on the topic."

As per all researched literature, Table 1. is providing summarized overview of pros and cons in blockchain implementation. It is clear that additional practical experiments will provide more information on this topic and give better base for decision.

Table 2. Advantages / challenges overview of blockchain in education implementation.

Advantages	Challenges
Student records verification	Price of development infrastructure
Reducing frauds in diplomas or previous education history	Fear of new technology among stakeholders
Decentralized online education and personal development	Skilled blockchain developers / providers
Distributed Learning platforms	Current technical limits / user experience

Copyright and privacy protection	"Felling" about technology from cryptocurrency point of view (lack of trust)
Ability to scale nationally, globally	
Smart contracts with automatic execution once terms are met	

Source: Gathered literature and author adjustment.

Currently it is possible to identify some main institutions / projects which are researching on optimal implementation of this technology in education. Naming a few could provide a good insight of situation to date:

A. Open university (The Open University, 2021) – Knowledge Media Institute within Open University is doing (among other technologies) a research initiative on the Blockchain. Leading IT enhanced movement in United Kingdom, this institution is trying to standardize badging, certification and reputation on the Web with the use of the blockchain as a trusted ledger. This University has over 170.000 students and own e-learning solution which makes a good foundation for new tech experiments. In order to make usage as simple as possible approach to the blockchain is synonymous with the Web (it should use own protocol and tools).

B. MIT – in Cambridge, Massachusetts, department of MIT (Massachusetts Institute of Technology, 2020) developed The Open Standard for Blockchain Credentials – BlockCerts. Academic success grades, projects, transcripts and even diplomas are to be stored on a Blockcerts blockchain for immutable insight into individual's past academic history. In 2018. (MIT, 2018) more than 600 students have used this option making their diploma lasting forever in this blockchain system. Sony Global Education (Sony INC., 2018) – one of the global tech leaders made a partnership with IBM in Japan and created own blockchain platform. It enables various institutions to add/track individual academic achievements and other student information on a main ledger in order to maintain irreversible records on students who transferred or furthered their education.

C. Disciplina (Disciplina.io, 2020), Estonian company uses blockchain to maintain a unified register of academic achievement and qualifications for universities. By assigning a score to someone based on his achievements or classes Universities can adjust, customize individualized learning plans. Student and Educator applications are tailored for corresponding user and solution is offered to public so that universities and students can become familiarized with the app.

4. Conclusion

From all research and gathered references it could be concluded that blockchain is a new technology which will sooner or later enter in everyday use of each individual. On the other side, it is clear that some objective obstacles are present which are making wider implementation at least a challenging task. Education as traditionally rigid field could use blockchain advantages, but the timeframe is seriously questionable. Modern technology as blockchain is should be more adopted before wider learning institution usage will be seen (like social network or webinars were in last decade).

Current research and case studies are theory oriented and practical solutions are still to be defined in the longer period of time. Also, more students, professors and administrative staff should be involved in such examples. Next step for this paper would be making a test model in local colleague where possibilities would be checked in detail as well as possible technology or social potential issues.

It is worth emphasizing that blockchain should not be perceived as a threat or replacement for educational institutions (similar to any other new technology which might appear). Innovative technpology must provide value across a wide range of educational processes; enabling learning to be more engaging and effective, cut down costs, improve trust, and allow greater security and privacy. Almost the same as when Web 2.0 was introduced main idea would be that technology on the long run should provide extra (spare) time for all education stakeholders which can be directed to (individual) student, learning excellence and modern knowledge needed for everyone in today's competitive market.

References:

1. Alammary, S. A. (2019). Blockchain-based applications in education: A systematic review. Advances in Blockchain Technology and Applications.
2. BigchainDB. (2016). BigchainDB - The blockchain database. Retrieved from https://www.bigchaindb.com/
3. Bitcoin & Cryptocurrency Exchange | Best Bitcoin Trading Platform - CEX.IO. (2021). Retrieved from https://cex.io/
4. Cipher LTD. (2020). How Blockchain Can Be Hacked: The 51% Rule and More. Retrieved from Cipher LTD: https://cipher.com/blog/how-blockchain-can-be-hacked-the-51-rule-1and-more/
5. Disciplina.io. (2020). DISCIPLINA – the first blockchain to create verified personal profiles based on academic and professional achievements. Retrieved from https://disciplina.io
6. Ethereum.org. (2021). Introduction to smart contracts | ethereum.org. Retrieved from https://ethereum.org/en/developers/docs/smart-contracts/
7. Frankefield, J. (2021). Cryptocurrency Definition: What Is Cryptocurrency? Retrieved from https://www.investopedia.com/terms/c/cryptocurrency.asp

8. Grech, A., & Camilleri, A. F. (2017). Blockchain in Education. Luxemburg: Publications Office of the European Union JRC Science for Policy Report.
9. Ivković, M. (2009). Osiguravanje kvalitete u visokom obrazovanju. List studenata Geodetskog fakulteta Sveučilišta u Zagrebu, 20-23.
10. Koptyra, K. &. (2020). Imagechain-Application of Blockchain Technology for Images. Sensors (Basel, Switzerland), 21, 21-33.
11. Kundu, A. B. (2021). COVID 19 response: An analysis of teachers' perception on pedagogical successes and challenges of digital teaching practice during new normal. Education and Information Technologies.
12. Massachusetts Institute of Technology. (2020). Digital Learning + Collaboration Studio= MIT Media Lab. Retrieved from https://www.media.mit.edu/groups/digital-learning-studio/overview/
13. MetaMask. (2021). Retrieved from MetaMask: https://metamask.io
14. Miriam Bar-Yam, K. R.-Y. (2002). Complex Systems Perspectives on Education and the Education System. New England Complex Systems Institute. Retrieved from necsi.edu.
15. MIT. (2018). Digital diplomas | MIT Technology Review. Retrieved from https://www.technologyreview.com/2018/04/25/143311/digital-diplomas/
16. Nenad Ivanović, D. (2021). Ni povećanje plaća ne zadržava radnike u Hrvatskoj. Retrieved from DW: https://www.dw.com/hr/ni-pove%C4%87anje-pla%C4%87a-ne-zadr%C5%BEava-radnike-u-hrvatskoj/a-58063511
17. Office of Educational Technology - Department of education USA. (2020, April 20). Blockchain in Education - Office of Educational Technology. Retrieved from https://tech.ed.gov/blockchain/
18. Peter Teffer, E. (2021). EU overestimated ICT jobs gap. Retrieved from EUObserver: https://euobserver.com/digital/137835
19. Puvača, M., & Zdrilić, I. (2012). Resistance to change in educational process adaptation. Interdiscplinary Management Research VIII, 255-262.
20. Raimundo, R., & Rosário, A. (2021). Blockchain System in the Higher Education. European Journal of Investigation in Health, Psychology and Education, 276-293.
21. S. Paparella, V. L. (2021). Trebamo tisuće IT-stručnjaka, zašto onda ne bismo uvezli? Retrieved from Večernji list: https://www.vecernji.hr/biznis/trebamo-tisuce-it-strucnjaka-zasto-ih-onda-ne-bismo-uvezli-1094454
22. Sara Šokić, S. (2019). Što studenti kažu o razlikama privatnih i državnih fakulteta? Retrieved from Studentski.hr: https://studentski.hr/studenti/sto-studenti-kazu-o-razlikama-privatnih-i-drzavnih-fakulteta
23. Shemesh Jesse, F. B. (2021). How Is The Business World Changing Today? Retrieved from Forbes: https://www.forbes.com/sites/forbesbusinesscouncil/2020/04/27/how-is-the-business-world-changing-today/?sh=5910d76e3972
24. Sony INC. (2018). Sony Global Education. Retrieved from https://www.sonyged.com/
25. Storj. (2015). Storj - Decentralized Cloud Storage. Retrieved from https://www.storj.io
26. The Open University. (2021). Knowledge Media Institute. Retrieved from http://kmi.open.ac.uk/