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WORKING ON HOLIDAY: THE THEORY AND PRACTICE OF WORKCATION

Brigitta Pecsek¹

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Abstract: *Work, leisure and sleep are the three core cyclical activities in our society. In the past work was distinct from non-work time, in fact ‘the 8-hour work, 8-hour leisure, 8-hour sleep day’ was at the very heart of past worker movements. So, the blur between work and leisure is a postmodern trend which has impacted the way we travel. This change is mainly due to the advances of technology, which have made work outside the workplace a reality even during holiday. Consequently, a hybrid tourism product called workcation has emerged and challenges the traditional concept of tourism. Both the theory and the practice of this phenomenon are in the focus of this research.*

Due to the lack of the tourism-focused theorization, the related literature is multidisciplinary and eclectic; therefore, this study takes a similar approach while embedding the topic into the tourism theory. The starting point is the change in work and leisure relationship, followed by the impact of technological advances on the work. Then I also formulate a tourism-focused workcation concept. For the empirical research an online survey was conducted with 340 participants. Based on the multidisciplinary literature and the result of my empirical research six types of workcation tourists were identified and described. Finally, a specific segment of workcation tourists is singled out as an attractive market for strategists and marketers planning sustainable tourism.

Keywords: *workcation, niche tourism, digital nomad, holiday stress*

JEL Classification Z32

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INTRODUCTION

This study aims to enhance formative and comprehensive approaches to conceptualizing and contextualizing workcation tourism. In the process, it formulates a tourism-focused definition and categorises workcation tourists. Studies dealing with the imbalance of work and leisure and their negative consequences are abound (Nippert-Eng, 1996; Haar et. al., 2014; Beigi, Shirmohammadi, 2017; Maragatham, Amudha, 2016; Wee Chan, Pervaiz, 2015; Shruti et. al., 2014; James, 2014; Süss, Sayah, 2013; Messersmith, 2007; Fleetwood, 2007; Hyman et. al., 2005). However, literature on the work on holiday with a tourism-focus is hard to come by and the existing scholarly works approach the topic from the working life perspective, the concept of workcation has not been in the forefront of scholarly debate. The shortage of relevant research is partly due to the lack of theoretical framework, even the expression 'workcation' is found only in slang dictionaries (online slang dictionary 2017) defined as: "a paid work trip that can be combined with aspects of taking a vacation. From 'work' + 'vacation'". The definition is primarily related to the digital nomad, who prioritises work over leisure, so it is oversimplified and one-sided, failing to grasp the different types of workcation tourists as my study will illustrate it later.

Without a widely accepted concept, the available literature is multidisciplinary and eclectic, therefore, this research takes the same perspective, looking into time, work and leisure through wider lenses, and only after the theoretical foundation is established, workcation tourism will be embedded into the realm of contemporary tourism theory. The springboard is the relationship between work and leisure and its changes over history, which leads to the discussion of the impact of the latest technological revolution on work and leisure. This theoretical base enables me to theorise workcation tourism and the characteristics of the different workcation tourists. The empirical part of the study discusses the findings of an online survey conducted with the participation of 340 respondents regarding their working habits and stress level during holiday. The conclusions will serve a lesson for tourism marketers and strategists, if they intend to build a workcation destination.

1. LITERATURE

Changes in working hours and leisure time

The proportion of work time and leisure time has profoundly changed in the history of mankind and the pendulum swung back and forth. It might come as a surprise that at the turn of the 18th century weavers in France worked only 180 days a year, while Hungarians worked 255 days in 2016 (Central Statistical Office 2016). In the past even protests for more working hours took place in several parts of Europe. The turning point was the industrial revolution when automation led to the substantial increase in working hours, days and shifts.

The emblematic place where the 8-hour day was first introduced is New Lanark Mills, in Scotland, today one of the UNESCO World Heritage Sites in the country. The footsteps of the mill owner, Robert Owen was then followed by the management of Ford Motors in 1914, which resulted in double profits and improved efficiency (McGregor, 2016).

Most countries introduced the 8-hour working day in the first half of the 20th century (table 1). It is beyond the scope of this study to make a detailed theoretical analysis on a country basis, however, it is clear that the reduction of working hours could not only be related to economic performance, but other political, historical and cultural factors might have had an influence. In Russia for example it became a law during Trotsky way before the more developed Belgium, while

Australia with British roots was the last one even lagging behind the militarily defeated and morally devastated Japan.

Table 1: The year of implementation of the 8-hour working day

Country	Year
Uruguay	1915
USA	1917
Russia	1917
Germany	1918
Spain	1919
Portugal	1919
France	1919
Iran	1923
Belgium	1924
Japan	1947
Australia	1951

Source: ILO, 2017

Nowadays alternative working arrangements such as shortened working weeks, flexitime, home office, job-share or temping have been gaining ground both globally and locally, and the fixed, 8-hour days is slowly becoming irrelevant. It has to be noted that the reason behind the spread of these alternative working hours might not have been the demand for better work-life balance, but it was mainly initiated by the industry side first, with the aim of improving efficiency by harmonising the workload with the working time. There are sectors like the IT where professionals might have a stronger say in their work schedule, but many employees do not benefit much from the more flexible arrangements. The most extreme form of this postmodern flexitime system is the zero-hour contract, which means that companies can employ staff without ever guaranteeing work. In Britain 910 000 people work on zero-hour contract (The Guardian 2017).

The long-anticipated ‘Age of Leisure’ (Honoré, 2005) is slipping away. A recent survey conducted by the Gallup Institute on the US workforce (2014) revealed that the total working hours of full-time workers reached 47 on average, which is almost a whole day more than a 40-hour week they fought for a century earlier. Half of the employees clock overtime and 25% of the Americans rack up 50 hours a week. The findings also showed that people in the USA work substantially more than workers in Western Europe (Saad, 2016).

When examining work-life balance, the length of paid leave plays a key role. Looking at the length of total paid leave (paid vacation days and paid public holidays) in different European countries, workers in Austria and Malta enjoy the most work-free days, totaling 38, Hungary with 33 days is on the top third of the list (Active absence 2017). Globally, Kuwait is the frontrunner with 43 days and an extra 21-day entitlement for those who have not been to Mecca yet (Global banking finance 2017). In the United States, the average number of paid vacation days offered by private employers is 10 days after 1 year of service, 14 days after 5 years, 17 days after 10 years, and 20 days after 20 years (Bureau of Labor Statistics 2017).

The role of modern technology in work-life balance

Present-day technologies have fundamentally changed our attitude towards work and leisure. In the 1990s the spread of the Internet, later the Internet-based technical advances including smart phones or video-chats, not to mention the social media, all have revolutionized the way we communicate both in our professional and private life. Before the Internet, our communications

depended solely on the efficiency of the postal service, which today is pushed aside due to the real-time communication forms (Gleick, 2003). Since both our official and private communications take place in the same virtual space, it poses a constant challenge to separate work from social life and it is up to the individuals and their working environment to what extent they are able to do that.

When it comes to our official dealings, e-mail has remained the main form of written communication, since all the exchanges are embedded in one another, so the whole conversation is well-documented, which makes search simple and easy. From the employer's side the main advantage of e-mail over the social media is that the whole content stays within the 'walls of the company', so from a confidentiality point of view it is less problematic to handle (HVG 2017). The same can be said for our private e-mail exchanges as well.

Compared with e-mails, the growing role of the social media in business and private life is much more controversial and conflicting. In case of tourism its role in marketing is the easiest to investigate (Albastroiu, Felea 2014; Munar, 2011). Within the social media the role of Instagram in tourism was closely scrutinized in several recent works including Bergström and Backman (2013) Fatani and Suyadnya (2015), Hanan and Putit (2014) and Murton (2014). The importance of Instagram is due to the fact that the visual manifestation reinforces the authenticity of a given attraction or destination. That is the reason why travelers are encouraged to take, post and share their own photos because potential tourists find the visual accounts of their fellow tourists more authentic than professional travel imagery.

The impacts of working on holiday: tourism perspective

As the fusion of working and private life intensifies, the fine line between work and holiday has also been disappearing. In the past the only people who worked during holiday were people on a business trip. There were limited opportunities to mix work with pleasure, if business travellers wished to pursue leisure activities, they had to extend their business trip and finance it from their own budget.

Nowadays working on holiday has become a norm, and those are the exceptions who could totally switch off and rest 24/7 without any contact with their business partners or colleagues. The collapsing borders in modern life is the focus of the oeuvre of Baumann (2000), whose theory on fluidity can also be applied to understanding postmodern tourism. According to his line of argument, the constant changes in our contemporary society makes individuals lose their identity to such an extent that they end up without roots. This is consistent with Eco's (2017) take on post-industrial society who blames the sickness of society on fluidity.

The phenomenon of fluidity is manifested in two hybrid tourism products: staycation (tourism without leaving their own environment) and workcation (working on holiday). Staycation emerged during the 2008 global financial crisis, when people were not willing to give up holiday altogether, therefore, they started to explore their own surroundings and engaged in tourism activities in the vicinity of their homes. From the perspective of tourism theory, it challenges the very definition of tourism because it raises the question: Is it necessary to move away from home to gain tourism experiences or is it enough to switch your brain into 'tourist mode'?

Workcation poses a challenge from another angle, namely, is it necessary to ignore work completely while on holiday? Based on my literature review and empirical research I formulate the following definition of workcation:

Workcation is a hybrid type of tourism when tourists travel for either leisure or dual (business and leisure) motive and due to the modern technology, they perform both work and leisure activities away from home.

The novelty of the definition lies in the fact that it is a more inclusive approach, covering pure leisure tourists who do not have any initial working motivation, but their life circumstances compel them to work. Then it also includes tourists with dual purposes who happily mix work with leisure. The various categories are described later in the discussion part of the empirical research.

Several scholars delved into the negative impacts of work during holiday over the last decade and many of them (Deci, Ryan, 2008; Marshall, 2012; Neulinger, 1982) emphasized that the inability of switching off is a source of stress and a cause for certain illnesses because without recharging their batteries employees are not able to pick up work and perform efficiently. Gilbert and Abdullah (2004) also agree that holiday relieves stress and improves well-being.

From the employees' side the most commonly mentioned argument against workcation is the inefficiency of multitasking as Silverman (2015) cites in his work. The author underlines that the combination of work and holiday might cause that the individual cannot perform 100% in any situation. He adds that the rest deficiency might be as harmful as skipping a holiday altogether.

The survey conducted by Ascentis (2017) came to similar conclusions and identified a group of employees who are dissatisfied due to the work expectations during holiday. 40% of those holidaymakers who are forced to work on holiday actively look for a new job, in contrast, only 21% of people who have supportive working environment intend to leave their current job. It can be concluded that respecting workers' right for a rest improves loyalty. This research also revealed that people working in supportive environment feel better recognised and valued.

On the other hand, long-term negative impacts cannot be substantiated yet, and other findings came up with different conclusions. It can happen that a workcation is more beneficial for the body and mind than skipping holiday altogether (Nawijn, Damen, 2014). The researchers asked 374 Dutch people about their travelling habits and 97% were satisfied with their work-leisure balance during their vacation. The respondents pointed out that even a workcation is less stressful than coming back to a huge pile of work after holiday. Top managers and small business owners stated that working during holiday help they keep the business going without a hitch.

Academics echoed the same sentiment in a survey done by ResearchGate (2017), in which all the respondents admitted to working on holiday because they can do more research during holiday. The comments revealed that scholars enjoy workcation because after the academic year full of teaching commitments coupled with administrative duties, they can finally slow down and spend time reading scholarly literature and writing studies. For many of them the slow process of reading and writing compared with the fast schedule of the academic year is relaxing and rejuvenating.

A recent US study explored the issue of workcation from a novel angle and examined the phenomenon of work martyrs. Those employees do not take any time off, for fear that no one can fill in for them. The research completed by GFK (Gesellschaft für Konsumforschung 2017) concluded that those employees perform at a lower level than their peers, and they are rewarded less in terms of a bonus or a raise.

The main point of all the literature reviewed is that the attitude to workcation greatly depends on the individuals' job, working arrangements and the supportive or unsupportive management. The full-time employees see workcation in a more negative light, mainly because they feel that they do

not have any time (neither working time, nor leisure time) that they can control. Small business owners and top managers have more freedom in terms of work-life balance and similarly to academics their attitude to workcation is more positive than that of the former group. The question remains: if full-time employees had the freedom to decide on work-life balance during their holiday, would that change their attitude to workcation?

2. METHODOLOGY

My research was completed in October 2017 when 340 Hungarian individuals, 230 men and 110 women, participated in the online questionnaire. The 12-question survey covered the frequency of holiday, the technical devices taken and used on holiday, the nature and the amount of work on holiday, and the stress associated to workcation. The composition of the sample is detailed below (table 2).

Table 2: Demographic profile of respondents

Age	Number	%
Born before 1946	21	6%
Baby boomer	59	17%
Generation X	152	45%
Generation Y Generation Z	88	26%
	20	6%
N=	340	100%
Occupation		
Employee	109	32%
Manager/Team leader	62	18%
Executive	63	19%
Pensioner	61	18%
Student	22	6%
Self-employed	23	7%
N=	340	100%

Source: own research

Looking at the age, generation X and Y were the two biggest groups with 71%. Occupational categories were selected in a way to be understood by the Hungarian respondents and to have relevance to the actual research. In terms of occupation the proportion of students and self-employed was negligible. The low number of the last group is unfortunate because according to the Central Statistical Office the number of small business owners with less than 10 employees reached 1.3 million in 2015. As it was established before, they have the freedom to decide on their own work-life balance, so exploring their attitude in the Hungarian context and compare it with global data would have been an eye-opening experience. However, their low level of participation in the study makes it impossible to single them out and analyse them as a separate group. The available empirical studies on workcation do not say much on the generational differences. One of the above cited research findings (Ascentis 2017) mirrors my results, they also found generation X and Y the most active during their vacation. 82% of generation X argued that they feel less guilty during holiday if they can work, while 77% of generation Y opined in the same way.

3. RESULTS AND DISCUSSIONS

The first question enquired about the frequency of taking vacations among the respondents.

Table 3: The number of vacations per year

Number of trips/year	%
less than one	3
one	41
2-3	47
more than 3	9

Source: own research

The table 3 shows that around half of the respondents make 2 or 3 trips a year, presumably, beside their long summer vacation they also go on 1 or 2 shorter holidays. Over 40% go on vacation once a year and only 3% do not travel yearly. So, taking a holiday is a preferred leisure activity regardless of age and occupation. The national data unveils similar results, Hungarians made 18 080 243 trips in 2015, which means that an individual had 1.8 trips a year (KSH 2017). Another survey commissioned by Danubius Hotels (2017) asked 6500 Hungarians and found that 53% of them travel more than once a year.

Work-related activities and technology used

The next question was raised regarding the three most common devices that tourists take for a trip.

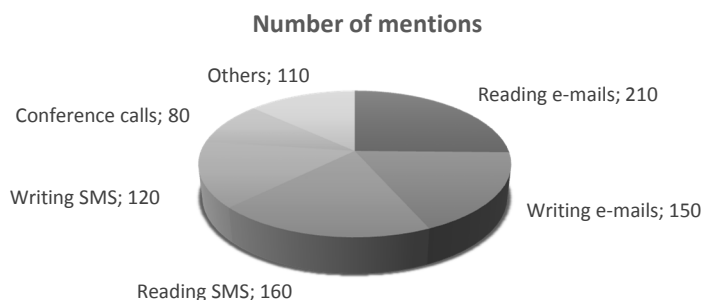
Table 4: Technological devices taken to vacation

Frequency	Devices		
	mobile	tablet	laptop
always	91%	6%	15%
rarely	9%	29%	41%
never	0%	65%	44%

Source: own research

As table 4 illustrates, mobile phones took over the role of computers on holiday, which mainly due to two main reasons. First, the wide range of functions smart phones have makes tablets and laptops unnecessary on short-term. Second, the baggage policy of low-cost airlines force passengers to travel as light as possible. Looking at the actual activities done on vacation (Figure 1), the most common activities mentioned can easily be done on the phone. Two passive activities: reading of e-mails and SMS finished on top, both can be done in parallel with leisure pursuits. The only activity that requires full attention is videoconferencing, however, only 10% engaged in this type of activity.

Figure 1: Activities on holiday



Source: own research

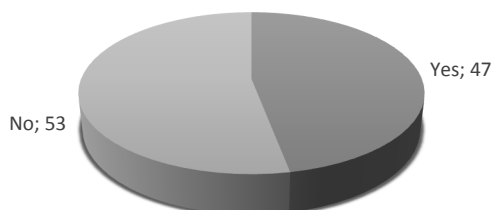
The HR buzzword 'multitasking' has been a fertile ground to make working activities on holiday more acceptable. Job advertisements regularly contain the ability of multitasking among their core requirements. The scope of this study does not allow to get into details, but I would cite two recent studies that proved: multitasking is unnatural and lowers the quality of work. Bradberry (2017) in his studies carried out at Stanford University found that multitasking harms the brain and decreases the IQ. McKeown (2014) in „Essentialism” claims that 'less is more', and it is more fruitful to concentrate on one task at a time and do it right than performing several tasks simultaneously and committing errors.

The GfK (Gesellschaft für Konsumforschung 2017) asked American full-time workers who were entitled to paid vacation in its research. Out of 7331 respondents 2598 had access to work outside the workplace, therefore, only their answers were analyzed. The survey revealed that 46% of vacationists work regularly on holiday, 27% occasionally, and another 27% do not work at all. It is important to note that the 62% of regular workers do not even take the whole of their paid leave annually, so they have much less time to regenerate.

Typology of workcation tourists

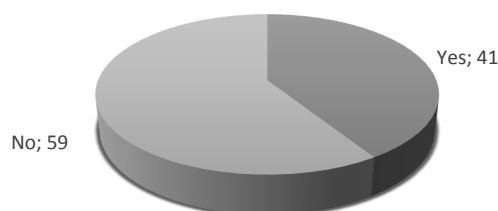
The core question of this research was related to job stress on holiday (figure 2 and 3). Respondents were asked about their stress level during vacation, whether they fret about their job or the quality and speed of the Internet access. Based on the findings I could identify four main categories of workcation tourists complemented with two subcategories. It should be noted that this research has a tourism-focus and the medical perspective was completely ignored.

Figure 2: Job stress on holiday



Source: own research

Figure 3: Stress because of technology access



Source: own research

The two questions produced similar results, 47% said work on holiday triggers stress and 41% said that even the inaccessibility to cutting-edge technology creates stress for them. In order to find out about the extent of overlap between the two groups, I made a correlation table and found four distinctive groups, adding two subgroups identified through my background readings.

1. Stress-sensitive workcation tourists

About 20% of the respondents can be qualified as highly sensitive to holiday stress, all of them are generation X and Y workers, occupation wise even spread.

These vacationists agonise over work as well as the slow technology, even if they do not have to perform any tasks during their holiday. Members of this group cannot let their hair down and return to work so exhausted, as if they had not gone on holiday at all. In terms of tourism this group is the hardest to satisfy because their anxiety is independent of the holiday infrastructure and environment. In this case employers and employees together should decide on 'off duty days' that can be extended later over a weekend or a whole week.

2. Technology – addict workcation tourists

About 20% of the respondents are addicted to technology, slightly younger group, the whole generation Z and all the students are part of this group.

About 20% of the respondents are addicted to technology, slightly younger group, the whole generation Z and all the students are part of this group.

This group is overanxious about the quality and speed of the technology available at a given destination. They obsessively check their phones and stay connected 24/7 regardless of having work to do or not. This group is easy to please, and they do not need a wealth of cultural and entertainment opportunities. As long as their need for cutting edge technology is met, these tourists are satisfied.

3. Workaholic workcation tourists

About 28% of the respondents can be put into this category, overwhelmingly generation Y, occupationwise even spread.

In psychology, this is a well-documented and researched group since workaholics existed way before the latest technological revolution. However, they did not travel extensively in the past

because they had to stop working while travelling. In tourism it is a relatively new travel segment, which requires quality accommodation, aesthetical environment and impeccable service to keep up appearances of being a genuine holidaymaker. They take all the latest technology with them; therefore, the quality of the technical infrastructure is irrelevant.

4. STRESS-FREE WORKCATION TOURISTS

About 32% belong to this stressless group, mostly men (80%), occupationwise even spread, slightly more generation X and baby boomers than younger generation.

These tourists can switch into 'vacation mode' and do not worry about unexpected work or inefficient technology. They can balance work and leisure in a way to keep their stress level at bay. They are ideal workcation tourists, because the sudden change in their work/leisure pattern do not influence their travel satisfaction.

- a. **Modern luddites:** a small proportion of stress-free workcation tourists identified through the literature review, defined by Penn and Zalesne (2007) in their book „Microtrends“. According to the authors there are creative professions such as writers or artists who have not succumbed to the present-day technology. For them using a typewriter, a pen or a notebook is part of the creative process, which fosters new thoughts and ideas. They are similar to workaholics in a way that inspiring and aesthetic environment is important for them. The ideal workcation retreat for them would be the contemporary version of art colonies.
- b. **Digital nomad:** also part of the group of stress-free workcation tourists who travel for dual purposes, therefore, in a narrow sense of the word they are not qualified as leisure tourists. While compiling the main characteristics of the digital nomad (table 4) I used web pages such as becomenomad.com and online interviews and reports (Russell, 2013; Nova, 2017).

Table 4: Characteristics of the digital nomad

Categories	Characteristics
Length of stay	longer length of stay
Preferred environment	urban or close to city
Working environment	anywhere
Daily routine	adapting to distant clients
Social interaction	they socialize with locals and fellow workcation tourists
Tourist type	slow tourist
Need for infrastructure	the depend on modern technology
Ecological footprint	smaller than traditional tourists' footprints
Type of accommodation	more modest, environmentally-friendly
Consumer basket	similar to locals
Type of experience	authentic experiences

Source: own research

This is only a selective inventory of characteristics of the digital nomad, comprising the most distinct features. These types of tourists tend to stay longer at the destination, therefore, they are considered slow tourists. Their daily routines differ from more traditional tourists because they have to adapt to their clientele who might live in different time zones. Due to their longer stay they socialize more with locals, might pick up some of their habits and customs. Digital nomads need state-of-the-art technology for their work, therefore, they prefer either city locations or to stay close

to the urban environment surrounded by spectacular landscape, where more cultural and entertainment opportunities are available. Since their lifestyle is similar to that of the locals in many ways, their ecological footprints are smaller. Yet, it greatly depends on the modern creature comforts they use, such as car that can easily counterbalance the positive impact of the longer length of stay. By the same token, if they do not consume local food, their need for import products (transport cost, environmental damage, traffic, noise) will make their footprints even bigger than that of mass tourists.

5. CONCLUSIONS AND RECOMMENDATIONS

The blurring line between work and leisure is a well-documented trend in our postmodern society, which led to the emergence of workcation tourism. This research set out to explore the topic from both theoretical and practical perspectives. The author attempts to theorise workcation by formulating a workcation definition and categorising workcation tourists.

Based on the literature review and the survey findings people suffering from job stress on holiday can be divided into six categories. The results of the research unveiled some segments that can be considered and attracted when a destination plans to embark on sustainable tourism developments. Both modern luddities and digital nomads can be an ideal target market for destinations planning to build workcation retreats and complementary infrastructure as a way of economic regeneration. Some good practices in Europe are available to explore, including specific German examples that could be applied in the Hungarian context as well. Workcation will always be a niche tourism product and Hungarian developers have to keep it in mind that the majority of future guests will come from foreign countries, therefore, cultural differences and language problems should be handled with tact and professionalism.

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THE PRIVATE DEMAND FOR INNOVATION: THE CASE OF EX - YU COUNTRIES

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Abstract: *In the era of high sophisticated technology, the innovation is recognized as a key driver towards better national competitiveness and economic growth, creating opportunities for better employment and better responding to global social challenges. At the company level however, innovation improves efficiency, boosts company productivity and provides numerous benefits to the consumers. Being identified as a key variable for the importance of demand for innovation, buyer sophistication signals the ability of buyers to select products and services based on performance rather than price. Furthermore, the companies witnessing more sophisticated domestic market are likely to sell products with higher quality and to better understand the customers' needs and how they perceive the value of the product.*

This paper aims to provide a comparative analysis of private demand for innovation in selected ex- YU countries using the two key indicators: "buyer sophistication" and "sales of new-to-market and new-to-firm product innovations for the period 2011-2016. Although sharing the same socio-political and historical background, the analysis of these selected countries show significant discrepancies among their business leaders' assessments about the level of their customer demand for innovation and business sophistication.

Keywords: *private demand, buyer sophistication, innovations, value, sales*

JEL Classification O31

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1. INTRODUCTION

The consumer is the basic economic unit that determines the quantity and the types of the products and services that are purchased, or will be purchased. Hence, demand is determined by the individual, businesses or public consumers who have “the desire or preference to purchase an affordable product or service” (NESTA, 2010). The preferences are a way of characterizing consumers’ relative desire to choose one from possible market offers in any given interaction (Australian Government, 2012). Therefore, demand expresses a willingness to pay a certain price for the satisfaction of a need or want (Mowery and Rosemberg, 1979). According to Kotler (2002), the customer value is define as “customer’s perception about the benefits received from using a product (service) relative to the cost and risks associated with acquiring it“. It simple expresses a ratio between “what the customer gets” and “what the consumer gives”, understanding that the customer gets *benefits* (functional benefits + emotional benefits) and assumes *costs* (monetary costs + time costs + energy costs+ psychic costs) (Kotler, 2002). Following Kotler’s logic, the company can increase the value of the customer offering by (1) raising benefits, (2) reducing costs, (3) raising benefits and reducing costs, (4) raising benefits by more than the raise in costs, or (5) lowering benefits by less than the reduction in costs.

Furthermore, it can be noticed that one key variable for the importance of demand for innovation is the buyer sophistication. This signals “...the ability of buyers to select products based on performance rather than price and, thus their willingness to purchase innovative products and services and to bear their higher costs at the beginning of the life cycle (Edler, 2011). This demand factor can shape innovation activity in two major ways (OECD, 2005): (1) for the development of new products, as firms modify and differentiate products to increase sales and market share; and (2) for the improvement of the production and supply processes in order to reduce costs and lower prices.

Innovation is the first attempt to put an idea into practice. This is distinct from invention, which is the first occurrence of an idea. Many definitions of innovation, including the OECD-Eurostat definition, explaining that innovation covers five areas (Fagerberg, 2005): product innovation, process innovation, marketing innovation, input innovation, and organizational innovation. Within each type of innovation, there are three levels of innovation (NESTA, 2010): incremental, radical and transformational. The incremental innovation refers of small continuous improvements that cause relatively little disruption, e.g. a new invoicing system; the radical innovation refers of new to the market or firm, often disruptive to the industry, discontinuous, e.g. a new product for sale or a new business model such as home delivery for a retailer and transformational innovation refers of new to the world, rare but big innovations that cut across all industries, e.g. the World Wide Web. The minimum requirement for an innovation is that „the product, process, marketing method or organizational method must be new (or significantly improved) to the firm” (Fagerberg, 2005) or other user and introduced on a market or that the new processes are used in production

It is important to note that the innovations must be commercialized, that is, launched on the market, or in other ways widely diffused to customers on a large scale in the economy or society. Criteria for success can include market share, number of sales, profit made, diffusion rate, beating competitors, or changes in customer’s behaviour. But, the high degrees of Buyer sophistication could explain higher shares of innovative sales.

In this paper, we are analyzing the demand for innovation in context of the selected ex-YU countries⁵ such as Croatia, Slovenia, Macedonia and Serbia during 2011 to 2016. These countries have a common past of about 45 years when they shared same market in the within of former Yugoslavia. For cultural or historical reasons, buyers may be more demanding for innovation in some countries than in others. Therefore, in this article, we explore the following questions:

- Do the customers in ex-YU countries differ in their degree of Buyer sophistication?
- How many sales of innovative products are realized by the companies in ex-YU countries?
- Do the business managers from ex-YU countries make a good assessment of private demand for innovation and in which ex-YU country it better is doing?
- In that group of adopter for now product belong the buyers from ex-YU countries?

In the next two sections, we present the methodological framework and data and the analysis based on the findings. At the end is the conclusion.

2. METHODOLOGY AND DATA

A better understanding of the consumer demand for innovation influence on organizational activities, but the companies have limited understanding about the consumers' preferences or the sophistication of the customers. Hence, our starting point is that the business leaders' understanding related to the buyers' sophistication, influences towards increasing sales of innovation product/services. Further, we assume that “higher degrees of buyer sophistication can explain higher shares of innovative sales” (Hollanders and Es-Sadki, 2017) in context of the ex-Yu countries during 2011 to 2016. In order to analyze these starting points, we need effective ways to measure it. Most aggregate, publicly available data focus on innovation is the European Innovation Scoreboard (EIS) that includes different indicators to measure and compare relative efficiency of the performance of country's innovation systems. The EIS data is from different data sources such as the Community Innovation Survey, EUROSTAT and other internationally sources such as the OECD and the United Nations. Second source, which characterize demand conditions across different countries is the Global Competitiveness Report (GCR) by the World Economic Forum (WEF). The GCR data is largely based on surveys of business leaders who give their subjective assessment on a whole series of demand side variables.

For the issues in this paper we used two indicators which characterize the demand for innovation by above two source. The first indicator, “Bayer sophistication“ is included in the Executive Opinion Survey of the World Economic Forum (WEF) (2011-2016) based on surveys of business leaders who give their subjective assessment of this demand variable. While this is not a hard indication, it nevertheless shows how business lenders in the countries perceive the situation, and those perceptions are the basis for decision making for innovation activities. The degree of Buyer sophistication measures, on a scale from 1 (low) to 7 (high), the degree of the preferences of individual consumers for innovative products, whether buyers focus more on price or quality of products and services. The second indicator, “Sales of new-to-market and new-to-firm product innovations (measures as % of turnover)“ is employed by the European Innovation Scoreboard (EIS) in order to takes the customers purchase of innovation into account. The EIS indicator “Sales of new-to-market and new-to-firm product innovations” (EISI. SNM&NFP innovation) has normalized score from 0 (min) to 1 (max).

⁵ The former Yugoslavia included Slovenia, Croatia, Serbia, Macedonia, Montenegro, Bosnia and Hercegovina, but for the last two countries the EIS data is not collected.

In order the two indicators scores to be comparable they should to have same value. So, we adjust the score of the GCR indicator “Buyer sophistication” (GCRI. BS) of each ex-Yu countries in the following way: the GCRI.BS score is divided by the number 7 which is the maximum of the best GCR score. For example, the GCRI. BS score of Macedonia for 2016 is 2.9 (on scale from 1 to 7), but after adjusting its score is 0,41 (on a scale from 0 to 1).

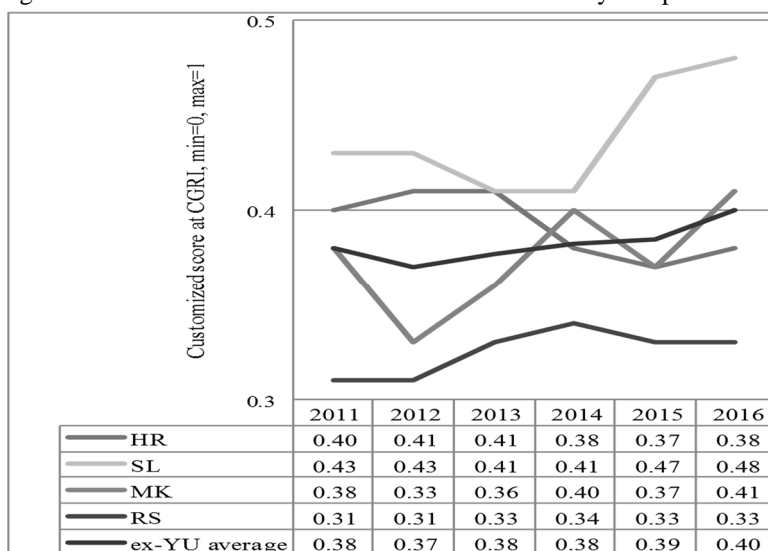
The comparative analysis between the indicators is based on the average score obtained by of the four scores of the ex-YU countries of given indicator. Furthermore, as “people differ greatly in their readiness to try new products ...and ...can be classified into the adopter categories after a slow start, an increasing number of people adopt the new product” (Rogers, 2003) „in this paper we classify buyers of the ex-YU countries into the three adopter categories: high adopters, moderate adopters and low adopters buyers. So, according to the indicators “Sales of new-to-market and new-to-firm product innovations (measures as % of turnover)“ the countries with five-years average score above of the five-years average score by all ex-YU countries indicates have high adopters buyers. Those countries whose the five-years average score scores, for same indicators, is equal to the five-years average score by all ex-YU countries have moderate adopter buyers. In the three group are countries with the five-year average score below from the five-year average score by all ex-YU countries, which have low adopter buyers.

3. ANALYSIS

For first question, *Do the customers in ex-YU countries differ in their degree of Buyer sophistication*, we look at the results presented in Figure 1. The figure shows overall comparison of the CGR’s indicator Bayer sophistication (CGRI. BS) with customized scores (from min=0 to max=1) between the ex-YU countries relative to the average for ex-YU countries that is 0,38 in 2011, to 0,40 in 2016. Hence, it can noted than the CGRI. BS scores are the highest of Slovenia compared to the average for ex-YU countries and in relation to the individual scores of other ex-YU countries. Contrary to this, the lowest degree of buyer sophistication has Serbia for all years. The Macedonian buyer sophistication go up in 2014, then fell down in 2015, while in 2016 the degree of buyer sophistication again grow. In Croatia from 2013 has trend of decreasing. from 2015 has trend of increasing the degree of, but are lower in relation to Slovenia

This means that buyers from Macedonia and Croatia, but especially from Serbia are not very prone or able to buy innovation products or leading edge technology. Thus, the pre-conditions for innovations to be absorbed in the market are challenging. “One reason for lower buyer sophistication can be limits of disposable income of private consumers” (Edler, 2009). Besides that, Edler (2009) suggests demand policies that target awareness, attitudes and skills of buyers, and on other hand to influence the innovation culture in the market, making buyers more risk taking, aware of innovations and empower them to use them.

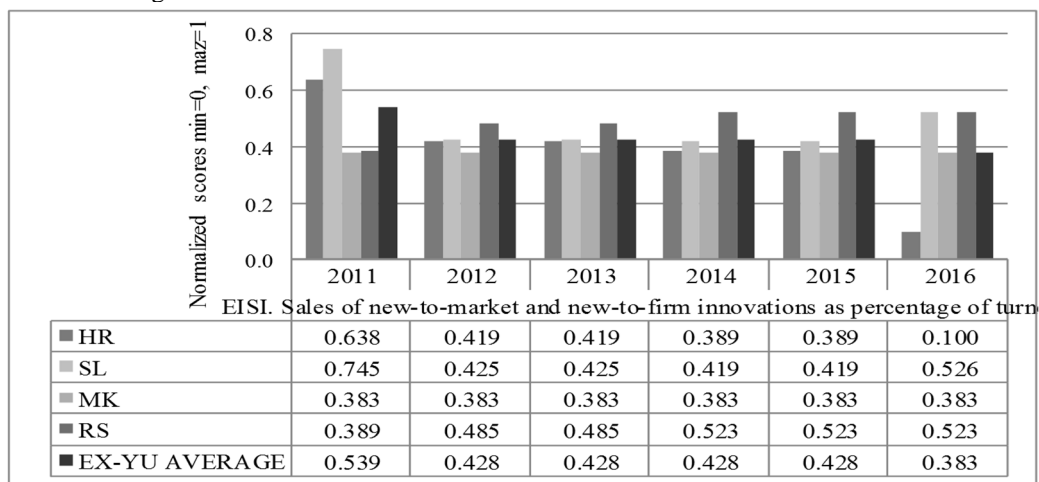
Figure 1: Differences between of ex-YU countries at Buyer sophistication



Source: author's calculations based on of the GCR data

As it was previously mentioned, the second question, *How many sales of innovative products are realized by the companies in ex-YU countries*, we consider through EIS indicators "Sales of new-to-market and new-to-firm product innovations" (EISI. SNM&NFP innovation) (see Figure 2).

Figure 2: Differences between of ex-YU countries of sales of innovations

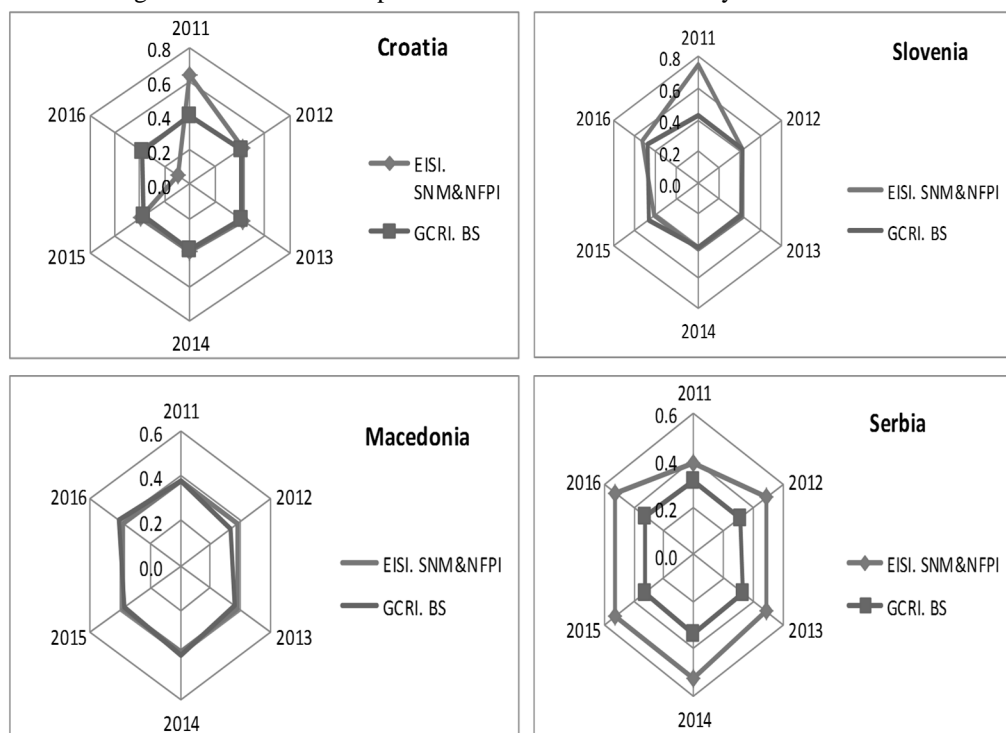


Source: author's calculations based on of the EIS data

From Figure 2, it can be noted that Serbia from 2012 to 2016 achieves the highest level of sales in relation to average at ex-Yu countries, followed by Slovenia. Macedonia has an unchanging constant for all five years, while Croatia has a serious fall in the sales of innovation in 2016.

Finally, for the third question (see Figure 3), *Do the business managers from ex-YU countries make a good assessment of private demand and in which ex-YU country it better is doing*, we doing a comparative analysis using above two indicators (GCI. BS and EISI. SNM&NFPI).

Figure 3: Assessment of private demand for innovation by business leaders



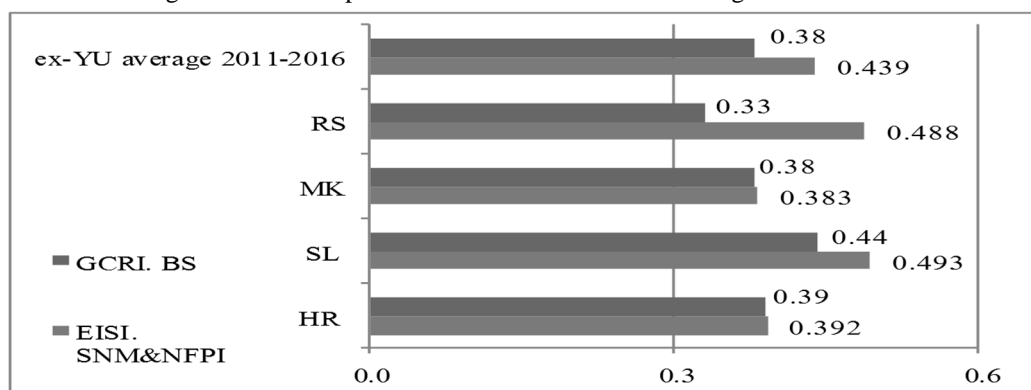
Source: author's calculations based on of the GCR data and EIS data

As the Figure 3 presents, Serbia has an obvious gap between the two indicators during 2011 to 2016, much sales of innovation in relation the assessment at low buyer sophistication. This means that the business leaders in Serbia think that most buyers are unwilling to pay for innovative products while on other hand its companies achieve high sales of innovation. This contradiction shows that business leaders in Serbia need better to understand customers' preferences and it to incorporate into their business strategies and innovative activities, in order to increase profits as a result of a greater offer with innovative products.

Similarly, the business leaders in Croatia (see Figure 3) should have a better understanding of the concept buyer sophistication, because they opposite from their colleagues in Serbia higher assess its buyers in relation low achieved sales of innovation in 2016. Fall on the sale for innovation show that the buyers in Croatia in 2016 made purchasing decisions for innovation based on the lowest price.

The business leaders in Slovenia and Macedonia show a greater understanding of purchasing decisions for innovation of its buyers because sales of innovation and it's assess for the sophistication of buyer is equal.

Figure 4: The best private demand for innovation during 2011 to 2016



Source: own compilation based on of the GCR data and EIS data

Finally, we do a comparative analysis between the ex-YU countries, based on the amount of adoption of new products by buyers, in order to classify them in one of the three earlier mentioned groups: high adopters, moderate adopters and low adopters buyers. For this purpose, we used the five-year average (2011-2016) scores of the two indicators (GCI. BS and EISI. SNM&NFPI) in relation of the five-year average score of ex-Yu countries (2011-2016). Figure 4 provides the ex-Yu countries' scores of those indicators. From the observed scores of the ex-YU countries Slovenia have the highest single value for the two the indicators, followed by Serbia that indicate that its buyers belong in the group high adopter of now product. Unlike them, the scores of Macedonia and Croatia are near to the five-year average score of ex-Yu countries that means that their buyers are in the group of moderate adopters.

Overall, this finding calls for change of demander's behaviour for innovation and transforming the market into a desirable direction, such as adopter of innovation product. For example, demand oriented policies which would have to influence the innovation culture in the market of each ex-YU countries, making buyers more risk taking, aware of innovations and encourage to adopter now product and to use it. Work done by Rothwell (2007) found that a majority of successful innovations where in fact reactions to perceived changes in demand preferences rather than due to radical developments on the technology side (Elder, 2013). Accordingly, innovation failures were often due to a misperception of what the market is ready and willing to accept, and a lack in sound marketing before and after innovations were generated. By taking advantage of opportunities to involve users early in the innovation process organisations can gain advanced insight from customers and maximize their competitive advantage (NESTA, 2010).

CONCLUSION

It is important to note that the innovations must be commercialized, that is, launched on the market, or in other ways widely diffused to customers on a large scale in the economy or society. Criteria for success can include market share, number of sales, profit made, diffusion rate, beating competitors, or changes in customer's behaviour. But, the high degrees of Buyer sophistication could explain higher shares of innovative sales.

Overall, the paper's finding calls for change of demanders' behaviour for innovation and transforming the market into a desirable direction, such as adoption of innovation product. For example, demand oriented policies which would have to influence the innovation culture in the market of each ex-YU countries, making buyers more risk taking, aware of innovations and

encourage to adopter now product and to use it. Accordingly, the innovation failures were often due to a misperception of what the market is ready and willing to accept, and a lack in sound marketing before and after innovations were generated. By taking advantage of opportunities to involve users early in the innovation process organizations can gain advanced insight from customers and maximize their competitive advantage.

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COMPARATIVE ADVANTAGES OF BULGARIAN PRODUCTION AND EXPORTS

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Abstract: *The present study focuses on the analysis of the competitiveness and the comparative advantages of Bulgarian production and exports. It is structured in two parts. The first part summarizes the positions of Bulgaria in the index of global competitiveness and the more important criteria related to foreign trade. In the second part some theoretical concepts for comparative competitive advantages are systematized. Out of them the indices of B. Belasa and M. Amir have been chosen and calculated and on this basis the conclusions about the comparative advantages and disadvantages of the Bulgarian production and export of certain commodities and commodity groups, manifested in 2012-2016, are drawn. Stepping on these conclusions the possibilities for expanding or restricting the export of specific commodity groups and for increasing the competitiveness of the Bulgarian economy are systematized. In this research mathematical and statistical methods are applied, mostly the index method, along with methods of analysis and synthesis.*

Keywords: *comparative advantages, exports and foreign trade, competitiveness*

JEL Classifications F10 • F14

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INTRODUCTION

In recent years, the Bulgarian economy has been recovering and gradually overcoming the effects of the externally induced crisis of 2009. Production in a number of industries has been increasing and stabilizing, domestic and foreign demand for Bulgarian goods has been revitalizing. During some years when there has been a more significant increase in exports than imports, foreign trade has been a real source of economic growth. Under these conditions it is obvious that there is a need for a more convincing export performance of products with higher added value, better absorption of opportunities for greater export of products from areas with proven competitive advantages.

The main objective of the present study is to analyze the comparative advantages of Bulgarian production and exports and to outline directions for increasing the competitiveness of the Bulgarian economy. To achieve this main goal: 1.) Bulgaria's positions on the Global Competitiveness Index and the more important criteria related to foreign trade are summarized; 2.) Some theoretical concepts about the comparative competitive advantages are systematized and the indices of B. Balassa and M. Amir are analyzed. On their basis, conclusions are drawn about the comparative advantages of the Bulgarian production and export of specific commodities and commodity groups and the possibilities for expanding or limiting the export of some commodity groups and from there for increasing the competitiveness of the Bulgarian economy.

1. FOREIGN TRADE AS A COMPETITIVENESS CRITERION

The assessment of the competitiveness of the economy can be built on different sets of criteria and sub-criteria. The most important of them and in a sufficiently wide range are being researched annually since 1989 (for Bulgaria since 2006) for many countries in the world and published in the International Competitiveness Yearbook of the Institute for Management Development - IMD, Switzerland.

The IMD Competitiveness Criteria are summarized in an Annex to the Country Profile Yearbook in four main categories, which refer to economic efficiency, government policies, business environment and infrastructure. Each of these four categories covers five sub-criteria. Within the first category of economic efficiency, a sub-criterion on external trade is also included (World Competitiveness Ranking, 2017).

The IMD Yearbook provides much more detailed information and data because the Global Competitiveness Index is subdivided into twelve pillars with detailed multiple sub-criteria for each pillar. In terms of foreign trade, the 6th pillar - which accounts for imports as a percentage of GDP and the 10th pillar - in which exports are included as a percentage of GDP, are of direct relevance.

In recent years, the positions taken by Bulgaria on IMD's core criteria and IMD's external trade sub-criteria are improving.

In the IMD report for 2017-2018, Bulgaria ranked 49th in global competitiveness while in 2012-2013 it was 62nd. According to the size of the foreign market, the country is in 55th place, but we have better positions in exports and imports of goods taken as a percentage of GDP - which are respectively 20th and 26th in 2017 (The Global Competitiveness Report 2017-2018). Improvement is also reflected in the overall assessment of international trade – there Bulgaria is climbing from 20th to 17th place (World Competitiveness Ranking, 2017). The ranking of Bulgaria considering the categories of economic indicators and efficiency is improving more obviously - from 49th place in 2013 we move to 37th place in 2017. This trend is backed strongly by the increasing price competitiveness of Bulgarian production and exports, in which area we have risen

for the last year from 11th to 5th place. Bulgaria occupies the 13th position according to the rate of growth of GDP.

The criteria and sub-criteria researched by the IMD are perceived as representative because they cover a broad set of data, provide a basis for international comparisons and reflect different aspects of the main competitiveness factors revealed in many theoretical concepts. A large number of them take into account, as the leading factors of competitiveness, labor costs, interest rates, exchange rates, economies of scale. In addition, account is taken of the effects of competition on the processes of technical and technological renewal, integration and globalization, which are more intensive in modern times. In this connection, for example, M. Porter stresses, "One country's competitiveness depends on the capacity of its industry to implement and modernize. Companies benefit from the best competitors in the world due to pressure and challenge. They benefit from strong domestic competitors, aggressive local suppliers and demanding local customers." (Porter, 1990) Along with the domestic, there is a growing emphasis on the growing role of external factors, given the accelerating flows of foreign trade and foreign direct investment. In a number of studies, there is a positive correlation between the openness of the economy and the position of the country ranked by competitiveness (Cabolis, 2017). Against this background, the conclusion that "the path to long-term economic growth includes focusing on exports, industry development, energy diversification and the creation of competitive small and medium-sized enterprises" is enhanced (Georgieva et al, 2014).

The effects of the expansion of foreign trade flows are simultaneously projected on competitiveness and economic growth rates, largely depending on the sectoral and commodity structure of exports. However, the different industries have a different level of competitiveness, so there is a need to identify and better absorb the export opportunities of production not of all but mainly in areas with competitive comparative advantages.

2. COMPARATIVE COMPETITIVE ADVANTAGES OF BULGARIAN EXPORTS

To evaluate the competitiveness of with regard to commodities and commodity groups, different theoretical and econometric methods and models can be applied.

The development of the theoretical concepts of foreign trade has been linked in the past to the ideas of Adam Smith and David Ricardo, who, as early as the 18th-19th century, gave rise to classical notions of absolute and relative advantages (Smith, 2010; Ricardo, 2015). The Heckscher-Olin model, which binds the competitiveness of the production and export of certain products more closely with the good availability of certain resources in the country, is particularly important. (Rauch, 1990). Many modern models have a theoretical-empirical character and complement various factors of competitiveness (Velinova, 2006). More prominent among them is the model of B. Balassa (1965, 1979), according to which the comparative advantages depend on the presence of physical and human capital and can change in the process of their accumulation in the given country. The index compiled by B. Balassa finds wide use in empirical research with a different geographic range, but shows some shortcomings for which it is criticized. In an attempt to overcome them and considering that they are due to its multiplication form, Alex Hoen and Jean Oostervahen suggest that the Balassa index be presented in an additive form (Hoen, Oosterhaven, 2006). At a later stage, the role of technologies for different degrees of specialization is emphasized since they are perceived as a potential source of comparative advantages (Dollar, 1993). A number of studies focus on the rejection (Falvey, Rodney, 1981) or confirmation (Rauch, 1990; Deardorff, 1980) of the prognostic opportunities in present day of the theories of comparative advantages of D. Ricardo and Heckscher-Olin. Certain contributions to the development of approaches to measuring and examining comparative advantages have also been made by T. Vollrath (1991) and

Hadzhiev (2014). Many empirical studies are devoted to the comparative advantages of trade between individual or groups of countries as well as between the countries of the European Union (Mora, 2001; Tullio, 2016; Zhelev, 2009). All of these studies have contributed to the development of methods to measure specific comparative advantages to help highlight sectors where a country has the potential to develop trade more sustainably and achieve economic growth.

In this study the B. Balassa index (1965, 1979) and the M. Amir index (2000) will be applied. They complement each other and make it possible to determine the decisive ("strong") sectors of a country by analyzing data lines for export flows over a given time period. By means of B. Balasa's approach the quantity of "Revealed Comparative Advantages" (RCA) is measured. The manifest shortcomings of the Ballasa Index are overcome by the improvement made by M. Amir, who presents the index in a different way.

To determine the specialization of the Bulgarian production, Bulgarian exports will be compared to certain commodity groups and the world exports of the same commodity groups. ITC (International Trade Center, Geneva) statistical information is used for the evaluation of Bulgaria's and world's exports in millions of dollars (see Annex 1). The commodity structure of exports is according to the Harmonized Nomenclature, the data being annual and covering the period 2012-2016.

To determine the relative advantages of Bulgaria's export to world exports, split by commodity groups, the following formula will be applied for calculating the Balassa index (Yarliyska, Dimitrova, 2012):

$$RCA_B^{BG} = \frac{Exp_i^{BG}}{Exp^{BG}} \div \frac{Exp_i^W}{Exp^W}, \quad (1)$$

where:

- RCA_B^{BG} is the Balassa index for Bulgaria,
- Exp_i^{BG} - the value of exports of commodity i from Bulgaria,
- Exp^{BG} - the value of the total exports from Bulgaria,
- Exp_i^W - the value of exports of commodity i in the world,
- Exp^W - the value of the total exports in the world.

The results from the application of formula (1) show that in the case of a competitive advantage, a specific Bulgarian product may be preferred and imported by any country in the world. A competitive advantage is present when the value of the index is greater than one. In such a case there are reasons to stimulate and increase the volume of the exported goods, thus increasing the competitiveness of all exports and the economy of Bulgaria as a whole. When the index is less than one there will be a loss in selling the product. In this case, the export of this commodity/commodity group should be limited, avoided or replaced by exports of other more competitive goods.

The value of the Balassas index is influenced by the relative share of the commodity in the country's total exports as well as by its share in world exports. This index may be too high when the share of the commodity in the country's exports is significant while at the same time it occupies less of the world's exports.

To ignore this shortcoming M. Amir proposes another version of the index (Amir, 2000). The Amir index reflects the change in market shares over the different periods in connection with which it is calculated by another formula (Yarliyska, Dimitrova, 2012). For Bulgaria, the Amir index is as follows:

$$RCA_A^{BG} = \frac{Exp_{it}^{BG}}{Exp_{it}^W} \div \frac{Exp_{it-1}^{BG}}{Exp_{it-1}^W}, \quad (2)$$

where:

RCA_A^{BG} is Amir's index for Bulgaria,

Exp_{it}^{BG} – the value of exports of commodity i from Bulgaria in the current period t,

Exp_{it-1}^{BG} – the value of exports of commodity i from Bulgaria in the previous period t-1,

Exp_{it}^W – the value of exports of commodity i in the world, in the current period t,

Exp_{it-1}^W – the value of exports of commodity i in the world, in the previous period t-1.

When interpreting the results of the Amir model both the RCA index values and the trends in their change are taken into account. When the index is bigger than one, but its value increases, the country's competitiveness in the production and export of certain goods is good and growing. With an RCA lower than one and has declined over the years, the market share shrinks, the country's competitive position in the export of certain goods is not good and worsens.

Based on the values of B. Balasa's indices stronger comparative competitive advantages for Bulgaria are seen in 2016, for example in the production and export of: lead and products made of lead; copper and copper products; wheat; zinc and articles thereof; wool; raw unprocessed leather; tobacco and tobacco products; oilseeds and plants; other seeds and plants for industrial and medical purposes; glass and glassware; fertilizers; garments and accessories for garments not knitted or knitted, etc. (see Annex 2) Despite their relatively lower added value, the export of these commodity groups can be expanded which will lead to increasing the competitiveness of the Bulgarian economy.

In some commodity groups there is a partial manifestation of the deficiency of the Balassa's index - its values for 2016 are high and do not fluctuate around one. This applies, for example, to: lead and articles thereof - with index of 13,4; copper and copper products - with index of 8,6; wheat and cereals - with index of 7,2; zinc and zinc articles etc. For these commodity groups the Balassa Index's conclusions should be accepted with some reservations mainly in order to take into account the results of the Amir index.

According to the values of the Ballasa Index there are also individual export examples in which there are comparative disadvantages. The Balassa index is less than one and underlines the need to limit the export of five commodity groups - iron and steel; cellulose from wood or other fibrous cellulose material like scrap paper; clothing and textiles; mineral fuels, mineral oils and products from their distillation, bituminous substances; pharmaceutical products. If, instead of them, other goods are exported, the contribution to competitiveness and economic growth will be more substantial. However, the Ballasa index for these several commodity groups is lower, but close to one. It is therefore possible to make efforts and achieve comparative advantages in the production and export of these goods.

The values of M. Amir's indices highlight Bulgaria's comparative competitive advantages in other commodities and commodity groups. According to these indices there are reasons to increase the production and export for example of: wheat; oilseeds and plants; other seeds and plants for industrial and medical purposes; clothing and accessories thereof, knitted or crocheted; essential oils, perfumery, cosmetics and toilet preparations; wool, felt and non-woven fabrics; ropes, cables and articles thereof, special yarns; articles of base metal, iron and steel; chemical products etc. (see Annex 2) For these commodity groups the Amir index values are higher and with the most pronounced and one-way upward trend.

It should be emphasized that the different commodity groups, which have been highlighted by the Balassa Index, show, in most cases, another dynamic of the Amir index - towards reduction or fluctuations. This confirms once again the inadequately convincing competitive advantage in these commodity groups. Our declining advantages, according to Amir's index, refer, for example, to lead and its products; copper and copper products; tobacco and manufactured substitutes for tobacco; products from the milling industry, malt, starch etc.

The need to limit exports also applies for goods with a uniquely downward trend in the value of the Amir index over the whole period under review. These include, for example, tobacco and substitutes for tobacco products; garments and clothing accessories not knitted or crocheted; other ready-made clothing and textiles; aircraft, spacecraft and parts for them. Although they are relatively small, these commodity groups are represented in Bulgarian exports and sometimes even in substantial volumes.

The aggregated commodity groups, according to the analysis of the values of the Balassa index or the Amir index, indicate a lagging behind in Bulgaria's production and exports in terms of sustainability and the emergence of higher-ranking advantages. There are still comparative advantages of a lower order, which are attributed to the availability of cheap and skilled labor, the production and use of relatively cheap electricity, the availability of primary raw materials and a favorable tax regime. They are the basis for achieving price competitiveness in which we rise from 11th to 5th place in the IMD rating. However, such advantages are unsustainable, have limited effects, are sensitive to changes in the international environment and are influenced by fluctuations in commodity prices on international markets. As a rule, they are important in creating and exporting products with relatively lower added value, focusing on resource extraction, labor-intensive production, assembly of products. Such advantages diminish their importance in the current conditions of changed competitive environment, especially under the influence of trade liberalization processes and market globalization.

The emerging tendency of broader inclusion in Bulgaria's exports of products with higher added value requires the achievement of more durable advantages of a higher rank. They are associated with the ability to develop high-tech production, to create and export goods with more processing stages and with higher intellectual content. Precisely these need to become priority directions for domestic and foreign investments and for state support in the future. Establishing appropriate prerequisites and implementing an innovative and export-oriented type of economic growth requires more public and private investment in science and research tailored to business needs and practically oriented education, support for start-ups and new high-tech businesses. This is also underlined in the Programme for Enhancing the Competitiveness of the National Economy of Bulgaria for the period 2014-2018.

CONCLUSION

In recent years there have been positive changes in foreign trade flows, which are a sign of a gradual increase in competitiveness and export efficiency. The results of the research of the Balassa Index and the Amir index for Bulgarian exports are not unequivocal, but allow the grouping of commodity groups with distinct competitive advantages as well as competitive disadvantages. They show that despite the emerging and still uneven transition to exports of products with higher added value, the export of low-value, resource-intensive types of products has not been completely overcome. In the context of the opportunities for increasing the competitiveness of the Bulgarian economy it is necessary to stimulate and expand the production and export of high-tech products and the reinvestment of received foreign exchange income and profits.

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Annex 1: Export of Bulgaria and World, commodity groups, 2012-2016*

Unit : US Dollar
thousand

Bulgaria

World

Code	Product label	Exported value in 2012	Exported value in 2013	Exported value in 2014	Exported value in 2015	Exported value in 2016	Exported value in 2012	Exported value in 2013	Exported value in 2014	Exported value in 2015	Exported value in 2016
TOTAL	All products	26698780	29510574	29386540	25778746	26087706	18459708910	18960159283	18970339459	16522585105	15862044431
85	Electrical machinery and equipment and parts thereof, sound recorders and reproducers, television ...	1852029	2323551	2491128	2509752	2531512	2195126794	2335905031	2403875743	2341918208	2332358812
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral ...	4319617	4348054	3705473	2737981	2406162	3393026283	3290844969	3045703878	1832063298	1525707478
84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	1848493	2135344	2296710	2043119	2082623	2082248229	2102020648	2160470707	1939245366	1892407158
74	Copper and articles thereof	2787053	3001757	2717826	2289684	1682092	173549530	166088633	156259279	130222858	119025151
10	Cereals	1061191	1579626	1231611	973495	1112363	120311259	123172743	119543275	105118803	93407663
99	Commodities not elsewhere specified	316201	323136	530215	655892	969906	302978922	325416992	369778988	403952483	266198997
62	Articles of apparel and clothing accessories, not knitted or crocheted	949452	1021449	1056250	904332	947272	193387078	208629455	234257478	220625936	221478157
30	Pharmaceutical products	743554	888283	1023735	898226	823557	469677940	490813200	516553337	502746009	505632740
87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	557715	694451	743943	711843	780328	1308767389	1355209293	1396237144	1325193827	1345616893
39	Plastics and articles thereof	599831	733895	793728	743146	741403	570361184	603608080	622338322	553761334	546550067
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal ...	728109	1009698	796141	611088	734460	93729964	100967623	100522627	87617941	88984342
61	Articles of apparel and clothing accessories, knitted or crocheted	711828	813329	843061	679282	733713	211725222	231619273	240427392	221728939	220645836
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; ...	468626	530179	634421	594759	646013	210776271	228816421	243774595	238847058	235326924
26	Ores, slag and ash	738818	741613	632145	534048	563410	237423365	249293800	233903965	158831203	158803414
73	Articles of iron or steel	454475	482191	513354	473951	530329	306488411	312230592	319412217	280946420	260001185
72	Iron and steel	922933	819160	728191	455483	442401	427777933	397838484	413529639	327575249	301120127
70	Glass and glassware	328433	340682	397942	391251	423829	71734209	74850209	74336688	69533364	69094426
38	Miscellaneous chemical products	69453	76814	99983	121692	350193	177994975	184777300	192318074	170280547	172158131

76	Aluminium and articles thereof	315929	357569	393738	364934	346724	161200664	165881589	176011843	165592321	158774822
74	Tobacco and manufactured tobacco substitutes	447296	507942	477062	373748	345684	43816441	45656761	45728055	40451309	41179877
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical ...	342603	287772	307457	285189	318750	554588009	564133374	575095532	543869609	536587572
44	Wood and articles of wood; wood charcoal	352795	364403	420476	352820	315128	119090107	132880599	141572756	126246464	128462011
40	Rubber and articles thereof	175765	233501	268309	261161	292162	221584576	208200370	193835699	167998707	162775777
33	Essential oils and resins; perfumery, cosmetic or toilet preparations	196634	221305	247195	250517	281680	105414920	113436461	118140237	111475061	115638075
51	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal ...	203901	273892	305635	273947	279217	106597550	99226445	96989562	86209014	87204330
95	Toys, games and sports requisites; parts and accessories thereof	149865	181285	218924	231936	270477	91923029	90581865	95356708	95597018	97683707
78	Inorganic chemicals, organic or inorganic compounds of precious metals, of rare-earth metals, ...	302683	278248	298595	283159	262062	129659430	126119710	121642216	110923462	99763006
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	189105	236570	261546	241960	254955	167608136	172851166	174640988	157042655	154350570
51	Fertilisers	260406	226063	241410	263557	243314	74911199	66999808	65081516	64254991	49904314
61	Preparations of cereals, flour, starch or milk; pastrycooks' products	194967	225888	241489	237342	237049	57987076	64727263	68159251	63264203	65560636
67	Footwear, gaiters and the like; parts of such articles	244949	262176	283426	236096	224640	117820675	129196468	142105686	134258404	135070716
52	Residues and waste from the food industries; prepared animal fodder	193937	254712	276256	233445	210570	73035475	81607877	82909078	71779635	68563029
70	Meat and edible meat offal	216055	187408	200993	167460	199195	117630751	124635571	131689693	109617492	113418302
64	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere ...	186802	231678	244671	207662	186443	81626334	93536885	97658045	75009013	72505318
69	Ceramic products	193880	190320	201260	174298	176275	47394719	51574478	56033434	57046900	50385688
78	Cocoa and cocoa preparations	74538	106270	135594	167877	172469	43954524	43961513	49851422	47680972	49545272
67	Zinc and articles thereof	166870	153934	187726	161009	163001	14980095	14031487	15752674	14802073	14419545
82	Lead and articles thereof	139458	171117	191081	159930	154807	6875395	7513019	7576719	6643689	7023905
70	Preparations of vegetables, fruit, nuts or other parts of plants	123399	132385	140023	133749	137554	57252982	61227268	61694658	62851740	58748363
72	Beverages, spirits and vinegar	165738	166752	147662	134275	136187	107945103	113676609	113438252	104699069	106141318
88	Miscellaneous articles of base metal	79454	84665	101254	107085	128200	58821441	62706486	67013129	64239841	62788763

'55	Man-made staple fibres	115083	129175	136822	120098	124472	39886235	41087320	42333892	39092190	36512990
'51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	107593	122976	129893	125295	117937	14552331	14516498	14347952	13260683	12551266
'53	Salt; sulphur; earths and stone; plastering materials, lime and cement	102843	105892	110037	110323	114774	46226048	45746955	46875951	42123248	38106987
'08	Edible fruit and nuts; peel of citrus fruit or melons	95265	116604	113394	112455	112019	90745108	99578053	105365162	103815656	107233198
'09	Coffee, tea, maté and spices	83406	78140	100415	96196	105063	48407674	45185670	49945858	48016409	47300137
'08	Articles of stone, plaster, cement, asbestos, mica or similar materials	73221	73536	77429	79380	96804	45221587	49665843	52612145	50494306	49081198
'07	Edible vegetables and certain roots and tubers	73281	77535	90566	78658	94824	58646583	66397955	67170263	61345189	69251988
'63	Other made-up textile articles; sets; worn clothing and worn textile articles; rags	106433	111632	108998	89524	94762	56681613	62444385	66432108	61266206	60087849
'17	Sugars and sugar confectionery	146738	130717	103878	89013	94504	52950833	51893883	46894414	40240643	42851900
'21	Miscellaneous edible preparations	61191	71385	82620	83687	90783	56861913	63095996	66566931	62362286	64809884
'86	Railway or tramway locomotives, rolling stock and parts thereof; railway or tramway track fixtures ...	100099	98366	95808	87603	79795	44351554	40294501	43356197	38324080	32183071
'34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial ...	57379	78144	79646	69589	76454	56077563	58329673	60056592	53679858	54162205
'29	Organic chemicals	107442	94102	93042	92251	75694	446629207	452114818	434907214	370637883	350800123
'16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates	31398	45884	65102	57061	75506	47445802	50037023	49946639	44324289	44639733
'71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad ...	219906	120505	101334	65544	75089	777547712	863857693	719694330	635642378	637581441
'55	Albuminoidal substances; modified starches; glues; enzymes	64566	80414	86273	81260	73945	26566670	28529468	29909081	26989428	26473008
'47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or ...	58388	74710	72898	63930	65279	45477016	46465871	46358156	44143158	43087110
'12	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles ...	54189	56027	65808	64108	64712	69218316	75075898	76631969	74998666	73749129
'54	Man-made filaments; strip and the like of man-made textile materials	45157	46182	46003	43854	63627	48116333	50358793	51264591	47034659	44617907
'56	Wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables and articles thereof	24464	32986	35698	40815	49044	22408428	23879860	25420803	23970435	23465892
'11	Products of the milling industry; malt; starches; inulin; wheat gluten	83159	85401	95419	51741	47111	18456192	19407493	19689985	18192968	17019204

96	Miscellaneous manufactured articles	36489	56286	56690	48798	45929	43648325	47426162	50193253	48269152	48911492
101	Live animals	33349	24861	18919	26199	43991	22261263	23310349	24512600	19226935	20367860
25	Cotton	30774	38438	41586	39520	41670	67758062	72036985	64078701	56354331	51183868
46	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, ...	27031	29258	33563	40866	38878	43619311	45993654	46127858	38581388	36268262
78	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal	39568	41041	43117	38657	38026	62923588	65035467	68129281	62202017	60324632
90	Knitted or crocheted fabrics	28390	31317	34346	32135	31070	30302333	32845395	34086135	33677694	32337159
101	Fish and crustaceans, molluscs and other aquatic invertebrates	28379	31169	26745	27925	30697	95867197	104826130	112889371	97394141	109921485
25	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring ...	27575	32598	32746	32790	26567	79646926	82057921	83892226	73893685	73943426
17	Raw hides and skins (other than furskins) and leather	36151	30855	26707	29413	24435	31944871	35692322	36402535	30163436	26342115
68	Ships, boats and floating structures	53642	5036	15785	8491	16999	158413279	146612793	138798883	133241520	123637347
16	Clocks and watches and parts thereof	15324	18735	14018	17207	16634	52824048	55408912	57550594	55326989	49947040
45	Carpets and other textile floor coverings	12136	16305	20291	18783	16520	14834147	15915818	16407043	14770721	14673576
85	Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery	5553	8575	11420	10894	12003	12708084	13394112	13639767	12628177	12121569
90	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage	8342	9357	8748	7508	11008	20858874	22152782	22484695	19318596	19846441
18	Other base metals; cermets; articles thereof	14859	11764	12556	10425	10302	18519124	17764610	18753586	16835225	15619472
50	Products of animal origin, not elsewhere specified or included	3851	6702	9278	6755	7339	9500890	10448149	10741767	8636471	8540887
65	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable ...	3446	4148	6089	6596	6801	24581973	25498411	26299293	24033104	23915631
88	Aircraft, spacecraft, and parts thereof	55817	35323	16006	9415	6750	287301601	313657254	322087459	331954984	328657803
59	Headgear and parts thereof	3317	4529	5678	4088	4541	7648146	8465489	9135945	8885990	9163539
26	Musical instruments; parts and accessories of such articles	3023	2693	3939	3508	3701	6643367	6538383	6658552	6320981	6182091
95	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations	6109	6132	5000	4310	3474	4395087	4647848	6535704	4460129	4176609
47	Fur skins and artificial fur; manufactures thereof	1070	2775	1638	1181	3120	12231489	14873309	12565476	11116066	8215224
99	Umbrellas, sun umbrellas, walking sticks, seat-sticks, whips, riding-crops and parts thereof	3342	4047	3636	3210	3087	3561440	3756255	4019199	3868794	3536314

13	Lac; gums, resins and other vegetable saps and extracts	1352	1634	2492	2978	2484	12722531	9312264	8703323	7092869	7026654
50	Silk	2561	2388	2444	1965	2222	3136902	3112103	2865962	2457651	2139408
53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn	2640	2897	2507	2761	1951	4004404	4282180	4718070	4675223	4139813
57	Photographic or cinematographic goods	20817	3770	3278	1647	1765	17935116	17263190	16486031	14647533	14536761
97	Works of art, collectors' pieces and antiques	901	1617	3323	2041	1745	23524488	24773812	27703010	29207824	28383064
67	Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles ...	2566	2714	2553	1320	1709	7174940	7908811	8652090	8867710	7337399
45	Cork and articles of cork	421	639	675	571	775	1700561	1761244	1822703	1596275	1642808
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	872	702	702	967	646	803514	818029	899200	904494	905445
46	Manufactures of straw, of esparto or of other plaiting materials; basket ware and wickerwork	185	344	391	360	229	2520211	2440519	2451225	2367703	2253668
5	Nickel and articles thereof	2351	12180	395	615	171	28671896	29128241	31751921	26272486	19326367
80	Tin and articles thereof	537	365	557	282	155	8331101	8045403	7855204	5406786	5147798
93	Arms and ammunition; parts and accessories thereof	1	0	2	2	2	15910717	18524488	13438935	16209664	14790498

* Source: International Trade Centre data.

Annex 2: Balassa Index and Amir Index for Bulgaria, 2012-2016*

Commodity Groups		Balassa index Bulgaria / World										Amir index Bulgaria / World							
Code	Product label	Balassa 2012		Balassa 2013		Balassa 2014		Balassa 2015		Balassa 2016		Amir 2013		Amir 2014		Amir 2015		Amir 2016	
'78	Lead and articles thereof	14.024	n/a	14.633	↑	16.280	↑	15.429	↓	13.401	↓	15.568	n/a	16.410	↑	15.533	↓	14.758	↓
'74	Copper and articles thereof	11.103	n/a	11.612	↑	11.228	↓	11.269	↑	8.593	↓	10.819	n/a	10.558	↓	10.783	↑	8.181	↓
'10	Cereals	6.098	n/a	8.240	↑	6.651	↓	5.936	↓	7.241	↑	8.213	n/a	6.451	↓	5.993	↓	6.702	↑
'79	Zinc and articles thereof	7.702	n/a	7.048	↓	7.693	↑	6.972	↓	6.873	↓	6.428	n/a	8.632	↑	7.522	↓	6.974	↓
'51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	5.112	n/a	5.443	↑	5.844	↑	6.056	↑	5.713	↓	5.286	n/a	5.773	↑	6.426	↑	5.633	↓
'24	Tobacco and manufactured tobacco substitutes	7.058	n/a	7.148	↑	6.735	↓	5.922	↓	5.104	↓	7.251	n/a	6.742	↓	6.015	↓	5.412	↓
'12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal ...	5.371	n/a	6.425	↑	5.113	↓	4.470	↓	5.019	↑	6.738	n/a	5.087	↓	4.474	↓	5.309	↑
'70	Glass and glassware	3.166	n/a	2.924	↓	3.456	↑	3.606	↑	3.730	↑	2.971	n/a	3.430	↑	3.873	↑	3.860	↓
'31	Fertilisers	2.403	n/a	2.168	↓	2.395	↑	2.629	↑	2.965	↑	1.888	n/a	2.325	↑	2.980	↑	2.398	↓
'62	Articles of apparel and clothing accessories, not knitted or crocheted	3.395	n/a	3.146	↓	2.911	↓	2.627	↓	2.601	↓	3.304	n/a	3.267	↓	2.841	↓	2.719	↓
'99	Commodities not elsewhere specified	0.722	n/a	0.638	↓	0.926	↑	1.041	↑	2.215	↑	0.667	n/a	1.051	↑	1.305	↑	1.521	↑
'19	Preparations of cereals, flour, starch or milk; pastrycooks' products	2.325	n/a	2.242	↓	2.287	↑	2.405	↑	2.198	↓	2.437	n/a	2.407	↓	2.562	↑	2.373	↓
'26	Ores, slag and ash	2.152	n/a	1.911	↓	1.745	↓	2.155	↑	2.157	↑	1.954	n/a	1.636	↓	1.680	↑	2.247	↑
'69	Ceramic products	2.828	n/a	2.371	↓	2.319	↓	1.958	↓	2.127	↑	2.512	n/a	2.518	↑	2.289	↓	1.957	↓
'18	Cocoa and cocoa preparations	1.172	n/a	1.553	↑	1.756	↑	2.257	↑	2.117	↓	1.512	n/a	1.990	↑	2.478	↑	2.291	↓
'55	Man-made staple fibres	1.995	n/a	2.020	↑	2.086	↑	1.969	↓	2.073	↑	2.026	n/a	2.149	↑	2.088	↓	2.017	↓
'61	Articles of apparel and clothing accessories, knitted or crocheted	2.325	n/a	2.256	↓	2.264	↑	1.964	↓	2.022	↑	2.403	n/a	2.348	↓	2.079	↓	2.096	↑
'15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal ...	1.323	n/a	1.773	↑	2.034	↑	2.037	↑	1.947	↓	1.607	n/a	1.987	↑	2.079	↑	2.051	↓
'23	Residues and waste from the food industries; prepared animal fodder	1.836	n/a	2.005	↑	2.151	↑	2.084	↓	1.867	↓	2.182	n/a	2.184	↑	2.072	↓	1.858	↓
'25	Salt; sulphur; earths and stone; plastering	1.538	n/a	1.487	↓	1.515	↑	1.679	↑	1.831	↑	1.433	n/a	1.552	↑	1.732	↑	1.726	↓

	materials, lime and cement																		
'35	Albuminoidal substances; modified starches; glues; enzymes	1.680	n/a	1.811	↑	1.862	↑	1.930	↑	1.698	↓	1.893	n/a	1.951	↑	1.999	↑	1.735	↓
'95	Toys, games and sports requisites; parts and accessories thereof	1.127	n/a	1.286	↑	1.482	↑	1.555	↑	1.684	↑	1.234	n/a	1.559	↑	1.790	↑	1.792	↑
'11	Products of the milling industry; malt; starches; inulin; wheat gluten	3.115	n/a	2.827	↓	3.128	↑	1.823	↓	1.683	↓	2.894	n/a	3.172	↑	1.934	↓	1.640	
'94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; ...	1.537	n/a	1.489	↓	1.680	↑	1.596	↓	1.669	↑	1.573	n/a	1.789	↑	1.795	↑	1.713	↓
'28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, ...	1.614	n/a	1.417	↓	1.585	↑	1.636	↑	1.597	↓	1.342	n/a	1.528	↑	1.713	↑	1.496	↓
'04	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere ...	1.582	n/a	1.591	↑	1.617	↑	1.774	↑	1.564	↓	1.775	n/a	1.688	↓	1.565	↓	1.574	↑
'86	Railway or tramway locomotives, rolling stock and parts thereof; railway or tramway track fixtures ...	1.560	n/a	1.568	↑	1.427	↓	1.465	↑	1.508	↑	1.387	n/a	1.534	↑	1.487	↓	1.319	↓
'44	Wood and articles of wood; wood charcoal	2.048	n/a	1.762	↓	1.917	↑	1.791	↓	1.492	↓	1.914	n/a	2.042	↑	1.834	↓	1.581	↓
'33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations	1.290	n/a	1.253	↓	1.351	↑	1.440	↑	1.481	↑	1.313	n/a	1.406	↑	1.560	↑	1.600	↑
'20	Preparations of vegetables, fruit, nuts or other parts of plants	1.490	n/a	1.389	↓	1.465	↑	1.364	↓	1.424	↑	1.446	n/a	1.476	↑	1.595	↑	1.386	↓
'09	Coffee, tea, maté and spices	1.191	n/a	1.111	↓	1.298	↑	1.284	↓	1.351	↑	1.010	n/a	1.434	↑	1.417	↓	1.386	↓
'17	Sugars and sugar confectionery	1.916	n/a	1.618	↓	1.430	↓	1.418	↓	1.341	↓	1.544	n/a	1.292	↓	1.397	↑	1.487	↑
'76	Aluminium and articles thereof	1.355	n/a	1.385	↑	1.444	↑	1.413	↓	1.328	↓	1.388	n/a	1.531	↑	1.526	↓	1.326	↓
'01	Live animals	1.036	n/a	0.685	↓	0.498	↓	0.873	↑	1.313	↑	0.699	n/a	0.524	↓	0.787	↑	1.449	↑
'56	Wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables and articles thereof	0.755	n/a	0.887	↑	0.907	↑	1.091	↑	1.271	↑	0.921	n/a	0.965	↑	1.182	↑	1.296	↑
'83	Miscellaneous articles of base metal	0.934	n/a	0.867	↓	0.975	↑	1.068	↑	1.241	↑	0.900	n/a	1.042	↑	1.176	↑	1.264	↑
'73	Articles of iron or steel	1.025	n/a	0.992	↓	1.038	↑	1.081	↑	1.240	↑	0.984	n/a	1.061	↑	1.092	↑	1.196	↑
'38	Miscellaneous chemical products	0.270	n/a	0.267	↓	0.336	↑	0.458	↑	1.237	↑	0.270	n/a	0.349	↑	0.466	↑	1.303	↑
'68	Articles of stone, plaster, cement, asbestos, mica or similar materials	1.119	n/a	0.951	↓	0.950	↓	1.008	↑	1.199	↑	1.017	n/a	1.006	↓	1.110	↑	1.214	↑

'40	Rubber and articles thereof	0.548	n/a	0.721	↑	0.894	↑	0.996	↑	1.091	↑	0.659	n/a	0.831	↑	0.991	↑	1.101	↑
'02	Meat and edible meat offal	1.270	n/a	0.966	↓	0.985	↑	0.979	↓	1.068	↑	0.997	n/a	1.040	↑	0.936	↓	1.151	↑
'16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates	0.458	n/a	0.589	↑	0.841	↑	0.825	↓	1.028	↑	0.605	n/a	0.839	↑	0.841	↑	1.079	↑
'64	Footwear, gaiters and the like; parts of such articles	1.437	n/a	1.304	↓	1.288	↓	1.127	↓	1.011	↓	1.392	n/a	1.415	↑	1.223	↓	1.060	↓
'48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	0.780	n/a	0.879	↑	0.967	↑	0.988	↑	1.004	↑	0.883	n/a	0.976	↑	1.020	↑	1.028	↑
'30	Pharmaceutical products	1.095	n/a	1.163	↑	1.279	↑	1.145	↓	0.990	↓	1.183	n/a	1.346	↑	1.280	↓	1.037	↓
'27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral ...	0.880	n/a	0.849	↓	0.785	↓	0.958	↑	0.959	↑	0.802	n/a	0.726	↓	0.662	↓	0.832	↑
'63	Other made-up textile articles; sets; worn clothing and worn textile articles; rags	1.298	n/a	1.149	↓	1.059	↓	0.937	↓	0.959	↑	1.232	n/a	1.126	↓	0.992	↓	0.980	↓
'47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or ...	0.888	n/a	1.033	↑	1.015	↓	0.928	↓	0.921	↓	1.028	n/a	1.012	↓	1.015	↑	0.937	↓
'72	Iron and steel	1.492	n/a	1.323	↓	1.137	↓	0.891	↓	0.893	↑	1.198	n/a	1.181	↓	0.811	↓	0.855	↑
'54	Man-made filaments; strip and the like of man-made textile materials	0.649	n/a	0.589	↓	0.579	↓	0.598	↑	0.867	↑	0.600	n/a	0.589	↓	0.630	↑	0.857	↑
'34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial ...	0.707	n/a	0.861	↑	0.856	↓	0.831	↓	0.858	↑	0.872	n/a	0.881	↑	0.853	↓	0.902	↑
'21	Miscellaneous edible preparations	0.744	n/a	0.727	↓	0.801	↑	0.860	↑	0.852	↓	0.785	n/a	0.845	↑	0.925	↑	0.922	↓
'07	Edible vegetables and certain roots and tubers	0.864	n/a	0.750	↓	0.870	↑	0.822	↓	0.833	↑	0.827	n/a	0.880	↑	0.862	↓	0.979	↑
'39	Plastics and articles thereof	0.727	n/a	0.781	↑	0.823	↑	0.860	↑	0.825	↓	0.805	n/a	0.848	↑	0.879	↑	0.848	↓
'22	Beverages, spirits and vinegar	1.062	n/a	0.942	↓	0.840	↓	0.822	↓	0.780	↓	0.966	n/a	0.838	↓	0.871	↑	0.824	↓
'57	Carpets and other textile floor coverings	0.566	n/a	0.658	↑	0.798	↑	0.815	↑	0.685	↓	0.688	n/a	0.823	↑	0.842	↑	0.708	↓
'84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	0.614	n/a	0.653	↑	0.686	↑	0.675	↓	0.669	↓	0.641	n/a	0.705	↑	0.696	↓	0.680	↓
'85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	0.583	n/a	0.639	↑	0.669	↑	0.687	↑	0.660	↓	0.662	n/a	0.688	↑	0.768	↑	0.685	↓
'49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, ...	0.428	n/a	0.409	↓	0.470	↑	0.679	↑	0.652	↓	0.420	n/a	0.471	↑	0.652	↑	0.638	↓

'08	Edible fruit and nuts; peel of citrus fruit or melons	0.726	n/a	0.752	↑	0.695	↓	0.694	↓	0.635	↓	0.804	n/a	0.735	↓	0.785	↑	0.683	↓
'50	Silk	0.564	n/a	0.493	↓	0.551	↑	0.512	↓	0.632	↑	0.476	n/a	0.507	↑	0.505	↓	0.573	↑
'58	Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery	0.302	n/a	0.411	↑	0.540	↑	0.553	↑	0.602	↑	0.422	n/a	0.550	↑	0.588	↑	0.602	↑
'60	Knitted or crocheted fabrics	0.648	n/a	0.613	↓	0.650	↑	0.612	↓	0.584	↓	0.646	n/a	0.675	↑	0.694	↑	0.584	↓
'96	Miscellaneous manufactured articles	0.578	n/a	0.763	↑	0.729	↓	0.648	↓	0.571	↓	0.807	n/a	0.771	↓	0.715	↓	0.603	↓
'41	Raw hides and skins (other than furskins) and leather	0.782	n/a	0.555	↓	0.474	↓	0.625	↑	0.564	↓	0.604	n/a	0.483	↓	0.595	↑	0.513	↓
'42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles ...	0.541	n/a	0.479	↓	0.554	↑	0.548	↓	0.534	↓	0.506	n/a	0.566	↑	0.616	↑	0.546	↓
'66	Umbrellas, sun umbrellas, walking sticks, seat-sticks, whips, riding-crops and parts thereof	0.649	n/a	0.692	↑	0.584	↓	0.532	↓	0.531	↓	0.711	n/a	0.625	↓	0.588	↓	0.505	↓
'05	Products of animal origin, not elsewhere specified or included	0.280	n/a	0.412	↑	0.558	↑	0.501	↓	0.522	↑	0.441	n/a	0.573	↑	0.463	↓	0.538	↑
'36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations	0.961	n/a	0.848	↓	0.494	↓	0.619	↑	0.506	↓	0.873	n/a	0.694	↓	0.485	↓	0.493	↑
'52	Cotton	0.314	n/a	0.343	↑	0.419	↑	0.449	↑	0.495	↑	0.355	n/a	0.372	↑	0.454	↑	0.468	↑
'14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	0.750	n/a	0.551	↓	0.504	↓	0.685	↑	0.434	↓	0.547	n/a	0.554	↑	0.791	↑	0.452	↓
'81	Other base metals; cermets; articles thereof	0.555	n/a	0.425	↓	0.432	↑	0.397	↓	0.401	↑	0.397	n/a	0.456	↑	0.409	↓	0.388	↓
'82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal	0.435	n/a	0.405	↓	0.409	↑	0.398	↓	0.383	↓	0.408	n/a	0.428	↑	0.418	↓	0.387	↓
'92	Musical instruments; parts and accessories of such articles	0.315	n/a	0.265	↓	0.382	↑	0.356	↓	0.364	↑	0.254	n/a	0.389	↑	0.388	↓	0.371	↓
'90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical ...	0.427	n/a	1.831	↑	0.345	↓	0.336	↓	0.361	↑	0.325	n/a	1.965	↑	0.365	↓	0.371	↑
'87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	0.295	n/a	0.329	↑	0.344	↑	0.344	↑	0.353	↑	0.332	n/a	0.354	↑	0.375	↑	0.373	↓
'06	Live trees and other plants; bulbs, roots and	0.277	n/a	0.271	↓	0.251	↓	0.249	↓	0.337	↑	0.281	n/a	0.255	↓	0.246	↓	0.361	↑

	the like; cut flowers and ornamental foliage																		
'65	Headgear and parts thereof	0.300	n/a	0.344	↑	0.401	↑	0.295	↓	0.301	↑	0.370	n/a	0.433	↑	0.329	↓	0.324	↓
'45	Cork and articles of cork	0.171	n/a	0.233	↑	0.239	↑	0.229	↓	0.287	↑	0.235	n/a	0.247	↑	0.231	↓	0.307	↑
'53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn	0.456	n/a	0.435	↓	0.343	↓	0.379	↑	0.287	↓	0.453	n/a	0.378	↓	0.431	↑	0.264	↓
'43	Furskins and artificial fur; manufactures thereof	0.060	n/a	0.120	↑	0.084	↓	0.068	↓	0.231	↑	0.142	n/a	0.071	↓	0.069	↓	0.178	↑
'32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring ...	0.239	n/a	0.255	↑	0.252	↓	0.284	↑	0.218	↓	0.256	n/a	0.257	↑	0.288	↑	0.228	↓
'13	Lac; gums, resins and other vegetable saps and extracts	0.073	n/a	0.113	↑	0.185	↑	0.269	↑	0.215	↓	0.080	n/a	0.173	↑	0.252	↑	0.222	↓
'91	Clocks and watches and parts thereof	0.201	n/a	0.217	↑	0.157	↓	0.199	↑	0.202	↑	0.222	n/a	0.163	↓	0.220	↑	0.190	↓
'59	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable ...	0.097	n/a	0.105	↑	0.149	↑	0.176	↑	0.173	↓	0.106	n/a	0.154	↑	0.185	↑	0.179	↓
'03	Fish and crustaceans, molluscs and other aquatic invertebrates	0.205	n/a	0.191	↓	0.153	↓	0.184	↑	0.170	↓	0.203	n/a	0.165	↓	0.182	↑	0.200	↑
'67	Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles ...	0.247	n/a	0.220	↓	0.190	↓	0.095	↓	0.142	↑	0.237	n/a	0.208	↓	0.112	↓	0.122	↑
'29	Organic chemicals	0.166	n/a	0.134	↓	0.138	↑	0.160	↑	0.131	↓	0.132	n/a	0.133	↑	0.156	↑	0.129	↓
'89	Ships, boats and floating structures	0.234	n/a	0.022	↓	0.073	↑	0.041	↓	0.084	↑	0.020	n/a	0.069	↑	0.045	↓	0.081	↑
'37	Photographic or cinematographic goods	0.803	n/a	0.140	↓	0.128	↓	0.072	↓	0.074	↑	0.131	n/a	0.123	↓	0.074	↓	0.076	↑
'71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad ...	0.196	n/a	0.090	↓	0.091	↑	0.066	↓	0.072	↑	0.097	n/a	0.076	↓	0.067	↓	0.075	↑
'46	Manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork	0.051	n/a	0.091	↑	0.103	↑	0.097	↓	0.062	↓	0.085	n/a	0.103	↑	0.108	↑	0.061	↓
'97	Works of art, collectors' pieces and antiques	0.026	n/a	0.042	↑	0.077	↑	0.045	↓	0.037	↓	0.043	n/a	0.087	↑	0.054	↓	0.038	↓
'80	Tin and articles thereof	0.045	n/a	0.029	↓	0.046	↑	0.033	↓	0.018	↓	0.027	n/a	0.045	↑	0.026	↓	0.018	↓
'88	Aircraft, spacecraft, and parts thereof	0.134	n/a	0.072	↓	0.032	↓	0.018	↓	0.012	↓	0.077	n/a	0.033	↓	0.022	↓	0.013	↓
'75	Nickel and articles thereof	0.057	n/a	0.269	↑	0.008	↓	0.015	↑	0.005	↓	0.266	n/a	0.009	↓	0.014	↑	0.004	↓
'93	Arms and ammunition; parts and accessories thereof	0.000	n/a	0.000	↓	0.000	↑	0.000	↓	0.000	↑	0.000	n/a	0.000	↑	0.000	↑	0.000	↓

Sources: calculations based on UN COMTRADE statistics.

REDUCING REGIONAL DISPARITIES IN THE IMPACT OF DEVELOPING CLUSTERS

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Abstract: *The issue of regional development aimed to reducing regional disparities is a current topic in the whole of the European Union. Socio-economic analysis of the region is starting activity in determining the development strategy of the region. In the analysis of regional development will use a variety of concepts and methods. Regional development concepts are always confronted with convergence or divergence. The main aim of this paper is to access the level of regional disparities in the Slovak Republic with a focus on the role of cluster in regional development. The analysis is carried out using the beta and sigma convergence of statistical data classified in the cross-sectional structure*

Keywords: *Region, Regional disparities, Beta convergence*

JEL Classifications C43 · O18 · R11

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1. INTRODUCTION

Regional policy is concerned with improving the welfare and performance of the regions. The aim of regional policy is to ensure the development of the regions and reduce the differences in their development. Different socio-economic level of the regions has an impact on the overall economic development of the country. Regional development is a set of economic, cultural and environmental processes and relationships that take place in the region. These relationships have a lasting impact on the economic, social and territorial development and for reducing these differences.

With the theory and practice of regional development combines the concept of cluster. The concept of the first cluster has defined its work by Michael Porter (1980). It is a geographic concentration of interconnected companies, specialized suppliers, service providers in related industries and institutions in a certain area. These businesses have both compete but also cooperate with each other. It is now considered as an important element of the concept of cluster development (Porter, 2000).

The dynamics of regional development is currently a frequent theme. Knowledge of the economic level of the regions and disparities is necessary due to the proposal for the next steps for the realization of development of the various regions. The main task of regional development is to reduce regional disparities and the promotion of economic growth with a view to raising the standard of living of the inhabitants of the region.

The basic aim of the paper is to evaluate the use of selected indicators of regional disparities in the Slovak Republic with a focus on the importance of clusters in regional development.

2. CLUSTERS AND REGIONAL DEVELOPMENT

The aim of regional policy is to ensure the development of the regions and reducing development disparities. Apply in the current global economy is only possible through the integration of the various partnerships and alliances. Such networking business can be, for example, the shape of the cluster. The cluster is an incentive for economic development. Regionality is the linchpin for the stable development of the cluster, which has an important role in the selection of the priority directions of investment in the region. The effectiveness of the investment is subject to the reciprocal links between the participants by strengthening the cluster (Krajňáková, 2016).

In the context of cluster definitions overlap with areas of cooperation and relations between firms, agglomerating effects, social capital, economies of scale, the transfer and dissemination of technology, innovation and knowledge management. Innovation, innovation policies and implementation strategies are one of the most important aspects of the current international economy and business development issues (Kordoš, Karbach, 2014; Sipa, Lemanska-Majdzik, Okreglicka, 2016).

The clusters are becoming particularly important in industries where the Gibratov law and where small enterprises are not growing faster than big companies are. Small businesses do not, therefore, one of its primary advantages over big firms (Leitão, Serrasqueiro, Nunes, 2010; Del Monte, Papagni, 2003).

Clusters play a major role in the development of the various regions by contributing to an increase in their competitiveness (Navickas, Vojtovic, Svazas, 2016). The importance of the cluster in regional development is based, in particular, in improving the Division of labour, increasing

migration of workers between enterprises, the cooperation of the undertakings within the framework of the Department, the growth in the number of jobs, higher wages, higher rate of patenting, creation of new types of businesses, their growth and survival rates and other benefits (Schwab, Porter, Sachs, 2001).

The promotion of regional development, the influence of the existence of the cluster in the region is influenced by several factors: the level of scientific-research base and access to research institutions and facilities in the region, the second entrepreneurial culture of the participating companies, the proximity of markets, and the level of transport infrastructure, the level of use of materials technology, the availability of skilled labour, availability of financing, availability and the ability to raw material and availability of inputs, availability and the level of potential participants in the cluster and the availability of foreign markets. The economic development of the country and its regions are affected by other factors, conditions and relations of the spectrum. New forms of specialization, institutionalization, the creation of regional, trans-regional and trans-national flows and processes in real time, including new perspectives on the structure of and changes to the comparative advantages of the countries and territories shall contribute to the the total change in economic development (Kordos, Vojtovic, 2016).

At present, Slovakia registered eleven major technology clusters. Innovation and Energy Agency keeps track of these clusters (Slovenská inovačná a energetická agentúra, <https://www.siea.sk/databaza-technologickych-klastrov>).

Table 1 Technological clusters in SR

	<i>Name of cluster</i>	<i>Region</i>
1	ABC - Academic Business Cluster	Bratislava
2	National Energetic Cluster NEK	Bratislava
3	Automotive cluster	Trnava
4	Electrotechnic cluster	Trnava
5	Slovak plastic cluster	Nitra
6	Z@ict	Žilina
7	1. Slovak engineering cluster	Banská Bystrica
8	Energetic cluster of Region Prešov	Prešov
9	Cluster AT+R	Prešov
10	Košice IT Valley z.p.o	Košice
11	BITERAP cluster	Košice

From the data, it is evident that in the region of Trenčín is not a technology cluster. The intention of the article is to compare the conditions of all counties with few economic indicators on the method of regional convergence. Based on the results of the analysis to define the potential of the Trenčín region for the creation of a technology cluster.

3. REGIONAL DISPARITIES

The reason for the implementation of regional policy are different levels of social and economic development between the various regions, what is referred to as regional disparities. Disparities are not only social and economic dimension, but can be understood by a broader, such as inequalities in spatial, geographical, political, social, environmental and resource (Habánik, Koišová, 2011).

In General, the concept of inequality, diversity or disparity reflects the diversity, disparity between different phenomena. To the understanding of the specific concept of regional disparities (RD) can be accessed from different points of view. By Kutscherauera (2010) represent diversity or disparity RD of the characters, events, or processes that have a clear spatial location, and there are at least two territorial entities in this structure. In European terms, are a measure of the level of economic, social and territorial cohesion of the RD of the European territory? In the article, we will explore the economic disparities.

One of the effective solutions of regional disparities is support the development of clusters in regions such as Havierníková and Strunz (2014) says: One possibility how to contribute to the regional development is interconnection between businesses, educational institutions and local government entities into the purpose-built configurations – clusters.

Regional disparities, which are exacerbated while existing spatial structure of the Slovak economy, which is inherently unbalanced does not create conditions for effective regional development and thereby are reduces the competitiveness of regions therefore the clusters represent a fundamental organizing framework for understanding local economy in regions and for developed economic performance and competitiveness (Král'ová, Sochuľáková, 2016).

Measurement and evaluation of regional disparities (RD)

The primary condition for balancing regional disparities is to quantify their level. The analysis is subject to obtaining the relevant data RD. This requires sufficient knowledge and guidance in a wide range of published methods and ways of their implementation. In general, one can speak of a threefold assessment of RD: selection of observational units, the selection of appropriate indicators and the selection of the appropriate method.

When choosing the observational units we only have statistical data that are available only in defined statistical territorial units at NUTS level. The correct selection of the indicators depends on many factors, from the definition of the RD, the objective pursued, which is to track the analysis. It further depends on the territorial scale, the power indicator lights and their evaluation. There are simple and composite (aggregated, integrated) indicators.

Composite indicators represent a higher degree of identification RD. Based on appropriate links a range of indicators. Their basic attribute is sufficient comparative ability, mathematical manageability and readability of the information. The method of aggregation is based on the use of multiple methods. Methods, tools and measures can be classified according to the different aspects of the RD. According to the mathematical complexity to simple and complex multivariate statistical methods. By the time the static and dynamic. According to a notice the power of the deterministic and stochastic. From a substantive point of view for easy and integrated. From the aspect of the development of the assessment on the convergent and divergent. Michalek (2014) defined by the basic concepts, approaches and methods for the measurement RD and divided them as follows:

- indirect methods (IE large-scale techniques, method, the semaphore, the point method),
- direct comparative methods (methods of statistic and dynamic interregional comparison),
- simple statistical method (method of spatial polarisation, the coefficient of variation)
- rates of spatial concentration (concentration coefficient, location quotient, Gini coefficient, Lorentz curve), indexes of entropys (Measure of entropy, Theil's index, Hoover's index),

- complex statistical models (regression models, correlation analysis, PCA analysis, Factor analysis, Cronbach coefficient alpha, Cluster analysis, method of distance from the fictional object, the analysis of time series)
- statistical summary of descriptive methods and variables (aggregate techniques, the method of the efficiency of the border, the distance from the target, the expert decision),
- new methods and tools (neural networks method, real convergence, GIS).

4. MATERIAL AND METHODS

In assessing the need for an integrated perspective on the issue arises RD. This is related to the construction of a Composite Indicator (*CI*). The Organization for economic cooperation and development (OECD) in 2008 has published the methodology and process of its construction. The composite indicator is a higher level of identification and interpretation of the RD (Handbook on Constructing Composite Indicators, 2017). For the calculation of the composite indicator itself for each region is used additional aggregate method. The formula for the calculation is the following:

$$CI_r = \frac{\sum_{i=1}^n I_{i,r} w_i}{\frac{\sum_{i=1}^n \sum_{r=1}^m I_{i,r}}{m}}, \quad (1)$$

where

$$I_{i,r} = \frac{x_{i,r} - \min_r(x_i)}{\max_r(x_i) - \min_r(x_i)} \quad (2)$$

in the case of a positive orientation of indicator $x_{i,r}$ a

$$I_{i,r} = \frac{\max_r(x_i) - x_{i,r}}{\max_r(x_i) - \min_r(x_i)} \quad (3)$$

in the case of a negative orientation of indicator $x_{i,r}$, i is number of indicator, r is region and w_i is the weight of indicator. If the value of the $CI_r \cong 1$, studied region r can be considered as the average. In the case of value greater than 1 for an above average and otherwise mediocre.

To comparing regions with a *CI*, we can use the methods of real convergence. It is used by several of the concepts: beta (β) convergence (absolute, conditional) and sigma (σ) convergence. Sigma convergence tests measure whether the variance in the regional distribution of the indicator. Beta convergence tests shall examine whether regions with low levels of indicator experienced stronger growth than regions with a high level of the indicator (Minařík, Borůvková, Vystrčil, 2013).

β -convergence

Under the process of convergence can be imagined, for example, reducing disparities between multiple variables at a time, up to a level where the difference converges to zero. The opposite of convergence is divergence represents the concept, according to which the less developed regions are growing faster than the more developed regions. The subject of research is the only condition for the beginning and end of the period under review. This can be a disadvantage, because the information on developments remain unused. β - convergence is examined by using the equation:

$$\frac{1}{T} \cdot \log \left(\frac{x_{i,t_0+T}}{x_{i,t_0}} \right) = a - \left(\frac{1-e^{-\beta T}}{T} \right) \cdot \log(x_{i,t_0}) + u_{i,t_0,t_0+T}, \quad (4)$$

x_{i,t_0} (x_{i,t_0+T}) is value of analysed indicator in time t_0 , ($t_0 + T$), β is the speed of convergence, u_{i,t_0,t_0+T} is the random component of the t_0 and $t_0 + T$. According to the directive of the straight line, β , if $\beta < 0$ there is a tendency for convergence, if $\beta > 0$ there is a tendency for divergence, if $\beta \cong 0$ it shows none of the tendencies. Coefficient of determination $r^2 = \frac{\text{var log } \bar{k}}{\text{var log } k}$, where \bar{k} is average growth of the reference indicator, indicates an estimated reliability of a linear trend. If the value of the coefficient of determination, close to 100%, it is considered a tendency (convergence) as a major. Otherwise, it is considered to be insignificant (Janssen, Hande, De Beer, Van Wissen, 2016).

5. EVALUATION OF THE REDUCTION OF THE DISPARITIES IN THE SLOVAK REPUBLIC

For the assessment of the appropriateness of the establishment of a technology cluster in the Trenčín region, we analysed the five economic indicators from the database of Statistical office of the Slovak republic. In brackets are given the units of indicators.

x_1 - Gross value added at current prices (mill. €), x_2 - The total regional employment in the industry, x_3 - Regional gross domestic product per capita (€), x_4 - Gross fixed capital formation in current prices (mill. €), x_5 - The economically active population. All indicators are positive orientation.

Comparison of the regions from the point of view of selected indicators for the period 2000-2016, was because the data for the year 2017 are not yet officially published. For the mutual comparability of indicators were recalculated on the middle condition of the population in a given region in a given year.

The determination of weights of indicators

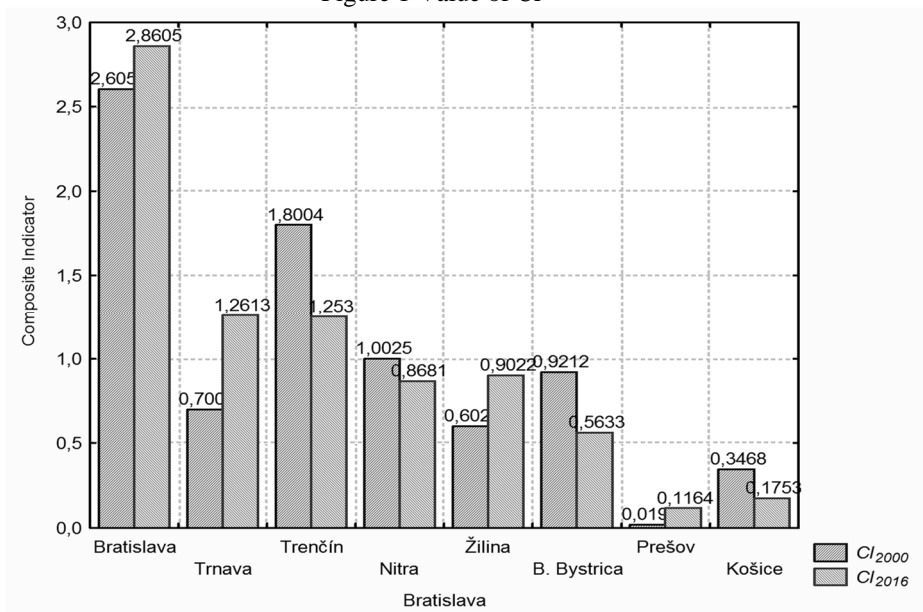
Each indicator included in the analysis was assessed by using a exploratory analysis. Descriptive statistics were calculated (location, variability and symmetry). Graphical methods are identified the extreme values, data independence, homogeneity. The starting point to determine the weights of the individual indicators was the PCA analysis.

Table 2. The weights of the individual indicators

Indicator x_i	x_1	x_2	x_3	x_4	x_5
Weight w_i	0,2964	0,1347	0,3429	0,0992	0,1268

Source: own processing

In the following column chart shows calculated values of CI for the year 2000 and 2016 for each region.

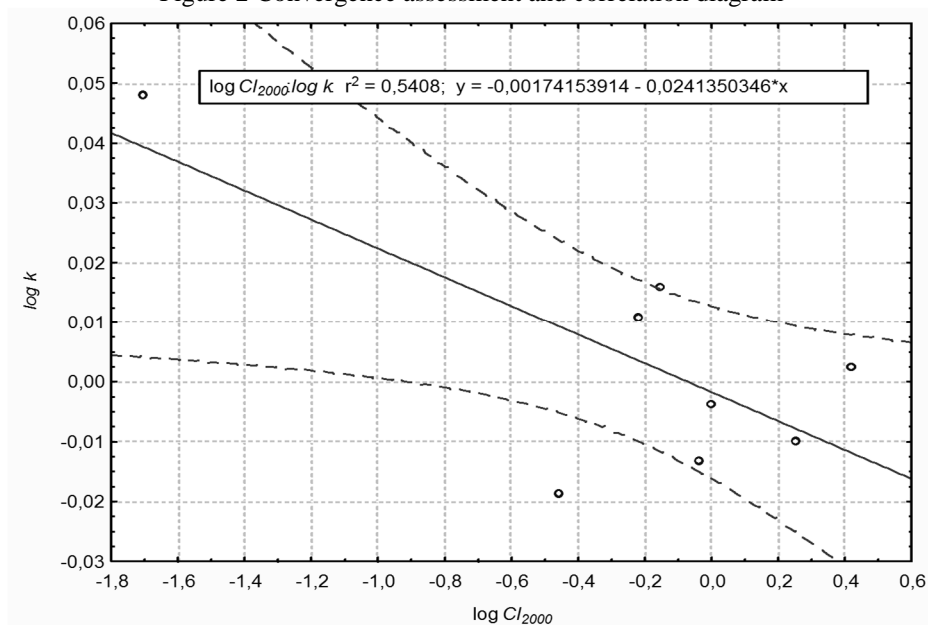
Figure 1 Value of *CI*

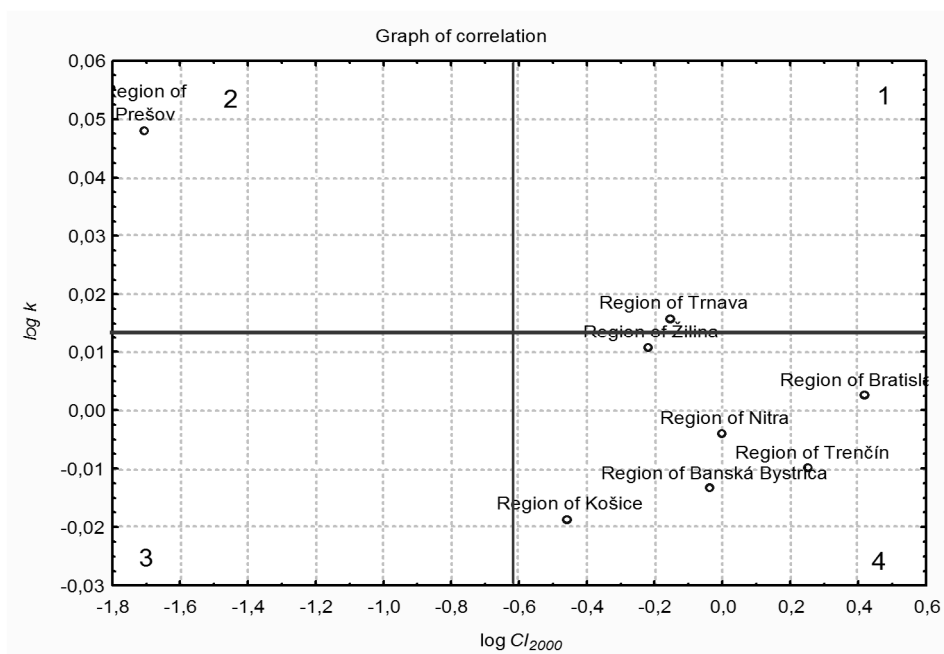
Source: own processing

From the chart you can see the value of *CI* in the economic sphere in some regions has grown, but has fallen in some regions. Most of this increase can be observed in the region. The biggest decline recorded by region.

The following chart may be assessed to the convergence regions tended to in the economic field. Of the correlation chart, it can be concluded on the position of the individual regions.

Figure 2 Convergence assessment and correlation diagram





Source: own processing

The development of the regions is compared using the method β -convergence. The graph shows the decreasing trend in the regression line, with a coefficient of determination $r^2 = 54,08 \%$, while the speed of convergence is 0,0241. Conclusion of the measurement β -convergence is thus, that in the reporting period in the eight regions with the convergence and regional disparities will diminish.

Correlation diagram is divided into four quadrants. The region of the first quadrant (Trnava) above the initial value of the highest economic growth at CI . The region of the second quadrant (Prešov) displays a combination of below-average initial value and the rapid pace of growth in the economic field. In the third quadrant was not on any region. In the fourth quadrant is situated six remaining regions. As regards economic matters, when the superior value of CI in the year 2000 showing the slowest growth.

CONCLUSION

The basic purpose of regional development is to sustainably increase the quality of life in the region. The realization of this objective requires a comprehensive approach to the assessment of differences between regions, and by assessing their potential for the formation of the cluster cooperation. One of the approaches is the measurement and comparison of regional development at the time of the level or the status of the quality of life in the region. One of the approaches is the measurement and comparison of regional development at the time of the level or the status of the quality of life in the region. In your post is constructed a composite indicator for economic levels remain scattered regions of Slovakia. For the base year of 2000 has been selected. We analyzed five key indicators of the economic area. By analyzing the PCA was found to be the weight of the indicators. One of them was subsequently constructed a composite indicator of the CI . From the results it is clear that the best value of CI underperforming districts. The worst value of CI already underperforming. During the period, however, rose. The highest increase recorded by the region of Trnava and the 0,5623. Long-term declines in the value of the composite indicator is in region

Trencin. The decrease is 0,5474. This drop is the largest of all regions. The idea of developing a technology cluster could help the region increase its economic potential. In the next part of the convergence of regional disparities have been evaluated using the method. It may be observed, that in this area, the disparities only very slowly diminish. In the framework of the more comprehensive meta-analysis of the problem as described, it would be better to use other alternative approaches. This paper is part of the solution of grant projects VEGA 1/0953/16 Evaluation of the impact of cluster on regional development of the Slovak Republic.

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CSR REPORTING AS A PRODUCT OF SOCIAL ACCOUNTING

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Abstract: *The development of the concept of corporate social responsibility has become the new and extremely important challenge for accounting. It is necessary that its methods and solutions allow for reflect newer and newer information needs. Because of its systemic character, accounting has to evolve to be able to constitute a basic information system. The development of social accounting is a welcome direction in this regard. It aims to identify measure and present the social and environmental issues related to the functioning of company. The CSR report is a tool for providing information related to corporate social responsibility. It shows the influence of company's activity on various group of stakeholders, by ensuring detailed data about management regarding aspects such as ethics, ecology, diversity in the workplace and community involvement. Instead of preparing corporate social responsibility reports some companies publish integrated reports which present in one document both financial and social issues in a holistic manner. The aim of the article is to present the problem of CSR reporting within the context of social accounting. The main subject of researches is the evaluation of trends associated with the publishing social reports in the national and international context as well as an analysis of the content of reports dealing with corporate social responsibility prepared by selected companies operating in Poland. The article is based on the analysis of Polish and English literature, selected studies and databases connected with the practice of CSR reporting as well as the reports prepared by companies covered by the survey. Results of the research lead to the conclusion that social reporting is a rapidly growing field in both national and international context. This is reflected by the number of reports dealing with corporate social responsibility submitted by companies to a databases connected with the practice of Corporate Social Responsibility reporting. However, the analysis of the content of this type of reports showed that comparison of data contained within documents prepared by individual companies may pose a problem.*

Keywords: *social accounting, CSR reporting, integrated reporting*

JEL Classifications D22 · M14 · M41

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1. INTRODUCTION

In the context of the dynamic changes in enterprises and their environment, the rationality of decisions and the undertaking of an informed market game are conditional on access to information. For that reason, stakeholders report the need of increased informational openness of enterprises. They expect useful information for making decisions, both current and predictive, which are presented in transparent, comprehensible form and allow creating view on the enterprise value as well as financial and non-financial factors which shape this value (Michalczuk, 2013).

However, practice shows that financial reporting, which is a basic communication tools, is not in a position to meet the growing information needs of various stakeholders, particularly in the context of corporate social responsibility and sustainable development. Therefore, efforts are being undertaken to develop a system which will allow mutual understanding and reduce asymmetry between enterprise and its stakeholders (Marcinkowska, 2013).

The aim of the article is to present the problem of CSR reporting within the context of social accounting. The main subject of researches is the evaluation of trends associated with the publishing social reports in the national and international context as well as an analysis of the content of reports dealing with corporate social responsibility prepared by selected companies operating in Poland.

2. SOCIAL ACCOUNTING AS A BROADER DIMENSION OF ACCOUNTING

Despite various form of transmission, accounting is the basic system, in which the economic information plays a crucial role. This follows from prevalence of this system. It has been created to communication to the stakeholders the real situation of company operating in the market. It also describe a company's ability to generate economic benefits and its efficiency of the use of resources. Accounting, being a universal, flexible and subjective information system enables the creation of a numerical "image" of generation, distribution and flow of the value and settlements between economic operators related thereto (Michalczuk, 2013). In social terms, accounting registers economic events regardless of real basis. This phenomenon has been aptly articulated by W. Handel (1982), who stated that „things may exist independently of our accounts, but they have no human existence until they become accountable. Things may not exist, but they may take on human significance by becoming accountable”.

In the traditional sense, accounting generates information, mainly of a financial nature. However, nowadays it is shaped by the environment in which its system is functioning (Zuchewicz, 2015). Recently, this environment is exerting increasing pressure on provide information showing not only financial performances but also non-financial data on intangible generators of company's value, corporate social responsibility as well as sustainable development (Bonsón, Bednárová, 2015; Michalczuk, 2013).

In this context broader dimension of accounting that is social accounting is discussed more and more nowadays. Undoubtedly, this is a wide term that includes a different forms and tools. Social accounting can be analyzed as a statistical-economic discipline used to capture economic processes on a macroeconomic scale (Biadacz, 2017). In terms of microeconomic, social accounting can be defined as „the process of communicating the social and environmental effects of organizations' economic actions to particular interest groups within society and to society at large (Gray, Owen, Maunders, 1987).

Therefore, it is reasonable to assume that social accounting includes a set of organizational activities that deals with the measurement, analysis and reporting of the social performance to concerned groups, both within and outside the organization (Islam, 2015). This approach to accounting extends its scope and means extending beyond the area of traditional financial settlement (Gray, Owen, Maunders, 1987).

3. CORPORATE SOCIAL RESPONSIBILITY REPORTING

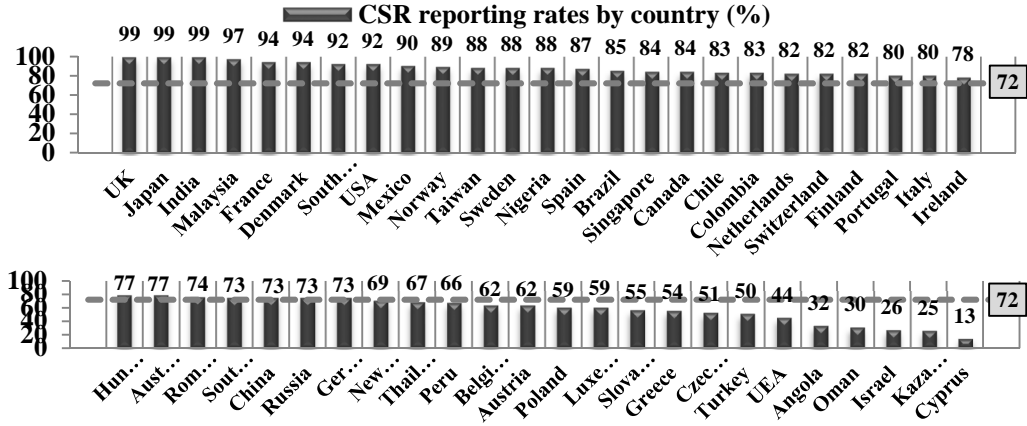
The development of social accounting is reflected in evolution of reporting system. This is because results of the measurements carried out within the social accounting must be reflected in reports prepared by the companies. The CSR report is a basis tool for providing information related to corporate social responsibility. It shows the influence of company's activity on various group of stakeholders, by ensuring detailed data about management regarding aspects such as ethics, ecology, diversity in the workplace and community involvement. More and more companies go beyond the scope of CSR reports and publish integrated reports, which open the opportunities for include in one document the information being generated these days by financial statement, management commentary, sustainability report and the other non- financial reports e.g. intellectual capital report (Michalczyk, Konarzewska, Mikulska, 2017).

Regardless of the form used by individual companies, corporate social responsibility reporting is becoming a common practice. This is reflected in research described in the report „The road ahead. The KPMG Survey of Corporate Social Responsibility Reporting 2017”. The research was conducted on 4.900 companies in 49 countries and regions and concerned with global trends in CSR reporting. The final results show that 72% of analyzed companies publish reports concerning corporate social responsibility. The situation for global business leaders is even more preferably. The results indicated that 93% of 250 largest companies by revenue based on the Fortune 500 ranking of 2016 prepare this kind of reports (KPMG Survey of Corporate Social Responsibility Reporting 2017).

When analysing the corporate social responsibility reporting by geographical segments it turns out that North and Latin America is the leading region in this respect. The overall CSR reporting rates in this region has reached 83% in 2017. Subsequently the Asia and Pacific (77%) and Europe (73%) were classified. The lowest reporting rate was recorded in the Middle East and Africa in which 52% of companies publish reports related to corporate social responsibility (KPMG Survey of Corporate Social Responsibility Reporting 2017). In the light of presented results, can be expected the growth in CSR reporting in Europe. This is due to the implemented the Directive 2014/95/EU of the European Parliament and of the Council which requires on large public interest entities to disclosure of non-financial and diversity information concerning environmental matters, social and employee-related matters, respect for human rights, anti-corruption and bribery matters (Directive 2014/95/EU).

The data contained within the KPMG's survey also allow to indicate countries which are the world's leaders in the field of corporate social responsibility reporting (figure 1). These include: Great Britain, Japan, India, Malaysia, France, Denmark, South Africa, United States and Mexico. Against this background, the practice of polish companies significantly deviates not only from the world's best practices but also from the global and European average. This is due to the fact that only 59% of the largest polish companies decide to prepare a reports containing information on corporate social responsibility. However, it should be emphasized that this result increased by five percentage points between 2015 and 2017.

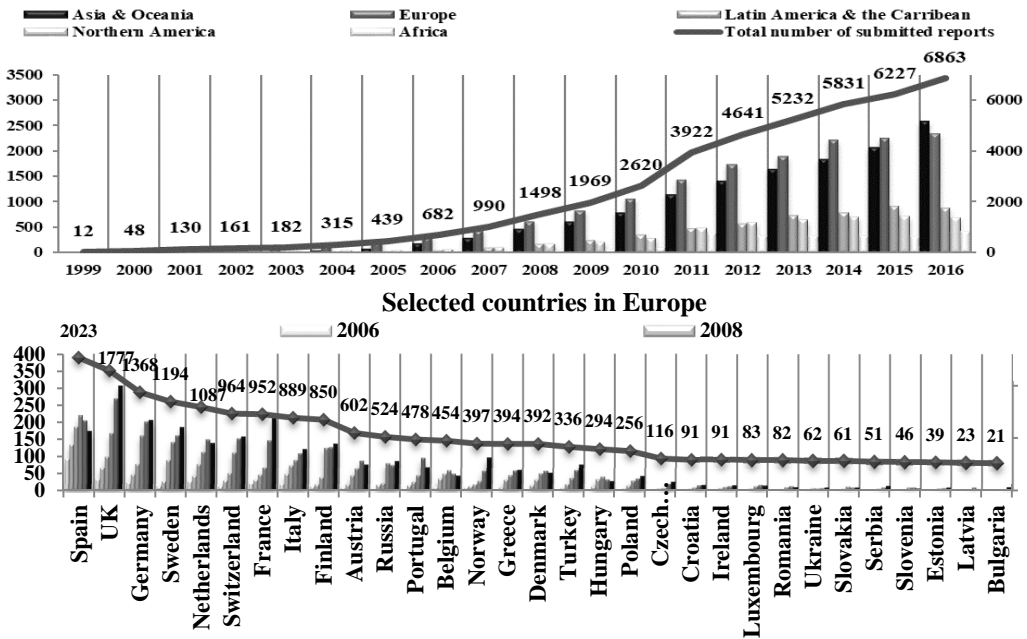
Figure 1: National rates of Corporate Social Responsibility Reporting in 2017.



Source: Author's own work based on: (KPMG Survey of Corporate Social Responsibility Reporting 2017)

The number of reports registered in *GRI Sustainability Disclosure Database* also confirms the increasing interest in the concept of CSR reporting. It contains the social reports prepared by companies from various sectors and geographical region, regardless of form, reporting period, and thematic scope as well as the applied norms and guidelines concerning the area of corporate social responsibility reporting. More than 46.000 reports were registered since the beginning of *GRI Sustainability Disclosure Database* in 1999. An important issue is the gradual increase in number of registrations in both global and regional scale (figure 2).

Figure 2: Number of CSR reports published in the GRI Sustainability Disclosure¹⁰.



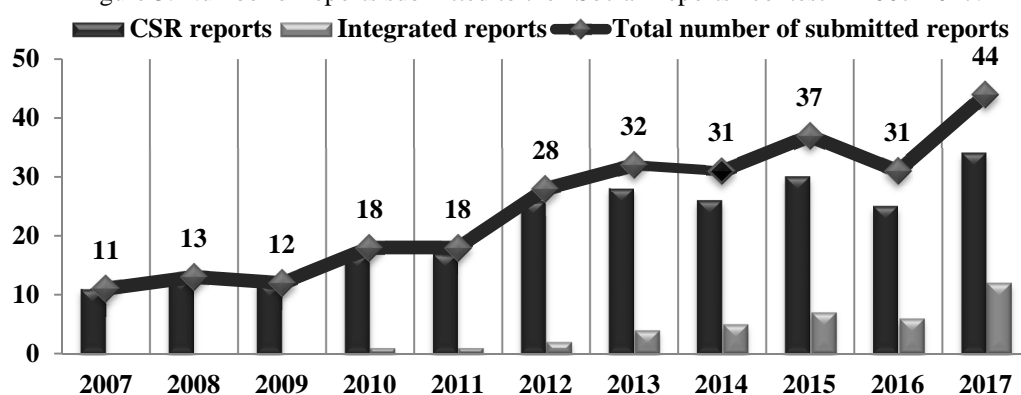
Source: Author's own work based on GRI Sustainability Disclosure Database

¹⁰ The data for 2017 were omitted because of incompleteness.

The growing interest in publishing CSR reports in the GRI Database can also be noted in activity of companies operating on the Polish market. Out of all 256 reports registered in the concerned period as many as 167 were prepared between 2013 and 2016. Moreover, it is expected that this increasing trend will continue in the future. This follows not only from the required to implement the Directive 2014/95/EU but also from the initiatives aimed at dissemination of non-financial reporting in Poland.

One of these initiatives is “Social Reports” contest organized since 2007, which rewards the best prepared reports in the field of corporate social responsibility. The aim of the initiative is to increase the transparency of organizations’ activities and show the good practices in social reporting. In the eleven editions of the contest, 275 reports were evaluated, of which record number of 44 reports were submitted in 2017. The fact that growing number of companies forgo the CSR reports and decide to publish integrated reports is also an important issue (figure 3).

Figure 3: Number of reports submitted to the “Social Reports” contest in 2007-2017.



Source: Author's own work based on: Biblioteka raportów

The procedure for evaluation of reports submitted to the “Social reports” contest is carried out in two stages. In the first stage, members of the jury consisting of experts in the field of economics, environmental protection, social issues and corporate social responsibility, individually evaluate the reports according to the criteria of completeness, trust and communication. The second stage involves the collate of individual evaluations and selection of best social reports. In the 2017 edition of “Social reports”, contest awards went to the reports prepared by: CEMEX Polska, PKN ORLEN, Bank Zachodni WBK, Budimex, Lafarge and the Doctor Piotr Janaszek PODAJ DALEJ Foundation. The analysis of data contained in these reports allows the identification of key areas covered by the social reporting (table 1).

Table 1: Content of social reports awarded in the “Social Reports” contest in 2017.

Organization name	Report name	Report type	Report structure	
CEMEX Polska (sector: construction)	Sustainable development Report 2015/2016	CSR report	1. About us: (CEMEX in Poland; CEMEX in the World; Management Board of CEMEX Polska; CEMEX against a background of a construction sector; Risk Management; Awards and distinctions; Membership in Associations	5. Our employees: (Employee profile; Employee health and safety; Programs to improve safety in the workplace; Organizational culture – a friendly workplace; talent development) 6. Our impact on the environment:

			<p>2. Our strategy: (OUR vision; Sustainable development strategy; Ethics; Dialogue with stakeholders; Communication with stakeholders)</p> <p>3. Our business: (Value chain; business model; Cooperation with suppliers; Supply chain; Responsible Production; products; Sustainable construction)</p> <p>4. Our customers: (CEMEX customers; Concentration on customers; Investments with the participation of CEMEX Polska products)</p>	<p>(Environmental Protection Management; Environmental impact; We build the future in harmony with nature; Our environmental education activities)</p> <p>7. Our neighbours: (Social commitment; CEMEX Poland's Building the Future Foundation; Employee Volunteering; Foundation in numbers; Support for local communities)</p> <p>8. About the report (How we prepared our report; Reporting aspects; Independent assurance report; Employment at the CEMEX Polska; Environmental performance; GRI Content Index).</p>
PKN ORLEN (sector: energy)	ORLEN Group 2016 Integrated Report	Integrated report	<p>1. The ORLEN Group and its environment: (Letter from the President of the Management Board; ORLEN Group 2016; Our environment; Our Report)</p> <p>2. Corporate Governance: (Letter from the Chairwoman of the Supervisory Board; Corporate governance at PKN ORLEN; Communication with the capital market; Major holdings of shares; Special shareholder rights; General meetings in 2016; Management and supervisory bodies; Remuneration policy)</p> <p>3. Risks and opportunities: (Risk Management; Opportunities)</p> <p>4. Our strategy: (Strategy implementation in 2014-2016; 2017-2021 strategy; Implementation of investments projects; Monitoring of strategy implementation; Market outlook in 2017)</p>	<p>1. Financial results (Consolidated financial statements; Auditor's opinion and report; ORLEN in figures)</p> <p>2. Our operations: (Research and development, Downstream, Retail, Upstream, Corporate functions)</p> <p>3. Sustainable development: (Outlook CSR 2017+; CSR strategy implementation; Indirect economic impacts; Diversity and equal opportunities; Responsible employer; Safety of Employees and Contractors; Environmental responsibility; Responsibility towards Customer; Responsibility towards Suppliers; Product responsibility; Society; Awards and distinctions)</p> <p>4. Outlook 2017+</p>
Bank Zachodni WBK (sector: banking)	2016 Corporate Social Responsibility Report	CSR report	1. About Bank Zachodni WBK: (An interview with the President; Who We are; Santander Group; How our impact changed; Stakeholders	1. Employees: (Priorities; Employment structure; Diversity; Friendly workplace; Benefits and work

			<p>dialogue; Suppliers and business partners; Organisations and associations; How we influence the environment)</p> <p>2. Strategy and management: (Management structure; Strategy and financial performance; CSR priorities; Ethics; Awards and recognitions)</p> <p>3. Customers: (Partnership cooperation; Retail customers; Bank for SMEs; Corporate Banking; Global Corporate Banking; Responsible selling; Customer satisfaction; Security of services and customer data)</p>	<p>conditions; Development; Health and safety)</p> <p>2. Social engagement (Our priorities; Education and the development of science; Promoting equal opportunities; Support of social initiatives; Bank Zachodni WBK Foundation)</p> <p>3. About the report: (Reporting process; Independent assurance report; GRI G4 Content Index; Contact)</p>
Budimex (sector: construction)	Integrated annual Report for 2016	Integrated report	<p>1. Letter from the president</p> <p>2. Awards and distinctions received in Poland in 2016</p> <p>3. About the company</p> <p>4. Market situation and perspectives</p> <p>5. Last year's results</p> <p>6. Contribution to infrastructure development</p> <p>7. Value model</p> <p>8. Management culture</p> <p>9. Managing responsibility in the supply chain</p> <p>10. About the report</p> <p>11. Financial results</p>	<p>12. Conditions, Occupational health and safety</p> <p>13. Impact on the local environment and biodiversity</p> <p>14. Relations with the local communities</p> <p>15. Prevention of unethical conduct and honest acting in business</p> <p>16. Quality and safety of construction sites</p> <p>17. Rational use of resources and environmental pollution</p> <p>18. Non-financial data tables</p> <p>19. Completion of strategy objectives for 2016-2020</p>
Lafarge (sector: construction materials)	Sustainable development Report 2016	CSR report	<p>1. About us: (An interview with the President of Lafarge in Poland; The 2030 Plan; LafargeHolcim in the world)</p> <p>2. In the interest of business: (Sustainability development; Good cooperation; Ethics)</p> <p>3. In the interest of people: (Our mission and premonitions; Who We are; Together - LafargeHolcim Foundation; We operate together)</p>	<p>4. In the interest of planet: (Sustainable architecture; Responsible supply chain; innovations for the environment)</p> <p>5. Basic information about the company</p> <p>6. Guide to the report</p>
Doctor Piotr Janaszek 'PODAJ DALEJ' Foundation	Social impact report 2016	CSR report	<p>1. History and Philosophy</p> <p>2. Mission and goals</p> <p>3. About the report and stakeholders</p> <p>4. "PODAJ DALEJ" and the United Nations</p>	<p>11. Good workplace</p> <p>12. Financial situation</p> <p>13. Rules and other external initiatives taken into account by the "PODAJ</p>

(sector: NGO)			Sustainable Development goals 5. Economic growth 6. The end of poverty 7. Sustainable cities 8. Education and knowledge sharing 9. Quality of life 10. Less inequality	DALEJ” Foundation 14. Awards and distinctions 15. Media and campaigns 16. Allies and donors of the foundation 17. Report profile 18. GRI Content Index
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Source: Author's own work based on: 2016 Corporate Social Responsibility Report; Budimex - Integrated annual Report for 2016; CEMEX - Raport zrównoważonego rozwoju 2015/2016, Raport oddziaływania społecznego 2016; Raport zrównoważonego rozwoju 2016; ORLEN Group 2016 Integrated Report

The analysis of the content of reports considering in this article shows a wide range of information enabling the evaluation of a company's CSR strategy and the influence of its activity on environment. In contrast to financial statements, the social reports are the substantive basis for decision-making not only for investors but also for other stakeholders. They contain the information relating to environmental issues and relationships with various groups of stakeholders such as customers, employees and local community. Admittedly, these reports contain a number of commonly declared values. Nevertheless, they are characterized by both a varied scope of information as well as different structure of presentation.

4. CONCLUSIONS

The accounting described as a language of business which is being used by modern economic world has to be constantly changing. Nowadays, direction of these changes is determined by information society as well as development of the concepts of corporate social responsibility and sustainable development. This necessitates the need for development a system that reflects the processes which were previously outside the area of accounting. Social accounting is such a system. It aims at collecting and reporting the information referring to social and environmental issues.

Social reporting is a rapidly growing field in both national and international context. This is reflected by the number of reports dealing with corporate social responsibility submitted by companies to *GRI Sustainability Disclosure Database* and the “Social Reports” contest. Despite the growing numbers of companies which prepare their social or integrated reports, the comparison of data contained in individual reports may pose a considerable problem. Therefore, is becoming necessary to standardize delivered data, as in the case of financial statements.

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DATA ENVELOPMENT ANALYSIS IN IMPROVING SECURITY LEVEL IN LOCAL GOVERNMENT UNITS^{11*}

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Abstract: *Digital transformation and global trends in Smart City development have brought on serious security challenges in governing smart data assets. The implementation of two-way communication between cities and citizens requires secure communication channels and efficient data management. Fast development of information communication technologies (ICT) demands for continues investments in new security options. In this paper, the author examined the efficiency of implemented security levels in local government units (LGUs) through Data Envelopment Analysis. The Data Envelopment Analysis enables benchmarking LGUs according to obtained results. The efficient LG units were further examined and were ranked using super-efficiency analysis. The inefficient LGUs can use the obtained results to improve their performance using projections and thus reach the efficiency frontier.*

Keywords: *Information security, LGU, Data Envelopment Analysis, super-efficiency*

JEL Classifications C61 · H79 · L86

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1. INTRODUCTION

Nowadays, no organization can survive unless it is ready to adopt changes brought by digital transformation. Having in mind that today's organizations completely rely on information and communication technologies that their survival depends on the use and a well-established implementation of these technologies. We can say that information security represents the next challenge. Information security has become an imperative because each organization uses, processes and stores, between other, confidential and business critical data. This challenge is also put in front of public institutions like hospitals, schools, high-educational institutions, as well as local government units (LGUs). That need to provide information and services, be open and transparent and on the same time provide security of its services and confidentiality of user's data. Implementing a safe and reliable infrastructure, is becoming more and more vital, so many authors addressing risk management often point out that information security is a crucial factor in e-Business (Safa et al., 2015).

A successfully implemented ICT can reduce the costs and speed in the implementation of business processes, reduce human resources costs, and even be a key factor in competitive advantages. The implementation of ICT in public administration goes beyond the goals of commercial information systems due to the fact that it includes goals related to community wellbeing, political and social goals, etc. The positive effects of implementing and using ICTs in the public sector are reflected, according to Brown (2005), in four major areas: 1) As part of the services can be obtained 24/7 by the citizens themselves, bureaucratic procedures i.e. costs are decreased, 2) Information has become an equally valuable public resource, 3) The network infrastructure contributes to better connectivity, teamwork and collaboration within the organization itself and its environment and 4) ICT implementation brought on a shift in accountability and management models (empowerment of subordinates and accountability to citizens). All this reduces structural hierarchy and consequently leads to qualitatively different working conditions and working relationships. However, e- Government also has its drawbacks.

The shortcomings of e-government implementation in the Republic of Croatia are outlined in the *Strategy E-Croatia 2020* (2015). The SWOT analysis shows that (p.42) apart from the lack of financial resources and organizational inadequacy, e- government faces the following threats: delays in execution and implementation, lack of high quality IT staff in public administration, the public fear regarding information security and personal data protection and the resistance to change i.e. to the transition from paper to electronic data processing.

Based on the reviewed literature, the Strategy for Electronic Administration 2009-2012 and the e-Strategy 2015-2020, according to which one of the key determinants for a successful e-Government is successful ICT and information security implementation which should ensure reliable, continuous and safe service delivery. The goal of this paper is to examine the level of security of electronic business operations in local government units using Data Envelopment Analysis (DEA).

2. METHODOLOGY

2. 1. Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a data-oriented, non-parametric approach in the evaluation of the efficiency of a set of entities called decision-making units (DMU).

The CCR (Charnes, Cooper, Rhodes) and the BCC (Banker, Charnes, Cooper) model are two basic models that are frequently used in efficiency analyses. According to these models, for each

decision-making unit (DMU) a virtual input, output and weights v_i and u_r are formed (Cooper, Seiford, Tone, 2006).

The desired common items of input and output are selected as follows (Cooper, Seiford, Tone, 2006):

- The numerical data should be available for each input and output, and should be positive for each DMU.
- The selected items (input, output and selected DMU) should reflect management (or the analyst's) interest in the components entering the evaluation of the relative efficiency.
- The items should be selected based on the principle of proportionality i.e. that a smaller amount of inputs and a larger quantity of output is preferable.
- The measurements units of various inputs and outputs need not be coincidental.

Let's assume that m inputs and s outputs with first two properties are selected, and that the input and output values are given as $(x_{1j}, x_{2j}, x_{3j}, \dots, x_{mj})$ and $(y_{1j}, y_{2j}, y_{3j}, \dots, y_{sj})$. The relative efficiency of each DMU is measured in line with the selected data, which means that it is necessary to solve n optimizations i.e. one for each DMU.

In the liner programming the problem form is given by:

$$\max_{\mu, v} \theta = \mu_1 y_{1o} + \mu_2 y_{2o} + \dots + \mu_s y_{so} \quad (2.1)$$

$$\text{with respect to } v_1 x_{1o} + v_2 x_{2o} + \dots + v_m x_{mo} = 1 \quad (2.2)$$

$$\mu_1 y_{1j} + \mu_2 y_{2j} + \dots + \mu_s y_{sj} \leq v_1 x_{1j} + v_2 x_{2j} + \dots + v_m x_{mj} \quad j = 1, \dots, n \quad (3.3)$$

$$\mu_1, \mu_2, \dots, \mu_s \geq 0 \quad (3.4)$$

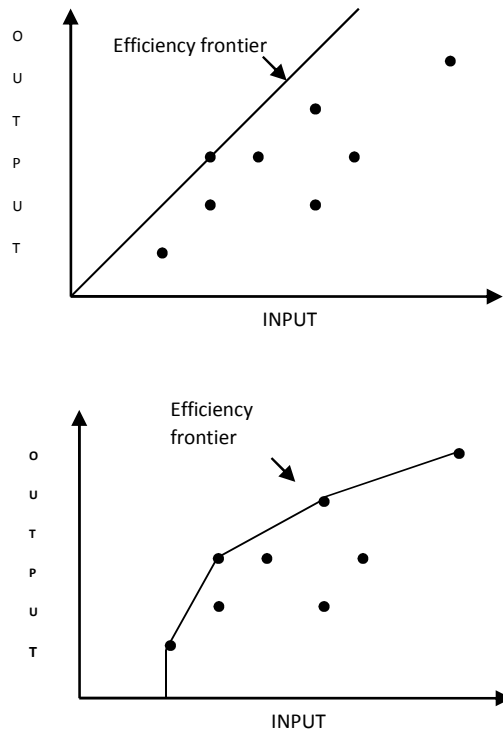
$$v_1, v_2, \dots, v_m \geq 0 \quad (3.5)$$

Constraints ensure that the ratio of "virtual output" and "the virtual input" do not exceed 1 for each DMU. The goal is to gain weight values (v_i) and (u_r) to maximize the ratio of the evaluated unit. The optimum value that can be obtained for θ^* is 1. We will assume that all inputs and outputs have a non-zero value, which will be reflected in the value of weights v_i and u_r . These will be assigned positive values.

The CCR and BCC models differ in that the BCC model, in contrast to the CCR model, includes the condition of convexity $\sum_{j=1}^n \lambda_j = 1, \lambda_j \geq 0, \forall j$ in constraints thus achieving that the frontier has

piecewise linear and concave features as shown in Figure 1. Namely, the convexity condition leads to variable return to scale.

Figure 1: Graphical presentations of the CCR and BCC models



Source: Author's

After basic analysis using these two models, efficient units are evaluated using super efficiency model.

2.2. Super efficiency model

As previously stated, all efficient DMUs according to data envelopment analysis are ranked equally in terms of performance. Standard DEA models have a large number of applications and modification. One of the most important extensions of the DEA model is the formulation of super-efficiency models used for ranking DMUs with an efficiency unity score. The most well-known super efficiency model is that established by Anderson and Petersen in 1993. This model involves executing standard DEA models (constant return to scale and variable return to scale) under the assumption that the evaluated DMUs are excluded from the reference set.

The super efficiency model is given by (Petersen, Anderson 1993):

$$\min E_j - \delta' s^- - \delta' s^+$$

subject to

$$E_j X_j = \sum_{\substack{k=1 \\ k \neq j}}^n z_k X_k + s^-$$

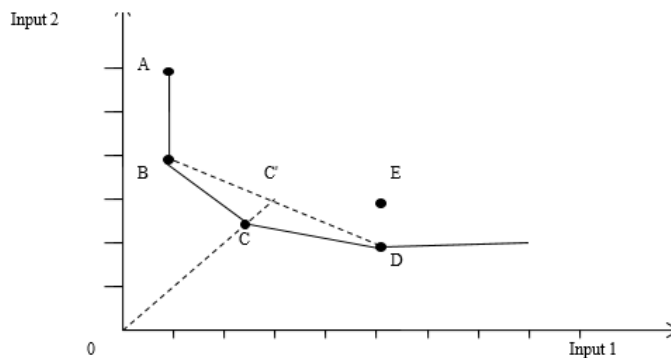
$$Y_j = \sum_{\substack{k=1 \\ k \neq j}}^n z_k Y_k + s^+, \quad Z, s^+, s^- \geq 0$$

where X_j represents the m-dimensional vector of input, Y_j the s-dimensional output vector, E_j the scalar which defines the share of the input vector for DMU necessary for producing the Y_j DMU's output vector within the frames of referent technology, Z the vector of intensity where z_k represents the intensity of the k-unit, δ the non-Archimedean infinitesimal, and e' the unity vector of appropriate dimension.

The consequence of excluding an evaluated unit taking from the reference set is easily understandable (see Figure 2). In the example there are five units marked with the letters from A to E. Each of the five units produces one output using two inputs. The stretch of the unity isoquant between given DMUs is presented in Figure 2.

Figure 2: Evaluating super-efficiency of DMU C

Ratio OC'/OC define measure of efficiency in the evaluation unit C according to the model



Source: Anderson, Petersen, 1993.

In Figure 2, the unity isoquant is stretched between $\langle BCD \rangle$ in which the efficient subset is represented by segments BC and CD.

If we consider the evaluation of unit A, we can say that it is inefficient, as it needs 4 more units of input 2 than unit B for the same input 1. The elimination of inefficient observations will not affect the spreading set of referent units. It can be concluded that the super efficiency model and the BCC model show the same index of efficiency for unit (point) B.

If we consider the evaluation of unit C, we can say that according to the BCC model, its index of efficiency equals 1. By eliminating unit C from the reference set, it is moved to a new unity isoquant stretching between the remaining elements from the set (A, B, D, E) at a minimal distance from its previous position. The reference point thus becomes $C'(6.0, 6.0)$ and unit C is assigned an efficiency index of 1.2 instead of 1.

The index of efficiency for the inefficient unit E in the new model will not change. The defined index of efficiency in the new model leads to the following ranking of units A – E: $B > D > C > A > E$.

In their paper, Lovell and Rouse (2003) suggested many possible uses for super efficiency models including ranking of efficient DMUs, classification of DMUs into extreme-efficient and non-extreme efficient groups, sensitivity of efficiency classifications, two person ratio efficiency games, identifying outliers in the data, calculating and decomposing a Malmquist productivity index, overcoming truncation problems in second stages regressions intended to explain variation in efficiency.

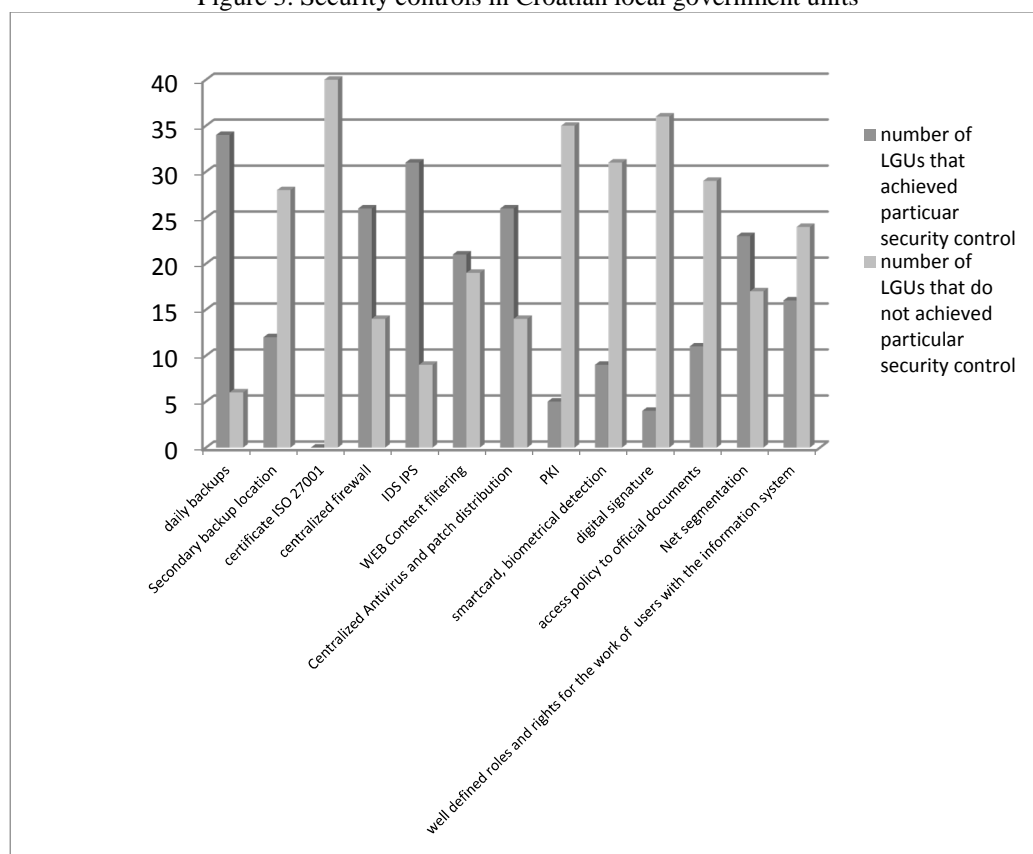
In practice, the use of DEA efficiency and super-efficiency models is widespread, especially in non-profitable sectors. There are several examples of evaluating the efficiency of local government unit management using the Malmquist approach, as well as examples of using DEA for evaluating the maturity level of ICT in LGUs and the impact of economies of scale and uncontrollable factors on the relative efficiency of municipal service delivery. Du et al. (2014) explore the super efficiency of Pennsylvania hospitals; in their article *University library benchmarking: An international comparison using DEA*, Reichmann and Sommersguter-Reichmann propose a framework for assessing the technical efficiency and calculate the super efficiency of 118 university libraries from Australia, Austria, Canada, Germany, Switzerland and the United States (Reichmann, Sommersguter-Reichmann, 2006); Chodakowska uses DEA to evaluate lower secondary schools' management (2005) and Pavlič-Skender and Jardas Antić (2015) use the BCC model to evaluate the efficiency of port management.

In this paper, the author uses the BCC and the super-efficiency models to evaluate the information security level in local government units (LGUs). Namely, information security has become a topical issue because in addition to the advantages of digitalization i.e. the transparency and availability of public services, there is an increasing demand for protection personal data (Miszczyński, 2013; Mamoon, 2012).

3. DATA AND ANALYSIS

The information systems of local government units (LGU) are analyzed based on five areas important for the functioning of e-Government. The data for the analysis of the efficiency of 41 local government units was gathered through a questionnaire developed by the author and sent out to the respective LGUs. The segments used in this research included data on the number of IT staff, maturity level of IT management, number of servers in LGUs, application and documentation coverage, and on implemented information security controls. Figure 3 presents the level of implementation of individual information security controls in Croatian LGUs.

Figure 3. Security controls in Croatian local government units



Source: Author

As we can see, daily backups are conducted in 85% of cities and IDS/IPS (Intrusion Prevention System/Intrusion Detection System) in 78% of them. However, the usage of all other control system is very concerning.

In order to analyze the efficiency level of information security, the above-presented security control have been aggregated to obtain an output. The number of selected items is limited by the number of LGUs. The number of units should be at least 3 times larger than the sum of selected inputs and outputs. In our analysis, four inputs and one output is selected.

Table 1. Table of selected inputs and output

Variables	Description
<i>Inputs</i>	
NoITstaff	Number of staff in IT department
CobIT Est	Maturity level of IT management
No.servers	Number of servers in LGU
Aplic-doc	Coverage with specific applications +documentation coverage
<i>Output</i>	
InfSec	Information security level

Source: Author

According to the table, the number of IT staff, maturity level of IT management, the number of servers in each LGU and specific application and documentation coverage are taken as inputs and security as the output in the analysis. The security output was obtained by assessing whether a certain city administration has implemented an Information Security Management System certified according to the International Standard such as ISO 27001, whether the users roles and rights within the information system are precisely defined, whether it has implemented smart card authentication, whether it has web content filtering, etc.

Table 2. Summary results of BCC and CCR output oriented models

	CCR	BCC
No. of DMU taken into analysis	41	41
No. of relatively efficient	6 (14.6%)	16 (39%)
Avr. relative efficiency	0.7515	0.8434
Maximum	1	1
Minimum	0.2436	0.4
No. of DMUs with relative efficiency below the average	20	16

Source: Author's calculation

After selecting the inputs and the output, we conduct Data Envelopment Analysis using two basic models. The BCC model was selected as preferable because the output does not change proportionally with the increase in inputs. According to the literature, the variable return to scale is taken as the preferable model if the difference between efficient DMUs in the BCC and the CCR model is significant. In our case that difference is approximately 24%.

Aggregate results show (Table 2) that the average DMU efficiency obtained by CCR is 0.84349 which means that if an average DMU wants to move on the efficiency frontier, it has to increase the output for 18.56% at the same level of inputs. There are 39% of relatively efficient units according to the BCC model and 14.6 % according to the CCR model. The average efficiency levels are high and amount to 75.15% according to CCR, and 84.3% according to the BCC model.

Table 3. Scores and ranks for 41 local government units

DMU	Score	Rank	DMU	Score	Rank
lgu 3	1	1	lgu 33	0.915	21
lgu 4	1	1	lgu 38	0.9057	22
lgu 5	1	1	lgu 1	0.8889	23
lgu 8	1	1	lgu 15	0.8873	24
lgu 9	1	1	lgu 21	0.8485	25
lgu 11	1	1	lgu 19	0.8333	26
lgu 17	1	1	lgu 16	0.7914	27
lgu 22	1	1	lgu 7	0.7778	28
lgu 23	1	1	lgu 39	0.7752	29
lgu 25	1	1	lgu 27	0.7714	30
lgu 26	1	1	lgu 36	0.7547	31
lgu 30	1	1	lgu 6	0.7059	32
lgu 32	1	1	lgu 12	0.6667	33
lgu 34	1	1	lgu 20	0.6667	33
lgu 35	1	1	lgu 31	0.6349	35
lgu 41	1	1	lgu 18	0.5714	36

lgu 2	0.9999	17	lgu 28	0.5333	37
lgu 37	0.9677	18	lgu 29	0.5	38
lgu 24	0.9474	19	lgu 10	0.4444	39
lgu 40	0.9474	19	lgu 14	0.4444	39
			lgu 13	0.4	41

Source: Author's calculations

As can be seen from Table 3, almost all big city local government units in the Republic of Croatia reach the efficiency frontier, as well as those who are geographically positioned very close to them as their closeness to big cities probably affects their awareness of the importance of information security. Moreover, Application and documentation coverage has shown to be the mostly correlated input with the security output, which might indicate that, those cities who have a well-established documentation base, have also better defined security procedures and roles according to Information Security Management System standards.

The next step is to calculate projections for each inefficient DMU i.e. the see how they can reach higher security levels with unchanged (or with minor changes) in inputs by using the reference set and by benchmarking the inefficient units with those units that have higher levels of efficiency i.e. security with similar inputs.

Table 4. Projections and reference set for an inefficient DMU

DMU	Score	Rank	Output Data	Projection	Diff.(%)
lgu 36	0.7547	31	6	7.95003	32.501
DMU	Score	Rank	Reference(Lambda)		
lgu 36	0.7547	31	lgu9 0.05	lgu 23 0.3	lgu 26 0.65

Source: Author's calculation

In Table 4 gives an example of projections and reference set for the LGU 36. This unit can reach the relative efficiency frontier if it improves its security level for 32.5% with minimum or no changes in inputs. The reference set for LGU 36 includes three LGUs with similar or lower values of inputs but with higher or same security level output. These three units represent role models for improving its performance.

Data Envelopment Analysis represents a valuable tool for benchmarking between homogeneous units that operate under similar conditions. Local government units fall into this category which allows for inefficient units to use projections and improve their performance. As the standard BCC and CCR models do not rank efficient units, this is done by using the super-BCC model.

Table 5. Efficiency ranking of efficient units according to the Super-BCC and the BCC models

Rank	DMU	Score (Super BBC)	Rank	DMU	Score (BCC)
1	lgu23	2.999925	1	lgu 3	1
2	lgu 5	1.9999	1	lgu 4	1
3	lgu 9	1.499993	1	lgu 5	1
4	lgu 4	1.499982	1	lgu 8	1
5	lgu 8	1.4	1	lgu 9	1
6	lgu 26	1.185366	1	lgu 11	1
7	lgu 11	1.142857	1	lgu 17	1
8	lgu 34	1.111969	1	lgu 22	1

9	lgu 3	1.090908	1	lgu 23	1
10	lgu 22	1.076923	1	lgu 25	1
11	lgu 41	1.067157	1	lgu 26	1
12	lgu 30	1.022727	1	lgu 30	1
13	lgu 2	1	1	lgu 32	1
13	lgu 32	1	1	lgu 34	1
13	lgu 17	1	1	lgu 35	1
13	lgu 25	1	1	lgu 41	1

Source: Author's calculation

The super-BCC model ranks efficient units while inefficient units retain the same levels of efficiency estimation. Moreover, the advantage of the super-BCC model is that it allows those units which have been estimated as efficient by the standard BCC to get their own reference set which could help them to improve their efficiency score. However, as we can see from the results, four of the units retained the same efficiency score in both models, as they have no possibility for improvement.

4. CONCLUSION

Modern e-Government puts the citizens in the focus of its business processes and provides maximal availability of e-Services 24/7/365 and at the same time enables high level of reliability and data security. However, technological developments are always accompanied by threats and possibilities of abuse, which pose a huge challenge in e-Business security.

The approach described in this paper can serve local government units in their risk management and decision making processes and help them increase the relative efficiency of their security levels. In addition to this, it can serve as model for testing the efficiency of security levels in institutions such as banks, insurance companies, hospitals, where the security levels of e-Business is of great importance as in these institutions every minor negligence in the safety of their system can cause damages of large proportion in both financial and operational sense.

The obtained results show that 39% of LGUs are relatively efficient according to the BCC model whereas only 14.6 % according to the CCR model. The average relative efficiency levels are high and amount to 75.15% according to CCR, and 84.3% according to BCC. However, we should point out that this paper analyses relative and not absolute efficiency. Moreover, Data Envelopment Analysis has proven to be a good tool for benchmarking homogeneous local government units. The strongest feature of DEA is that it provides for projections which can be used as guidelines by inefficient or less efficient LGUS in their improvement, in our case, in increased information security levels.

In the future, this research could be extended to include local government units from developed EU member states as this would provide new projections due to possible changes in the reference set. In addition to this, further research could focus on other possibilities provided by DEA, such as the possibility to divide local government units into separate categories according to their size or the number of available services. Another direction could be to restrict input (output) weights that are of less importance in assessing security levels i.e. by placing constraints on the weights which might provide for more realistic results. The third possibility could be to use DEA's window analysis to see and analyze the trends in security improvements or the lack of the same through longer periods of time.

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OVERVIEW OF SELECTED BANKRUPTCY PREDICTION MODELS APPLIED IN V4 COUNTRIES

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Abstract: *Bankruptcy prediction models are often an applied tool for detecting unfavourable development of the financial situation of the company. The prediction of financial health of business entities is the most important information because of dynamic development of the business environment. Many prediction models are known nowadays. They are different by their reliability (predictive ability), the composition of used variables, trade union orientation, the degree of consideration of domestic market conditions etc. It is clear from this that it is not possible to create a universal, unified prediction model that would be able reliably and with sufficient time to indicate unfavourable company financial development leading to bankruptcy applied in all sectors or regions. Introductory part of contribution is devoted to the literature review of issues and the definitions of the concept of bankruptcy based on the so-called non-prosperity indicators (profit, total liquidity and equity/liabilities ratio), that take into account the current legislation of this issue in the Slovak republic. Then the contribution discusses the role and significance of prediction models in corporate practice, compares the advantages and disadvantages of models containing accounting and market indicators. The authors also devoted the space to identifying restrictions on the usability of known foreign bankruptcy models in economic conditions of V4 countries and to define a set of the most frequently applied models taking into account specific economics conditions in these countries.*

Keywords: *Bankruptcy Prediction Models, Financial Health, V4, financial ratios*

JEL Classification G33 · C5

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1. INTRODUCTION

Financial health is a term reflecting the overall financial situation of a business entity. It is possible to consider a business entity financially healthy if it is able to finance its liabilities with assumption of continuous existence and development. The basic aspects of business entity's financial health include profitability, liquidity and financial stability.

The efforts to achieve early recognition of the business entity financial instability led to establishment of new methods for financial analysis, so-called prediction models. They act as indicators of early warning of business entity's negative financial development - forecasting - based on the history of entity's results. Such models are based on the prerequisite that business entity heading towards bankruptcy shows specific financial differences, symptoms in comparison with financially healthy entity (problems with current ratio, net working capital, profitability, etc.) for certain period of time beforehand. Similarly, it is necessary to emphasize that none of the financial analysis prediction methods may be deemed as 100% reliable and it is not possible to include conditions specific for entity's environment.

2. BANKRUPTCY PREDICTION MODELS

2.1 History

Historically, the development of business entity bankruptcy prediction may be divided into several time periods with characteristic application of different methods for development of bankruptcy prediction models. The early studies were in the form of a simple financial analysis based on financial ratio analysis (a single-dimension analysis) a comparison of values between successful and failing business entities. 1930 was one of the most significant milestones when the Bureau of Business Research published a report on the Study of Indicators of Failing Manufacturing Business Entities. The study analysed 24 indicators in 29 business entities with the goal to determine basic characteristics of failing business entities. The indicators of each business entity were then compared with average values of indicators to enable observation of differences, basic characteristics of failing business entities and trends. In 1942, Merwin published results of his study that focused to small business entities. The study confirmed that in case of comparison of successful and failing business entities, the basic signs appear as early as 4 to 5 years before the insolvency. For the first time in the history of financial pressure modelling, Chudson (1945) discovered that within a certain industry, business entity size and profitability, it is possible to see a characteristic behaviour of surveyed values of indicators. He named the occurrence "clustering of ratios".

The period of 1930-1965 may not be considered, from the methodology point of view, as a period of development of bankruptcy prediction models, it was more or less a financial analysis of ratios. A significant milestone in this matter came by Beaver's study (1966), which was the first to introduce the bankruptcy prediction model upon application of a single-dimension analysis. This study could represent the second generation of prediction model evolution, up to the end of 1980s. At the conclusion of his study, Beaver recommended for the future to consider simultaneous evaluation of several indicators at the same time. Promptly, this requirement was picked up by Altman (1968) who caused a small revolution in perception of business entity financial pressure prediction. The Altman's model is the first ever bankruptcy prediction model from the point of using a multi-dimension analysis.

Altman's work (1968) served as motivation for other academicians and researches who emphasized mainly limiting assumptions of discriminant analysis from the statistical point of view. Their main

answer was development of conditional probability models with main models based on logit and probit method. The first model using logistic regression (logit) was Ohlson model (1980) with benefit that it was not necessary to meet basic statistic preconditions such as linearity, homoscedasticity, etc. Balcaen and Ooghe (2008) who summarize models for the past 35 years until 2006 in their study, present that such model outlasted the prediction ability of Altman's model. The Zmijevski model (1984) was developed in the similar fashion; it used probit analysis for development of bankruptcy prediction model. Such two methods, often with various variations, have been used to this day.

The study of Dimitras et al. (1998) included also other methods and models applied during 1980s and 1990s. Such authors mention for example work of Frydman et al. (1985) utilizing the recursive distribution algorithms method, Gupta et al. (1990) applied mathematical programming for the business entity failing prediction issue. Other studies applied the survival analysis (Luoma and Laitinen, 1991), expert systems (Messie and Hansen, 1998) and multi-factor model (Vermeulen et al., 1998). Furthermore, there were other methods recorded, using decision management, such as Zollinger (1982), Zopounidis (1987), Siskos et al. (1994), Andenmatten (1995), Dimitras et al. (1995).

The late 1990s brought opportunities by utilization of IT equipment and machine learning. That meant exploitation of artificial intelligence techniques of which development has been going on until present day and it is still not over. Kumar and Ravi (2007) provide a very good overview of bankruptcy prediction models in their paper, being a complex overview of papers utilizing statistical methods and artificial intelligence methods used for bankruptcy prediction of business entities and banks.

Finding the suitable bankruptcy prediction model is the task for economists and analysts from all over the world. Despite a large number of various models, which have been created by using different methods with the aim to achieve the best results, it is still challenging to predict bankruptcy risk, as corporations have become more global and more complex (Kovacova, Klietnik, 2017).

Research in the field of bankruptcy prediction has been a much discussed topic recently. Currently, it is possible to observe some kind of hybridisation in the field of bankruptcy prediction, combining various elements of the aforesaid methods, thus creating one complex model integrating their advantages. If we compare advantages and disadvantages of utilizing statistical methods versus methods utilizing machine learning and artificial intelligence, the basic advantage of statistical methods is in their simplicity. Moreover, it is definitely possible to establish that models based on accounting data and statistical models are clear and applicable for managerial decisions as well as for company practice. To the contrary, advantages of models utilizing complex programming techniques and algorithms are in higher prediction ability in comparison with statistical models. Such advantage is consequently negated by reduced applicability in managerial practice since majority of such models (such as neural networks) include input parameter values and output value of a dependant variable. However, for a manager, it is not clear which variable and to what extent contributed to the resulting value of a dependant variable.

2.2 Definition of bankruptcy

Tinoco and Wilson (2013) emphasize that using definition of bankruptcy from the legal point of view is not the best solution when creating a bankruptcy prediction model. Their argument is that insolvency of a business entity may last for longer and date of bankruptcy, according to a corresponding regulation, does not have to correspond with the actual date of origin of business

entity's financial problems. Moreover, the authors continue that due to frequent changes in legislation regarding bankruptcy during model assessment, capturing for example financial reports for the last 5 years, the results may be distorted causing reduced prediction ability of a model. Balcaen and Ooghe (2008) provide the following disadvantages regarding definition of bankruptcy according to a legal regulation:

- Legal definition of bankruptcy varies according to a country for which the bankruptcy prediction model was established. If we want to compare a legal definition of bankruptcy in studies from various countries, it is clear that each country has own specific modifications of legal framework when it comes to bankruptcies.
- The moment of legal bankruptcy fails to reflect the actual date of bankruptcy. There may be a great difference in time between the actual bankruptcy and bankruptcy according to legal framework.
- It is even possible that a business entity showing characteristics of being bankrupt does not have to declare bankruptcy legally.
- There is a possibility that companies having problems may combine with another entity or taken over by another entity, instead of filing for bankruptcy. In such case, they would not be registered together with companies with financial difficulties, even despite the fact of having financial difficulties.

There are various terms used to name the financial difficulties of a business entity, which may cause difficulties with interpretation of results, such as financial distress, financial problems, financial health of a business entity, insolvency, liquidation, dissolution. According to such definitions, it is necessary to distinguish between financial distress and bankruptcy.

Altman and Sabato (2010) define financial distress upon Basel II as a situation when the obligor is past due more than 90 days on any material credit obligation to the bank. During our studies we also came across other definitions, such as one that the business entity is subject to financial distress if $EBITDA < \text{financial costs (interests, cost of debt)}$ for the minimum of two consecutive years or financial distress represents first year in which its cash flow is less than the actual repayments of long-term liabilities (Tinoco, Wilson, 2013). The majority of the aforesaid definitions mention importance of cash flow as a basic prerequisite having preventive impact from financial problems of the business entity. We would like to remind that not all definitions of financial distress may be used in conditions of economies of Central and Eastern Europe due to lack of developed financial market. The reason being is that calculation includes factors and indicators using market values of shares or bonds.

Bankruptcy is defined as financial insolvency or legal proceedings for solving financial commitments of an insolvent debtor (being person or entity). The purpose of bankruptcy proceedings is to distribute assets to creditors in a fair way and (in majority of cases) release the debtor from further financial commitments. Bankruptcy may be declared by debtor alone (voluntary bankruptcy) or by creditors (involuntary bankruptcy).

Corporate failure can exist in various types and dimensions, and has different effects on stakeholders according to magnitude of the failure and its type. The rise of corporate failure in different types brought about the use of different definitions and different concepts connoting failure. Over the past 35 years, the topic of "business failure prediction" has developed to a major research domain in corporate finance. Many academic studies have been dedicated to the search for the best corporate failure prediction, based on publicly available data and statistical techniques (Kliestik, Kocisova, and Misankova, 2015).

The subject of our long-term research in the field of financial health prediction is also to determine conditions for unsuccessfulness of a business entity in Slovakia, arising due to a combination of

legal and accounting aspects. We created a universal benchmark for classification of an enterprise into successful or unsuccessful by using limit values of three financial ratios: **R** - return on assets (net), **L** - total liquidity, **Z** - indicator of financial independence, we named them **unsuccessfulness indicators** while taking into account valid legal regulations of the Slovak Republic stipulating conditions for unsuccessfulness of an enterprise.

According to our specified conditions, an enterprise has been marked unsuccessful, if it simultaneously fulfilled all three criteria:

- Total liquidity $L < 1$.
- Profit after tax gains a negative value (indicator **R** is negative)
- The ratio of equity to liabilities, i.e. indicator $Z < 0.04$.

Table 1 explains more closely the selected ratios in terms of input variables necessary for their quantification and verbal interpretation.

Table 1: Unsuccessfulness indicators

Indicator label	The calculation procedure (input variables)	Interpretation
<i>R</i>	(profit after tax) ÷ (liabilities)	how many euros of profit (net profit) accounts for 1 euro in capital
<i>L</i>	(short-term assets) ÷ (short-term foreign capital)	highlights the immediate ability of the company to settle all current liabilities through immediate liquidity and equivalents and monetization of short-term receivables and inventory
<i>Z</i>	equity ÷ foreign capital	represents the share of equity and foreign capital in assets financing - refers to the degree of coverage of foreign capital by own resources

Tinoco and Wilson (2013) state that bankruptcy prediction is important for various stakeholders, mainly owners, managers, employees, creditors, suppliers, customers and government. Development and application of models capable of bankruptcy prediction may be important for them mainly in two directions:

- An early warning system - such models are useful for all parties (managers, authorities) since it enables to adopt certain measures to prevent bankruptcy.
- The models may be helpful for decision-making of financial institutions, evaluation and selection of business entities to establish cooperation with or even to invest into.

Bankruptcy prediction models vary in the method applied for their structure as well as in the nature of indicators included subsequently. Some bankruptcy prediction models include current market as well as accounting indicators while the others include just accounting variables. Beaver et al. (2005) present 3 key reasons why market indicators are significant for bankruptcy prediction:

- market prices reflect complex mixture of information,
- values of market variables are easier to track in time - it is possible to capture their dynamic development, to the contrary with financial indicators, published quarterly, if so (in Slovakia, it is on annual basis),
- market indicator values may constitute the volatility indicator (models including also market indicators are of a higher quality in comparison with indicators including just accounting data).

Agarwal and Taffler (2008) compared the performance of bankruptcy prediction models including accounting as well as market indicators. The authors advocate opinion that models including accounting data are better, since:

- bankruptcy is not a sudden event, it is a result of poor performance for several years and such development for several years provides values of individual financial reports,
- credit terms provided by a bank to business entity are predominantly based on financial indicators and such information is a result of financial report analysis,
- quite often, the data necessary for market indicator models is not available.

On the other hand, Agarwal and Taffler (2008) state the following disadvantages of accounting data based models:

- accounting data represent past performance therefore it is not possible to be used for predictions,
- conservatism and historical expenses accounting mean that the actual value of assets may differ to a great extent from the recorded accounting value,
- accounting data is often subject to manipulation by management.

The majority of generally applied bankruptcy prediction models were developed in developed market economies thus limiting their applicability in transforming countries. A significant limitation of using foreign prediction models in the Visegrad Group (V4) countries is based mainly upon the following aspects: limited effectiveness of share market, narrow profiling of a model to specific industry, differences in size and capital power of a business entity, inconsistency of legal regulations, impact of macroeconomic environment, etc. In the following part of this paper, we provide basic knowledge representing the current state of the financial health prediction issue in the V4 countries.

2.3 Poland

Fijorek and Grotowski (2012) point out that in the last 20 years, there have been several attempts to create the bankruptcy prediction in the Polish economy environment. According to the authors, the fundamental problem for the process of company bankruptcy evaluation is lack of good quality data regarding business entities in the standardized form. If we look back, the most used method for creation of such models was by using discriminant analysis. Since 1990s to the present, there have been models developed by Mączyńska (1994), Pogodzińska and Sojak (1995), Gajdka and Stos (1996), Hadasik (1998) and Hołda (2001). From the most current models, there have been models applying logistic regression, neural networks and decision trees developed, e.g. Wędzki (2005) and Hołda (2006).

The broader overview of research in Poland is provided by Prewysz-Kwinto and Voss (2015) who recorded 15 models developed by various authors, specified in detail in literature. The goal of their research was to introduce results of empirical studies related to application of financial analysis and bankruptcy risk identification carried out between Polish business entities. The authors also provide 3 reasons why it is not possible to apply foreign models for other countries: particularity of economies of individual countries, applied accounting standards, access to information.

One of the most recent models, not yet applied in Polish business entities, is the Firth model, developed by Kaczmarek (2016). The model applies logistic regression for classification of business entities to successful and unsuccessful. The sample consisted of 426 business entities subject to bankruptcy declaration in the previous year and 1,936 successful business entities

selected within the same period. According to the author, it has been the largest set of company data in the context of bankruptcy threat level modelling.

2.4 Hungary

In Hungary, the legal background for processes of bankruptcy and liquidation of business entities was constituted in 1991 therefore there is no long-term tradition of bankruptcy prediction in Hungary. The first model of financial health prediction in Hungary was developed in 1996 by Virág and Hajdu (1996), reviewed and updated by the same authors in 2001. The first model included data of companies from 1990 and 1991. The basic methodology included discriminant analysis and logistic regression. Out of 154 business entities undertaking in processing industry, included in the model, 77 were solvent and the same number of business entities were insolvent. All business entities included in the sample employed at least 300 employees. During the course of model development, there were 17 financial ratios evaluated (Virág, Kristóf, 2005).

The most recent model was introduced by Bauer and Endrész (2016), estimating probability of bankruptcy for Hungarian business entities, utilizing the probit method. The estimated model shows significant performance for recognition between failing and healthy business entities. The benefit of this model is combination of micro as well as macro information, enabling to capture aggregate risk level dynamics, mainly in times of on-going economic crisis.

2.5 Czech Republic

The first attempts to develop a prediction model in the Czech Republic came in 1995 when the Neumaier couple developed the first prediction model with the working title “IN95”. The model was reviewed four years later; the emphasis was put mainly to development of company value as the main goal of its activities. The result was an “IN99” index.

In conjunction with “IN05” model, there were new attempts to create a prediction model that could be used as a support tool for decision-making to more stakeholders. Jakubík and Teplý (2008) developed a new index named “JT”, evaluating financial stability of Czech business entities. The index is based on the financial scoring model while for model estimation, the logistic regression was used. Within development of the model, there were seven indicators of business entity bankruptcy assessed, one year before identification of business entity’s financial distress.

One of the most up-to-date papers regarding prediction models in the Czech Republic comes from Kubíčková and Nulíček (2016) who strive to prepare structure of business entities’ financial health model. The first part of research includes characteristics of prediction ability possibilities of discriminant analysis. The second part of research defines possible indicators/predictors of financial distress that could be, in a certain way, combined into a resulting bankruptcy model. The model alone compares various views of factors influencing financial situation of business entities and puts them into contrast with indicators used so far in scientific works (with special regard to models in transition economies). The result is a set of 39 indicators verified in the subsequent stage of the research by discriminant analysis.

2.6 Slovakia

In comparison with other countries, the research regarding financial health prediction in Slovakia is clearly undersized. From the view of a complex bankruptcy prediction model focused exclusively to Slovak business entities, we found just a small circle of models. One of them is a Ch-index Chrastinová (1998) and G-index Gurčík (2002) model, developed for evaluation

financial health of business entities undertaking in agricultural industry. Chrastinová (1998) utilized data of Slovak business entities and upon discriminating analysis; she developed an equivalent of a bankruptcy prediction model. CH-index is orientated to the agricultural industry only. For development of this prediction model, there were over 1,000 business entities undertaking in the agriculture industry analysed.

Mostly, there are prediction models from Czech Republic or worldwide-known models applied for Slovak companies; such models are considered as less suitable tools for bankruptcy prediction due to reliability of results.

3. CONCLUSION

There are various prediction models, differing in approaches and methods applied for their compilation, demand for input data, number of variables, form of interpretation of results, etc. The existence of large number of models is caused by the fact that there is not universal application in various sectors and economic conditions. It is understandable that creators of prediction models strive to create a model that is able to provide a required value of prediction capability within the longest possible period of time, however, it is very difficult in the environment of ever-changing market conditions.

The difference of environment requires development of an optimum combination of indicators and development of original models designed for one particular economy. Due to the place of origin, structure of individual indicators and their weights in models, the possibility to use such individual models for business entities in conditions of Slovak economy is considerably problematic and limiting. Due to the aforesaid, we think it is important to develop a prediction model that would eliminate the aforesaid shortcomings and take the current economic situation of Slovakia into account. Only then, it is possible to provide a high prediction reliability of the model, being the decisive criteria for its quality.

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LINKING TEACHING METHODS TO THE SATISFACTION AND SUCCESS OF STUDENTS IN ONLINE STUDY MODE

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Abstract: *The purpose of our article is to link teaching methods to the satisfaction and success of students in online education. The creative courses, especially in the fully online education process, is challenging innovation in teaching. The specificity of an online study with one-month performance of courses is to force the lecturer to become more effective, and students in a compact learning effort. We have found that teaching using creative methods increases the effectiveness of students' study and performance; although not equally to all, but even the less successful students did not feel "losers". Among the creative methods we have taken into consideration are the fun theory, the introduction of icons/references with the possibility of student identification, teaching with examples of good practices, cooperation with the economy in solving practical challenges and virtual mobility of students from various educational institutions and countries. The article presents and analyzes data from student evaluations and questionnaires in six courses, especially from the point of view of how the creative methods described in the article when innovating, such as virtual student mobility and work in international mixed online teams and cooperation with the economy, influence both the the general satisfaction of students with the subject as well as the acquisition of planned subject specific and general competence of subjects. In conclusion, we find that on-line studies require a very precise and targeted lecture. If students want to acquire the required competences, the relationship between theory and practice is about 30 : 70. Our recommendation is that students fully conquer a smaller amount of content than superficially transform the larger one. We believe that our findings will help lecturers in the field of creative subjects, in addition to creative communication and advertising, as well as subjects in the field of public relations, in introducing creative methods of teaching in everyday lectures and, consequently, with more successful outcomes of the subject.*

Keywords: *teaching methods, online education, student evaluations*

JEL Classifications I21 · I23

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1. INTRODUCTION

One of the greatest challenges which lecturers in higher education (specifically in the field of communication and other “soft skills”) face is determining the most effective teaching strategies for students. Understanding student involvement in learning can help lecturers design the most effective curriculum and determine how students best learn. To meet this demand, many lecturers are using active learning pedagogies as a social and informal process where ideas are casually exchanged student involvement and intellectual and interpersonal activities (Menges, Weimer, 1996). Among the active teaching methods of teaching this article discusses a collaborate or team-based learning, fun theory, the introduction of icons/references with the possibility of student identification, teaching with examples of good practices, cooperation with the economy in solving practical challenges and virtual mobility of students from various educational institutions and countries. We understand active learning as a process involving students not only “doing” things, but analyzing what they are doing.

»Communication is a risky business ...« (Andersen, 2007) and when we teach in that field, we become well familiar with this slogan. If we want to follow different paths in communication's curriculum and at the same time be successful, then the only path forward is to use a wide range of different methods, theories and cases. The next step is to emphasize the ones which are proven to be highly successful in teaching and got high grades in students' own evaluation.

A lot of scientific material is daily published, republished and reviewed, so it is important for our methods to pragmatically reflect and adapt beyond the old ex cathedra style of teaching. One must also take into account that new methods of learning are being developed every day in the field of basic communication science. We do not want to wait for the theory is completely developed by academics before using it, since by using it, when it is still new and evolving, students can contribute, get a chance to test it and are granted the opportunity to evaluate it.

We also think that students have a right to be able to learn without being bored out of their minds, as a lot of listeners in ex cathedra classes are. Just thinking about ex cathedra, »the phrase has come to be used with regard to statements made by people in positions of authority, and it is often used ironically to describe someone speaking with overbearing or unwarranted self-certainty« (Merriam Webster), one can still describe a lot of university teaching.

2. USING THE ACTIVE TEACHING METHODS IN PRACTICE

Based on our students' evaluations, we do not think it is exaggerated to say that our educational methods differ from the style described above. For our teaching of advertising campaigns and courses in the public relations fields, we got some really informative commentaries:

- * Professor has held extraordinary interesting webinars.
- * Professor put a lot of hard work into webinars.
- * I love that a lot of creativity was demanded and we can let our imagination run wild.
- * Professor gave me a really substantive feedback which is really great.
- * I love all this freedom of creativity.
- * I like exercises which stimulate creative thinking.
- * I love exercises where we can use theory in practice.

Beside this we recommend a mixture of lively, energetic, even fun teaching, which can yield better results since people become more motivated to study interesting content in a relaxed atmosphere.

»What we need to maintain our interest in life, is a justified expectation of pleasant surprises. (And yes, you can expect a surprise if you're not logically omniscient.) This excludes the herbal profusions, the poorly worked-out plans, and the supernatural. The best reason for this justified expectation is experience, that is, being pleasantly surprised on a frequent yet irregular basis.« (Yudkowsky, 2009).

Yudkowsky is not an academic, but he has received a lot of attention as one of the AI bloggers. We can find the proof in neuroscience: »According to Dr. Matt Bellace at Lynn University in Florida, laughter releases the neurotransmitter dopamine, which serves as a reward for the brain, creates a sense of euphoria, and plays a pivotal role in our motivation to continue the behavior. Dr. Bellace notes that the benefits of laughter include improved immune functioning, stress relief, increased tolerance for pain, improved cardiovascular health, reduced anxiety, and improved mood.« (Brandom, 2017).

And this is what all of us in training business want to accomplish: We like it when dopamine is released in our students' brains every time we teach them something interesting and enjoying. Because »even learning something new triggers these feelings of euphoria, but only if it's something really engaging and awesome« (Kites in the Classroom, 2018).

How can we accomplish this »engaging and awesome« learning? The answer is: maybe with hard work, excellent preparation and innovative tools!

2.1. USING HUMOR AS A TEACHING METHOD

The fun theory is based on the discoveries of neuroscientists that a fun-filled theory, supported by current examples from practice, stimulates the ability to memorize content and acquire new knowledge. Humor in educational settings serves a variety of positive functions beyond simply making people laugh. Humor builds group cohesion and people respond more positively to each other when humor is present; it brings them together. Humor helps individuals cope with stress; it relaxes them. But, as Weimer notes, "not all the functions of humor are positive. If humor is used divisively or to disparage others, it weakens group cohesion. Humor has negative impacts when it is used as a means of control. For example, given the power dynamic in the classroom, it is highly inappropriate for instructors to target students by making fun of their ignorance or beliefs." (Weimer, 2013).

We know that teachers/lecturers are not selected or trained to be comedians or entertainers, but we know that a positive climate for learning, and enjoyment, is correlated with retention of information and putting knowledge to work in everyday situations (including tests). Every theme can be approached with good will and with empathy to students. They are more relaxed and they learn more and process information more efficiently.

2.2. CASE STUDY

We use the case study method of teaching for two reasons. Firstly it helps with the teaching of theory which is by default quite boring. Second and most importantly, we use it as a homework problem that the students can really concentrate and bite into. It is important that we operate with a real business problem, so we at the same time can bring learning to real life and vice versa.

»Case studies are effective ways to get students to practically apply their skills, and their understanding of learned facts, to a real-world situation. They are particularly useful where situations are complex and solutions are uncertain.« (Case Studies, UNSW Sydney).

Qualitative research shows that is one of the most efficient tool we can use. Comments in the evaluation questionnaire praise practical realization of advertising actions an some public relations courses.

* I love practical orientation of the subject and the fact we didn't have to cram like we always have to.

* Homework was connected to real case!

* Subject was very interesting. A lot of practical work through which we were able to connect to theory. Super and not boring at all!

* The everyday problems.

* Possibility to use practical knowledge in reality.

2.3. TEAM-BASED LEARNING

Teamwork is the collaborative effort of a team (a group of interdependent individuals who work together towards a common goal, with clearly defined roles within the team in order for everyone to have a clear purpose) to achieve a common goal or to complete a task in the most effective and efficient way. Team-based learning is "an evidence based collaborative learning teaching strategy designed around units of instruction, known as "modules," that are taught in a three-step cycle: preparation, in-class readiness assurance testing, and application-focused exercise." (Team-Based Learning Collaborative, 2018).

Since we are teaching basic business skills we must consider, which knowledge is the most required for students entering jobs, where building relationships and success go hand in hand.

»Findings from a questionnaire administered to undergraduate students in a communication research course indicate that involvement in cooperative learning is a strong predictor of a student's academic performance. A significant positive relationship was found between the degree to which grades are important to a student and his or her active participation in cooperative learning. Further, the importance of grades and sense of achievement are strong predictors of performance on readiness assessment tests.« (Tsay, Brady, 2010).

One of the important features of our business school in online education is team work in a virtual learning environment. Taking into account the strict instructions for team work, students learn more, in addition to subject matter, also social skills, which are exaggerated by the excessive use of social networks and similar benefits of the use of information and communication technology in the background. Here, the role of lecturers and online tutors is in promoting, motivating and directing. Students learn by they can also help each other, which benefit both the advanced and less advanced students.

2.4. COMPETITION

Our evaluations prove the same. Sense of achievement is a very strong stimulation. We try to upgrade it with competitions between teams - the winner gets a symbolic prize from our sponsors, which are involved in our lectures by case study methods.

For instance, when we declared that every member of the winning team will get an artistic T-shirt from our sponsor, a startup company, students reacted enthusiastically with the results being even better than usual.

Competition is a context in which a situation in which someone is trying to win something or be more successful than someone else or to do better than all of the others (Cambridge Dictionary, 2018). Competition exists when there is scarcity of a desired outcome. To say that we are preparing students for the real world by putting them in artificially constructed competitive situations is to impose on them a specifically biased world-view (Johnson, Johnson, 2006). In a broad sense, lecturers collectively create a more or less competitive future by the way we encourage our students to think and treat one another.

2.5. COOPERATIVE LEARNING

Johnson, Johnson, and Smith (1991) suggested that cooperative learning is more than simply “working in groups,” and should include the following:

- positive interdependence where team members are reliant on one another to achieve a common goal, and the entire group suffers the consequences if one member fails to do his or her work;
- individual accountability where each member of the group is held accountable for doing his or her share of the work;
- face-to-face promotive interaction where, although some of the group work may be done on an individual basis, most of the tasks are performed through an interactive process in which each group member provides feedback, challenges one another, and teaches and encourages his or her groupmates;
- appropriate use of collaborative skills where students are provided with the opportunity to develop and implement trust - building, leadership, decision - making, communication, and conflict management skills; and
- group processing in which team members establish group goals, the assessment of their performance as a team occurs periodically, and they often identify changes that need to be made in order for the group to function more effectively.

2.6. REVERSE TEACHING

The traditional mode of education has been classroom lectures, where the lecturer explains a topic, followed by homework that includes student exercises. In reverse teaching, the students first study the topic by themselves, and then present it in the (in our case, in the virtual) classroom. When reverse teaching is used, the classroom becomes more interactive and the teacher has ample opportunity to provide individualized guidance when it is most needed. The role of the classroom teacher is then to tutor the student when they become stuck, rather than to impart the initial lesson. This allows time inside the class to be used for additional learning-based activities, including use of differentiated instruction and project-based learning. The lecturer guiding the students, allowing them to assist the other students when they are assimilating information and creating new ideas.

3. CONCLUSION

In this article, we presented some of the methods by which we try to introduce a difference in (virtual) lecture room. In addition to trying to be moderately casual at lectures and fun to some extent, we find that with each implementation of a particular course it grows itself. On the other hand, the abovementioned methods of submitting substances to the lecturer require considerable involvement in the subject. At the beginning, much energy has to be invested in preparing the subject and finding practical examples for students' work. In the end, taking feedback from students and adhering to them requires the holder of the course to update it in the future course of the course.

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MDA FINANCIAL DISTRESS PREDICTION MODEL FOR SELECTED BALKAN COUNTRIES

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Abstract: *The issue of company financial distress and the early prediction of potential bankruptcy is one of the most discussed issues of economists around the world in recent decades. The most widely used method to create these models is Multidimensional Discrimination Analysis from the first attempts in the 1960s to the present. In the paper we present prediction model for some emerging market countries in Balkan region created using a Multidimensional Discriminant Analysis method based on real data from the financial statements obtained from Amadeus - A database of comparable financial information for public and private companies across Europe. Our database contains data more than 200 000 companies and about 25 predictors. Using this model, it is possible to predict the financial difficulties of companies one year in advance.*

Keywords: *Prediction model, Financial distress, Multidimensional Discrimination Analysis, Prediction ability.*

JEL Classifications C52 · C53 · G33

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1. INTRODUCTION

Bankruptcy of the company brings huge economic losses for the investors and other stakeholders. Its existence calls for an analysis of the bankruptcy causes and early identification of signs of approaching bankruptcy. These signs can be reflected in the company financial statements. For this reason, accounting data are a common source of information for assessing the financial situation of an enterprise (Siekelova et al, 2017).

Many authors are trying to create a model for early identification and prevention of financial distress or bankruptcy. Such model is significant contribution to the efficiency of company management. In this area, papers by Altman and Ohlson can be considered as groundbreaking (Kliestikova, Misankova and Kliestik, 2017). Altman (1968) created the first commonly used bankruptcy model using a Multidimensional Discrimination Analysis (MDA). According to many authors, Altman's model still represents an effective tool to predict bankruptcy (Li, Ragozar, 2012). Another commonly used technique for creation of prediction models is logistic regression (logit) models. In 1980, this technique of prediction model creation was used for the first time by Ohlson (1980).

Currently, there exists many prediction models developed at a particular time and in conditions of particular economies. Many of them have been created for companies in a particular sector of national economy. For example, in New Zealand Chung, Tan and Holdsworth (2008) have created classification model for companies in the field of finance industry. Sun and Li (2012) have applied the Logit method and also MDA method for creation of company distress prediction model in China. In Iran, Shams, Sheikhi and Sheikhi (2011) have developed a Logit bankruptcy prediction model. Bellovary, Giacomino and Akers (2007) have described the situation about existing models for predicting bankruptcy from 1930 to 2007. In 2017, Altman et al. (2016) use the original Z-Score model developed by Altman in 1983 for non-financial companies across all industrial sectors, from 31 European and three non-European countries using different modifications of the original model.

Of course, even authors in the western part of the Balkan region are concerned with the issue of bankruptcy prediction models. For example, Jovanovic, Todorovic, Grbic (2017) and Simic, Kovacevic, Simic (2012), but also Obradovic et al. (2018) have created prediction models for Serbian companies. The topic of identifying financial problems is also discussed for Croatian companies (Kundid, Ercegovic; 2011; Sarlija, Jeger, 2011; Pervan, Pavic, Pervan, 2014; Zikovic, 2018). Further, for Slovene companies several prediction models have been created (Bonca, Ponikvar, Pusnik and Tajnikar, 2015; Zidek, 2016).

2. SAMPLE AND METHODOLOGY

Our database contains data more than 200 000 companies from Croatia, Serbia, Slovenia, Macedonia and Montenegro. Table 1 lists the frequencies of these companies according to these countries. The most numerous is the group of Croatian companies and, on the other hand, the least of Montenegrin.

Table 1: Company frequencies

<i>Country</i>	<i>Frequency</i>	<i>Percent</i>
Croatia	64076	31,5
Macedonia	44973	22,1
Montenegro	6730	3,3
Serbia	42017	20,6
Slovenia	45804	22,5
Total	203600	100,0

Real data in our database was calculated from the financial statements obtained from Amadeus - A database of comparable financial information for public and private companies across Europe. Table 2 lists potential predictors and the methods of their calculation. Two of these predictors are indicators: country-specificity and size of the companies (Small, Medium and Large)). These indicators have to be encoded as dummy variables. The remaining predictors are financial ratios calculated from financial statements from the year 2015.

Table 2: List of predictors

<i>Predictor</i>	<i>Formula</i>
X01	Sales/Total Assets
X02	Current Assets/Current Liabilities
X04	Net Income/Shareholders Equity
X07	Net income/Total Assets
X08	Working Capital/Total Assets
X09	EBIT/Total Assets
X10	Liabilities/Total Assets
X11	Current Assets/Total Assets
X12	Cash & Cash Equivalents/Total Assets
X15	Current Liabilities/Total Assets
X16	Current Assets/Sales
X18	Stock/Sales
X20	Net Income/Sales
X21	Non-current Liabilities/Total Assets
X22	Cash & Cash Equivalents/Current Liabilities
X24	Working Capital/Sales
X25	Current Ratio
X26	(Current Assets-Stock)/Current Liabilities
X27	ROA
X28	ROE
X30	Solvency Ratio
X35	Profit Margin
X36	Net Current Assets
X37	Working Capital
Country	Croatia, Macedonia, Montenegro, Serbia or Slovenia
Size	Small, Medium or Large

Our aim is to create a model predicting the company's financial distress one year in advance. Therefore, the output variable *Distress* identifies the financial distress of the companies in 2016. Table 3 describes the frequencies and percentages of companies in selected countries.

Table 3: Frequencies of companies

Country	Distress	Frequency	Percent
Croatia	No	46103	72,0
	Yes	17973	28,0
	Total	64076	100,0
Macedonia	No	36317	80,8
	Yes	8656	19,2
	Total	44973	100,0
Montenegro	No	3987	59,2
	Yes	2743	40,8
	Total	6730	100,0
Serbia	No	31754	75,6
	Yes	10263	24,4
	Total	42017	100,0
Slovenia	No	37935	82,8
	Yes	7869	17,2
	Total	45804	100,0
Total	No	156096	76,7
	Yes	47504	23,3
	Total	203600	100,0

To identify relevant predictors and create financial distress prediction model, Multidimensional Discrimination Analysis was used, which is probably the most frequently used algorithm. Using stepwise discrimination analysis we find relevant predictors of financial distress, with only those predictors being included in the model that possess a sufficient discriminating power. The choice of relevant predictors can also be done on the basis of the test of equality of means between groups of companies that are in financial distress and that are not, but the stepwise method, besides selecting variables, also solves the problem of multi-collinearity.

The main result of this analysis is Fisher canonical discriminant function. It is a linear function of the relevant predictors that separates companies into group of companies in financial distress or healthy companies. For classification of company into one of these two groups, using this discriminant function we can calculate discriminant score. We compare this score with the weighted averages of centroids (average scores in the groups of companies). If we use a constant in discriminant function, it is enough to compare the discriminant score value to zero. Analogously, we could decide on the company's engagement on the basis of the value of Fisher's linear discriminant functions.

If we want to assess the overall quality of the model, we will assess the statistical significance of canonical discriminant function. The contribution of individual predictors to explaining the overall variability can be judged by standardized coefficients of discriminant function and their statistical significance. The classification ability of the obtained model is evaluated by the classification table. This table contains data of the percentages of mistakenly and correctly classified objects in each group. If the model is validated on the sample it was designed for, the classification ability is slightly overvalued. It is appropriate to divide the data into the training sample, used for the model creation and the testing sample, where we verify the classification ability of the model. The size of a training sample is commonly 80 %, and 20 % for testing sample.

3. RESEARCH RESULTS

As already mentioned, we use the stepwise Multidimensional Discriminant Analysis to create a prediction model. First, we look at the results of One-way ANOVA to identify predictors that differentiate companies into a group of companies in financial distress and healthy companies. Table 4 shows these results. We can exclude variables X16, X18, X21 and X24 from the next analysis because we cannot claim that their mean values for the two groups of companies are significantly different.

Table 4: Tests of Equality of Group Means

<i>Predictor</i>	<i>Wilks' Lambda</i>	<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
X01	,999	60,619	1	81705	,000
X02	,998	202,352	1	81705	,000
X04	,999	51,565	1	81705	,000
X07	,999	117,866	1	81705	,000
X08	,997	206,373	1	81705	,000
X09	,995	372,558	1	81705	,000
X10	,968	2693,394	1	81705	,000
X11	1,000	28,749	1	81705	,000
X12	1,000	11,874	1	81705	,001
X15	,968	2671,314	1	81705	,000
X16	1,000	,107	1	81705	,744
X18	1,000	,042	1	81705	,838
X20	1,000	27,066	1	81705	,000
X21	1,000	2,119	1	81705	,145
X22	,999	87,517	1	81705	,000
X24	1,000	,146	1	81705	,702
X25	,998	202,355	1	81705	,000
X26	,998	161,802	1	81705	,000
X27	,995	375,779	1	81705	,000
X28	,996	317,439	1	81705	,000
X30	1,000	4,746	1	81705	,029
X35	,993	574,576	1	81705	,000
X36	1,000	13,947	1	81705	,000
X37	1,000	8,566	1	81705	,003
Country=Croatia	,999	87,811	1	81705	,000
Country=Macedonia	1,000	36,123	1	81705	,000
Country=Montenegro	1,000	21,029	1	81705	,000
Country=Serbia	,999	68,605	1	81705	,000
Country=Slovenia	1,000	13,803	1	81705	,000
Size=Small	,997	281,895	1	81705	,000
Size=Medium	,997	237,597	1	81705	,000
Size=Large	1,000	27,225	1	81705	,000

The canonical correlation of discriminant function is significant, but is not very high (only 0,224).

Table 5: Canonical correlation

<i>Function</i>	<i>Eigenvalue</i>	<i>% of Variance</i>	<i>Cumulative %</i>	<i>Canonical Correlation</i>
1	,053	100,0	100,0	,224
<i>Test of Function(s)</i>	<i>Wilks' Lambda</i>	<i>Chi-square</i>	<i>df</i>	<i>Sig.</i>
1	,950	4218,298	17	,000

The stepwise method included variables to the model one by one. Table 5 shows final list of relevant predictors in our model. Moreover, Table 6 describes the discrimination ability of individual variables. Variables X10 and X15 have the greatest discrimination ability.

Table 6: Standardized Canonical Discriminant Function Coefficients

<i>Variable</i>	<i>Coefficient</i>
X01	,082
X02	,242
X04	-,095
X09	-,205
X10	,525
X11	-,148
X12	,104
X15	,517
X20	-,062
X22	-,051
X27	,362
X28	-,373
X35	-,206
Country=Montenegro	,040
Country=Serbia	-,164
Country=Slovenia	-,062
Size=Small	,237

By using unstandardized canonical discriminant function coefficients (in Table 6); we can calculate a discriminant score for every company that allows to include a company into the group of companies in financial distress or healthy companies.

Table 7: Canonical Discriminant Function Coefficients

<i>Predictor</i>	<i>Coefficient</i>
X01	,025
X02	,037
X04	-,016
X09	-1,111
X10	3,861
X11	-,511
X12	,527
X20	-,015
X21	-1,928
X22	-,016
X27	2,077

X28	-,467
X35	-1,290
Country=Montenegro	,226
Country=Serbia	-,371
Country=Slovenia	-,135
Size=Small	,567
(Constant)	-1,977

Analogously, we could decide on the company's inclusion based on the values of Fisher's Linear Discriminant Functions. For every company, we calculate the value of these discriminant functions. The greater value identifies inclusion to one of the companies groups.

Table 8: Classification Function Coefficients

<i>Predictor</i>	<i>Distress</i>	
	<i>No</i>	<i>Yes</i>
X01	,053	,084
X02	,187	,233
X04	-,004	-,024
X09	,035	-1,360
X10	9,249	14,096
X11	8,012	7,370
X12	1,465	2,127
X20	-,003	-,021
X21	6,313	3,893
X22	-,082	-,102
X27	5,385	7,993
X28	-,725	-1,312
X35	1,736	,116
Country=Montenegro	3,393	3,676
Country=Serbia	3,490	3,025
Country=Slovenia	3,542	3,373
Size=Small	3,992	4,704
(Constant)	-9,470	-12,685

For practical use of the model it is necessary that the model has sufficient discrimination ability. We evaluate this ability on the basis of a classification table. Based on the Table 8, it is clear that the model has a high ability to identify company financial distress (93,5 % for the training sample and 90,9 % for the testing sample). The prediction model has relatively high overall discrimination ability. This is because 75,6 % of companies in the testing sample were correctly classified. This prediction ability is 76,0 % for the training sample cases.

Table 9: Classification Results

<i>Sample</i>		<i>Distress</i>	<i>Predicted Group Membership</i>		<i>Total</i>
			<i>No</i>	<i>Yes</i>	
Training Sample	Count	No	88259	36577	124836
		Yes	2473	35571	38044
	%	No	70,7	29,3	100,0
		Yes	6,5	93,5	100,0
Testing Sample	Count	No	22127	9082	31209
		Yes	866	8645	9511

	%	No	70,9	29,1	100,0
		Yes	9,1	90,9	100,0

4. CONCLUSION REMARKS

We have designed a prediction model for companies from Croatia, Macedonia, Montenegro, Serbia and Slovenia predicting the risk of financial difficulties one year in advance. Multidimensional Discriminant Analysis was used for its creation. We use data calculated from real financial statements of more than 200,000 companies obtained from database Amadeus - A database of comparable financial information for public and private companies across Europe. From the original 32 predictors (24 financial indicators and 8 dummy variables), 17 predictors remained in the model. These predictors are not burdened by multi-collinearity, and provide the best identification of financial distress of companies.

Using canonical discriminant function from our model one can calculate discriminant score of a company and based on this score, it is possible to predict the financial distress of this company. Overall prediction ability of the model is relatively high (about 76 %). But financial distress prediction ability is more than 90 %. Therefore, we can consider the model to be relatively reliable for prediction of financial distress one year in advance. Although the model was created for companies in selected Balkan countries, it may be applicable also to other emerging market countries.

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PROPOSED INDEX CALCULATION FOR ECONOMICS RANKING

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Abstract: *Index; is a display in which more than one variable is included and is used to measure the proportional variation of the movements of these variables. Indices are useful because they allow summarization and comparison by making the data simple. In this study; a new index calculation has been proposed with the help Fuzzy Clustering method. Calculation of Index prepared with 10 index values used in the literature. The indices are; Open Market, Budget Transparency, European 2020-Competitiveness, Economic Freedom (by Heritage Foundation), Economic Freedom (by Fraser Institute), Depth of credit information, Financial Stability, Trade Facilitation, Financial Inovation and Global competition. FCM Calculations are made with Matlab.2016 and other calculations are made with Microsoft Excel.2017 programmes.*

There are variables which have different numbers and structures used in each index calculation. These variables have different weights within themselves. In this study, weights were calculated for the new index value which will be created by using the sequences created because of these indices. The weights of each index value obtained by the Fuzzy Clustering Analysis are multiplied by the index values to create a new index order.

European countries were re-ordered under the title "Economy". It can interpret this new index order as a general summation of all other orders. Thus, the order of the countries under different subject headings will be calculated together with the orders in a specific area (economy, law etc.).

Keywords: *Index Calculation, FCM, Economics*

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1. INTRODUCTION

Index; is a display in which more than one variable is included and is used to measure the proportional variation of the movements of these variables. This proportional change can vary according to time or place. Therefore, indices are useful because they allow summarization and comparison by making the data simple. The indices can be used for comparisons, current situation analyzes or future estimates that are calculated for different years, settlement areas or items.

In recent years, many organizations have calculated their own index values. These indices, which do not have legal and economic sanctions, are perhaps the most important indicators in terms of showing the current situation of countries, cities or societies. It is also possible to analyze the future with different calculations of indexes made with different variables. With these indices we can see the closest position to the truth about the point and the future of mankind.

Many countries or organizations calculate their own index values in relevant areas. Indices as “Index of Mother” prepared by Save the Children Organization and “Index of Better Life” prepared by the OECD can be given as examples. These indices can be presented by sorting, by grouping or mapping observations. So that the results are both presented and visually summarized by the interested persons or institutions.

In literature, there can be seen relevant papers about indices. Carlsson and Lundström (2002) investigate what specific types of economic freedom measures are important for growth. Gwartney, Lawson and Holcombe (1999) examine the importance of economic freedom by using an index that measures economic freedom in four basic areas: Money and inflation, economic structure, takings and discriminatory taxation, and international trade. Lerman and Yitzhaki (1984) derive a convenient way to calculate the Gini coefficient, using the covariance. Harzing and Van der Wal (2009) proposed a new data source (Google Scholar) and metric (Hirsch's h -index) to assess journal impact in the field of economics and business.

2. INDEX OF ECONOMICS

In an economically free society, each person controls the fruits of his or her own labor and initiative. Individuals are empowered—indeed, entitled—to pursue their dreams by means of their own free choice (Miller, Kim, 2015). Economic freedom and democracy affects economic performance by identifying organizational structure. One of the important part of this performance is the index of economics. The Index of Economic Freedom is a helpful tool for a variety of audiences, including academics, policymakers, journalists, students, teachers, and those in business and finance.

Few foundations calculate his own indices with different methods. To give an example to this indices; Index of Economic Freedom (prepared by Heritage Foundation and Wall Street Journal), Economic Freedom of the World (prepared by Fraser Institute) and World Survey of Economic Freedom (prepared by Freedom House).

In an economically free society, individuals are free to work, produce, consume and invest in any way they please. With the help economic freedom index, we simply analyses the country's economic freedom levels or classify them in to similar groups.

3. CLUSTERING ANALYSIS

Clustering is the assignment of a set of observations into subsets (called *clusters*) so that observations in the same cluster are similar in some sense. Clustering is a method of unsupervised learning, and a common technique for statistical data analysis used in many fields, including machine learning, data mining, pattern recognition, image analysis, bioinformatics and marketing.

Clustering analysis is a statistical classification technique for discovering whether the individuals of a population fall into different groups by making quantitative comparisons of multiple characteristics. The objective of cluster analysis is the classification of objects according to similarities among them and classify the data into groups (Balasko, Abonyi and Feil, 2005).

In fuzzy clustering, fuzzy techniques are used to cluster the data and with these techniques an object can be classified in more than one cluster. This approach comes into the picture as an suitable method when the clusters cannot be separated from each other distinctly or when some units are uncertain about membership.

Fuzzy clusters are functions modifying each unit between 0 and 1 which is defined as the membership of the unit in the cluster. The units which are very similar to each other hold their places in the same cluster according to their membership degree. Fuzzy clustering is based on distance measurements as well like crisp clustering algorithms. The structure of the cluster and the algorithm used to specify which of these distance criteria will be used. Some of the convenient characteristics of fuzzy clustering can be given as follows (Naes, Mevik, 1999):

- i. It provides membership values which are convenient to comment on.
- ii. It is flexible on the usage of distance.
- iii. When some of the membership values are known, they can be combined with numeric optimization.

The advantage of fuzzy clustering over crisp clustering methods is that it provides more detailed information on the data. But there will be too much output when there are too many individuals and clusters so it will difficult to summarize and classify the data. Moreover, fuzzy clustering algorithms, which are used when there is uncertainty, are generally complicated (Oliveira, Pedrycz, 2007).

4. FUZZY C-MEANS

Fuzzy C-Means algorithm forms the basis of all clustering techniques that depend on objective function. It was developed by Bezdek (1974a, 1974b). When the FCM algorithm comes to a conclusion, the dots in the p dimension space become a sphere-shaped figure. It is assumed that these clusters are approximately the same size. Cluster centers represent each cluster and they are called prototypes. Euclidean distance d_{ik} between the data and the cluster center is used as the distance measurement and can be calculated by formula given in Equation.1.

$$d_{ik} = (x_i - v_k) = \|x_i - v_k\| = \left[\sum_{j=1}^p (x_{ji} - v_{jk})^2 \right]^{1/2} \quad (1)$$

where x_k represents the position observation value in the coordinated system, and v_i represents the cluster center. It is necessary to know the actual number of clusters and the membership degrees of the individuals beforehand to be able to put this technique into practice. However, in practice, it

is difficult to know these parameters before the application. For these, it is possible to find these values through the method of trial and error or through some techniques developed [11]. The objective function used for this clustering method is as follows:

$$J(u, v) = \sum_{j=1}^n \sum_{t=1}^c u_{jk}^m \|x_{ji} - v_{jk}\|^2 \quad (2)$$

This function is the weighted least square function. n parameter represents the number of observations, and c represents the number of clusters. u_{jk}^m is the membership of x_j in k -th cluster, $J(u, v)$ value is a measure of the total of all weighted error sum of squares. If the $J(u, v)$ function is minimized for each value of c , in other words if it is derived from the 1st degree according to v_j 's and made equal to 0, the prototype of FCM algorithm can be given in Equation.3:

$$v_{jk} = \frac{\sum_{j=1}^n u_{jk}^m x_{ik}}{\sum_{j=1}^n u_{jk}^m} \quad (3)$$

In equation.3, it symbolizes; the number of cluster with c , fuzziness index with m , process ending criteria with \mathcal{E} and membership degrees matrix with U of FCM algorithm generate cluster prototypes at random. By taking means of these values, membership degrees matrix is calculated as given in Equation.4 (Sintas, Cadenas and Martin, 1999).

$$u_{ik} = \left[\sum_{j=1}^c \left(\frac{d_{ji}}{d_{jk}} \right)^{\frac{2}{m-1}} \right]^{-1} \quad (4)$$

U cluster prototypes are updated in all iteration and the processes are repeated until $\|U^{(t)} - U^{(t-1)}\|$ value reach to previously determined error term. After FCM algorithm is implemented membership degrees are used in other to decide which individual will participate in which cluster. For each individual; the highest cluster membership is observed and this individual is added to that cluster (Erilli, Yolcu, Eğrioğlu, Aladağ and Öner, 2011).

5. PROPOSED INDEX CALCULATION

Indices are calculated with the help of several variables. The proposed index is calculating with fuzzy clustering analysis. The suggested steps are given as follows:

- i. The variables forming each index value (they must be in the same cluster) are clustered by the fuzzy clustering analysis. (Here, it will be easier to organize the data as 2 clusters. It is the easiest method to set up a very large number of observations in addition to the observations that make up the index value for this and set the result as 2 sets).
- ii. After applying the FCM method, cluster membership degrees of each observation are calculated. Cluster membership degrees take place between 0 and 1 for each observation.
- iii. The membership degrees are multiplied with scores and rankings used in related indices separately.
- iv. This is done for all index values which will be used in proposed index.

At the end, two different index sequences based on both rank order and scoring are calculated.

6. APPLICATION

In application, it is used 10 different indices for 42 European countries to calculate new proposal index. The indices are; Open Market, Budget Transparency, European 2020-Competitiveness, Economic Freedom (by Heritage Foundation), Economic Freedom (by Fraser Institute), Depth of credit information, Financial Stability, Trade Facilitation, Financial Innovation and Global competition. FCM Calculations are made with Matlab.2016 and other calculations are made with Microsoft Excel.2017 programmes.

Every index calculation prepared with different variables. The variables used in index calculations is given below:

Economic Freedom index - Heritage Foundation (Property Rights, Freedom from corruption, Fiscal Freedom, Government Spending, Business Freedom, Labor Freedom, Monetary Freedom, Trade Freedom, Investment Freedom, Financial Freedom), European 2020 Competitiveness Index (Enterprise environment, Digital agenda, Innovative Europe, Education and training, Labour market and employment, Social inclusion, Environmental sustainability), Open Market (Trade Openness, Trade Policy Regime, Foreign Direct Investment Openness, Trade Enabling Infrastructure), Budget Transparency Index (The open budget survey results), Economic Freedom - Fraser Institute (The breadth of the State's field of activity: expenditures, taxes and initiatives, Legal structure and property rights Powerful money access International trade liberty, Legislation on credit, labor and business), Financial Stability Index (Regulatory Capital / Risk Weighted Assets, Regulatory Stage 1 Capital / Risk Weighted Assets, Unpaid Debts (Decrease in Provisions) / Capital, Unpaid Debts / Total Gross Debts), Trade Facilitation Index (market access, customs management, infrastructure and working environment), Financial Innovation Index (public expenditure, venture capital), Global competition Index (Basic requirements, infrastructure, macroeconomic situation, health and primary education)

In analysis, the variables that located in each index are clustered by FCM separately and cluster membership degrees are calculated for each observation. In Table.1, results of FCM membership degrees are given for selected countries for Open Market and Competitiveness Indices.

Table 1: FCM Results for selected indices and countries

COUNTRIES	Open Market		FCM	Competitiveness		FCM
	Ranking	Score		Ranking	Score	
Germany	17	3,9	0,9966	7	5,28	0,9987886283
Albania	34	3,1	0,9178	35	3,4	0,9980829292
Austria	15	4,1	0,9997	8	5,16	0,9991957125
Belarus	34	3,1	0,9178	35	3,4	0,9982250786
Belgium	6	4,6	0,9631	12	4,93	0,9990932259
United Kingdom	20	3,9	0,9753	10	5,13	0,9982526951
Bosnia-H.	34	3,1	0,9178	35	3,4	0,9982250786
Bulgaria	25	3,7	0,9987	31	3,75	0,9993472675
Czech Rep.	11	4,1	0,992	21	4,33	0,9999967039
Denmark	16	4,0	0,9993	6	5,32	0,9979980533
Estonia	12	4,1	0,9967	15	4,74	0,9997489385
Finland	21	3,9	0,9864	1	5,70	0,9969806536

France	23	3,7	0,9684	13	4,81	0,9991981639
Croatia	34	3,1	0,9178	27	3,87	0,9991182493
Netherlands	2	4,8	0,958	5	5,41	0,9976840355
Ireland	3	4,8	0,9579	14	4,75	0,9998348288
Spain	26	3,6	0,952	16	4,47	0,9999818968

The new index calculation was made separately according to the 10 index scores and rankings of the countries. The total score is calculated by multiplying the scores and the total ranking is calculated by multiplying the rankings with FCM coefficients in Microsoft Excel.

As an example, for calculation, let's get the total score of Germany. The index scores of Germany's are given as follows: Open Market (3,9), Competitiveness (5,28), Economic Freedom-Heritage (74,2), Financial Stability (34,1), Global competition (5,65), Trade Facilitation (5,49), Depth of credit information (8), Budget Transparency (69), Financial Innovation (99) and Economic Freedom-Fraser (7,68). FCM Results for same indices are; 0,9966; 0,9987; 0,9779; 0,9999; 0,9977; 0,9998; 0,8219; 0,9565; 0,8587 and 0,7056. if we multiply the scores of each index with the results of the FCM, we get the following result: 255,9023.

The total scores and ranking scores for all countries are calculated similarly to this example. The total order is sorted from smallest to largest and the order of the proposed index is determined according to this order. Similarly, the total scores is sorted from largest to smallest and the index order according to the scores is determined.

The index ranking obtained according to the Rankings is given in the Table 2.

Table 2: Proposed Index Ranking According to Rankings Points

According to Rankings			
1	Switzerland	22	Latvia
2	Netherlands	23	Portugal
3	United Kingdom	24	Slovenia
4	Norway	25	Italy
5	Finland	26	Romania
6	Germany	27	Hungary
7	Denmark	28	Turkey
8	Sweden	29	Russia
9	Luxembourg	30	Bulgaria
10	Austria	31	Croatia
11	Iceland	32	Macedonia
12	Ireland	33	Albania
13	Estonia	34	Cyprus
14	Belgium	35	Ukraine
15	France	36	Greece
16	Lithuania	37	Serbia
17	Czech Republic	38	Bosnia and Herzegovina
18	Poland	39	Moldova
19	Spain	40	Montenegro
20	Slovakia	41	Kosovo under UNSCR 1244/99
21	Malta	42	Belarus

Similarly, the index ranking obtained according to the Scores is given in the Table 3.

Table 3: Proposed Index Ranking According to Score Points

According to Scores			
1	Finland	22	Italy
2	Sweden	23	Poland
3	Denmark	24	Spain
4	Switzerland	25	Slovenia
5	Netherlands	26	Croatia
6	Iceland	27	Romania
7	Estonia	28	Hungary
8	Norway	29	Bulgaria
9	Austria	30	Cyprus
10	Germany	31	Greece
11	France	32	Serbia
12	United Kingdom	33	Malta
13	Belgium	34	Russia
14	Lithuania	35	Macedonia
15	Czech Republic	36	Montenegro
16	Portugal	37	Kosovo under UNSCR 1244/99
17	Luxembourg	38	Moldova
18	Ireland	39	Albania
19	Latvia	40	Ukraine
20	Turkey	41	Belarus
21	Slovakia	42	Bosnia and Herzegovina

According to results given in Table 2 and 3, Nordic countries take place in top 10. Countries like Switzerland, United Kingdom and Netherlands are other countries at the top.

The question of which index order is more important here may come to mind. It may be thought that the sequential calculation is more realistic. Because there is a difference between the scorers, but the ranking is always between 1 and 42. Thus, the calculation shows that it performs with a certain range and minimum variance. The correlation coefficient between the two calculations is found as 0,922 and it is significant at level 0,01.

Finally, if we perform FCM to all countries with all scores we get 6 clusters according to economics variables. Classification results is given in Table 4:

Table 4: FCM Results for European Countries

Cluster I	Cluster II	Cluster III	Cluster IV	Cluster V	Cluster VI
Netherlands	Germany	Belgium	Czech Republic	Bulgaria	Albania
Switzerland	Austria	Ireland	Estonia	Italy	Belarus
Luxembourg	United Kingdom	Malta	France	Cyprus	Bosnia and Herzegovina
	Denmark		Spain	Hungary	Croatia
	Finland		Latvia	Poland	Montenegro

	Sweden		Lithuania	Romania	Kosovo under UNSCR 1244/99
	Iceland		Portugal	Turkey	Macedonia
	Norway		Slovakia		Moldova
			Slovenia		Russia
					Serbia
					Ukraine
					Greece

Looking to Table 4, we can say that first 2 cluster can be named as “Strong Economies”, cluster 3 and 4 can be named as “Medium-Level Economies”, cluster 5 and 6 can be named as “Weak Economies” for the European countries.

6. CONCLUSION

Today, many different indices are being calculated. The aim here is to see the current situation of the relevant countries, cities or companies and to compare them with the other competitors. All indices are using different types of variables and methods. So that different index results can be seen in the same area.

In this study, it is used Fuzzy Clustering Analysis to determine Index of Economics. A new index calculation has been proposed with the aid of 10 different index calculations previously calculated for the economics. The fuzzy clustering analysis was used in the proposed calculation. The proposed method is based on the scores and rankings aids used in previous index calculations.

According to the results of the analysis, the Nordic countries, Switzerland, Netherlands and the United Kingdom were in the top rankings in both index lists. It should not be surprising that these countries, which have strong economies, are also ranked high in their high prosperity rankings.

With different methods, organizations can better analyze their current situation. With the help of this study, it has been presented that fuzzy classification methods can be successfully used for index calculation or ranking measures.

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