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***FULL PAPERS***

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*Dr. Patrycja Chodnicka-Jaworska*

ISBN: 978-605-70583-3-1/September 2021

KADIR HAS UNIVERSITY/ONLINE - VIRTUAL
25-26 August 2021
Istanbul, TURKEY

**Published by:**
***BC PUBLISHING***

**www.rsepconferences.com CONFERENCE PROCEEDINGS/FULL PAPERS ISBN: 978-605-70583-3-1/September 2021**

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BC Publishing

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Publisher: BC Publishing
Certificate No: 6641
Address: Mustafa Kemal Mah. 2134. Sokak Dereli Apt. No:15/2 Cankaya/Ankara/Turkey

Publication Date: 1.09.2021
ISBN: 978-605-70583-3-1

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# CONTENTS

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**22nd RSEP** International Economics, Finance & Business Conference – Virtual/Online
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*Klestincova, S. pp.1-15*

# Possibilities of gender pay gap elimination via taxes in the age of digitalization[1]

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## Abstract

There exists plethora of evidence on gender pay gap existence and many countries try to eliminate it. New data and studies done by OECD show, that gender pay gap is getting bigger much faster as digitization is becoming part of our lives and also integral part of work life in the new Industry 0.4 era. The digitalization works therefore as a drive motor for gap widening. Our motivation for research is to find the ways how to slow down or eliminate this negative trend of gender pay gap widening. In this work we have focused on the ways of gender pay gap elimination by tax related measures. Furthermore, the importance of GPG elimination can be argued by the fact, that even if the pay gap does not seem as an problem in the current moment, its accumulation over lifelong period may hardly affect behavior of individuals. From above mentioned evidence the research question has raised. In case of Slovak Republic tax and levies system, are there any possible ways of gender pay gap elimination rules, with provision, that such adjustment would have fiscally neutral effect on tax income. If yes, which of them would be the best one to implement? The aim of our work is to find out possible ways of lowering or eliminating the pay gap between men and women by tax related rules, under fiscally neutral constrain. Results of our work reveal, that to reach reduction of GPG of average net income by 1%, tax rate for women has to be lowered to 18.62% from original 19% and male tax rate should be set on 19.28% from original 19%. In case of elimination of GPG by 5% the tax rates should be set on 17.08% for female and 20.39% for male taxpayers. The second approach based on attributable and deductible non-taxable item to income, in the amount of GPG, may lower GPG from 20.23% to 10.57%.

***Keywords:*** tax, gender pay gap, equality, digitalization

***Jel Codes:*** J16, H21, E24

## 1. Introduction

Pay gap can be described as "the difference between the average pay of two different groups of people, for example men and women". (Cambridge Dictionary, 2021) There are many kinds of pay gaps, starting with well-known gender pay gap (from here and on GPG), then ethnicity pay gap, disability pay gap or even generation pay gap. In our work we focus on gender pay gap. To elucidate the problem of GPG, we can mention that, out of every 1USD that men can earn, for the same job done, women is able to earn only 0,77USD. (United Nations, 2021). Furthermore, there are also evidences, that women have 2,5 times more unpaid workhours if we count as workhour also household chores and time spend on childcare. (United Nations, 2021) Some of the reasons why GPG exist may be based in biology and in the differences in physique of man and woman body. Evidence show that menstruation cycle may affects absenteeism of woman in work, which then leads to at least 14 percent earnings differential between men and women. (Ichino & Moretti, 2009) On the other hand, studies of Canadian medical workers show, that significant part of the gap cannot be explained by less working hours women have due to either health issues or childcare. (Cohen & Kiran, 2020) Also, different life choices have been marked as factor affecting the GPG. This means, that women whose priorities are based more on altruistic principles, than it could be in case of men, may earn less. What more, woman, that find themselves to be more oriented on childcare than on career progression search for job not so intensive. (Chevalier, 2007) One of many interesting researches aimed on GPG show, that even if in current moment we see only small GPG between men and women, in lifelong period the gap accumulates (Rao, 2018) (Esteves-Sorenson & Snyder , 2012), and cause substant effect on the behavior of for

[1] **Acknowledgement:** VEGA No 1/0779/19 Challenges of digitization of the economy in the field of taxation, possible solutions and their assumptions. This research paper is and outcome of the research project VEGA No 1/0779/19 Challenges of digitization of the economy in the field of taxation, possible solutions and their assumptions.

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example two very similar individuals, with similar social background at the begging of their work life and career (Ridgeway & Correll, 2004).

Other factors that may affect pay gap differences are namely: different average highest education levels; marital status of women and men; career expectations; ethnicity, economics sectors. (Duarte, Esperança, Curto, Santos, & Carapeto, 2010), (Chevalier, 2007) Biases among the men and women in case of different labor supply can be divided into two groups. Out of which one is created from implicit and the second from explicit biases. (Sainsbury, 1999)

Elimination of gender inequality in education and employment may lead also to economic growth. Study that had examined effect of gender inequalities in education and employment, show that economic growth is impeded due to existence of these gender inequalities. What more, this negative effect can be done through distorting incentive, directly, and indirectly it can negatively affect level of investment and population growth. (Klasen, 1999)

So far, we have pointed out, that there are several kinds of pay gaps we face. In our work we focus on GPG. As we have mention on previous part, there exist many evidences in different types of publications, that GPG does exist, and what more, it may affect negatively not only the quality of man and woman life (Rao, 2018) (Esteves-Sorenson & Snyder , 2012), but also economy indicators, for example economics growth or population growth. (Klasen, 1999) Knowing all of this information, authorities all over the world, especially in developed countries try to eliminate GPG and thus make better fundaments for their country prosperity. Some research show, that GPG is more or less slowly closing in some countries. (Graf, Brown, & Patten, 2018) However, some new research reveal, very strong factor, that may counterwork the initiatives in GPG elimination. Digitalization, STEM and new era of Industry 4.0 may destroy effort, that has been put into the GPG elimination. Digitalization is changing almost all of the areas of our lives and it creates new challenges for policymakers in many areas. (Kubicová, 2021) (Bouwman, Nikou, Molina-Castillo, & de Reuver, 2018) According to new data and publications, digitalization is able to expand GPG. (Wajcman, Young, & Fitzmaurice, 2020) ( European Institute for Gender Equality, 2018) (United Nations, 2021) For example, the difference in the percentage of men and women having digital skills is not so significant, according to European Institute for Gender Equality (from here and on EIGE). 92% of all women have digital skills and in case of man it is 93% of all man. ( European Institute for Gender Equality, 2018) What makes the difference according to the EIGE publications, is digital confidence. Where differences between woman (63%) and man (73%) are much more present. ( European Institute for Gender Equality, 2018) According to the Opinion of the European Economic and Social Committee on 'Digital gender gap', it is necessary to remove digital gender gap, by focusing on education, creation of female digital role models and increasing number of women working in STEM. (Barbucci, 2018) Different level and confidence in use of digital skills among different genders still creates digital gender gap, which may affect for example ability to find, obtain and keep employment. (EIGE, 2021)

There are also solutions how to combat with GPG widening, for example improvement in education, overcoming of stereotype barriers that may inhibit women from work in ICT and STEM, strengthening 'Women in Digital' and the 'Digital4Her' initiative by European Commission and many others. (Barbucci, 2018) (United Nations, 2021) ( European Institute for Gender Equality, 2018) One of many ways, how can be gender equality done is based on Gender Responsive Budgeting (from here and on only GRB). GRB principle requires, to spend for example governmental or municipal budget, the way, that men and women will benefit from usage of public goods equivalently. GRB has been applicated in Morocco, and the positive results has shown after few years. (Grown & Valodia, 2010) We have to mention, that GRB does not mean to create 2 separate budgets, or even to spend the same amount of budget on men and woman. GRB means, that even if we spend different amounts of public finance on men needs or woman needs, at the end benefits for each of the groups would be the same. (Khalifa & Scarparo, 2020) (Galizzi, Bassani, & Cattaneo, 2018) As far as GRB is aimed on spending of public budget, it may take a long time to implement it and even longer time to see the positive outcomes of this approach. However, if we take a look on the public budget from the opposite side, not form the side of spending but from the side of income, some scholars offer also to eliminate GPG from this opposite side. Across the countries we can find progressive taxation, linear, so called flat tax, taxation or regressive taxation. Taxes may affect decision making and overall person behavior in both, positively and negatively ways in many different areas of life. (Kubicová & Záhumenská, 2017) (Ziolo, Bak , & Cheba, 2019) In case of progressive taxation if income of individual increases, tax rate does so. Opposite of it is regressive tax rate, which is decreasing as the taxable income gets higher. Linear tax rate, so called "flat tax" is characterized by the fixed tax rate that does not change even if the taxable income changes. Regressive tax rate is not commonly used, and definitely it is not possible to reduce GPG by it. On the other hand, progressive taxation is well known for its ability to reduce inequalities in society. This type of taxation of income from employment is also used in conditions of Slovakia. It is said that progressive tax system is perceived as the

tool reducing income inequalities across the low- and high-income earners. The question arises, whether it could be used also in case of gender income inequalities. Some scholars bring into the problem of existing GPG idea of Gender Based Taxation (from here and on only GBT). (Alesina, Karabarbounis, & Ichino, 2011) (Bastani, 2013) As far as women have less elastic labor supply than men, Ramsey's optimal criterion can be satisfied by different taxation of these two groups of people. (Alesina, Karabarbounis, & Ichino, 2011) (Guner, Kaygusuz, & Ventura, Taxation, aggregates and the household. , 2008) Another research show, that if women were taxed at lower marginal tax rate it would increase their labor supply and also output. In this research authors estimated that if married women were taxed at 4% (8%), it could lead to increase of output by 3.9% (3.4%) and women labor supply could increase about 6.9% (4.0%), respectively. (Guner, Kaygusuz, & Ventura, 2012) Also, some authors think, that if there is possible to apply GRB to eliminate GPG, then even more efficiently would be for government to apply gender-responsive taxation (from here and on GRT). (Fofana, Chatti, Corong, Bibi, & Bouazouni, 2016) Taxes show as an efficient tool in eliminating GPG. (Brock, 2009)

It is needed to mention, that tax system even among the EU can be different from State to State. As a simple example can be tax system in Slovakia, where only individuals are able to file a tax return, meanwhile in France the tax return can be filled by a whole family. Research show, that especially the second mentioned type of tax system can be more likely to cause even bigger GPG. (Sainsbury, 1999) (Guner, Kaygusuz, & Ventura, 2012) The reason is, that if breadwinner, as it used to be due to GPG, is a man, his income is taxed at lower marginal tax rates, if the tax system is progressive, and the income of second earner, that use to be women, face to higher marginal income tax rate. (Sainsbury, 1999) (Guner, Kaygusuz, & Ventura, 2012) (Guner, Kaygusuz, & Ventura, 2008)

At the time when European Economic Community (from here and on only EEC), that we now know as European Union, has been settled to reach the aim of facilitating a harmonious development of economics activities among the Member States. (EUR-Lex, 1957) Elimination of gender equalities has not been one of the main goals of EEC, until today, when it has been established as fundamental objective and value of EU. (Gunnarsson & Spangenberg, 2019) Tax systems as an possible tool for elimination of GPG, now in many countries is designed to be gender neutral. However, it is now known, that even if tax system treats men and woman equally, or neutrally, tax system affects men and women differently, based on different socioeconomics aspects of different genders. (Gunnarsson & Spangenberg, 2019)

## 2. Data, research question and hypothesis

Firstly, we would like to find out, if GPG in Slovakia exist, and if yes, in what scale are women paid for the same job less than men. To reach the answer to this question, we have used the data from Statistical Office of the Slovak Republic. (Statistical Office of the Slovak Republic, 2021) Our data consists of time series from 2013 to 2019 (where last valid data is 2019) and the value of average gross income of male and female employees in the observed year. Then gross female/male incomes were transferred to net incomes according to Slovak tax system principles. After this adjustment, formula for GPG evaluation has been used, to calculate the value of GPG in percent.

Formula to GPG evaluation (Oelz, Olney, & Tomei, 2013), (Eurostat, 2021):

$$GPG = \frac{AW_m - AW_w}{AW_m} * 100 \quad [\%]$$

Legend:

GPG – Gender pay gap

$AW_m$ – Average annual wage of male

$AW_w$ – Average annual wage of female

*H1: We estimate GPG in Slovakia to be above the average GPG of EU countries in all observed years.*

This hypothesis is based on presumption, that Slovakia as some other EU countries have in past been under influence and later on also occupation of the Soviet Union. This generally known fact affects many countries until now by a bit lower level of development of countries.

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If the presumption of higher GPG in Slovakia than in EU, is going to be confirmed, then we would try to compare actual progressive taxation system used in Slovakia with flat-tax system, with objective at its GPG elimination abilities. Generally, the flat-tax system is considered to be strongly neutral taxation system. However, as we have mentioned in Introduction, even if the tax systems are designed to be neutral, different socioeconomics aspects of men and women may cause, that the tax system may be neutral but at the same time does not have to be also fair. According to these presumptions, we have developed the following hypothesis.

*H2: Tax system with progressive tax rates, as the one that is used in Slovakia, is more suitable in an effort to lower GPG than system with "flat-tax" rate.*

In case of hypothesis acceptation, we will try to answer our following research question.

*Research question: How could be actual tax system of Slovakia modified, taking into account the fiscal budget constraints, so it will be possible to lower or eliminate GPG.*

To answer research question, we have designed new models of taxation, that may be used in Slovakia. Firstly, we have designed new tax rates, that eliminate GPG after taxation by 1% and 5%, without impact on state budget income. And secondly, we have designed approach, based on attributable deductible item to taxable income to reduce GPG, without impact on state budget.

To research the scale of digitalization and its gender gap creating possibilities, we use data from Eurostat database. We chose three types of data describing different relationship between Information and Communication Technologies (from here and on only ICT) and employment of female and male. We obtained following data: ICT personnel in total employment (ISOC_BDE15AP); Employed persons with ICT education by sex (ISOC_SKI_ITSEX); Employed ICT specialists by sex (ISOC_SKS_ITSPS). Data can be found in Appendix Table 5.

It is well known fact, that in new digital era employers need to hire employees disposing with appropriate digital skills and appropriate level of digital literacy. What more, well played job offers are now mainly situated in field of STEM (Science, Technology, Engineering and Mathematics). (European Commision, 2019) Many research papers and articles dealing with GPG state, that its partial source can be found by observing the data, that reveal different levels of internet or digital devices use among females and males. (European Commision, 2019), ( European Institute for Gender Equality, 2018), (EIGE, 2021) Combination of fewer females specializing in ICT with the fact, that one of the well-played job offers are in STEM, leads to possibility of GPG widening due to digitalization of everyday life and most importantly also work life. According to these findings of previous research and our presumption of digital gender gap existence, we decided to map this situation in Slovakia. Firstly, we have looked at how many, out of all persons employed, are specifying in ICT. This data can help confirm presumption, that in actual age of digitalization more people are hired to positions, which require digital and computer skills. Then we zoomed on how many out of all employed persons has ICT education where we show results for both female and male workers. We went even further and looked also on percentage ratio of employed ITC specialists by their gender. We use both observations to ensure accuracy in observations. All data are displayed in results on Graph 2 - 4.

## 3. Results and discussions

Based on the results displayed in Graph 1, where we have evaluated the value of GPG before and after taxation in years 2005-2019, we can confirm our hypothesis H1. In case of Eurostat dataset, the data in years 2005 to 2009 are missing. However, in case of the rest observable years we can see that GPG in case of EU 29 countries is significantly lower than in case of Slovakia.

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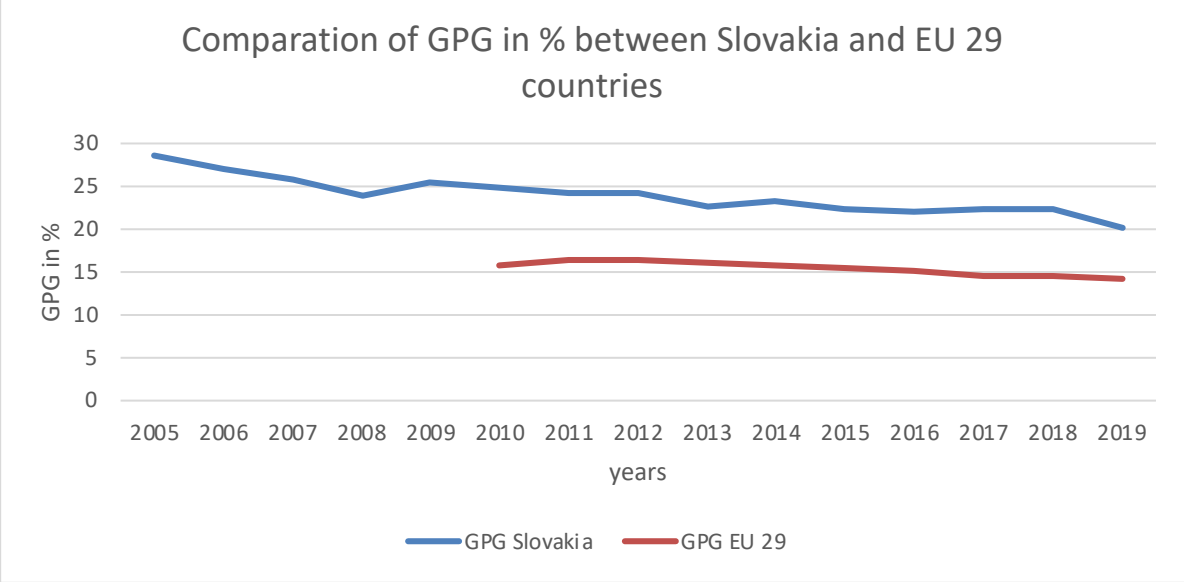


**Graph 1.** Percentage of GPG in Slovakia and EU 29 countries

**Source:** Author's own calculation and Eurostat data (Eurostat, 2021)

In case of each year the flat-tax system, without non-taxable item of income, has no effect on value of GPG before and after taxation. Results are presented in Table 2 which can be found in appendix of this paper. We can confirm that this tax system as it is known is neutral and does not affects GPG at all. On the other hand, in case of progressive tax system evaluation of GPG in Slovakia the results show, that this type of taxation could be the way to eliminate GPG. Results are presented in Table 1 which can be found in appendix of this paper. It is needed to state, that progressive tax system for individuals (personal income tax – PIT) in Slovakia is based on principle of 19% tax rate that applied until the taxable income in a given tax period, calendar year, does not exceed 176.8 times the amount of the applicable subsistence minimum, inclusive. For last year used in our data, 2019, 176.8 times the applicable subsistence minimum is 36,256.38€. (Financial Administration Slovak Republic, 2019). The amount of taxable income that exceeds this value in a given tax period is taxed by 25% tax rate. In our research we have used the average monthly gross income of male and female. Average income times 12 months in a tax period, does not exceeds in any observed year the amount of 176.8 times the amount of the applicable subsistence minimum in given year. According to this fact we could think, that current, progressive, taxation system in Slovakia should have the same effect as flat-tax rate, if we count with value of average income. However, in Slovakia, taxpayer can also use non-taxable item. if the taxpayer's tax base in 2019 is equal to or lower than 100 times the amount of the applicable subsistence minimum, 20.507€, then the amount of the annual non-taxable part of the taxpayer's tax base is 19.2 times the amount of the subsistence minimum, that means 3,937.35€. This amount has to be divided by 12 months in year and then it can be deductible from monthly taxable income. This nontaxable item causes, that current tax system in Slovakia is able to reduce the GPG, that also can be seen in Table1, where GPG before taxation is grosser than after taxation. These results confirm the hypothesis H2, that, tax system with progressive tax rates, as the one that is used in Slovakia, is more suitable in an effort to lower GPG than system with "flat-tax" rate.

Acceptation of the hypothesis H2 lead us to answer to our research question, whether could be actual tax system of Slovakia modified, taking into account the fiscal budget constraints, so it will be able to lower or eliminate GPG. Our results referred to this research question are displayed in Table3 and Tabel4, which are part of the appendix. It is important to keep in mind, that we have settled the constrain of unchanged amount of taxes collected and paid to the state budget. This led us to two possible ways of actual tax system modification.

Firstly, we present the results of approach based on attributable and deductible item to taxable income. If we evaluate the absolute amount of GPG and use this value as attributable item to male taxable income and at the same time we use this item as the deductible item in case of female average income, the GPG decreases from 20.23% to 10.57%. In our calculation the originally used non-taxable item used in Slovakia remain unchanged and also remain in the formula used to calculate the net income.

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The second approach designed to eliminate GPG has been based on setting different tax rates to different genders. In this approach we have observed, how should tax rates help to eliminate GPG of net income by 1% and by 5%. The results of our work have shown, that to reach elimination GPG of average net income by 1% the tax rate for women has to be lowered to 18.62% from original 19% and male tax rate should be set on 19.28% from original 19%. In case of elimination of GPG by 5% the tax rates should be set on 17.08% for female and 20.39% for male taxpayers.

Our work is also focused on digitalization ability to wide GPG. Intuition behind this presumption is explained in part Introduction as well as in Data. Thus, we will now focus only on results, that in all observed data, has confirm presumptions stated in part Data. Results are displayed in Appendix in Graphs 2 - 4, and in Table 5. In Graph 2 and Table 5, we can see that percentage ratio of persons employed in ICT has mainly increasing trend. According to these data we can see how digitalization chances requirements of employers on employees. What more Graphs 3 and 4 reveal, how small percentage of woman compared to man is employed as person with ICT education or as an ICT specialist. These results are in accordance with findings of other research mentioned in part Data and Introduction. Although the fact that, percentage ratio between female and male specialist ICT workers in last years 2018-2020 is leveling off, these changes are very small. However, the percentage ratio of persons employed, with ITC education, is receding if we look at data of past few years. At the first year with observable data for both female and male workers 2012, ratio between male to female employees with ICT education was 76,7 % males to 23,3% females, compared to year 2020 when ratio hits 86,8% to 13,2%. Looking apart from these annual changes, the digital gap among genders is still huge and in case of employed persons with ICT education is still widening.

## 4. Conclusion

Presence of GPG may negatively influence real economy growth, it also has many negative effects in lifelong decision making, earnings and overall standard of living of individuals, only due to fact, that these individuals have different genders. Moreover, with the ever-expanding digitization of the economy, scholars have proven, that we may face to widening of GPG, due to digitalization and different adaptational response to digitalization among different genders. In our research we have examined data which have proven the existence of digital gender gap. Also, we have confirmed the influence of digitization on labour market by observing growing trend of the ratio of employees employed in the field of ICT to the total number of all employed persons within Slovakia. Rising ratio of ICT workers on total amount of workers in economy, persisting digital gender gap and fact, that many well-paid jobs are in STEM suggest the important role od digitalization in GPG existence. focused on elimination of GPG offer a wide range of possibilities to close this gap. Many approaches are focused on increasing education and closing the educational gap through this way. These approaches are especially focused on the field of IT and digitalization, that is widening the GPG. Other approaches, focus on the implementation of various statutory rules for the equal evaluation of different gender labor. However, despite these rules on non-discrimination on the basis of gender, the GPG persists. Theoretical sources also provide us with another way to eliminate GPG, and thus by using the state's fiscal policy. It can be used from both sides. From the side of government budget spending by approach of “budget responsible spending”, or from the side of taxes.

In our research, we tried to use various approaches of modification of current taxation system, to eliminate GPG in Slovakia. Results of our paper reveal, that to achieve a reduction of GPG of average net income by 1% the tax rate for women has to be lowered to 18.62% from original 19% and male tax rate should be set on 19.28% from original 19%. In case of elimination of GPG by 5% the tax rates should be set on 17.08% for female and 20.39% for male taxpayers. The second approach to lower GPG by usage of taxes has been based on deductible and attributable part of income equal to value of GPG. By this approach we have monitored GPG decrease from 20.23% to 10.57%. In our research we see also some limitations. It is almost impossible to calculate value of GPG in selected company, because the salaries may differ even if two persons tend to do the same work. However, it is common practice, that in companies especially small businesses, employees have different types of employment contract. Some of them may be paid by working hours, some of them may be paid from the fulfillment of the standard, even if these two employees are in the same position, due to the different employment contracts they may earn different amounts of money. On the other hand, the first approach, based on different tax rates may be criticized for failing to meet the requirement for tax neutrality, but it is important to state, that without this change the GPG persist, and it creates inequality constantly over a long period of time.

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## Appendix

**Table 1.** Calculation of GPG after taxation, social and health levy in case of progressive taxation and application of non-taxable part of the tax base in Slovakia

| Calculation of GPG after taxation, social and health levy in case of progressive taxation and application of non-taxable part of the tax base in Slovakia | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Male income** | | | | | | | | |
| Year | 2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | |
| Gross income (average male income in Slovakia) | 1399 | 1315 | 1233 | 1167 | 1117 | 1085 | 1021 | |
| Health insurance contributions (4%-employee levy) | 55,96 | 52,6 | 49,32 | 46,68 | 44,68 | 43,4 | 40,84 | |
| Social security contributions (9,4%-employee levy) | 131,5 | 123,61 | 115,9 | 109,69 | 104,99 | 101,99 | 95,97 | |
| Health insurance and social security contributions together | 187,46 | 176,21 | 165,22 | 156,37 | 149,67 | 145,39 | 136,81 | |
| Tax base after deduction of social security and health insurance contributions | 1211,54 | 1138,79 | 1067,78 | 1010,63 | 967,33 | 939,61 | 884,19 | |
| Non-taxable part of the tax base | 328,12 | 319,17 | 316,94 | 316,94 | 316,94 | 316,94 | 311,32 | |
| Tax base after deduction of non-taxable part of the tax base | 883,42 | 819,62 | 750,84 | 693,69 | 650,39 | 622,67 | 572,87 | |
| Income tax (19%/25% - in case of average income 19% tax rate is used) | 167,84 | 155,72 | 142,65 | 131,8 | 123,57 | 118,3 | 108,84 | |
| Net income | 1043,7 | 983,07 | 925,13 | 878,83 | 843,76 | 821,31 | 775,35 | |
| **Female income** | | | | | | | | |
| Year | 2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | |
| Gross income (average female income in Slovakia) | 1116 | 1024 | 960 | 910 | 867 | 834 | 791 | |
| Health insurance contributions (4%-employee levy) | 44,64 | 40,96 | 38,4 | 36,4 | 34,68 | 33,36 | 31,64 | |
| Social security contributions (9,4%-employee levy) | 104,9 | 96,25 | 90,24 | 85,54 | 81,49 | 78,39 | 74,35 | |
| Health insurance and social security contributions together | 149,54 | 137,21 | 128,64 | 121,94 | 116,17 | 111,75 | 105,99 | |
| Tax base after deduction of social security and health insurance contributions | 966,46 | 886,79 | 831,36 | 788,06 | 750,83 | 722,25 | 685,01 | |
| Non-taxable part of the tax base (does not exist) | 328,12 | 319,17 | 316,94 | 316,94 | 316,94 | 316,94 | 311,32 | |
| Tax base after deduction of non-taxable part of the tax base | 638,34 | 567,62 | 514,42 | 471,12 | 433,89 | 405,31 | 373,69 | |
| Income tax (19%/25% - in case of average income 19% tax rate is used) | 121,28 | 107,84 | 97,73 | 89,51 | 82,43 | 77 | 71 | |
| Net income | 845,18 | 778,95 | 733,63 | 698,55 | 668,4 | 645,25 | 614,01 | |
| **Comparison of GPG based on income before and after taxation** | | | | | | | | |
| GPG before taxation | 20,22873 | 22,12928 | 22,14112 | 22,02228 | 22,38138 | 23,13364 | 22,52693 | |
| GPG after taxation | 19,02079 | 20,76353 | 20,69979 | 20,51364 | 20,78316 | 21,43649 | 20,80867 | |
| Difference between GPG values after and before taxtion | 1,207943 | 1,365751 | 1,441326 | 1,508642 | 1,598218 | 1,697155 | 1,718267 | |

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**Table 2.** Calculation of GPG after taxation, social and health levy in case of flat-tax model

| Calculation of GPG after taxation, social and health levy in case of flat-tax model | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Male income** | | | | | | | | | |
| Year | 2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | | |
| Gross income (average male income in Slovakia) | 1399 | 1315 | 1233 | 1167 | 1117 | 1085 | 1021 | | |
| Health insurance contributions (4%-employee levy) | 55,96 | 52,6 | 49,32 | 46,68 | 44,68 | 43,4 | 40,84 | | |
| Social security contributions (9,4%-employee levy) | 131,5 | 123,61 | 115,9 | 109,69 | 104,99 | 101,99 | 95,97 | | |
| Health insurance and social security contributions together | 187,46 | 176,21 | 165,22 | 156,37 | 149,67 | 145,39 | 136,81 | | |
| Tax base after deduction of social security and health insurance contributions | 1211,54 | 1138,79 | 1067,78 | 1010,63 | 967,33 | 939,61 | 884,19 | | |
| Non-taxable part of the tax base | - | - | - | - | - | - | - | | |
| Tax base after deduction of non-taxable part of the tax base | 1211,54 | 1138,79 | 1067,78 | 1010,63 | 967,33 | 939,61 | 884,19 | | |
| Income tax (19%) | 230,19 | 216,37 | 202,87 | 192,01 | 183,79 | 178,52 | 167,99 | | |
| Net income | 981,35 | 922,42 | 864,91 | 818,62 | 783,54 | 761,09 | 716,2 | | |
| **Female income** | | | | | | | | | |
| Year | 2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | | |
| Gross income (average male income in Slovakia) | 1116 | 1024 | 960 | 910 | 867 | 834 | 791 | | |
| Health insurance contributions (4%-employee levy) | 44,64 | 40,96 | 38,4 | 36,4 | 34,68 | 33,36 | 31,64 | | |
| Social security contributions (9,4%-employee levy) | 104,9 | 96,25 | 90,24 | 85,54 | 81,49 | 78,39 | 74,35 | | |
| Health insurance and social security contributions together | 149,54 | 137,21 | 128,64 | 121,94 | 116,17 | 111,75 | 105,99 | | |
| Tax base after deduction of social security and health insurance contributions | 966,46 | 886,79 | 831,36 | 788,06 | 750,83 | 722,25 | 685,01 | | |
| Non-taxable part of the tax base (does not exist) | - | - | - | - | - | - | - | | |
| Tax base after deduction of non-taxable part of the tax base | 966,46 | 886,79 | 831,36 | 788,06 | 750,83 | 722,25 | 685,01 | | |
| Income tax (19%) | 183,62 | 168,49 | 157,95 | 149,73 | 142,65 | 137,22 | 130,15 | | |
| Net income | 782,84 | 718,3 | 673,41 | 638,33 | 608,18 | 585,03 | 554,86 | | |
| **Comparison of GPG (%) based on income before and after taxation** | | | | | | | | | |
| GPG after taxation | 20,2283 | 22,1287 | 22,1410 | 22,0236 | 22,3805 | 23,1326 | 22,5272 | | |
| GPG before taxation | 20,2287 | 22,1293 | 22,1411 | 22,0223 | 22,3814 | 23,1336 | 22,5269 | | |
| difference between GPG after and before taxation | 0,0005 | 0,0005 | 0,0001 | -0,0014 | 0,0009 | 0,0010 | -0,0003 | | |

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**Table 3.** Comparison of a new method of calculating net income based on a GPG attributable / deductible item and current system of net income calculation in Slovakia

| Comparison of a new method of calculating net income based on a GPG attributable / deductible item and current system of net income calculation in Slovakia. | Current system of net income calculation | | A new method of calculating net income based on a GPG addable / deductible item | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| Gross income | 1 399,00 € | 1 116,00 € | 1 399,00 € | 1 116,00 € |
| Health insurance (4%) | 55,96 € | 44,64 € | 55,96 € | 44,64 € |
| Social contributions (9,4%) | 131,51 € | 104,90 € | 131,50 € | 104,90 € |
| Sum of health insurance and social contributions | 187,46 € | 149,54 € | 187,46 € | 149,54 € |
| Tax base after discount of social contributions and health insurance | 1 211,54 € | 966,46 € | 1 211,54 € | 966,46 € |
| Non-taxable part of the tax base | 328,12 € | 328,12 € | 328,12 € | 328,12 € |
| Attributable (Male)/ deductible (Female) item to the tax base in the amount of GPG | - | - | 245,08 € | 245,08 € |
| Tax base | 883,42 € | 638,34 € | 1 128,50 € | 393,26 € |
| Income tax (19%) | 167,85 € | 121,28 € | 214,41 € | 74,71 € |
| Net income | 1 043,70 € | 845,18 € | 997,13 € | 891,75 € |
| Total tax income to the state budget | 289,13 € | | 289,12 € | |
| GPG value in % according to current/new system | 20,23 | | 10,57 | |

**Table 4.** Calculation of new tax rates that would eliminate the GPG of net income after tax by 1% and 5%

| Determination of a new tax rate that reduces the GPG of taxable income by 1% | | |
|---|---|---|
| | Female | Male |
| Tax base after discount of non-taxable part of tax base | 638,34 | 883,42 |
| The amount of tax in the case of the original tax rate of 19% of taxable income | 121,28 | 167,85 |
| Amount of tax eliminating GPG of taxable income by 1% | 118,83 | 170,30 |
| New tax rate eliminating GPG of taxable income by 1% | 18,62 | 19,28 |
| Total income to the state budget in the case of 19% tax rate | 289,13 | |
| Total income to the state budget in the case of new tax rates | 289,13 | |
| **Determination of a new tax rate that reduces the GPG of taxable income by 5%** | | |
| | Female | Male |
| Tax base after discount of non-taxable part of tax base | 638,34 | 883,42 |
| The amount of tax in the case of the original tax rate of 19% of taxable income | 121,28 | 167,85 |
| Amount of tax eliminating GPG of taxable income by 5% | 109,03 | 180,10 |
| New tax rate eliminating GPG of taxable income by 5% | 17,08 | 20,39 |
| Total income to the state budget in the case of 19% tax rate | 289,13 | |
| Total income to the state budget in the case of new tax rates | 289,13 | |

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**Table 5.** Summary table – digital gender gap

| Summary table – digital gender gap | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Years | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | |
| Percentage of the ICT personnel in total employment | | | | | | | | | | | |
| Slovakia | 2,2 | 2,72 | 2,85 | 2,79 | | 2,86 | 2,92 | 3,04 | 3,18 | 3,31 | |
| Employed ICT specialists by sex [ISOC_SKS_ITSPS$DEFAULTVIEW] | | | | | | | | | | | |
| EU27 MALE | 83,0 | 82,9 | 83,3 | 83,8 | 83,5 | 83,0 | 82,9 | 82,8 | 82,1 | 81,5 | |
| Slovakia MALE | 82,5 | 86,6 | 91,0 | 88,0 | 88,1 | 90,3 | 85,6 | 86,9 | 86,0 | 84,2 | |
| EU27 FEMALE | 17,0 | 17,1 | 16,7 | 16,2 | 16,5 | 17,0 | 17,1 | 17,2 | 17,9 | 18,5 | |
| Slovakia FEMALE | 17,5 | 13,4 | 9,0 | 12,0 | 11,9 | 9,7 | 14,4 | 13,1 | 14,0 | 15,8 | |
| Employed persons with ICT education by sex [ISOC_SKI_ITSEX$DEFAULTVIEW] | | | | | | | | | | | |
| EU27 MALE | 80,8 | 81,7 | 82,8 | 83,6 | 83,4 | 84,0 | 84,6 | 84,6 | 82,7 | 82,8 | |
| Slovakia MALE | 86,8 | 76,7 | 85,7 | 85,5 | 91,2 | 88,4 | 84,4 | 83,8 | 86,6 | 86,8 | |
| EU27 FEMALE | 19,2 | 18,3 | 17,2 | 16,4 | 16,6 | 16,0 | 15,4 | 15,4 | 17,3 | 17,2 | |
| Slovakia FEMALE | | 23,3 | 14,3 | 14,5 | | 11,6 | 15,6 | 16,2 | 13,4 | 13,2 | |

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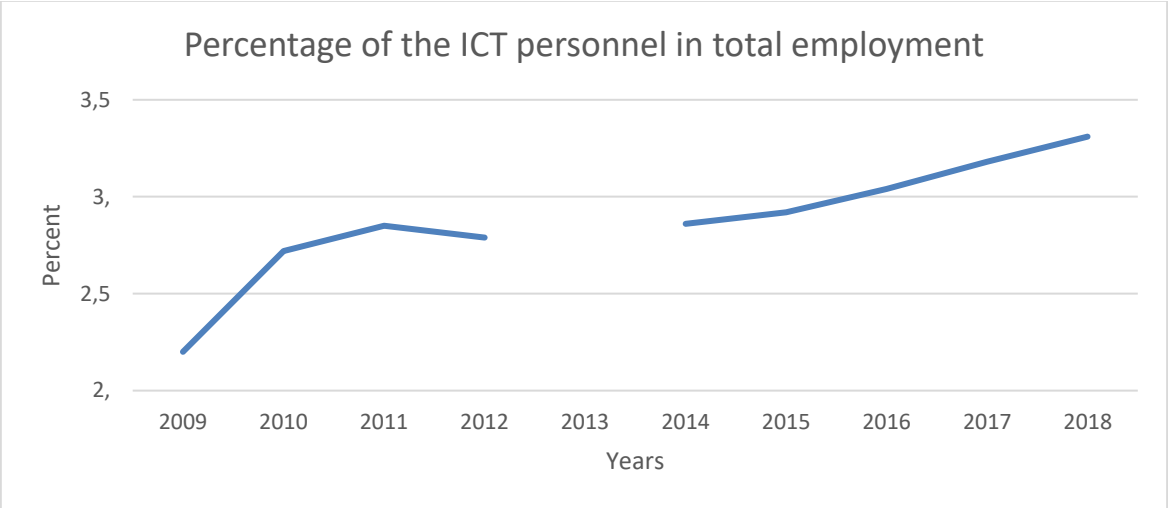
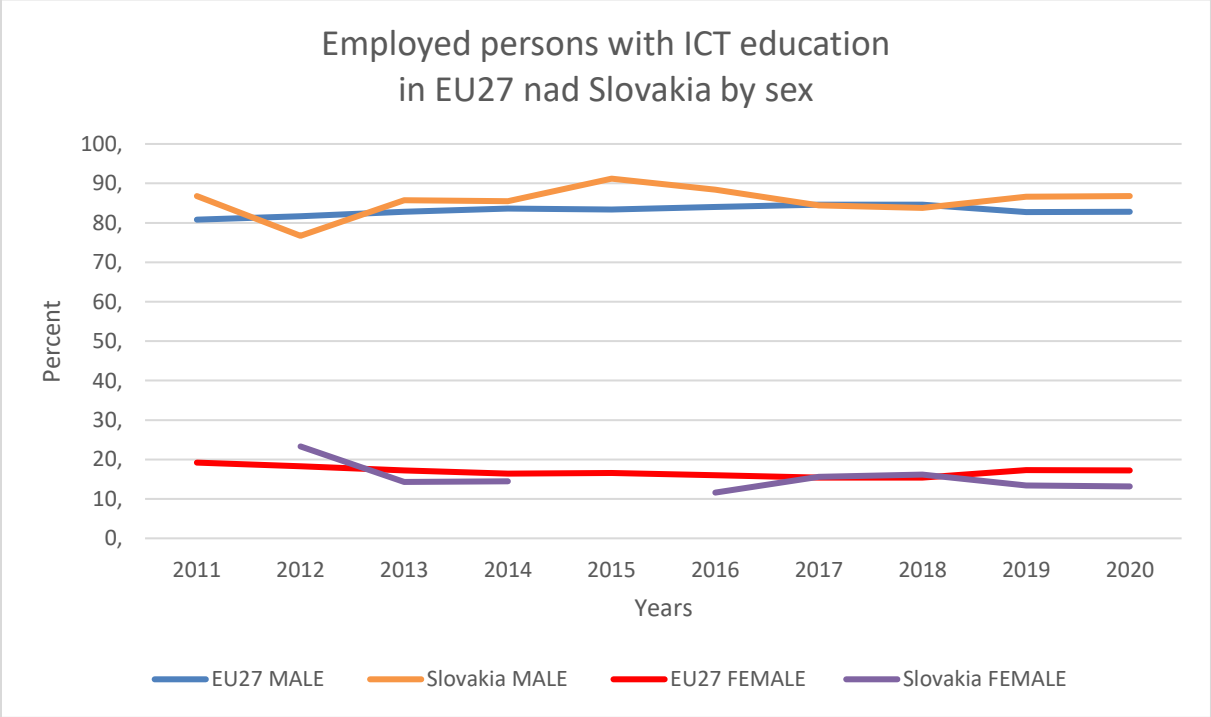



**Graph 2.** Percentage of the ICT personnel in total employment




**Graph 3.** Employed persons with ICT education in EU27 nad Slovakia by sex

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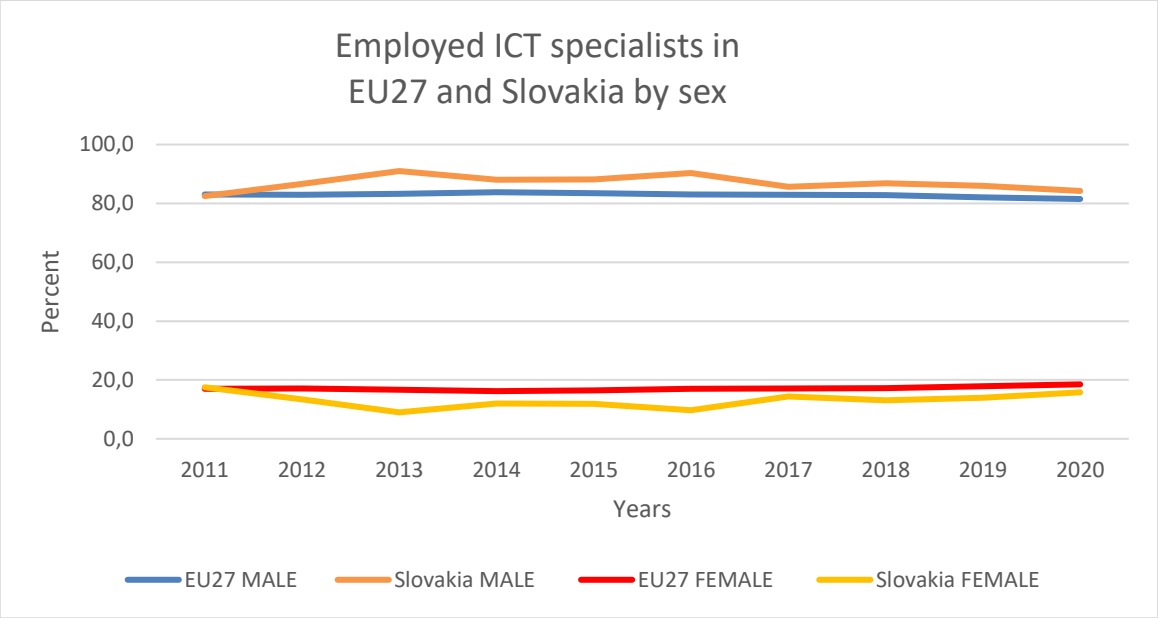


**Graph 4.** Employed ICT specialists in EU27 and Slovakia by sex

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*Serban, O. pp.16-25*

# Testing multilevel knowledge economy pyramid model in environmental and agriculture fields. Case study: Romania

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## Abstract

The value added of this research is consisting of stressing the importance of knowledge in the process, understanding the dynamics of knowledge process, generating connections among stakeholders, build up thematic structures, functional layers, knowledge ecosystems and environment. In other words, Multilevel Knowledge Economy Pyramid (MKEP) model is coming with an innovative and pretty exhaustive approach able to cover environmental and agriculture context, too. Generally speaking, can we talk about productivity for a manufactured good as long as mass production of this item could harm the natural environment or is not contributing to a certain increasing of standard of living? For this research, the objective is to give a new perspective to the approach of TFP analysis, and to understand the dynamic and interaction of its components. The neo-liberal model is targeting market and capital as main objective, but MKEP model is targeting knowledge and people. In the first one, the driven force is the accumulation of capital and in the last one, the driven force is the dissemination of knowledge. In the neo-liberal approach, the main issue is competition, but in the MKEP approach the main outcome is collaboration.

***Keywords:*** knowledge, natural resources, environment, climate change, productivity

***Jel Codes:*** D83, O13, O44, Q54, O49

## 1. Introduction– identification of the need

Considering the evolution of resources productivity, along the last 25 years, Romania is in the last position among EU Member States. Resource productivity is the ratio between gross domestic product (GDP) and domestic material consumption (DMC). DMC considers the total amount of materials which are the input in economy and represents the quantity of raw materials from a certain region used in a year, including the difference between phisical imports and exports. By this indicator, we are able to assess the level of using resources to create products and shows the weight of consumption for domestic market and for export market.

The trend of resource productivity in the last 25 years is represented in the Figure 1:

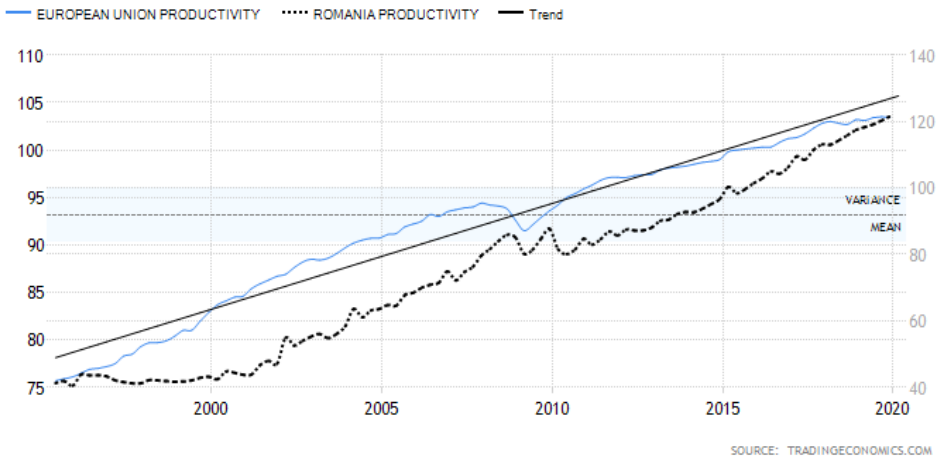


**Figure 1.** Trend of resource productivity: Romania Vs. EU

**Source:** European Union Productivity 1995-2019 https://tradingeconomics.com/european-union/productivity

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On the one hand, this graph shows us that in Romania the value added for raw materials is constantly bellow the EU countries, and the graphs reveals the amplitude of the gap, on the other hand. Because of these differences, it is necessary to dramatically change the strategy considering preserving the reservoir of natural resources in three ways:

- Direct way – by use less resources for the same amount of products;
- Indirect way – by put more value in the process in order to obtain high level processing products;
- Smart way – combining both direct and indirect in a way to replace the tangible use of materials with intangible use of knowledge;

To follow the smart way there is needed to create the foundation for knowledge transformation in an economy. Once the knowledge is identified as input in a process, then through creativity, innovation and entrepreneurship conducts to productivity and competitiveness improvement.

Regarding the agriculture, according to Eurostat data, in Romania 23% of the population is involved in agriculture, comparing with 4 – 4.5% with the average of EU countries. Despite of the granularity and other major issues in this field, almost ¼ of the population is a big opportunity to treat agriculture with maximum of interest when we talk about transferring best practice, improve specific education programmes, fostering innovation, and adopting the ultimate technology.

This is an important shift at policy-making level, in order to understand the importance of modern agriculture for whole economy. We identified two opportunities at this point: the large number of the population involved and the favourable natural pedo-climate circumstances for developing agriculture based on the highest standards of scientific research.

## 2. Creating the model – Multilevel Knowledge Economy Pyramid (MKEP)

A new public policy in environmental and agriculture field is an important objective for policymakers, and the scope of this research is to create a knowledge friendly platform (model) to make easier the decision-making process at governmental level. This process is very well balanced in the Multilevel Knowledge Economy Pyramid, where the foundation of the model is based on the four pillars of Knowledge Economy:

- Economic and institutional regime
- Education and skills
- Information and technology infrastructure
- Innovation system

Up to this foundation are built three structures:

- Knowledge Triangle: knowledge ecosystem of education-research-business;
- Triple Helix: cooperation between administration-university-industry
- Smart Specialisation: collaborative environment of local communities-university-entrepreneurship;

The Multilevel Knowledge Economy Pyramid model is represented in the Figure 2. As you can see below, in the model there are 4 levels:

- At the base, there is the knowledge level – specific to the Knowledge Economy
- Level one is productivity – specific to business and innovation
- Level two is competitiveness – specific to smart growth
- Level three is welfare – specific to standard of living

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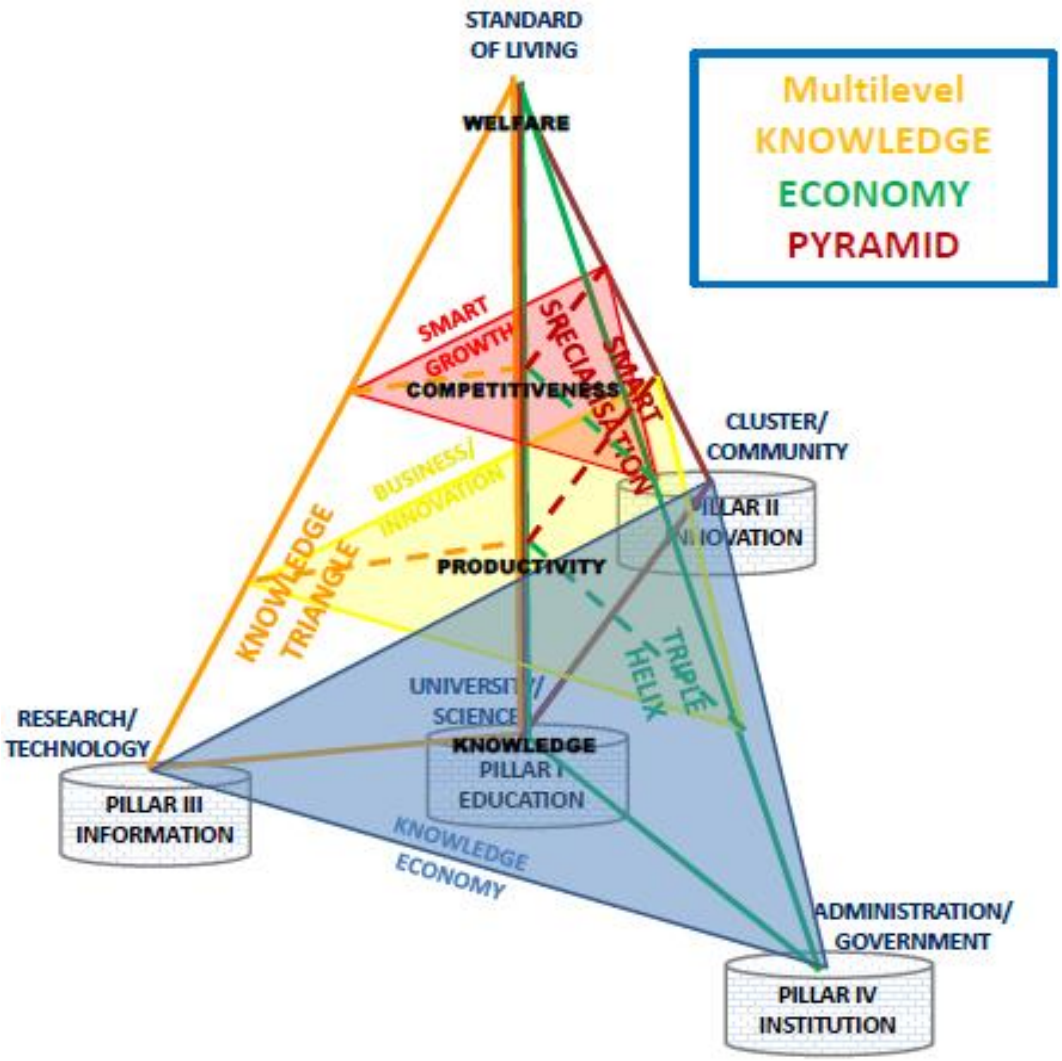


**Figure 2.** Multilevel Knowledge Economy Pyramid model

**Source:** The author own representation (Șerban, 2020, p. 116)

### 3. Research progress – related scientific literature

In a recent study the authors talk about the necessity for convergence between knowledge and technology (Rocco & Others, 2013, p.16). They are referring to the 5 principles of such a convergence: interdependence between nature and society, dynamic system-logic deduction, divergence at the base of new creation of innovation and creativity, specific higher-level cross-domain languages, and the visionary research. The authors reveal the synergistic benefits for the human performance, such as: human wellness, increase productivity, economic development, create "Cognitive Society", sustainable environment, build the foundation for education, and innovative society.

In the dedicated literature, there are many ways to try to simplify the connection between different sectors and knowledge, but most of them are referring to a limited number of connections, not sufficient to cover the entire landscape. MKEP model succeeds to represent in a very concise way the synergy of knowledge environment among the stakeholders who are contributing to increasing the value of knowledge in the process.

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*Serban, O. pp.16-25*

## 4. The new paradigm of development – investing in innovation

Today, in the global competition there are several actors who don't play in different sectors of manufacturing, services, or communication, but they are playing in the field of innovation by spending lot of resources for R&D in 2018. The top innovators at worldwide level are Amazon (23 billions US dollars), Alphabet (16 billions), Volkswagen (16 billions), Samsung (15 billions), Intel (13 billions), Microsoft (12 billions) and Apple (12 billions). For example, the entire budgetary allocation for R&D at national level in Romania is 1.2 billions US dollars.

This is a fact: there is no progress in R&D sectors without a consistent allocation of resources. At this point, Romania will benefit of consistent allocation for R&D from structural funds for the next period (2021 – 2027) and National Plan of Recovery and Resilience which is still in negotiation with the European Commission. Unfortunately, the allocation for R&D sector from national budget is still under 0.5% of GDP. For comparison, according to 2017 Eurostat source, at EU level the average allocation for R&D is 2.07%, US 2.78%, China 2.13%, and South Korea 4.55%. At the EU level, top performers are Sweden, Austria, Denmark, and Germany with an R&D intensity above 3% of GDP. The challenge of these allocations is to create a friendly R&D environment with a robust strategy and strong capacity building (UNCTAD, 2021, p.56).

In 2019, European Commission reveals that the potential for one Euro invested in R&D could create a return of 11 Euro in GDP for a 25 years perspective.

In the Oslo Manual 2018, for a better standardization of the concepts, innovation is described as deriving "from knowledge-based activities that involve the practical application of existing or newly developed information and knowledge" and the contribution of research to innovation is underlined as *"Research and experimental development (R&D), is one of a range of activities that can generate innovations, or through which useful knowledge for innovation can be acquired… besides OECD/Eurostat (2018, p.46) remarks the measurement importance for innovation."* In the same source, knowledge is seen as the generator for ideas, models and methods, all these creating the basement for innovation.

The scope of the Oslo Manual is to create the premises for standardization considering well defined concepts and powerful measurement tools. In other words, along with other notorious point of views coming from OECD, World Bank, Asian Productivity Centre, European Institute of Innovation and Technology, the most relevant studies and researches in the knowledge field, related with innovation, productivity and competitiveness, come to validate the findings in the description of MKEP.

## 5. Searching for solutions for environmental and agriculture issues

By the proposed shift form natural resources consumption driven economy to a smart economy with Multilevel Knowledge Economy Pyramid in place, Romania will follow the path of decoupling economic growth from the extensive use of non-renewable resources (Sanye-Mengual and Others, 2019, p.4). In this context, there is required a better harmonization of national strategies from different fields: environment, business, education, research, technology.

In an EU ranking system for resource productivity, in the first position considering the best performance is the Netherlands with 5.4 Euro/kg and last position is Romania with almost 0.4 Euro/kg. Among the EU countries, Romania constantly achieves the weakest performance in resource productivity, as you can see in the Figure 3:

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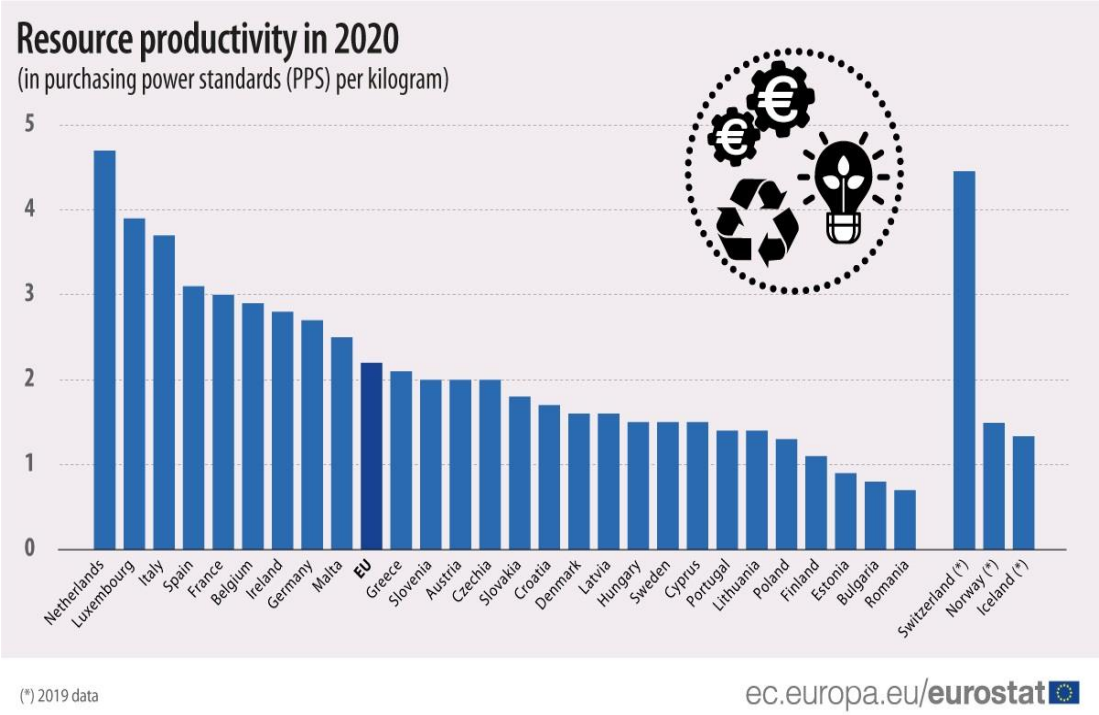


**Figure 3**: the level of performance in resource productivity for EU countries

**Source:** https://ec.europa.eu/eurostat/documents/4187653/11581515/EU-RESOURCE-PRODUCTIVITY-PPS.jpg

In the last years, due to the impact of climate change to the global economy, there is solid evidence that environmental issues are affecting productivity (Laha, 2017, p.3549-3614). By this rationale, in the analysis of TFP we have to include also the dynamic of environmental factors. This approach is generally valid for the entire economy with a special impact for agriculture. Climate change is impacting at a big scale the entire agriculture, all over the world. This impact has determined the governments to make a big change in policy-making process and consider revising the environmental infrastructure, educational programs, national strategies, alternative energy, taxation, farmer subsidies, etc. For example, the use of non-renewable resources is still high with a level of 80% considering the total energy consumption. Quick response of the policy-makers is necessary to come up with solutions in order to make a dramatically shift to renewable resources consumption.

From environmental protection perspective, there is a direct correlation between competitiveness and transition to a low-carbon economy (Ellis, 2013, p.31). Countries with a much more competitive positions are capable to allocate big budgets for dealing with climate change outcomes. In order to address environmental issues, performant economies have to adopt expansive technologies with a great impact on the cost of production. Even the cost is increasing, the capability to cover the natural damages is bigger. In this process of delivering high-tech green solutions in the environmental field, the role of innovation is very important. Sustainable growth is much more than economic growth. Nowadays, when the discrepancy between social layers, differences between countries and the gap between skills levels are more obvious than ever, growth perspective just from economic perspective, direct competition or amount of profit is not enough.

In the equation of sustainable growth, we must include cohesion among international economies, fair distribution of product between capital and labour (Keune, 2021, p.31), and actions for mitigate climate changes.

The actual conditions of development at global scale impose concrete actions in order to take into account the integrated growth system including environmental issues, social concerns, and economic dynamics (Le Blanc, 2015, p.9).

As in our model, MKEP, productivity and competitiveness are just preliminary stages for social welfare and standard of living. At the same time, the climate change issues had changes the economic dynamics in such a way to create premises to respond quickly and to consolidate resilience. In other words, this is a complete framework

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of sustainable development. The contribution of our model (MKEP) to sustainable development is supported by the concept of adding knowledge in the production function as an endogenous variable. Basically speaking, an important part of capital, that one allocated to resources is replacing by the added value of knowledge in the processes. At this point, replacing the non-renewable resources is tremendous important and development of knowledge in the fields like biotechnology, nanotechnology, new materials, medicine, ITC and others, plays a key role in sustainable growth.

In such a context, new economies had emerged, and a lot of attention and resources are distributed to low-carbon economy or inclusive economy. From this perspective is no room for diminishing the roles of green economy and social cohesiveness. Measuring prosperity of a nation just in the key of GDP level is not productive if we don't take into consideration the structure of GDP and the perspective for a sustainable growth.

In this equation of sustainability, apart industrial activities, a special role is played by agriculture. In this field, there are two trends:

- Environmental conservation – mitigation of the climate changes effects, reducing chemical residues from the soil, water supply management, ecological footprint, etc;
- Proactive positioning – fostering biodiversity, rural development, food security, etc;

## 6. Contribution for social welfare

Social welfare is not consisting just in more money in the population's pocket, better jobs, bigger houses or fastest cars, but clean environment, bio-food, green energy, healthy soil and air, too. From this perspective, the agriculture is contributing in a consistent way to close the loop of sustainable environment.

Welfare and environmental components discussed above are also a great challenge for measuring productivity. Of course, natural resources productivity is already developed in several studies and research at the global level, and the measuring system is not so hard to develop as long the awareness for such an approach is in place.

The challenge here is to understand the new trends on the market oriented towards green economy and healthy environment beside the necessity of rapid response and resilience for the effects of climate changes.

From this perspective, we can conclude at this point that productivity and competitiveness alone didn't reveal the entire picture of sustainable development without environmental care and social welfare components. Moreover, TFP as a residual has to very much consider these two components, too.

As an example, can we talk about productivity for a manufactured good as long as mass production of this item could harm the natural environment or is not contributing to a certain increasing of standard of living? Probably the right answer is YES/NO: in the old production model the answer is YES, in the endogenous growth model which consider knowledge as a resource and social welfare and healthy environment, the answer is NO.

After this doubt is clarified we can say that now we have the complete framework of TFP considering environmental and agriculture issues. Understanding better the TFP layout, it is the starting point to improve the measurement system. *"There is much debate in the scientific community on how to measure productivity and efficiency, as this poses major challenges both from a methodological and data availability perspective… besides European Commission (2016, p.3) remarks the productivity measurement system in agriculture."*

For this research, the objective is to give a new perspective to the approach of TFP analysis, and to understand the dynamic and interaction of its components.

Innovation is playing an important role in approaching environmental issues as long as there are necessary real solutions for low-carbon energy, green economy, mitigation of climate changes, clean air and soil, and food security.

There is a direct correlation between use of natural resources, sustainable development, and standard of living. So, analysing the level, rate and structure of resources consumption could create a solid base to identify the premises for development on the long-run, and welfare, too.

A robust measurement system for consumption of resources is the footprint analysis performed by WWF in their annual report Living Planet Report. This analysis reveals inequalities in matter of using natural resources around the globe.

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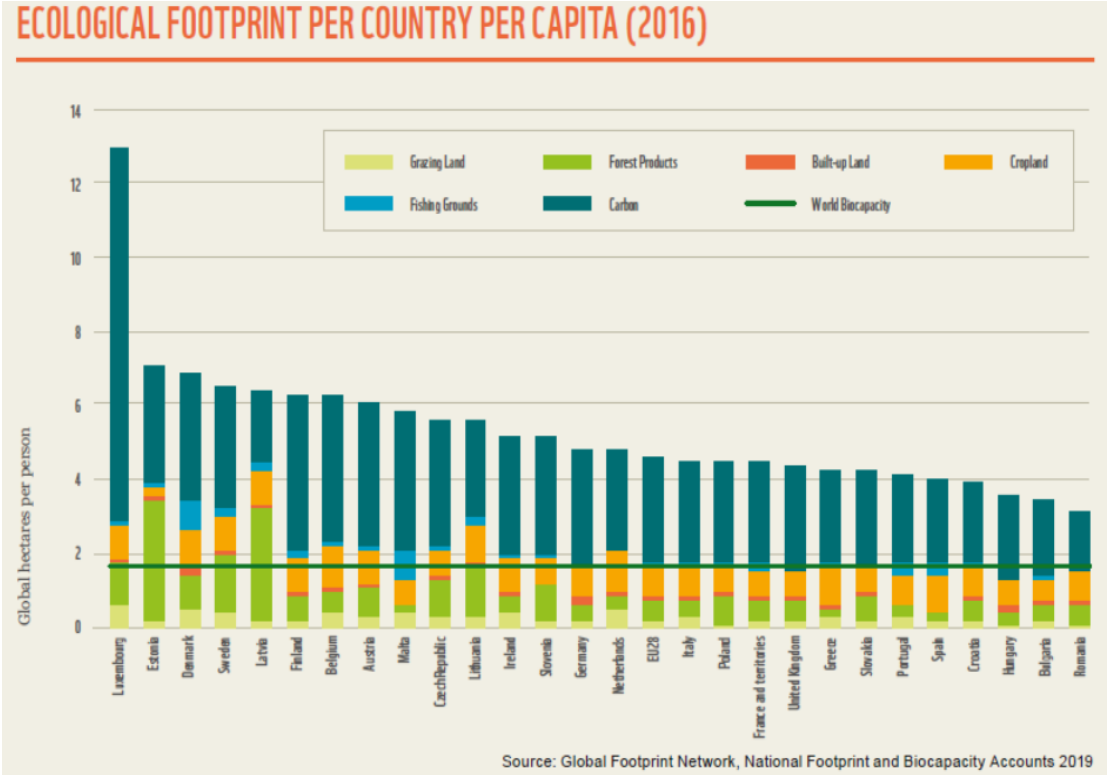


**Figure 4**. Position of Romania in the EU footprint ranking system

**Source:** https://www.weforum.org/agenda/2019/05/europeans-are-living-beyond-earth-s-means/

As you can see, in 2016, among all the EU Member States, Romania had the smallest footprint, the equivalent of 192 days (number of days to consume available resources for one year) comparing with Luxembourg with only 46 days.

Considering the other indices of development mentioned before, especially those related to productivity, innovation, competitiveness, and domestic materials consumption, we can say that this position of Romania, the country with the smallest footprint among EU countries, is relying on the availability of a considerable reservoir of resources, but the incapacity of this country to benefit by this advantage in order to transfer this asset in an increased value added for raw materials, productivity and competitiveness improvement.

If we add the low level of population welfare in Romania, the profile is like a country with huge potential not reflected in sustainable development through high productivity and competitiveness as development drivers.

## 7. Methodology – comparing different development approaches

At this point, it is a fact that investing in human capital will increase the standard of living for population and the consequence is having more awareness for environmental issues. Our model, MKEP, is keeping all these components in the same framework and shows the contribution of actors, interaction of stakeholders, framing of structures, layers of development, and the synergy created in such an ecosystem.

As a parallel between these two models of development, neo-liberal one and MKEP, we have to stress the fundamental difference: as long as the neo-liberal model is targeting market and capital as main objective, MKEP model is targeting knowledge and people. In the first one, the driven force is the accumulation of capital and in the last one, the driven force is the dissemination of knowledge.

In the neo-liberal model, the more capital you can accumulate, the more dominant the position in the market is. In the MKEP model, the more knowledge you share, the more benefits for sustainable growth you can obtain.

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In the neo-liberal approach, the main issue is competition, but in the MKEP approach the main outcome is collaboration.

Specific, for environmental issues, thinking on how to deal with climate changes effects, what do you think is the best response: competition or collaboration? How could help if, at international level, the fight against natural disasters is performed individually, with more or less efforts, on the one hand, or in a collaborative approach by vast regions, on the other hand?

For social disparities, inclusiveness, welfare, and so on, what is the best answer: competition or collaboration? How could solve the problem of skills level in a country with no access to technology and how to increase the incomes for population in a low value-added products economy?

In matter of productivity, agriculture field plays a very important role because of some particularities which define in a specific way the connection between anthropic effects and the environmental and natural conditions themselves.

In order to know the value of outcomes, in agriculture field we have to measure followings:

- The efficiency of labour;
- The effectiveness of machinery;
- The level of technology;
- The environmental and natural opportunities or threats.

## 8. Development perspectives

A special attention has to be paid to food security concerns generated by the continuous increasing of the population, on the one hand, and effects of climate change, on the other hand (Jayne and Others, 2021, p.11). In 2050, a not so complex estimation reveals an increasing of population up to 9 billion. Regarding the natural conditions and environmental issues, this is very hard to consider for an accurate projection, but a series of natural disasters, increasing the global temperature, greenhouse effects, increasing the carbon level, and many others externalities of human interventions, could give us a quite pessimistic perspective regarding the status of natural resources.

Even in the terms of industrial development the concept of productivity and competitiveness is quite complex, considering its particular conditions, in agriculture the flow knowledge-innovation-creativity-productivity-competitiveness is much more complex. As an example, measuring the outputs of the process in a country with favourable natural conditions is not the same thing as in a country with natural disadvantages. In this case, TFP in agriculture have to consider the natural opportunities and threats (FAO, 2018, p.35).

So far, productivity in agriculture was viewed in standard terms, such as capital, availability of natural resources and labour. In the last years, considering the effects of climate changes, implementation of high-end technology, and the advance of scientific work, had generated a different perspective.

In other words, productivity in agriculture is more sensitive than industry because of the action of variable depending on natural conditions: rain regime, dry period, erosion, effects of climate changes, pollution of water, air, and soil, etc. These variables could affect in a significant way the equilibrium on the market generating unexpected variations on demand side or supply side.

At the same time, dynamic of the population plays a particular role for productivity in this sector. Continuous increasing of population determines a constant pressure on the demand side. The same could affect the phenomenon of migration from one place to another.

Moreover, there are other factors generated by the human intervention on the natural habitats which interfere with agriculture field, such as enlarging urban areas, build up the infrastructure in transport or environment, deforestation, etc.

Finally, and here we are on the common place of dealing with productivity as in any other sector – especially industry, very important are technology, scientific solutions, and high skills of operators.

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*Serban, O. pp.16-25*

Ultimate technology like GPS monitoring, genetics, biotechnology, laser scanning, autonomous machineries, and many others, all these have a positive impact over TFP in agriculture.

Science is very involved in this process, with a great contribution to provide new solutions for seeds, pesticides, fertilizers, or new species of hybrids or animal breed, etc.

To manage ultimate technology and science in agriculture, it is needed high qualified specialists able to implement the new solutions and to contribute at productivity increasing. At this point, highly considerable is the agriculture field as a knowledge platform to transfer technology, innovation, and advanced education programmes in low-income countries. In these countries, considering that agriculture is the main activity and contributor to growth, this is the gate for starting the transformation of the economy according to the high standards of productivity and strengthen the position on competitiveness at global level. Once the competitive standards, increased skills, advanced technologies, and other valuable assets of sustainable growth are in place, the agriculture field could be an efficient platform to transfer best practices to the entire economy, when we talk about low-income countries. Considering that agriculture is the area where the human action is dealing directly with natural resources, especially water and soil, a good approach at the beginning of the environmental issues is quite effective for sustainable development.

From strategical and geo-political perspective, at the EU level, there is a constant increasing of productivity in agriculture. After 2004, once the accession of Member States from Eastern Europe become a reality, the situation was improved considering the natural potential existent in this side of Europe.

R&D investment for agriculture is the best way to move forward in productivity achievements. For this reason, the biggest challenge is the awareness of farmers for introducing the results of R&D in the specific operations. At the same time, as it is the case of Romania where the subsistence agriculture is common, it is beneficial to work on the side of cooperation and creating associative forms. Implementing R&D solutions in agriculture is more efficient for quite large farms. Science outcomes ready to be implemented in agriculture are not so cheap, but the results of farming are quite superior comparing with traditional way. This is the reason why, in order to compete in the food market, based on the R&D implementation, it is efficient to perform in big agriculture exploitations.

R&D in agriculture is beneficial for several reasons:

- Better adaptation to climate changes;
- Increasing of production and quality of products;
- Reducing operational costs;
- Mitigate externalities for natural environment;

## 9. Adapting and validating the MKEP model for agriculture

As in the other economic sectors, in agriculture productivity is based on innovation, creativity, and entrepreneurship. Remembering, here we are in the knowledge ecosystem very well represented by our model, MKEP. The value of knowledge is created in the same process, starting with the foundation of Knowledge Economy with the four pillars of education, technology, institutions, and innovation, where collaborative approach, partnering structures, institutional correlation and stakeholders' involvement is the essence of knowledge functionality for growth. A real exemplification of validating our model is the existence of EIP-AGRI (European Innovation Partnership for Agricultural Productivity and Sustainability), created at the level of EU. As in our model, this institutional framework is the promoter of knowledge ecosystem between farmers, consultants, managers, researchers, administrators, entrepreneurs, and representatives of dedicated associations, with the scope to create interconnectivity among actors for transferring better the R&D results in the real activities. Beside this structure, there are some other working groups which support the activities, such as AKIS (Agricultural Knowledge Innovation Systems), or SCAR (Standing Committee for Agricultural Research).

At EU level, under this strategic partnership, Common Agricultural Policy plays an important role in countries form Eastern Europe, considering the two pillars based on direct subsidies and rural development, respectively. By this strategy, there were improved the investment activities, new technologies, rural infrastructure, biodiversity, and others, giving more chances to the new Member States to exploit the full potential of natural conditions and to reduce the performance gap in agriculture if we compare with the level of old Members States.

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*Serban, O. pp.16-25*

## 10. Conclusion – knowledge awareness

We conclude at this point that the reality reveals the need for an ecosystem where knowledge is improved along the chain knowledge-innovation-creativity-entrepreneurship-productivity-competitiveness, more aware about a dedicated knowledge framework, as in our model. As we already validate for industrial sector, and now in environmental and agriculture fields, MKEP model is also a workable conceptual framework, where knowledge is a resource and increasing productivity and competitiveness are the outcomes of this process.

From this perspective, education is very important. Improving the knowledge from theoretical and practical perspective is necessary for increasing the value of products in the farm. As a statistic, in Romania 96% of farm managers develop their activities based just on practical experience (European Commission, 2016, p.9).

In the equation of TFP, the role of labour-intensive processes is less important. We have to underline the role of technology, R&D, education and institutional capacity. Knowledge is the foundation for this representation of TFP with innovation, creativity, and entrepreneurship in place.

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*Griskjane, N. pp.26-36*

# Intellectualization of Economy in Latvia

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## Abstract

The main characteristics of the smart economy are intellectualization, institutionalization, ecologization and socialization of the economy. This article analyzes the intellectualization of the economy, its main characteristics and indicators in Latvia. Taking into account the fact that the main goal of the smart economy is to increase the level of welfare, then the impact of intellectualization of the economy on GDP per capita in Latvia is determined.

***Keywords:*** intellectualization, science, innovation, welfare, economy.

***Jel Codes:*** C87, O11, O34

## 1. Introduction

Nowadays, the economy is increasingly intelligent and intelligent, characterized by the fact that knowledge and information will now become the main resources of the economy. The intellectualization of modern economy is an objective process, which is naturally determined by the quality of the person's place and role in the system of economic relations. Simultaneous transformation of a person into a goal, means and condition of economic activity imposes an obligation to describe in a new way the processes of individual and social reproduction (Ivanov, 2020).

Intellectualisation of the economy is a process of economic transformation that takes into account knowledge, and information and services have the highest added value. The main characteristics of intellectualization of the economy are: increase in the number and importance of intellectual jobs, increase in new knowledge, knowledge and information are the main production resources of business, horizontal cooperation, increasing demands on people's knowledge and skills, scientific and technical progress in all economic sectors, social infrastructure growth, sustainable economic development growth, improvement of working conditions, development of socially oriented economy. Knowledge and information are resources that, compared to other resources, can be characterized by infinity (Hadkova, L., 2015).

It should be noted, first of all, that the intellectualization of the economy is not directly determined by the informatization of society and the economy. The intensification of the information space is only a favorable condition for the intellectualization of the economy, but it is not its essence. Intelligence is a repository of potential information, but not the information itself. Intelligence is a functional element of a text message (Menshikov, V., 2020). Second, the quantitative growth and qualitative renewal of the economic information sector is not an argument in favor of the service sector's priority over the economic transformation sector as a whole or material production. The economy of any period of human development has always been both transformative and informative. In the process of evolution, people, knowing the world, received new information, developed his knowledge and at the same time improved his material base. The progressive development of the society envisages a change in the priorities of certain economic resources (Ivanov, 2020).

The goal of this article is to analyze and determine indicators of intellectualization of the economy impact on welfare in Latvia. For achieving the goal of this article, the following tasks are determined: 1. charactirize the indicators of intellectualization of the economy in Latvia; 2. to determine method for determing the indicators of intellectualization of the economy impact on the welfare in Latvia; 3. analyze the indicators of intellectualization of the economy impact on the welfare in Latvia; 4. make conclusions.

## 2. Description of intellectualization of the economy in Latvia

In Latvia, the intellectualization of the economy can be characterized by some negative trends: population decline, mass emigration, “brain drain” (internal and external), relatively low innovative activity of the company, low level of R&D investment, insufficient cooperation between scientists and companies, social inequality, etc. According to Eurostat statistics, the share of innovative entrepreneurship in Latvia has increased from 19.3% in 2001 to 30.3%

in 2016, but it is about half less than the EU average (49.5% in 2016). The turnover of innovative business in the EU is on average in the range of 13%, but in Latvia it is in the range of 5%. R&D expenditure per capita in Latvia is 12-24 EUR, but in Germany and Norway 400-600 EUR. To solve this problem, educated and highly qualified human resources are needed, so organizations that have been engaged in scientific research have a crucial role to play. In addition, it was determined that an important step for the development of the Latvian economy through the prism of innovation capacity is to increase funding for research. (Lukjanska, R., 2014).

Taking into account the NACE classification, the scientific research work is reflected in M and M72 group. According to the CSB data, group M group is 4,06% of the total value addes and M72 is 0,5% of the total value added in Latvia. Compared to 2009, in 2018 the added value of M72 group increased by 136.2% or 78973 thousand euros and, compared to 2017 – by 3.5% or 4616 thousand euros. Analyzing the value added of group M by regions, then in Riga region it makes up 6.74% of the region's total value added, in Pieriga region – 2.87% of the region's total value added, in Kurzeme region – 2.12% of the region's total value added, Zemgale in the region – 2.03% of the total value added of the region, in Vidzeme region – 1.91% of the total value added of the region and in Latgale region – 1.26% of the total value added of the region.

According to the CSB statistical data (see Table 1), it can be seen that the number of organizations engaged in scientific research in Latvia 2009-2019 increased by 37.7%. This growth can be characterized by the growth in the number of research organizations in the private sector – by 38.6% and in the public sector – by 33.3%. Among them, the number of organizations engaged in scientific research in the public sector decreased by 3 organizations in ten years, but the number of organizations in the higher education sector (universities and colleges) increased by 22 organizations.

According to the CSB data, in 2009-2019 the number of personnel in the public and private sectors increased: respectively by 6.6% and 14.2%. The public sector employs 80.2% of the total number of employees in organizations engaged in scientific research.

**Table 1.** Number of organizations and staff engaged in scientific research in Latvia 2009-2019

| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number of organizations engaged in scientific research** | 321 | 319 | 468 | 424 | 422 | 490 | 357 | 345 | 392 | 414 | 442 |
| - Public sector, including high schools | 57 | 52 | 75 | 81 | 80 | 79 | 76 | 79 | 76 | 76 | 76 |
| - Private sector | 264 | 267 | 393 | 343 | 342 | 411 | 281 | 266 | 316 | 338 | 366 |
| **Number of staff involved in scientific research** | 5485 | 5563 | 5432 | 5593 | 5396 | 5739 | 5570 | 5120 | 5378 | 5806 | 5923 |
| - Public sector, including high schools | 4457 | 4303 | 4562 | 4763 | 4415 | 4357 | 4425 | 4224 | 4422 | 4585 | 4749 |
| - Private sector | 1028 | 1260 | 870 | 885 | 981 | 1382 | 1145 | 896 | 956 | 1221 | 1174 |

**Source:** made by CSP statistcs database

In 2006, Hills, analyzing the role of higher education in the USA national innovation system, determined that in the USA national innovation system, almost all research is conducted for private industrial development, but the largest number of research is conducted in universities. A similar situation can be seen in Latvia, because companies do not need to maintain separate staff who will be engaged in scientific research work, but higher education institutions can successfully do this work.

In Latvia, the process of merging different universities is underway in order to promote the rational use of state budget funds and increase the efficiency of educational institutions. This is a popular practice in Europe and the United States. For example, in 2019 Daugavpils Medical college became a branch of Daugavpils University, In Latvia, double study programs are now being merged, because the number of accredited programs has steadily increased to 976 study programs. Ministry of Education and science of Latvia offer to close study programms where are small amount of students. Latvian high schools trying to cooperate with others countries.

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*Griskjane, N. pp.26-36*

In 2009-2019, the number of higher education institutions in the country decreased by 17%: the number of state higher education institutions decreased by 20% and the number of private higher education institutions decreased by 13.3%. This decrease can be attributed to the fact that there are 3 higher education institutions per 1 million inhabitants in Sweden and Denmark, 7 higher education institutions per 1 million inhabitants in Finland and 15 higher education institutions per 1 million inhabitants in Latvia. In Denmark and Finland, an average of 4,000 students study at one university, while in Latvia an average of 1,500 students study at one university. Now in Latvia is 6 universities and 21 high schools, as well as 2 foreign high schools.

The decrease in the number of students can be related to demographic problems, when in 2009-2019 the number of students decreased by 30.2%: in state higher education institutions decreased by 16136 students or 22.8%, but in private universities – by 14064 students or 48% (see Table 2). All this can affect the quality of education as well as the level of welfare.

**Table 2**. Number of high schools and students

| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of high schools | 35 | 34 | 35 | 36 | 36 | 35 | 32 | 32 | 29 | 29 | 29 |
| - Public high schools | 20 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 16 | 16 | 16 |
| - Private high schools | 15 | 17 | 18 | 19 | 19 | 18 | 15 | 15 | 13 | 13 | 13 |
| Number of students | 100074 | 91982 | 84724 | 81744 | 76793 | 73946 | 73504 | 72842 | 71278 | 70146 | 69874 |
| - Public high schools | 70769 | 66410 | 62082 | 61624 | 58467 | 56723 | 57027 | 56840 | 55839 | 54856 | 54633 |
| - Private high schools | 29305 | 25572 | 22642 | 20120 | 18506 | 17223 | 16477 | 16002 | 15439 | 15290 | 15241 |

**Source:** author's made by CSB statistics database

The positive side of higher education in Latvia is that in 2021 5 Latvian higher education institutions are included in the international ranking of academic and research institutions "SCImago Institutions Rankings": Riga Stradina University is in 676th place, Latvian University is in 740th place, Rigas Technical University is 766th, Latvia University of Agriculture is in 866th place and Daugavpils University is in 817th place (SCImago Institutions Rankings, 2021).

Analyzing the CSB data, it can be seen that the average salary of employees engaged in scientific research sectors in 2009-2019 is higher than the average in the country. However, the average salary of employees working in the education sector is lower than the average in the country (see Table 3).

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**Table 3.** Average monthly earnings of employees in scientific research work, education and the country by sectors in 2009-2019

| | 2009 | | | | 2011 | | | | 2013 | | | | 2016 | | | | 2019 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In total | Public sector | Government | Private sector | In total | Public sector | Government | Private sector | In total | Public sector | Government | Private sector | In total | Public sector | Government | Private sector | In total | Public sector | Government | Private sector |
| Average in the country | 654 | 717 | 749 | 616 | 660 | 701 | 748 | 636 | 715 | 766 | 833 | 688 | 859 | 886 | 1002 | 845 | 1076 | 1103 | 1295 | 1067 |
| Scientific research work | 774 | 773 | 772 | 781 | 1008 | 1007 | 1001 | 1028 | 1026 | 1009 | 1006 | 1092 | 1169 | 1168 | 1161 | 1107 | 1500 | 1560 | 1560 | 1233 |
| Education | 620 | 617 | 747 | 665 | 570 | 567 | 725 | 658 | 602 | 596 | 746 | 660 | 703 | 700 | 864 | 717 | 867 | 863 | 1147 | 872 |

**Source:** author's made by CSB statistics database

**Table 4.** Total funding of enterprises, state, higher education and foreign scientific research work in Latvia in 2009-2019, million EUR

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| **TOTAL:** | **109.56** | **141.43** | **145.42** | **139.50** | **162.80** | **152.10** | **110.40** | **137.90** | **186.20** | **195.10** |
| *Enterprises* | *42.54* | *35.14* | *34.58* | *30.40* | *45.30* | *30.50* | *23.80* | *33.30* | *41.60* | *47.40* |
| Basic research | 2.47 | 1.24 | 4.41 | 3.48 | 4.06 | 6.70 | 1.00 | 2.28 | 2.38 | 2.66 |
| Applied research | 6.44 | 12.10 | 9.08 | 14.87 | 17.10 | 11.50 | 7.08 | 10.24 | 12.11 | 13.82 |
| Experimental developments | 31.6 | 25.89 | 19.31 | 21.01 | 36.68 | 19.44 | 18.90 | 25.01 | 31.79 | 34.76 |
| *State* | *28.88* | *31.87* | *34.72* | *33.40* | *41.70* | *49.80* | *52.70* | *60.10* | *63.90* | *69.00* |
| Basic research | 7.11 | 10.22 | 8.03 | 5.97 | 11.53 | 8.95 | 7.06 | 9.22 | 9.08 | 5.95 |
| Applied research | 17.64 | 22.82 | 31.18 | 33.21 | 25.49 | 23.44 | 24.01 | 21.58 | 26.53 | 23.15 |
| Experimental developments | 0.38 | 0.023 | 0.22 | 1.15 | 1.96 | 6.61 | 4.08 | 5.21 | 6.83 | 7.77 |
| *Higher education* | *49.87* | *69.24* | *73.16* | *59.52* | *65.99* | *75.62* | *48.28* | *64.38* | *97.54* | *106.98* |
| Basic research | 24.70 | 30.09 | 34.58 | 24.51 | 32.33 | 36.85 | 25.43 | 31.15 | 55.04 | 57.46 |
| Applied research | 17.00 | 35.35 | 34.79 | 30.38 | 28.40 | 32.27 | 18.83 | 27.65 | 36.85 | 37.87 |
| Experimental developments | 3.07 | 3.80 | 3.79 | 4.63 | 5.26 | 6.49 | 4.02 | 5.58 | 5.65 | 11.66 |
| *Foreign* | *36.57* | *72.14* | *72.28* | *72.00* | *72.00* | *68.50* | *30.70* | *41.10* | *77.30* | *75.40* |

**Source:** author's made by CSB statistics database

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*Griskjane, N. pp.26-36*

Analyzing the CSB data on the total funding for scientific research, it can be seen that the main sources of funding are funding from the higher education sector and the foreign sector (see Table 4). During the nine years, the funding of the higher education sector for scientific research work increased by EUR 63.11 million or 143.86%, foreign funding increased by EUR 38.83 million or 106.18%, state funding increased by EUR 40.12 million. or 138.92% and enterprise financing increased by 4.86 million EUR or 11.42%.

The higher education sector finances basic research the most (53.74% of total higher education funding), the state finances applied research the most (33.55% of total public funding) and the business sector finances experimental development the most (73.33% of total funding of enterprise sector financing).

Basic research is theoretical or empirical (often experimental) research with the aim of formulating new theories and explaining the basic regularities according to the field. In turn, applied research is research in which the results of basic research are used to functionally solve specific tasks. Applied research is characterized by the practical applicability of the obtained results, for example, by opening the possibility to improve certain processes, increase and promote the further development of the product/service, find out opinions/attitudes, etc. Applied research topics can cover a wide range of subjects, all of which relate to practical rather than theoretical problems.

At the same time, it can be mentioned that the main economic directions of Latvia in terms of total value added are trade (25% of total value added), public sevtor (17% of total value added), real estate operations (12.5% of total value added). value added) and manufacturing (12% of total value added). In 2019, the gross capital investments of budgetary institutions in tangible assets are 1.39 million EUR (93.53%) and in intellectual capital is 0.96 million EUR (6.47%).

## 3. Method used to determine the impact of economic intellectualization indicators on welfare in Latvia

The most common methods used for the analysis of economic indicators are economic mathematical modeling, correlation and factor analysis, scenario forecasting and expert opinion. For this research about the impact of economic intellectualization indicators on welfare in Latvia, the author also uses one of these methods – i.e., the method of correlation and regression analysis.

From a theoretical point of view, the method of correlation analysis helps to determine the closeness of the relationship between intellectualization of the economy indicators and welfare indicators. Theoretically, it is determined that the correlation coefficient is in the range from -1 to +1. Among them, the closer the correlation coefficient is to 1, the stronger the link between the two variables. It should be added that the F-test (p-value) must first be performed before drawing conclusions on the impact of indicators of economic intellectualization on the welfare. If the p-value is less than 0.05, then an alternative hypothesis can be accepted that there is a linear relationship between the two indicators (the result is statistically significant). But if the p-value is greater than 0.05, then the alternative hypothesis that there is a linear relationship between these indicators cannot be accepted (the result is not statistically significant). However, this does not mean that there is no link between these indicators at all. In turn, the regression analysis method helps to determine the impact of intellectualization indicators on welfare indicators, increasing them by 1%. The regression coefficient has the same sign as the correlation coefficient.

After receiving the obtained result, it is also necessary to correctly and accurately interpret the obtained results and understand these regularities. In order to better understand the results of the correlation and regression analysis obtained by the author, the author performs additional analysis based on real statistical data in Latvia in 2009-2019 from the official statistical database of the CSB.

In author's research, the author will focus on the double logarithmic form in order to find out how intellectualization indicators impact welfare in Latvia. To be able to use the double logarithmic form, need:

- ✓ For feature Y variables y1, y2, ... yn to calculate logarithm ln(y1), ln(y2),... ln(yn);
- ✓ For feature X variables x1, x2, ... xn to calculate logarithm ln(x1), ln(x2), ... ln(xn);
- ✓ Linear regression analysis tools should be used in a similar way to one-factor and multifactor linear regression analyzes, taking into account logarithmic values instead of factorial and effective features.

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The logarithmic form can be written using the following formula:

$ln(y) = ln(x1) + ln(x2) + ... + ln(xn) + c$ , where

y – dependent variable;

x1, x2 – independent variable;

c – const.

This form creates the elasticity of the resultant (dependent variablr y) feature against the factual (independent variable x) features. The coefficient at the independent variable X shows the percentage increase in the dependent variable Y if the independent variables x1, x2, ..., xn increase by 1%. For example, what percentage of welfare indicators in Latvia will change if the intellectualization indicators increase by 1%. It must also be borne in mind that the double logarithmic form must be used where there is reason to have flexibility.

## 4. The impact of intellectualization of the economy indicators on welfare in Latvia

In order to determine the impact of intellectualization on the welfare in Latvia, the author first calculates the correlation coefficient (see Table 5).

**Table 5**. Correlation coefficients between intellectualization indicators and GDP per capita in Latvia in 2009-2019

| | GDP per capita in Latvia | GDP per capita in Rigas region | GDP per capita in Pieriga region | GDP per capita in Kurzemes region | GDP per capita in Zemgales region | GDP per capita in Vidzemes region | GDP per capita in Latgales region |
|---|---|---|---|---|---|---|---|
| **Number of organizations in scientific research work** | **r= 0,422 p-value=0,196** | **r= 0,294 p-value=0,381** | **r= 0,332 p-value=0,318** | **r= 0,444 p-value=0,172** | **r= 0,339 p-value=0,308** | **r= 0,270 p-value=0,423** | **r= 0,407 p-value=0,214** |
| Public sector | r= 0,676 p-value=0,022 | r= 0,690 p-value=0,019 | r= 0,667 p-value=0,025 | r= 0,802 p-value=0,003 | r= 0,766 p-value=0,006 | r= 0,652 p-value=0,030 | r= 0,801 p-value=0,003 |
| Private sector | r= 0,336 p-value=0,312 | r= 0,253 p-value=0,454 | r= 0,315 p-value=0,345 | r= 0,414 p-value=0,206 | r= 0,301 p-value=0,369 | r= 0,232 p-value=0,493 | r= 0,374 p-value=0,258 |
| **High schools** | **r= -0,802 p-value=0,003** | **r= -0,723 p-value=0,012** | **r= -0,765 p-value=0,006** | **r= -0,713 p-value=0,014** | **r= -0,731 p-value=0,011** | **r= -0,796 p-value=0,003** | **r= -0,744 p-value=0,016** |
| Public sector | r= -0,772 p-value=0,005 | r= -0,693 p-value=0,018 | r= -0,769 p-value=0,006 | r= -0,734 p-value=0,000 | r= -0,747 p-value=0,008 | r= -0,647 p-value=0,024 | r= -0,701 p-value=0,016 |
| Private sector | r= -0,628 p-value=0,034 | r=-0,567 p-value=0,069 | r= -0,585 p-value=0,059 | r= -0,538 p-value=0,088 | r= -0,552 p-value=0,078 | r= -0,662 p-value=0,016 | r= -0,545 p-value=0,085 |
| **Staff in scientific research work** | **r= 0,323 p-value=0,296** | **r= 0,170 p-value=0,618** | **r= 0,181 p-value=0,593** | **r= 0,166 p-value=0,625** | **r= 0,193 p-value=0,569** | **r= 0,202 p-value=0,556** | **r= 0,209 p-value=0,558** |
| Public sector | r= 0,296 p-value=0,377 | r= 0,123 p-value=0,719 | r= 0,208 p-value=0,540 | r= 0,294 p-value=0,579 | r= 0,225 p-value=0,507 | r= 0,080 p-value=0,814 | r= 0,582 p-value=0,819 |
| Private sector | r= 0,140 p-value=0,682 | r= 0,110 p-value=0,747 | r= 0,042 p-value=0,902 | r= -0,063 p-value=0,853 | r= 0,045 p-value=0,895 | r= 0,181 p-value=0,593 | r= -0,030 p-value=0,916 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Students** | **r= -0,942 p-value=0,000** | **r= -0,966 p-value=0,000** | **r= -0,963 p-value=0,000** | **r= -0,963 p-value=0,000** | **r= -0,962 p-value=0,000** | **r= -0,990 p-value=0,000** | **r= -0,923 p-value=0,000** |
| Public high schools | r= -0,939 p-value=0,000 | r= -0,954 p-value=0,00 | r= -0,956 p-value=0,000 | r= -0,930 p-value=0,00 | r= -0,950 p-value=0,000 | r= -0,931 p-value=0,000 | r= -0,918 p-value=0,000 |
| Private high schools | r= -0,947 p-value=0,000 | r= -0,979 p-value=0,000 | r= -0,990 p-value=0,000 | r= -0,994 p-value=0,000 | r= -0,975 p-value=0,000 | r= -0,954 p-value=0,000 | r= -0,937 p-value=0,000 |
| **Average monthly earnings of employees in scientific research work** | r= 0,986 p-value=0,000 | r= 0,935 p-value=0,000 | r= 0,962 p-value=0,000 | r= 0,944 p-value=0,000 | r= 0,957 p-value=0,000 | r= 0,940 p-value=0,000 | r= 0,937 p-value=0,000 |
| Public sector | r= 0,987 p-value=0,000 | r= 0,925 p-value=0,000 | r= 0,957 p-value=0,000 | r= 0,941 p-value=0,000 | r= 0,953 p-value=0,000 | r= 0,933 p-value=0,000 | r= 0,955 p-value=0,000 |
| Private sector | r= 0,892 p-value=0,000 | r= 0,904 p-value=0,000 | r= 0,906 p-value=0,000 | r= 0,882 p-value=0,000 | r= 0,894 p-value=0,000 | r= 0,891 p-value=0,000 | r= 0,862 p-value |
| **Total research funding** | **r= 0,744 p-value=0,009** | **r= 0,641 p-value=0,034** | **r= 0,674 p-value=0,023** | **r= 0,699 p-value=0,017** | **r= 0,671 p-value=0,024** | **r= 0,629 p-value=0,038** | **r= 0,710 p-value=0,014** |
| **Business funding for research** | **r= -0,049 p-value=0,885** | **r= 0,212 p-value=0,532** | **r= -0,186 p-value=0,584** | **r= -0,191 p-value=0,575** | **r= -0,203 p-value=0,549** | **r= -0,150 p-value=0,704** | **r= -0,173 p-value=0,612** |
| basic research | r= 0,014 p-value=0,967 | r= 0,097 p-value=0,797 | r= 0,001 p-value=0,997 | r= -0,059 p-value=0,863 | r= 0,066 p-vaalue=0,846 | r= 0,021 p-value=0,952 | r= 0,053 p-value=0,874 |
| applied research | r= 0,527 p-value=0,096 | r= 0,525 p-value=0,097 | r= 0,530 p-value=0,093 | r= 0,563 p-value=0,071 | r= 0,500 p-value=0,118 | r= 0,483 p-value=0,132 | r= 0,544 p-value=0,084 |
| experimental developments | r= 0,016 p-value=0,764 | r= -0,124 p-value=0,716 | r= -0,162 p-value=0,766 | r= -0,116 p-value=0,735 | r= -0,149 p-value=0,663 | r= -0,001 p-value=0,998 | r= -0,334 p-value=0,686 |
| **Public funding for research** | **r= 0,962 p-value=0,000** | **r= 0,931 p-value=0,000** | **r= 0,939 p-value=0,000** | **r= 0,903 p-value=0,000** | **r= 0,936 p-value=0,000** | **r= 0,965 p-value=0,000** | **r= 0,905 p-value=0,000** |
| basic research | r= 0,024 p-value=0,944 | r= 0,074 p-value=0,829 | r= 0,068 p-value=0,841 | r= 0,157 p-value=0,645 | r= 0,136 p-value=0,691 | r= 0,141 p-value0,680 | r= 0,124 p-value=0,717 |
| applied research | r= 0,393 p-value=0,231 | r= 0,449 p-value=0,166 | r= 0,447 p-value=0,168 | r= 0,472 p-value=0,143 | r= 0,458 p-value=0,157 | r= 0,300 p-value=0,571 | r= 0,503 p-value=0,115 |
| experimental developments | r= 0,758 p-value=0,007 | r= 0,825 p-value=0,002 | r= 0,750 p-value=0,008 | r= 0,628 p-value=0,038 | r= 0,748 p-value=0,008 | r= 0,836 p-value=0,001 | r= 0,685 p-value=0,021 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **High schools funding for research** | **r= 0,723 p-value=0,012** | **r= 0,577 p-value=0,063** | **r= 0,634 p-value=0,036** | **r= 0,666 p-value=0,025** | **r= 0,634 p-value=0,036** | **r= 0,570 p-value=0,067** | **r= 0,678 p-value=0,024** |
| basic research | r= 0,768 p-value=0,06 | r= 0,617 p-value=0,043 | r= 0,660 p-value=0,027 | r= 0,671 p-value=0,024 | r= 0,672 p-value=0,024 | r= 0,641 p-value=0,033 | r= 0,630 p-value=0,019 |
| applied research | r= 0,611 p-value=0,046 | r= 0,528 p-value=0,095 | r= 0,592 p-value=0,055 | r= 0,667 p-value=0,025 | r= 0,594 p-value=0,054 | r= 0,466 p-value=0,148 | r= 0,665 p-value=0,026 |
| experimental developments | r= 0,850 p-value=0,001 | r= 0,783 p-value=0,004 | r= 0,786 p-value=0,004 | r= 0,759 p-value=0,007 | r= 0,770 p-value= 0,006 | r= 0,788 p-value=0,004 | r= 0,770 p-value=0,001 |
| **Foreign research funding** | **r= 0,370 p-value=0,263** | **r= 0,297 p-value=0,375** | **r= 0,328 p-value=0,325** | **r= 0,389 p-value=0,237** | **r= 0,332 p-value=0,319** | **r= 0,229 p-value=0,488** | **r= 0,396 p-value=0,226** |

**Source:** made by author's calculations in SPSS Statistics

From the author's calculations, it was determined that there is a moderately close and positive correlation coefficient (p-value = 0.022) between the number of organizations in scientific research work in the public sector and GDP per capita. Among all regions of Latvia, the largest correlation between the number of organizations in research work in the public sector and GDP per capita is in Latgale region (p-value = 0.003), Kurzeme region (p-value = 0.0003) and Zemgale region (p-value = 0.006). But in other regions there is a moderately close and positive correlation: Riga region (p-value = 0.019), Pieriga region (p-value = 0.025) and Vidzeme region (p-value = 0.030).

The author's calculations determined that there is a very stong and positive corellation coefficient between average wage of employees in scientific research and the GDP per capita. This means that as the average wage of employees in scientific research increases, so does the GDP per capita. According to CSB statistics, during 10 years the average wage of employees in scientific research was increased by 93,8% or 726 euro, but GDP per capita – by 79,9% or 7062 euro.

There is a strong and positive correlation coefficient between total funding for research and GDP per capita (r = 0.009). This means that an increase in total funding for research contributes to an increase in GDP per capita. The most detailed correlation analysis determined that the business funding for applied research and GDP per capita has a moderately strong and positive correlation coefficient (p-value = 0.096). Also in all regions of Latvia, the business funding for applied research has a moderately close and positive effect on GDP per capita. 29.16% of the total business funding for applied research is allocated to the business funding for applied research. There is a very strong and positive correlation coefficient (p-value = 0.000) between total public funding for research and GDP per capita. Among them, there is a very strong and positive correlation coefficient (p-value = 0.007) between public funding for experimental developments and GDP per capita. In 2009-2019, the state funding for experimental developments increased very rapidly: by 1944.74% or 7.39 million EUR. There is a very strong and positive correlation coefficient between university funding for research and GDP per capita (p-value = 0.012): fundamental research (p-value = 0.006), applied research (p-value = 0.046) and experimental development (p-value = 0.001).

On the other hand, there is a very strong and negative correlation coefficient between the number of high schools and GDP per employee, as well as the number of students in high schools and GDP per capita. The same result was determined in all regions of Latvia: the number of high schools and students has a negative impact on GDP per capita. This can be explained by the fact that in 2009-2019 there was a decrease in the number of students in all higher education institutions. But already in the middle of the 19th century, in the newspaper "Latvijas Avīzēs", Krišjāns Valdemārs (founder of the Aināži Maritime School in Latvia) said that Latvians need three things: firstly schools, secondly schools and thirdly schools.

In order to determine how the indicators of economic intellectualization impact GDP per capita in Latvia, the author compiled log-linear equations of regression, taking into account the results of correlation analysis (see Table 6).

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**Table 6.** Log-linear regression equations on the impact of intellectualization of the economy indicators on the GDP per capita in Latvia in 2009-2019

| **Latvia** |
|---|
| ln(IKP_per_capita) = 0,718ln(organiz_sk_zpd_valsts_sektors)-0,45ln(augstskolas)-0,72ln(studenti)+0,778ln(strad_men_vid_d_sam_zpd)+0,728ln(strad_vid_men_d_sam_zpd_valsts)+0,922ln(strad_vid_men_d_sam_zpd_priv)+0,581ln(kop_fin_petij)+0,243ln(uzn_fin_liet_petij)+0,458ln(valsts_fin_petij)+0,064ln(valsts_fin_eksper_izstr)+0,431ln(augstsk_fin_petij)+0,394ln(augstsk_fin_fund_petij)+0,309ln(augstsk_fin_liet_petij)+0,344ln(augstsk_fin_eksper_izsr)+12,125 |
| **Rigas region** |
| ln(IKP_per_capita)=0,865ln(org_zpd_valsts_sektors)+0,815ln(strad_vid_d_sam_zpd)+0,754ln(strad_vid_d_sam_zpd_valsts)+1,032ln(strad_vid_d_sam_priv)+0,553ln(kop_fin_petij)+0,268ln(uzn_fin_liet_petij)+0,076ln(valsts_fin_eksper_izstr)+0,380ln(aigstsk_fin_petij)+0,350ln(augstsk_fin_fund_petij)+0,295ln(augstsk_fin_liet_petij)+0,350ln(augstsk_fin_eksper_izstr)+9,296 |
| **Pierigas region** |
| ln(IKP_per_capita)= 1,032ln(org_zpd_valsts_sektors)+1,000ln(strad_d_sam_zpd)+0,930ln(strad_vid_d_sam_zpd_valsts)+1,232ln(strad_vid_d_sam_priv)+0,693ln(kop_fin_petij)+0,322ln(uzn_fin_liet_petij)+0,558ln(valsts_fin_petij)+0,083ln(valsts_fin_eksper_izstr)+0,498ln(augstsk_fin)+0,446ln(augstsk_fin_fund_petij)+0,394ln(augstsk_fin_liet_petij)+0,419ln(augstsk_fin_eksper_izstr)+8,381 |
| **Kurzemes region** |
| ln(IKP_per_capita)= 0,775ln(org_zpd_valsts_sektors)+0,678ln(strad_vid_d_sam_zpd)+0,632ln(strad_vid_d_sam_zpd_valsts)+0,829ln(strad_vid_d_sam_zpd_priv)+0,497ln(kop_fin_petij)+0,237ln(uzn_fin_liet_petij)+0,391ln(valsts_fin_petij)+0,048ln(valsts_fin_eksper_izstr)+0,362ln(augstsk_fin_petij)+0,314ln(augstsk_fin_fund_petij)+0,307ln(augstsk_fin_liet_petij)+0,280ln(augstsk_fin_eksper_izstr)+8,645 |
| **Zemgales region** |
| ln(IKP_per_capita)= 0,759ln(org_zpd_valsts_sektors)+0,705ln(strad_vid_d_sam_zpd)+0,656ln(strad_vid_d_sam_zpd_valsts)+0,862ln(strad_vid_d_sam_zpd_priv)+0,489ln(kop_fin_petij)+0,416ln(valsts_fin_petij)+0,059ln(valsts_fin_eksper_izstr)+0,313ln(augstsk_fin_petij)+0,322ln(augstsk_fin_fund_petij)+0,280ln(augstsk_fin_liet_petij)+0,291ln(augstsk_fin_eksper_izstr)+8,439 |
| **Vidzemes region** |
| ln(IKP_per_capita)= 0,793ln(org_zpd_valsts_sektors)+0,848ln(strad_vid_d_sam_zpd)+0,788ln(strad_vid_d_sam_zpd_valsts)+1,053ln(strad_vid_d_sam_zpd_priv)+0,562ln(kop_fin_petij)+0,525ln(valsts_fin_petij)+0,080ln(valsts_fin_eksper_izstr)+0,377ln(augstsk_fin_fund_petij)+0,365ln(augstsk_fin_eksper_izstr)+8,331 |
| **Latgales region** |
| ln(IKP_per_capita)= 0,789ln(org_zpd_valsts_sektors)+0,685ln(strad_vid_d_sam_zpd)+0,640ln(strad_vid_d_sam_zpd_valsts)+0,826ln(strad_vid_d_sam_zpd_priv)+0,514ln(kop_fin_petij)+0,400ln(valsts_fin_petij)+0,053ln(valsts_fin_eksper_izstr)+0,375ln(augstsk_fin_petij)+0,329ln(augstsk_fin_fund_petij)+0,311ln(augstsk_fin_liet_petij)+0,289ln(augstsk_fin_eksper_izstr)+8,266 |

**Source:** made by author's calculations in SPSS Statistics

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*Griskjane, N. pp.26-36*

From the obtained calculations of the author, the following tendencies were determined in Latvia and regions of Latvia:

1. with the increase of the number of scientific research organization in the public sector by 1% or 3 organizations, GDP per capita in the country increases by 0.72% or 150,81 euro, GDP per capita in Riga region increases by 0.87% or 127,25 euro, GDP per capita in Pieriga region increases by 1.03 % or 75,36 euro, GDP per capita in Kurzeme region increases by 0.78% or 55,21 euro, GDP per capita in Zemgale region increases by 0.76% or 43,63 euro, GDP per capita in Vidzeme region increases by 0.79% or 45,98 euro and GDP per capita in Latgale region increases by 0 .79% or 39,39 euro.
2. with the increase of GDP per capita by 1% or 209,45 euro, the number of high schools in the country decreases by 0,45%. In 2009-2019 time period the amount of high schools was decreased by 6 higher education institutions: by 4 higher education institutions in public sector and by 2 higher education institutions in private sector.
3. with the decrease GDP per capita by 1% or 209,45 euro, the number of students in the country decreases by 0,72% or 72 students. It's meaning that decreas in amount of students by 1 people, GDP per capital decrease bu 2,90 euro.
4. with the increase of the average monthly salary of employees in scientific research work by 1% or 7,75 euro, the GDP per capita in the country increases by 0.78% or 117,63 euro.
5. with the increase of the total amount of funding for scientific research by 1% or 1,09 million euro, the GDP per capita in the country increases by 0.58% or 87,47 euro, the GDP per capita in the Riga region increases by 0.55%, the GDP per capita in the Pieriga region increases by 0.69%, GDP per capita in Kurzeme region increases by 0.50%, GDP per capita in Zemgales region increases by 0.49%, GDP per capita in Vidzemes region increases by 0.56% and GDP per capita in Latgales region increases by 0.51 %.
6. with the increase of the business funding for applied research by 1% or 0,06 million euro, the GDP per capita increases by 0.24% or 36,19 euro. In 2009-2019, business funding for applied research increased by 7.38 million EUR or 114.60% and makes up 29.16% of the total amount of business funding for scientific research.
7. with the increase of state funding for experimental developments by 1% or 0,0037 million euro, the GDP per capita in the country increases by 0.06% or 9,05 euro. In 2009-2019, the state funding for experimental development increased very rapidly by 7.39 million EUR or 1944.74% and makes up 11.26% of the total amount of state funding for scientific research.
8. High schools funding for all types of scientific research has a positive effect on GDP per capita in Latvia and its regions. With the amount of high schools funding increasing by 1% or 0,50 million euro, the GDP per capita in the country is growing by 0.43% or 15,56 euro. This can be related to the fact that 54.8% of the total amount of funding for scientific research is made up of high schools funding for scientific research.

## 5. Conclusions

The smart economy is a new process of economic transformation that takes into account the following processes – intellectualization, institutionalization, ecologicalisation and socialization of the economy. In this article, the author looked at the process of intellectualization of economy in Latvia.

In all regions of Latvia and in Latvia as a whole, a very strong and negative correlation was established between the number of higher education institutions and students and GDP per capita. This means that the number of high schools and students has a negative effect on the welfare levels. Various measures have now been taken to increase the number of students in Latvian high schools (including the attraction of foreign students). According to CSB statistics data, the number of foreign students in Latvian high schools in 2014-2019 time period has increased by 111,83% or 2657 students and made up 7,20% of total students amount. But it is necessary to strengthen the higher education system and the development of science not only through increases in the number of universities and students, but also through other measures. For example, there is a need to increase funding for scientific research.

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The author's calculations determined that the total amount of funding has a positive effect on the GDP per capita in Latvia. The most detailed calculations determined that the welfare indicators in Latvia are positively influenced by business funding for applied research and public funding for experimental development, as well as high schools funding for basic research, applied research and experimental development.

The process of intellectualization of the economy determines that the main resources of the economy are knowledge and information. T.Stewart once said that information is the most important source material for solving current and future problems. Employees who were not engaged in intelectual work, can no longer receive the same pay as before. Author's calculations shows that with the increasing of average earnings for scientific research workers, also increase the GDP per capita.

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*Capik, E., Doyar, B.V., Aytar, S. pp.37-48*

# Utility maximization under triangular fuzzy prices

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## Abstract

In microeconomics, a consumer who consumes goods (or services) such as $x_1$ and $x_2$ at fixed prices such as $p_1$ and $p_2$ is assumed to maximize their utility under the budget constraint. However, it is well-known that the prices are not fixed in real life. In this work, therefore, the prices are assumed to vary within a certain range. For a presumptive consumer, the variation is modeled using triangular fuzzy numbers. Then, the utility is maximized by considering the fuzzy constraint function. Using centroid and signed distance methods, furthermore, the fuzzy numbers are defuzzificated. Finally, the outcomes from crisp and fuzzy cases are compared. Results suggest that the highest level of utility can be obtained if the prices of the goods are left-skewed.

***Keywords:*** Microeconomics, Utility maximization, Triangular fuzzy numbers.

***Jel Codes:*** C02, D00, D12

## 1. Introduction

Consumer theory has an essential position in microeconomics. This subfield explains the consumption decision of the consumer subject to a certain budget and preferences. Barten and Böhm (1982, p. 381) indicate that consumer theory aims to examine how various assumptions affect consumer demand, purpose, behavior, and constraints. Also, Levin and Milgrom (2004, p. 1) emphasize that the consumer theory is worth to be considered separately due to its economically valuable outcomes.

It can be assumed that the prices of goods and services are constant. This acceptance, however, is rarely valid in real life since the prices usually fluctuate. Therefore, a more reasonable consumer analysis can be achieved if price variations are taken into account.

This study aims to calculate the optimal quantities of goods for a hypothetical consumer by considering price changes with fuzzy numbers. For this purpose, prices of the goods are represented by triangular fuzzy numbers and the utility of the consumer is maximized. Then, the fuzzy results obtained are defuzzificated by applying centroid and signed distance defuzzification techniques. The outcomes of the study vary by the shifters (i.e., the magnitude of price variation) and the defuzzification techniques. Compared to the situation where prices are fixed (i.e., the crisp case), higher or lower consumption and utility can be obtained.

This work is organized as follows: It begins by explaining utility maximization. Section 3 reviews the literature. Section 4 presents the preliminaries on fuzzy numbers. Section 5 revisits the utility maximization from the point of fuzzy numbers. Section 6 includes an example considered both in crisp and fuzzy senses. The last section concludes.

## 2. Utility Maximization

$X$ is the consumer's *consumption set* which represents their possible consumption bundles. The consumption set is presumed to be closed and convex as well as non-negative in $\mathbb{R}^k$ (Varian, 1992, p. 94). For the consumption bundles can be ordered, the preferences should fulfill the assumptions of completeness, transitiveness, continuity, monotonicity, local non-satiation, and convexity (see Varian, 1992, p.p. 94-98; Mas-Colell, Whinston and Green, 1995: p.p. 5-16).

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The *utility function* characterizes consumption behavior (Varian, 1992, p. 95). It assigns high values to more preferred bundles and low values to less preferred bundles in an ordinal manner (Mas-Colell, Whinston and Green, 1995, p.p. 8-9; Varian, 2010, p.p. 55). If we represent consumption bundles as vectors and show them with bold lowercase letters, then the utility function is a function $u: X \to \mathbb{R}$ such that $\mathbf{x} \succ \mathbf{y}$ if and only if $u(\mathbf{x}) > u(\mathbf{y})$. If the assumptions hold, then the continuous utility function can represent the consumer's behavior (Varian, 1992, p. 95).

The preference ordering is geometrically represented by *indifference curves*. All consumption bundles that provide an equal level of utility to the consumer (in other words, the bundles that are indifferent) form an indifference curve (Varian, 1992, p. 96).

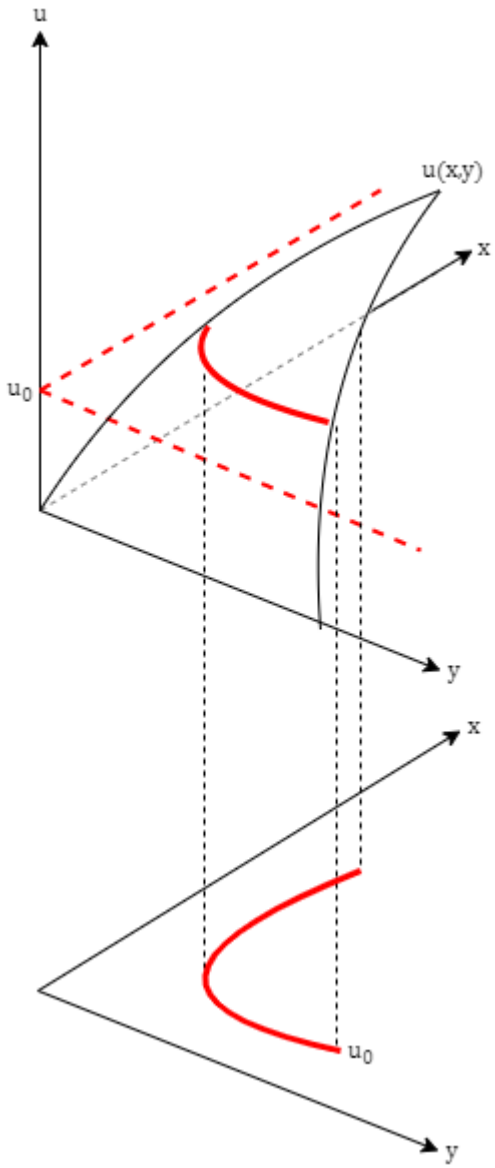


**Figure 1.** Utility function and indifference curve

**Source:** Nechyba (2011, p. 91)

Figure 1 shows the relationship between the utility function and the indifference curve for goods such as $x$ and $y$. Specific values of the utility function correspond to different indifference curves. When the utility function equals to $u_0$, corresponding indifference curve can be drawn as in Figure 1.

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*Capik, E., Doyar, B.V., Aytar, S. pp.37-48*

The *marginal rate of substitution (MRS)* refers to the slope of the indifference curve at a specific point. It shows how much of a one good a consumer must give up consuming more of the other good (Varian, 2010, p. 48; Jehle and Reny, 2011, p. 12). The MRS can be derived from the total differential of a utility function $u(\mathbf{x}, \mathbf{y})$ as follows (Varian, 1992, p. 98; Nechyba, 2011, p. 94):

$$du = \frac{\partial u}{\partial \mathbf{x}} d\mathbf{x} + \frac{\partial u}{\partial \mathbf{y}} d\mathbf{y} = 0.$$

Solve out for $\partial \mathbf{y}/\partial \mathbf{x}$:

$$\frac{\partial \mathbf{y}}{\partial \mathbf{x}} = -\frac{\frac{\partial u}{\partial \mathbf{x}}}{\frac{\partial u}{\partial \mathbf{y}}} = MRS.$$

If the individual increases the consumption of **x**, for strictly convex indifference curves, the MRS diminishes in an absolute sense. Put it differently, when an individual increases the consumption of one good in equal amounts, the amount they must give up on the other good gradually decreases (Varian, 2010, p.p. 51-52).

Say an individual consumes two goods, namely $x_1$ and $x_2$. Also, the individual has $m$ units of money and let $p_1$ and $p_2$ be the prices of goods $x_1$ and $x_2$, respectively. Then the set of bundles that the consumer can afford is (Varian, 1992, p. 98):

$$B = \{x_1, x_2 \in X : p_1 x_1 + p_2 x_2 \leq m\}.$$

Then the consumer's utility maximization problem can be represented by (Varian, 1992, p. 98):

$$\max_{x_1, x_2 \in X} u(x_1, x_2) \text{ such that } p_1 x_1 + p_2 x_2 \leq m.$$

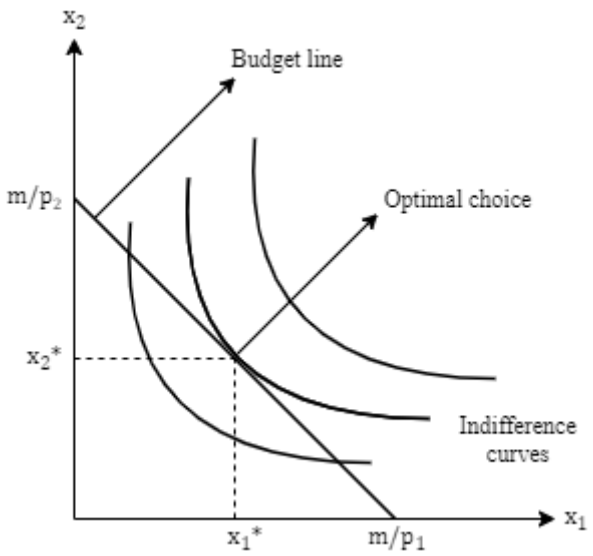


**Figure 2.** Utility maximization

**Source:** Varian (2010: 74); Jehle & Reny (2011: 22)

The solution to this problem is described graphically in Figure 2. The problem can be solved using the Lagrangian method (Varian, 1992, p. 100; Varian, 2010, p. 92):

$$\mathcal{L} = u(x_1, x_2) - \lambda (p_1 x_1 + p_2 x_2 - m).$$

Here, $\lambda$ is the Lagrange multiplier. To find $x_1^*$ and $x_2^*$ (which indicate optimal consumption amounts of the goods), following three first-order conditions need to hold (Varian, 2010, p. 92):

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*Capik, E., Doyar, B.V., Aytar, S. pp.37-48*

$$\frac{\partial \mathcal{L}}{\partial x_1} = \frac{\partial u(x_1^*, x_2^*)}{\partial (x_1)} - \lambda\, p_1 = 0,$$
$$\frac{\partial \mathcal{L}}{\partial x_2} = \frac{\partial u(x_1^*, x_2^*)}{\partial (x_2)} - \lambda\, p_2 = 0,$$
$$\frac{\partial \mathcal{L}}{\partial \lambda} = p_1 x_1 + p_2 x_2 - m = 0.$$

If the first-order condition for $x_1$ is divided by the first-order condition for $x_2$, then the Lagrangian is removed and we have an interpretable result (Varian, 1992, p. 100; Varian, 2010, p. 92):

$$\frac{\frac{\partial u(x_1^*, x_2^*)}{\partial x_1}}{\frac{\partial u(x_1^*, x_2^*)}{\partial x_2}} = \frac{p_1}{p_2}.$$

As seen, the left-hand side is MRS. Solving this equation for $x_1$ and $x_2$ gives optimal consumption amounts.

## 3. Literature review

Fuzzy logic is frequently used in a lot of fields and economics is not an exception. The benefits of using fuzzy logic in the field of economics are emphasized. For instance, Ponsard (1988) argues that the fuzzy set theory can be used to cope with unsolvable problems of classical economics. Shepherd and Shi (1998) show that a modeling strategy based on fuzzy logic provides a powerful and efficient method for estimating nonlinear and linear economic relations. Abdoulaeva and Nedosekin (2015) propose an approach for constructing a fuzzy logic model to predict the elasticity of a country's or region's mobilized economy. Furthermore, Suripah and Zetriuslita (2019) consider fuzzy logic as an alternative to solving economic problems.

Some of the studies based on fuzzy logic are also interested in the production side. For a linear demand function, Yao and Wu (2000a) demonstrate that the maximum revenue in the fuzzy sense can be greater or lesser than in the crisp case. Yao and Lin (2000) calculate optimum fuzzy profit using fuzzy demand and linear cost functions. They indicate that the results are the same both for the fuzzy and the crisp cases. Using triangular fuzzy numbers, Björk (2009) demonstrates that both the demand and the delivery time for a good in real-life situations and the optimization problem can be handled. Liu (2011) uses the α-cut method to derive the upper and lower bounds of the profit value at different specific α-cuts to find the long-run maximum profit for the Cobb-Douglas production function. Celikbilek, Erenay and Suer (2015) maximize the total net profit and minimize the total risks associated with the supply chain network design by using a fuzzy mixed-integer linear programming approach for a supply chain network design problem. Finally, Mandal, Garai and Roy (2016) solve Cobb-Douglas production function-based models by applying geometric programming techniques in a fuzzy environment. They also present the feasibility and efficiency of the proposed model.

In the literature, it is seen that the consumer theory is also studied within the scope of fuzzy logic. For example, Chen, Lee and Eden (1983) aim to investigate certain properties of a fuzzy utility function and analyze consumer behavior characterized by maximizing fuzzy utility subject to a budget constraint. For the manufacturing industry, Dean Ting and others (1999) develop a fuzzy multi-feature utility model which is more efficient than traditional cost models. In Aliev's (2009) study, a characterization theorem regarding the existence of a fuzzy utility function, which represents the weak order relationship defined on the fuzzy set of alternatives, is presented. Lastly, Ruiz and Mejías (2014) use the concept of fuzzy numbers to deal with uncertainty in classical utility theory. The paper presents a mathematical approach to address uncertainty in consumer decision-making using fuzzy MRS for two goods.

In the field of engineering economics, Lee, Lin and Gupta (2003) focus on the prediction of cash flows and show that the trapezoidal fuzzy numbers are suitable. Beilin (2017) also shows that the use of trapezoidal fuzzy numbers for fuzzy measures of linguistic values is more suitable than triangular fuzzy numbers in engineering economics.

Other studies assessing economics in the fuzzy environment are reviewed as follows. Ponsard (1984) examines the compatibility of the fuzzy partial equilibrium of consumers and producers to verify the compatibility of the equilibria of economic units. It is concluded that the basic conditions for the existence of a spatial general equilibrium in a fuzzy economy are less restrictive than in an ordinary economy. For linear supply and demand

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*Capik, E., Doyar, B.V., Aytar, S. pp.37-48*

functions, Yao and Wu (1999) fuzzify the coefficients and estimate consumer and producer surpluses. The results indicate that the surpluses can be better or worse than those in the crisp case. In the study of Yao and Chiang (2003), the total demand and the total storage cost per unit are first fuzzified with triangular fuzzy numbers, then the minimum total cost and optimal order quantity are defuzzificated with the center of gravity and marked distance methods and the results were compared. As a result of the study, it was seen that the total cost in the fuzzy sense gave better results. Dow and Ghosh (2009) argue that Keynes' analysis of speculative money demand can be usefully understood in terms of fuzzy sets. Muthu and Adhithyan (2017) rank and compare the performance of Indian banks and analyze the marketing difficulties in the banking sector using fuzzy logic. Ferrer-Comalat, Corominas-Coll and Linares-Mustarós (2021) represent investment as a fuzzy number and evaluate that consumption and savings depend on the lagged income through uncertain factors.

## 4. Preliminaries

Let $\tilde{A} = (a_1, a_2, a_3)$ be a fuzzy number that has the membership function as follows:

$$\mu_{\tilde{A}}(x) = \begin{cases} \dfrac{x - a_1}{a_2 - a_1}, & a_1 \le x \le a_2, \\ \dfrac{a_3 - x}{a_3 - a_2}, & a_2 \le x \le a_3, \\ 0, & otherwise. \end{cases}$$

Here, the fuzzy number $\tilde{A}$ is known as a *triangular fuzzy number* (see Figure 3). We signify the set of all triangular fuzzy numbers by $\mathcal{F}(T)$ (Kaufman and Gupta, 1992).

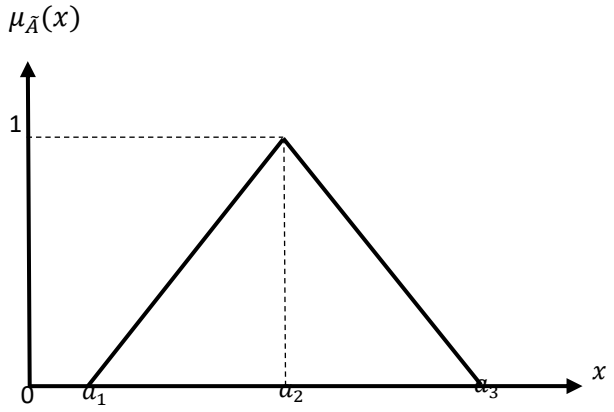


**Figure 3.** Triangular fuzzy number $\tilde{A} = (a_1, a_2, a_3)$

**Source:** Kaufman and Gupta (1992)

Note that the function $a_1$ defined by:

$$a_1(x) = \begin{cases} 1 & , \text{ if } x = a. \\ 0 & , \text{ otherwise.} \end{cases}$$

where $a \in \mathbb{R}$, is a fuzzy number (Kaufman and Gupta, 1992).

Here, the operations of *summation* and *scalar multiplication* on the set $\mathcal{F}(T)$ of triangular fuzzy numbers can be examined. For $\tilde{A}, \tilde{B} \in \mathcal{F}(T)$, the fuzzy number $\tilde{C} = (a_1 + b_1, a_2 + b_2, a_3 + b_3)$ is known as the sum of $\tilde{A} = (a_1, a_2, a_3)$ and $\tilde{B} = (b_1, b_2, b_3)$ and we write $\tilde{C} = \tilde{A} + \tilde{B}$. Let $k$ be a real number. Then *scalar multiplication* is described as (Kaufman and Gupta, 1992):

$$k\tilde{A} = \begin{cases} (ka_3, ka_2, ka_1), & k < 0, \\ (ka_1, ka_2, ka_3), & k > 0. \end{cases}$$

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*Capik, E., Doyar, B.V., Aytar, S. pp.37-48*

Defuzzifying methods allow the fuzzy numbers to be converted into crisp numbers. Using the *centroid method,* we defuzzify the fuzzy number $\tilde{A} \in \mathcal{F}(T)$ as (Yao and Chiang, 2003):

$$d^{c*}\left(\widetilde{A}, 0_1\right) = \frac{1}{3}(a_1 + a_2 + a_3).$$

*Signed distance* defuzzification method is introduced by Yao and Wu (2000b). If $\tilde{A} \in \mathcal{F}(T)$ then the signed distance of $\tilde{A} = (a_1, a_2, a_3)$ can be shown as:

$$\boldsymbol{d^{s*}\left(\widetilde{A}, 0_1\right) = \frac{1}{4}(a_1 + 2a_2 + a_3).}$$

## 5. Utility maximization in fuzzy sense

Then the consumer's utility maximization problem can be represented by (Varian, 1992, p. 98):

$$\max_{x_1, x_2 \in X} u(x_1, x_2) \; such\ that\ p_1 x_1 + p_2 x_2 = m.$$

For the quantities $x_1$ and $x_2$, let the prices $p_1$ and $p_2$ vary around $(p_1 - \Delta_L^1, p_1 + \Delta_R^1)$ and $(p_2 - \Delta_L^2, p_2 + \Delta_R^2)$ respectively, where $0 < \Delta_L^1 < p_1$, $0 < \Delta_L^2 < p_2$, $\Delta_R^1 > 0$ and $\Delta_R^2 > 0$.

Using the triangular fuzzy numbers, we fuzzify the prices $p_1$ and $p_2$ as

$$\mu_{\widetilde{p_1}}(x) = \begin{cases} \dfrac{x - p_1 + \Delta_L^1}{\Delta_L^1}, & p_1 - \Delta_L^1 \leq x \leq p_1, \\ \dfrac{p_1 + \Delta_R^1 - x}{\Delta_R^1}, & p_1 \leq x \leq p_1 + \Delta_R^1, \\ 0, & otherwise. \end{cases}$$

(See Figure 4) and

$$\mu_{\widetilde{p_2}}(x) = \begin{cases} \dfrac{x - p_2 + \Delta_L^2}{\Delta_L^1}, & p_2 - \Delta_L^2 \leq x \leq p_2, \\ \dfrac{p_2 + \Delta_R^2 - x}{\Delta_R^2}, & p_2 \leq x \leq p_2 + \Delta_R^2, \\ 0, & otherwise. \end{cases}$$

(See Figure 5) i.e, we write

$$\boldsymbol{\widetilde{p_1} = \left(p_1 - \Delta_L^1, p_1, p_1 + \Delta_R^1\right).} \quad \textbf{(1)}$$

and

$$\boldsymbol{\widetilde{p_2} = \left(p_2 - \Delta_L^2, p_2, p_2 + \Delta_R^2\right).} \quad \textbf{(2)}$$

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*Capik, E., Doyar, B.V., Aytar, S. pp.37-48*

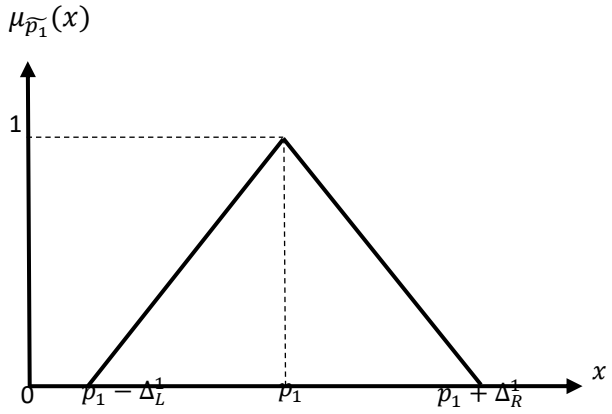


**Figure 4.** Triangular fuzzy number $\widetilde{p_1}$

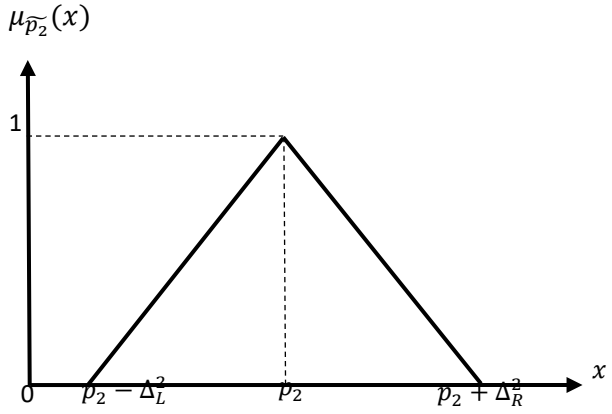


**Figure 5.** Triangular fuzzy number $\widetilde{p_2}$

Now we apply two defuzzification techniques to defuzzify the prices $\widetilde{p_1}$ and $\widetilde{p_2}$.

*5.1. Utility maximization using the Centroid Defuzzification Method*

Using the centroid method, we defuzzify the prices $\widetilde{p_1}$ and $\widetilde{p_2}$ in the equations (1) and (2) as

$$E_{p_1}^c = \frac{1}{3}(p_1 - \Delta_L^1 + p_1 + p_1 + \Delta_L^1) = p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1),$$

$$E_{p_2}^c = \frac{1}{3}(p_2 - \Delta_L^2 + p_2 + p_2 + \Delta_L^2) = p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2).$$

In this paper, we use the (common) Cobb-Douglas utility function $u(x_1, x_2) = x_1^a x_2^{1-a}$, where $a > 0$. Hence the consumer's utility maximization problem is

$$\max u(x_1, x_2) = x_1^a x_2^{1-a} \; subject\ to\ E_{p_1}^c x_1 + E_{p_2}^c x_2 = m.$$

The Lagrangian for this problem is written as:

$$\mathcal{L}^c = x_1^a x_2^{1-a} - \lambda\left(\left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right)x_1 + \left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right)x_2 - m\right).$$

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*Capik, E., Doyar, B.V., Aytar, S. pp.37-48*

The first-order conditions are:

$$\frac{\partial \mathcal{L}^c}{\partial x_1} = a x_1^{a-1} x_2^{1-a} - \left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right) \lambda = 0,$$

$$\frac{\partial \mathcal{L}^c}{\partial x_2} = (1-a) x_1^{a} x_2^{-a} - \left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right) \lambda = 0,$$

$$\frac{\partial \mathcal{L}^c}{\lambda} = m - \left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right) x_1 - \left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right) x_2 = 0.$$

Rearranging the first two expressions as:

$$\left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right) \lambda = a x_1^{a-1} x_2^{1-a},$$

$$\left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right) \lambda = (1-a) x_1^{a} x_2^{-a}.$$

Dividing them by each other gives:

$$\frac{\left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right)}{\left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right)} = \frac{a x_1^{a-1} x_2^{1-a}}{x_1^{a} x_2^{-a}} = \frac{a x_2}{(1-a) x_1},$$

$$x_2 = \frac{(1-a)\left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right)}{a\left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right)} x_1.$$

Writing this into the third expression:

$$m - \left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right) x_1 - \left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right) \frac{(1-a)\left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right)}{a\left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right)} x_1 = 0.$$

Solving for $x_1$ gives:

$$\boldsymbol{x_1^{c*} = \frac{ma}{\left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right)}.} \quad \textbf{(3)}$$

Since

$$x_2 = \frac{(1-a)\left(p_1 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right)}{a\left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right)} x_1.$$

Then

$$\boldsymbol{x_2^{c*} = \frac{(1-a)ma}{a\left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right)} = \frac{(1-a)m}{\left(p_2 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right)}.} \quad \textbf{(4)}$$

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*Capik, E., Doyar, B.V., Aytar, S. pp.37-48*

*5.2. Utility Maximization using the Signed Distance Defuzzification Method*

Similarly, we defuzzify the prices $\widetilde{p_1}$ and $\widetilde{p_2}$ in the equations (1) and (2) using the signed distance method as

$$E^s_{p_1} = \frac{1}{4}(p_1 - \Delta^1_L + 2p_1 + p_1 + \Delta^1_L) = p_1 + \frac{1}{4}(\Delta^1_R - \Delta^1_L),$$
$$E^s_{p_2} = \frac{1}{4}(p_2 - \Delta^2_L + 2p_2 + p_2 + \Delta^2_L) = p_2 + \frac{1}{4}(\Delta^2_R - \Delta^2_L).$$

In this case, the consumer's utility maximization problem is

$$\max u(x_1, x_2) = x_1^a x_2^{1-a} \; subject \; to \; E^s_{p_1} x_1 + E^s_{p_2} x_2 = m.$$

The Lagrangian for this problem is written as:

$$\mathcal{L}^s = x_1^a x_2^{1-a} - \lambda\left(\left(p_1 + \frac{1}{4}(\Delta^1_R - \Delta^1_L)\right)x_1 + \left(p_2 + \frac{1}{4}(\Delta^2_R - \Delta^2_L)\right)x_2 - m\right).$$

Similar to the centroid method we get

$$\boldsymbol{x_1^{s*} = \frac{ma}{\left(p_1 + \frac{1}{4}(\Delta^1_R - \Delta^1_L)\right)}}. \quad \textbf{(5)}$$

and

$$\boldsymbol{x_2^{s*} = \frac{(1-a)m}{\left(p_2 + \frac{1}{4}(\Delta^2_R - \Delta^2_L)\right)}}. \quad \textbf{(6)}$$

## 6. An Example

Let

$$\boldsymbol{\max u(x_1, x_2) = x_1^{1/2} x_2^{1/2} \; subject \; to \; 25x_1 + 20x_2 = 400}.$$

We calculate $x_1^* = 8$ and $x_2^* = 10$. Hence, the maximum utility is

$$u(8,10) = 8^{1/2}10^{1/2} = 8.94.$$

Now, we fuzzify the prices $p_1$ and $p_2$ as

$$\boldsymbol{\widetilde{p_1} = \left(25 - \Delta^1_L, 25, 25 + \Delta^1_R\right)}.$$

and

$$\boldsymbol{\widetilde{p_2} = \left(20 - \Delta^2_L, 20, 20 + \Delta^2_R\right)}.$$

*6.1. Centroid Method*

The Lagrangian for this problem is written as:

$$\boldsymbol{\mathcal{L}^c = x_1^{1/2} x_2^{1/2} - \lambda\left(\left(p_1 + \frac{1}{3}\left(\Delta^1_R - \Delta^1_L\right)\right)x_1 + \left(p_2 + \frac{1}{3}\left(\Delta^2_R - \Delta^2_L\right)\right)x_2 - 400\right)}.$$

Using equations (3) and (4), the solution of this equation is:

$$\boldsymbol{x_1^{c*} = \frac{400}{2\left(25 + \frac{1}{3}(\Delta^1_R - \Delta^1_L)\right)}}.$$

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*Capik, E., Doyar, B.V., Aytar, S. pp.37-48*

and

$$x_2^{c*} = \frac{400}{2\left(20 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right)}.$$

Hence, the maximum utility is

$$u_c(x_1^{c*}, x_2^{c*}) = \left(\frac{400}{2\left(25 + \frac{1}{3}(\Delta_R^1 - \Delta_L^1)\right)}\right)^{1/2} \left(\frac{400}{2\left(20 + \frac{1}{3}(\Delta_R^2 - \Delta_L^2)\right)}\right)^{1/2}.$$

*6.2. Signed Distance Method*

The Lagrangian for this problem is written as:

$$\mathcal{L}^s = x_1^{1/2} x_2^{1/2} - \lambda\left(\left(p_1 + \frac{1}{4}(\Delta_R^1 - \Delta_L^1)\right)x_1 + \left(p_2 + \frac{1}{4}(\Delta_R^2 - \Delta_L^2)\right)x_2 - 400\right).$$

Using equations (5) and (6), the solution of this equation is:

$$x_1^{s*} = \frac{400}{2\left(25 + \frac{1}{4}(\Delta_R^1 - \Delta_L^1)\right)}.$$

and

$$x_2^{s*} = \frac{400}{2\left(20 + \frac{1}{4}(\Delta_R^2 - \Delta_L^2)\right)}.$$

Hence maximum utility is

$$u_s(x_1^{s*}, x_2^{s*}) = \left(\frac{400}{2\left(25 + \frac{1}{4}(\Delta_R^1 - \Delta_L^1)\right)}\right)^{1/2} \left(\frac{400}{2\left(20 + \frac{1}{4}(\Delta_R^2 - \Delta_L^2)\right)}\right)^{1/2}.$$

*6.3. Results*

Let us give the maximum utility values calculated using different fuzzified parameters in the table below.

**Table 1.** Maximum values of utility for the methods of centroid and signed distance

| | $\Delta_L^1$ | $\Delta_R^1$ | $\Delta_L^2$ | $\Delta_R^2$ | $x_1^{c*}$ | $x_2^{c*}$ | $x_1^{s*}$ | $x_2^{s*}$ | $u_c(x_1^{c*}, x_2^{c*})$ | $u_s(x_1^{s*}, x_2^{s*})$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **Case 1 (crisp)** | 0 | 0 | 0 | 0 | 8 | 10 | 8 | 10 | 8.9443 | 8.9443 |
| **Case 2** | 1 | 2 | 1 | 2 | 7.8947 | 9.8361 | 7.9208 | 9.8765 | 8.8121 | 8.8448 |
| **Case 3** | 2 | 1 | 2 | 1 | 8.1081 | 10.1695 | 8.0808 | 10.1266 | 9.0805 | 9.0460 |
| **Case 4** | 1 | 2 | 2 | 1 | 7.8947 | 10.1695 | 7.9208 | 10.1266 | 8.9602 | 8.9560 |
| **Case 5** | 2 | 1 | 1 | 2 | 8.1081 | 9.8361 | 8.0808 | 9.8765 | 8.9304 | 8.9337 |

We can interpret Table 1 as follows:

Case 1: Crisp case.

Case 2: When each price is right-skewed, the optimal utility obtained from both centroid and signed distance methods is lower than in the crisp case.

Case 3: When each price is left-skewed, the optimal utility obtained from both centroid and signed distance methods is higher than in the crisp case.

Case 4: When $p_1$ is right-skewed and $p_2$ is left-skewed, the optimal utility obtained from both centroid and signed distance methods is higher than in the crisp case.

Case 5: When $p_1$ is left-skewed and $p_2$ is right-skewed, the optimal utility obtained from both centroid and signed distance methods is lower than in the crisp case.

As a result, it is observed that the highest utility value can be obtained if the prices of the goods are left-skewed.

## 6. Conclusion

In this study, instead of fixing the prices of $p_1$ and $p_2$ corresponding to the products $x_1$ and $x_2$ in the constraint function, we maximize the utility by considering the prices can change in a certain range. This change is modeled with triangular fuzzy numbers. Defuzzification is made by centroid and signed distance techniques. As can be seen in Table 1, the use of fuzzy numbers can bring higher utility as well as lower. Higher or lower values can be obtained by using other fuzzification and defuzzification techniques available in the literature. These values may vary depending on the parameter of fuzziness selected by the expert and the model to be used for utility maximization.

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*Octavian, S. pp.49-64*

# Analysis of productivity and competitiveness challenges in Romania

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## Abstract

The best way to have consensus on development of a measuring system of Total Factor Productivity (TFP) is the solution of current research which try to explain better the metamorphosis of the knowledge in the process. The question is: what do we prefer, to stay in an obsolete environment with dizzy figures about performance in productivity and competitiveness field, or to promote a new model capable to disclose the most important features for a robust environment in productivity and competitiveness, where all the stakeholders are interconnected, integrated, and deeply committed to increase the standards in addressing these issues? The solution proposed is Multilevel Knowledge Economy Pyramid (MKEP) model as a valuable tool for better understanding of the dynamics, trends, directions, scope, structures, levels of knowledge environment. This model is tested in the specific economy of Romania by comparing aggregate indices in productivity and competitiveness considering international databases and ranking systems. The result of this approach consists of the conclusion that policy making and decision-making process at governmental level in terms of productivity and competitiveness is the most sensitive point with a crucial importance for sustainable development. Building on this issue, MKEP is the backbone of institutional capacity around the productivity and competitiveness, and the structure for governmental policy in this respect.

***Keywords:*** Total Factor Productivity, innovation, knowledge, sustainable development , welfare.

***Jel Codes:*** D24, O30, D83, Q01, I31

## 1. Introduction- General layout of productivity and competitiveness in Romania

For Romania, the Total Factor Productivity (TFP) is the main contributor to the potential growth. The level of potential growth has increased up to 4.5% in 2017 and continues to increase until the pandemic crisis. The contribution of labour to total growth is still weak, and the perspective is negative because of the ageing population.

According to the analysis of EU trends – "Commission Staff Working Document: Country Report Romania 2019" the situation of contribution to the potential growth in 2018, at level of Romania for 18 years is represented in the Figure 1.

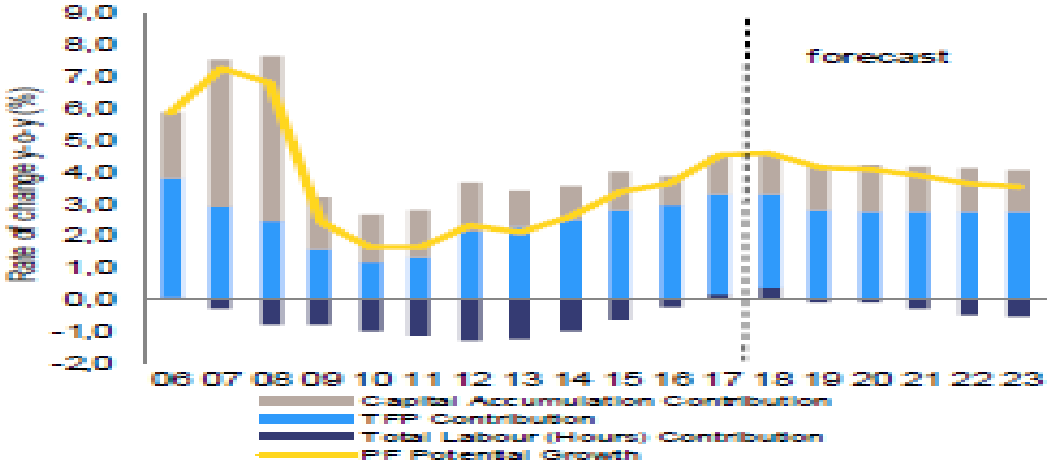


**Figure 1.** Contribution to the potential growth in Romania for 18 years in a row

**Source:** European Commission Country Report Romania 2019, SWD (2019, p.8):

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To mention that the trend until 2023 was calculated without the SARS COV-19 influence. Anyway, as in the South-Korean and many other developed economies, contribution of labour to GDP is becoming negative.

In Romania, the situation before pandemic crisis was quite stable at macroeconomic level with a constant solid trend for growth (4.4% in 2018 and 4.1 in 2019) (European Commission, 2020, p.111). For 2020, the expectation was a drop with 6%, and the figure at the end of the year was a decreasing of GDP with 3.9%.

Before crisis, labour productivity was 4.2% in 2018, respectively 3.8% in 2019. For 2020, the average labour productivity per person was -1.1% comparing with the previous year.

Reffering to the GDP rate in Romania, from 1990 to 2018, it was a constant increasing comparing with the other EU Member States, excepting the 2008-2010 crysis, as you can see in the Figure 2 below:

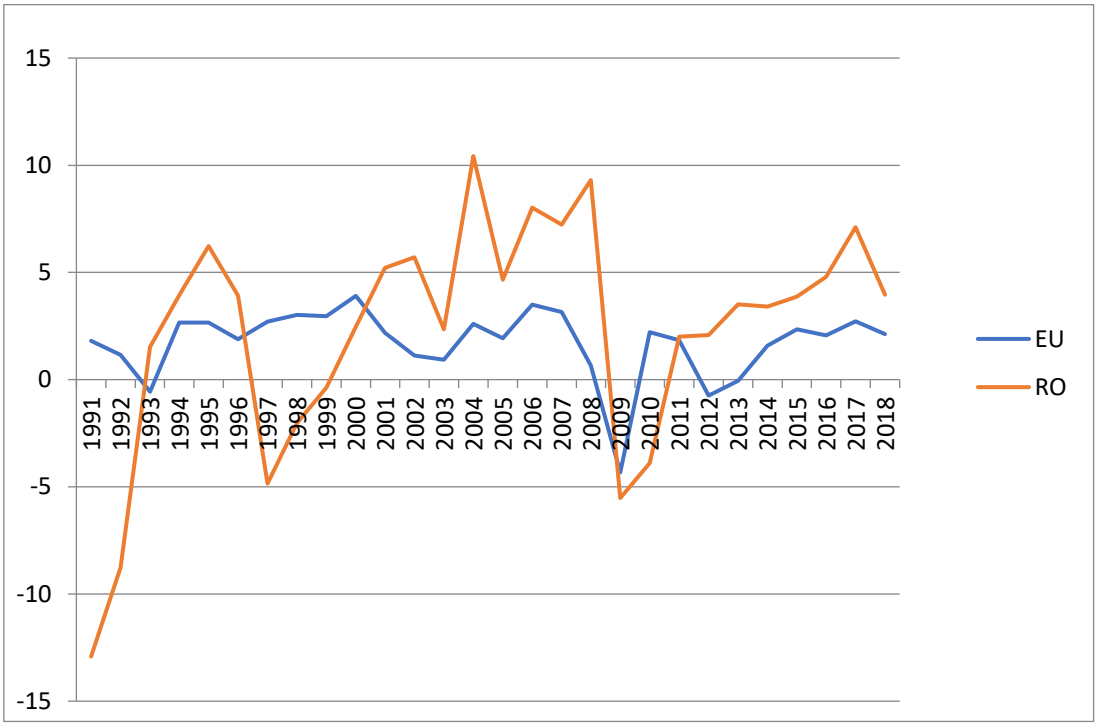


**Figure 2.** Romania GDP fluctuation over the last 28 years

**Source:** The author own representation based on the data collected from World Bank and OECD national accounts

The level of productivity is still very low in Romania, but the increasing rate is quite robust in the last years. From the growth analysis in Romania, we can depict some particularities:

- Wages increasing overcome productivity increasing – this determines an increasing of structural deficits at the macroeconomic level;
- Growth is based on consumption and in the long run this will affect the structural deficit;
- Until 2020, Romanian economy doesn't succeed to avoid a procyclical approach – the higher the GDP increasing rate, the bigger the structural deficits;
- Competitiveness based on low labour costs is decreasing continuously considering the not realistic increasing of wages and the alignment of labour costs level with the EU countries;
- Higher demand of goods and services is not covered by the internal supply and the contribution of imports is important to cover the gap – this determines accelerating the increasing of commercial deficit;
- Low level of value added on domestic products determines small revenues for highly qualified jobs and the consequence is the migration of skilled workers abroad;

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Considering these aspects, there is necessary to accelerate the implementation of a recovery plan in order to achieve macroeconomic stability, reducing the structural deficits, improve the commercial balance, and increase the efforts for higher productivity based on TFP contribution to GDP. *"…weak TFP growth can be the consequence of prevailing institutional and regulatory rigidities. These can stifle the intensity of competition, and negatively influence a variety of economic outcomes, such as productivity, innovation and income distribution… besides Bauer and Others (2020, p.16) remarks the impact of TFP over governmental approach."*

## 2. Statement - Changing the paradigm of productivity and competitiveness

The purpose of this study is to create premises to change the attitude for productivity by understanding better the entire picture. Basically speaking, there is no small or high level of productivity, the most important thing is the reference. If we find the way to give up the less productive activities and to spread the more productive ones based on value of knowledge, then the reference in calculating productivity is different. So, the question is: what do we prefer, to stay in an obsolete environment with dizzy figures about performance in productivity and competitiveness field, or to promote a new model capable to disclose the most important features for a robust environment in productivity and competitiveness, where all the stakeholders are interconnected, integrated, and deeply committed to increase the standards in addressing these issues?

In a broad approach, as in the Multilevel Knowledge Economy Pyramid (MKEP) model , productivity is an attitude at individual level, a commitment at organizational level and a movement at national level. In Knowledge Economy environment, productivity is everybody's business. As in the case with the top ten performers as multinational companies, the strategic objective of these organizations is innovation, and not only the purpose to create a certain product; the value added in any product is innovation. Apple is not a manufacturer of cell-phones, but is a provider of smart devices with high performance, technology, and applicability in the communication field.

The new challenges of COVID-19 crisis reveal the limitations of staying prisoner in the old model of addressing productivity if we keep as reference the GDP and number of employees. During 2020, GDP drastically drops and the entire macro-economic indicators fall down. At the same time, the studies reveal that labour productivity level for the employees working at home is higher now than before the crisis. In this period there are several economic and social sectors interrupted at all: hospitality, tourism, air transportation, etc. In such conditions, all the figures related with productivity are not relevant. What we are trying to show is that the old attitude for computing productivity and competitiveness is not bad, but it has several limitations. In the new model these limitations are removed, and the productivity and competitiveness processes are focused on the creation of the appropriate environment for increasing performance. In this area we have to improve the measurement system in order to have a better image of TFP.

## 3. Understanding better the Total Factor Productivity (TFP)

Considering the role of TFP in creating GDP, it is important to succeed to come up with a better measuring system. TFP is very complex and hard to measure with standard procedures, metrics or tools. In order to suceed establishing a more aqurate measuring system for TFP, there is necessary a deeper analysis and better understanding of it. TFP is a residual in production function if we consider the other two factors, capital and labour, as a conservative representation of production inputs.

There are many economists who demonstred the necesity to complete the production function with some others factors coming from education, research, technology. In previous studies (Șerban, 2018, p.24), we already showed that the process of measuring these variables is very complex, it is not homogeneous and the propensity for error is very high. By this mean, our vision about completing the contribution factors to the production is to describe all the mentioned rezidual variables in a sinle concept, that means knowledge. This is the reason why we have to reduce all the processes related to education, research, technology, etc at the level of knowledge value.

The conclusion at this point is that it is easier to measure the value of knowledge as a standardization of all rezidual inputs, instead to use an exhaustive list of inputs coming from different related fields. Our proposal acording to what is better to use in the processes the standardization of knowledge value is more appropriate at macroeconomic level, too, as long the oposite (complexity of various factors) is reliable only at microeconomic level. Based on research at microeconomic level (Cegolon, 2014, p.8), there is already accepted that private return to education for any additional year of study is around 6%-8% of additional wage in developed countries. The finding is quite

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important, but it is very difficult to compare this return on education when we talk about different level of developments, education or salary.

The same is the problem of measuring the contribution of technology by any specific situation. It is well known that in an automotive factory, the more robots in the production process, the higher the productivity and probably the quality of the products. In spite of this facts, it is counterproductive to change the machineries at any moment when a new technology is available on the market. The increased costs for new technology will be reflected in products and this could affect the market as long as the price for an updated car is not affordable for customers. Secondly, the production flow could not be intrerrupted any time when new robots are disclosed.

To make affordable the process of measurement of all these variables, it is much easier to standardize all the related inputs in the shape of knowledge value. Starting the process earlier in the flow of value creation will be beneficial for the later stages.

In such a context, the approach of Multilevel Knowledge Economy Pyramid model (MKEP) is providing a real solution for revising the negative trends of development, including the migration of knowledge with the skilled workers.

## 4. Context - The importance of productivity and competitiveness for welfare

According to OECD research, there is a direct correlation between productivity and individual well-being. In our point of view, MKEP model is addressing the productivity and competitiveness ecosystems as social and economic movement with impact of the standard of living for the population not just individuals. The OECD study is limited just to the correlation between higher productivity and higher individual prosperity considering that the performers in productivity will benefit of wage increasing. These correlations are very well captured in the Figure 3.

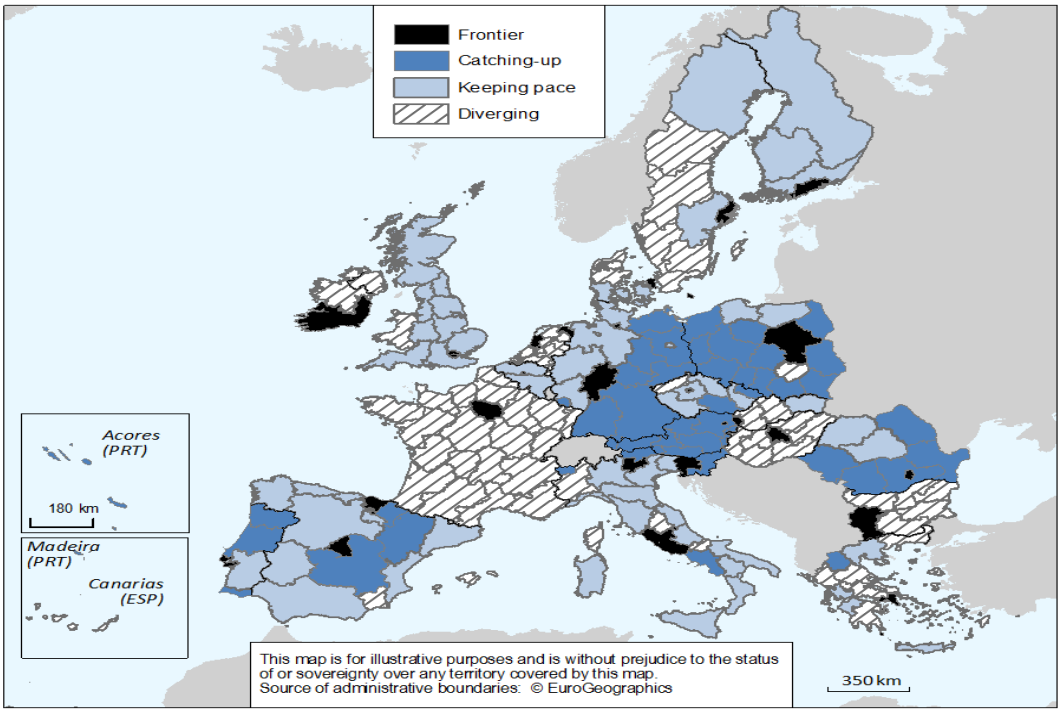


**Figure 3.** Productivity dynamics at the regional level in the EU

**Source:** OECD (2018, p.44)

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The concept of frontier in this matter is related with the aggregate regions with the highest level of ratio GDP/worker and represents 10% of employment by country. Performance of catching-up and diverging areas is more than 5% for the span of 2000-2014 comparing with frontier regions in their country.

At the same time, based on the actual studies in the field of productivity, the correlation between employment and productivity is negative one. In our vision, this is the narrow approach of addressing productivity issues. The contribution of labour to potential growth could be a positive one on the long run, but in the short and medium run is still negative. To reverse this trend and turn this correlation into a positive one, it is necessary to put more value on labour considering knowledge. Increasing skills based on education, training, learning is the way not only for a higher level of labour value but is a realistic and adapted procedure to increase the value of knowledge. *"... investments in innovative activity and the uptake of new technologies by firms will depend on the availability of appropriately skilled workers… besides Bartelsman (2019, p.18) remarks the role of education for the level of skills."*

Turning back to the Theory of Endogenous Growth, this knowledge is a production resource for a long and sustainable perspective development considering the correlation between employment and productivity.

The same, there are two perspectives for competitiveness:

- A narrow one, where the total output is bigger than input, or resulted value in the process is higher than the value of resources, or the efficiency of machinery is higher today than yesterday;
- A broad one, where the conventional machinery is replaced by new technology, disruptive innovation is disclosing new segments of customers, new materials are used in the flow of production, or horizontal competition reveals new domains with higher level of effectiveness in order to develop the same output.

## 5. Analysis of innovation concept

Understanding the concept, the dynamic and interconnectivity with the knowledge ecosystem, could help in developing a better measurement system of innovation with a great influence over the economic growth, sustainability and smart development.

In Oslo Manual is very clear stated that *"innovation is central to improvements in living standards and can affect individuals, institutions, entire economic sectors, and countries in multiple ways. Sound measurement of innovation and the use of innovation data in research can help policy makers better understand economic and social changes, assess the contribution of innovation to social and economic goals, and monitor and evaluate the effectiveness and efficiency of their policies… besides OECD/Eurostat (2018, p.19) remarks the role of innovation for social welfare."*

Standing alone, innovation is able to determine increasing of competitiveness, but in a context of knowledge creation in the economic and social processes, innovation determines productivity improvement. When the entire process – knowledge value, innovation, creativity, entrepreneurship, productivity, and competitiveness – is followed by the development of a certain country or region, then the picture is complete and the scope of increasing the standard of living is ready to be achieved.

In the OECD studies presented in the Oslo Manual 2018, there are various ways to disclose knowledge with economic value and the results are different, as you can see in the Figure 4, such as followings:

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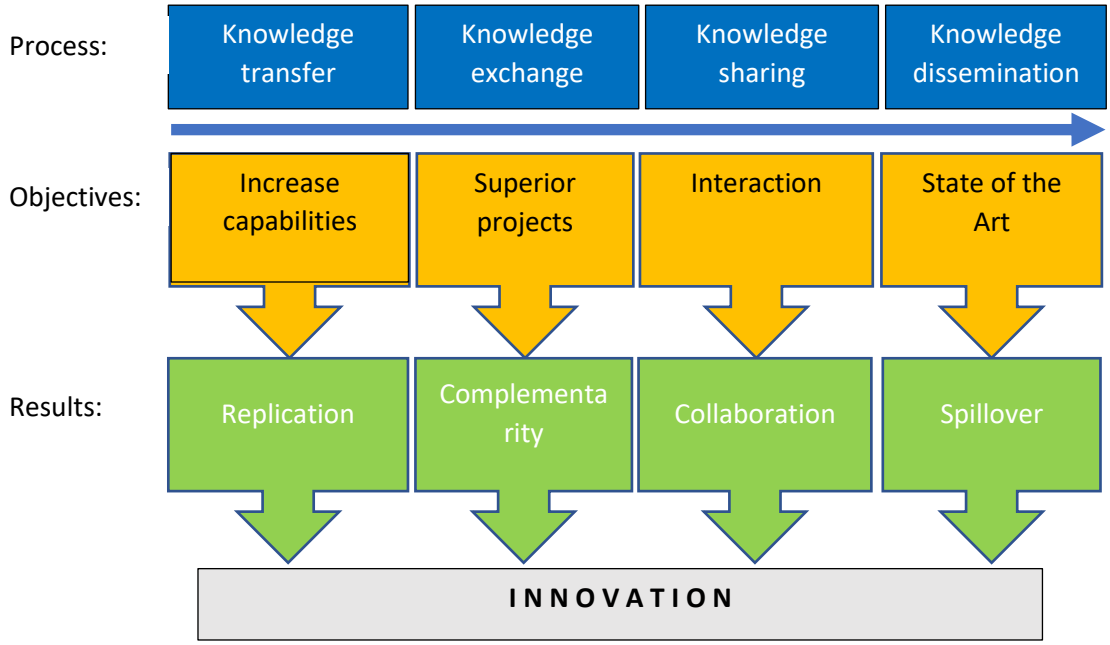


**Figure 4.** The value of knowledge at level of processes, objectives, and results

**Source:** The author own representation based on the information from OECD, Oslo Manual 2018

- Knowledge Transfer – the approach is top-down considering the value of knowledge – that means a knowledge organization create a model ready to be adopted by other organization and the result is replication;
- Knowledge exchange – the approach is at the same level considering the value of knowledge – that means creation of a common project better than individual ones and the result is complementarity;
- Knowledge Sharing – the approach is an intrinsic one within the individuals or groups with the same goals – that means creating a friendly knowledge environment and the result is collaboration;
- Knowledge Dissemination – the approach is from internal to external environment – that means an already created benchmark in the field of a certain knowledge is accepted as state of the art in the field and the result is spillover effect (OECD/Eurostat, 2018, p.p. 1-258).

Innovation level is determined by indicators; these could be qualitative or quantitative ones considering both products and process. Qualitative indicators for product could be: level of customer satisfaction for new products, quality improvement level on the reference market, etc

Quantitative indicators for product could be: increasing sales, increasing market share, etc.

For process, qualitative indicators could be: number of jobs created in the innovation process, number of employees in innovative processes, etc. The same for process, quantitative indicators could be: increasing turnover, new implemented technologies, etc.

Related to relevance of data collected by different organizations, the results are quite reliable but the flow of knowledge creation from value of knowledge to innovation, creativity, entrepreneurship, productivity, and competitiveness is split at the level of each of these components. There is needed more integration of studies, research, and data collection according to MKEP model in such a way to understand better the correlations between all the factors involved. By this mean, it is easier to observe how the value of knowledge or innovation influence productivity and how strong is the correlation from productivity and competitiveness. Moreover, most of the studies are limited to these levels of productivity and competitiveness, or just the level of GDP dynamic, but it is

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obvious the need to go further to link all these with welfare of population. Considering the complexity of this approach, the objective of this study is not to develop a huge database according to the already mentioned criteria, but to increase the awareness for such a necessity and to find the directions to follow in order to have all data in the same place.

## 6. Challenges in front of productivity and competitiveness analysis

Comparing limitative way to measure productivity at the National Institute of Statistics (labour productivity, or ratio between GDP and number of employees, etc), understanding better the complexity of TFP could enlarge the perspective of researchers to go deeper in the effort to have more measurement for such a residual in the production function. Anyway, the purpose to come up in a short time with a magic formula capable to show with a nondebatable accuracy the value of knowledge creation in every stage of the process, this is an overwhelming task for any specific organization either (OECD, APO, WB, EIT, etc).

To make progress in this direction, there is needed a better understanding of the concepts, the dynamic of the factors, genesis, correlations, impact, and many others things. Then, based on enhancing the awareness for necessity of measuring better the knowledge in the process, there is necessary to standardize the definitions, concepts, indicators, and instruments. At this point, developing appropriate strategies able to cover the relevant fields, such as education, research, administration, technology, business, local communities, this is an integrative approach capable to address better the issues. At this end, a step further is creating institutional capacity as a real integrator at national level. Gathering the entire capacity building in a network at international level will be the state of the art of this path for better measurement of knowledge in the process or economy.

Beyond the limitative measurement of single-factor productivity (ratio between output and labour hour, or the output obtained from a certain installation, or the efficiency of a resource unit in order to realize the envisaged output), it is necessary to adopt the more complex but realistic way of measuring TFP. If we succeed to break down labour, machinery, resources in the matter of knowledge, the process of measuring TFP is much easier. Basically speaking, this is the shift between the neoclassical model of Solow (Solow, 1956, p.p. 65-94), where technical progress is an exogenous factor, and theory of growth model of Romer (Romer, 1986, p.p. 1002-1037), where technical progress is a result of knowledge, and this is an endogenous variable in the production (Șerban, 2020, p.p.758-774).

In a narrow perspective, productivity measurement system is limited just to find out the efficiency and effectiveness of the production, which is a positive attitude but not enough. In a broad perspective, to struggle measuring as much as possible of TFP reveals a proactive attitude for the future processes. Based on this data, information, and knowledge, the leadership could have a depth insight in the next processes, could control and coordinate better the variable of the future activities.

Limitation of productivity measurement only in the shopfloor where blue-collars are involved is an obsolete approach already overcame by the complexity of the actual processes. Considering the context of mass production analysis realized in a huge production line where the output has a tangible value is no more appropriate for much complex processes where the customization and specificity is very high, where white-collars and high skilled specialists are involved and the output has an increased intangible value. Nowadays orientation to work in projects where people from different departments are involved, where intellectual property is in place for some specific solutions, where the Internet contribution is intrinsic, and tacit knowledge is a great contributor, this determines researchers to find new mechanisms in order to implement an appropriate measurement system of productivity.

Finally, the market itself is changing, the dynamic of demand is different, and customer satisfaction is totally changed. For example, green economy (technology, environment, resources, equipment) needs a different perspective over productivity measurement system. Today requirements for digitalization will require different standardization of the work, different knowledge, and different resources. All these processes ask progress in the TFP measurement territory.

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## 7. Solution - Multilevel Knowledge Economy Pyramid model as an appropriate environment to deal with challenges

The finding of the study of MKEP model (Șerban, 2020, p.p.108-128) is that before to proceed in the process described above, the main action is to create a knowledge environment among the relevant stakeholders and to define the framework for using the inputs of knowledge in order to stimulate innovation, creativity, and entrepreneurship to have outputs such as increasing productivity and competitiveness.

The most important thing in the productivity and competitiveness approach is not to limit our perspective just to increase the performance as it is, but to create a robust performance driven system. This process is not one shot at the time, it is a long run approach, it needs more observations, simulations and experiments performed in a continuous changing environment. Sometimes, there is necessary to learn from mistakes, other time we need more knowledge, or to understand better the broad picture and the role of individuals in this framework. For managers it is important to create a knowledge friendly environment, gathering more information from the market, stimulate innovation, creativity and entrepreneurship in the organization. At the same time, from the managers perspective, it is necessary to create a collaborative environment between individuals or groups in the organization, also with other organizations.

In previous work "Knowledge Economy Pyramid: Transforming Knowledge Value in Increasing Productivity and Competitiveness" (Șerban, 2018, p.p.1-256) we already analysed the role of the KEP model in defining the productivity and competitiveness national strategy for a country awareness about implementation of Knowledge Economy principles. The contribution of our studies about Knowledge Economy Pyramid is that to offer a conceptualization of all the processes – innovation, creativity, entrepreneurship – at level of knowledge and how to improve the value of knowledge in the economic processes.

Considering the "volatile" status of TFP, the efforts for capturing, measuring, and standardizing are very laborious, but still continue until a unanimous accepted model is adopted. Anyway, there is no silver bullet so far, just partial approaches, depending on the purpose, method, and institution which conduct the research. As we already mentioned, there are notorious institutions at global level, such as WB, OECD, EIT, APO, etc, with particular measurement systems based on different databases, expressed by composite indices considering various factors, indicators, groups, and categories.

At this point, the issue is to validate the model proposed, adoption as a common framework in order to deal with TFP variables, unifying the efforts of the institution involved, and standardizing a common measurement system. Of course, as we mentioned before, TFP "volatility" is very hard to manage, but our proposition is to generate unanimous accepted pathway, then to improve the model, considering various particularities. So far, the most important thing is the importance of identifying the value added of knowledge, creativity, innovation and entrepreneurship as key factors for increasing productivity and competitiveness. The contribution of MKEP model is on the side of understanding better the process, on the one hand, and on the side of creating a well-defined environment for boosting knowledge, creativity, innovation and entrepreneurship, on the other hand. Nonetheless important is the contribution of MKEP model to identify the stakeholders for a sustainable development in the context of productivity and competitiveness, and the tools, methodologies and measurement systems they can use to create progress. MKEP helps us to focus on the relatively limited area in order to develop further researches and policies in the knowledge creation, innovation, creativity, and entrepreneurship as results of education strategies, technological progress, digitalization and government awareness.

## 8. Methodology of TFP breakdown

Before considering this process ended, there is necessary some convergence in measuring TFP, then to define the real convergence of the productivity and competitiveness outputs around the world.

Great researchers already developed some mechanisms to adjust the TFP process. This is the case of Error-Correction-Model (ECM) considered in the models of Nicolletti, G and Scarapetta (Nicollettti and Scarapetta, 2003, p.p. 1-66), Domenech, R. and A. de la Fuente (Domenech and Fuente, 2006, p.p. 1-36), Aghion, P. and P. Howitt (Aghion and Howitt, 2009, p. 81). Considering modelled approach developed by these researchers, it is concluded that we can consider the productivity convergence in the long-run. Of course, the volatility of the process coming from the complexity of manifestation of variables in different fields, countries, regions, is still remaining, and the desire to approximate the error is still high.

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On the short perspective, we cannot talk about a consolidate convergence, but catching-up process.

----------(5)----------

$$\Delta(TFP^{TR})_{it} = c + \alpha_i + \beta_0[TFP^{TR}_{it-1} - TFP^{TR}_{Lt-1} - \alpha_i] + \beta_1\Delta(TFP^{TR})_{Lt} + \varepsilon_{it}$$

(1) (3) (4) (2)

(1) - TFP trend growth in observed country *i*, in time *t*;

(2) - TFP trend growth in the forerunner country *L* in time *t*;

- shows the impact of spillovers from the frontier economy;

(3) - TFP levels logarithm in country *i*;

(4) - TFP levels logarithm in the forerunner country *L*;

(5) - the gap between productivity in country *i* and the frontier, conditional on the fixed effect $\alpha_i$;

*c* - a constant term

$\alpha_i$ - shows country fixed effect which considers time invariant differences across countries;

$\beta$ - coefficients on the respective explanatory variables; we assume that $\beta_0$ must be negative, indicating that if national TFP is below the forerunner country level, TFP must grow faster.

Considering the trend among EU countries, the main factors contributing to productivity convergence are followings:

- Performance in education – positive correlation between quality in education and TFP;
- Skills improvement process - ability to manage new technology;
- Increasing innovation investments – positive correlation between knowledge value and TFP;
- Enlarging both public and private allocations for R&D;
- External funding opportunities – as in the case of Romania (Operational Programme Competitiveness, National Plan for Recovery and Resilience, etc)

Regarding the types of convergence, it is already stated that Sigma convergence describes the drivers of reducing dispersion among various economies over time, and Beta convergence reveals a negative correlation between TFP level achieved by a country and the initial level of productivity.

At the same time, in measuring TFP convergence a very important role is played by the development model to use:

- Neo-liberal model uses absolute Beta convergence approach, with accent on the exogenous technical advancement, where the accumulation of capital is the main driver; here we have a single steady state equilibrium considering the homogenous production factors;
- New-growth theory uses conditional Beta convergence approach, with focus on the endogenous growth, where the Intellectual Capital is the main driver; here we have different steady states considering the differences of Intellectual Capital;

For a country as Romania, we can talk about Beta convergence, considering the poor level of productivity, but the increasing rate is higher than the rates in performer countries. This is the case of catching-up economies. Sigma convergence is just referring to the reducing the gap between performers and lagging behind countries. In this case, the increased rate of growth in Romania is necessary, but is not enough to reduce that gap.

It is at maximum of interest that policymakers to understand the new paradigm of productivity and competitiveness and to reflect in public policy for sustainable development the ecosystems of knowledge we are creating within MKEP, the interaction between stakeholders, the intensity and complementarity of these connections. MKEP is a valuable model to make clear the advantage of balancing national strategies in education, research,

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industrialization, SME's, along with some cross-functional public policies such as productivity and competitiveness as a whole.

Making separate good strategies without harmonization among them is missing the synergy at the national level and the spillover effect of innovation, creativity and entrepreneurship. Disparate approach of these factors for sustainable growth will reduce the intensity of their action.

The issue of one size fits all magic formula for TFP is not workable as long as there is no consensus at international level, the typical development by regions is very heterogenous, the awareness among countries is not similar, and there are some bias in objective measuring depending on local strategies.

Coming with a silver bullet solution is very challenging, as long as a short formula cannot catch the entire phenomenon and the dispersion is very high, but a complex formula needs a standardization of variables, indices, categories, and indicators.

The best way to have this consensus on a measuring system of TFP is the proposal of current research which try to explain better the metamorphosis of the knowledge in the process. Here, we come up with MKEP model as a valuable tool for better understanding of the dynamics, trends, directions, scope, structures, levels of knowledge environment. The purpose of this work is the harmonization of these concepts which define the components of TFP.

Considering the research we developed so far, in order to progress on the harmonization of perspectives about TFP, it is a matter of creating consensus among the most important organizations all over the world, such as OECD, Asia Productivity Organization, European Institute of Innovation and Technology, American Productivity and Quality Center, World Bank, and some more representative organizations.

Creating the same scales of value, same categories of variables, working with similar indicators and aggregating common indices, we can create a robust platform for standardization with extremely valuable role on benchmarking, ranking and performing for all countries around the globe.

This consensus on expressing TFP at international level will create the premises for mapping the performance on productivity and competitiveness, to identify the most determinant factors, the best methodology, and taking measures for improvement.

Considering the findings of this research on the way to understand competitiveness in the actual context of economic growth, the issue of organizing and delivering the most appropriate policy is the most influential factor for increasing the performance.

Policy making and decision making process at governmental level in terms of productivity and competitiveness is the most sensitive point with a crucial importance for sustainable development. Building on this issue, MKEP is the backbone of institutional capacity around the productivity and competitiveness, and the structure for governmental policy in this respect.

In order to make this shift, there is necessary to boost the competitiveness of the country. In our model (MKEP), competitiveness plays a strategic role and allows the policy-makers to create the strategical premises for business environment improvement, considering a creative-innovative-entrepreneurship alignment in economy. Working under the same scope, different actors, such as universities, research centres, administration, local communities, and companies are able to balance their assets in the field of creating value added by knowledge processes, and it will create synergy in this new knowledge environment.

Aiming directly to the peak of the pyramid, social welfare, it is an ambitious objective, but without the foundation, structures and levels of the knowledge pyramid, the standard of living for the population is not sustainable, and all the efforts will have a small or no long run effects.

## 9. The need for integrated public policies

Education system, represented by university in our model, plays a very important role in the knowledge architecture. It is well known that any reform in education system takes time to show consistent results. In spite of this, there is no alternative way for sustainable development without a new reform in education. It is necessary to make a shift from memorization and gattering an entire bunch of information in different fields of science, to the status of instilling learning attitude, strengthening of soft-skills and think outside the box behaviour. At the

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foundation of this reform is placed the curriculum improvement, adaptation, flexibility, and connection with the real economy and society. Moreover, digitalization gain a new and important role in the education system in two directions:

- Spreading information and knowledge through educational programmes
- Preparing the profile of the next generation of specialists with high skills in managing digital processes

To be able to deliver these outputs, the education system needs a different profile of teachers, specialists with proven results in the education field and a solid background of cooperation projects or performing jobs in the economic and social field. This mix of profile, theoretic and practical approach is able to deliver more customized education programs. Moreover, beside theoretical and practical skills, students need basic instruments for learning how to learn, to understand the integration in diversity, to understand the importance of communication, to manage behaviour, attitude, and personality, to find and stimulate creativity, innovation and entrepreneurial skills, to develop critical thinking and problem-solving abilities, to understand the value of knowledge and the process of knowledge creation.

Restructuring productivity and competitiveness strategy is a mix of reforms in other sectors, such as education, research, industry, administration, regionalization, civil society. Basically speaking, this is a top-down approach, considering our pyramid model, where the objective is increasing the welfare for the population as a result of a competitive position, based on higher productivity determined by increasing the value of knowledge through innovation, creativity, entrepreneurship. The bottom of the pyramid is the reform in education, technology, research, administration, local community.

In this pyramid, if the participants succeed to implement collaboration, complementarity and connection between institutions, stakeholders, structures, and levels, then the entire pyramid is a knowledge environment where the knowledge ecosystems provide knowledge synergy. This environment is a strategic laboratory for TFP. Each component of the pyramid is able to contribute to a clearer image and performance of TFP.

The role of decision-maker at governmental level is tremendous important because the owner of the reform decisions is there. In other words, beside the research driven attributes of the pyramid model, there is plenty of contribution of the model to create the support for policy-making process at governmental level.

## 10. Measurement tools for an accurate analysis of productivity and competitiveness – Romania case study

One of the most accurate tools for measuring performance in the competitiveness field is the Global Competitiveness Index 4.0 (GCI 4.0). This tool provides an annual benchmarking catalogue for assessing the progress of the factors involved in productivity. The process is starting by defining 12 pillars, as it shows in the Table 1:

**Table 1:** Pillars of Global Competitiveness Index 4.0

| Pillars | |
|---|---|
| 1. Institutions | 7. Product market |
| 2. Infrastructure | 8. Labour market |
| 3. Digitalization | 9. Financial system |
| 4. Macroeconomic stability | 10. Market size |
| 5. Health | 11. Business dynamism |
| 6. Skills | 12. Innovation Capability |

**Source:** the author own representation based on the information from GCI Report 2019 (WEF, 2019, p.2)

This index validates our hypothesis according to what there is a strong and positive correlation between competitiveness and standard of living. In order to improve the competitiveness position, it is necessary to restore productivity and growth, to transform it in welfare.

As a matter of fact, in this research we take 2019 as the last year of analysis, the last year before the pandemic crisis. COVID-19 disease changes all the figures and disrupts the trend and the activity in 2020. Analysis of

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sanitary crisis impacting the global economy is beyond the purpose of this work. Accordingly, we'll analyse the data and information up to 2019.

In the ranking table of GCI 4.0 in 2019, the top 10 performers out of 141 countries are: Singapore (84.8), USA (83.7), Hong Kong (83.1), Netherlands (82.4), Switzerland (82.3), Japan (82.3), Germany (81.8), Sweden (81.2), UK (81.2), Denmark (81.2). Romania is ranking the 51st with a score of 64.4, just behind Mauritius (64.3), Oman (63.6), Uruguay (63.5), Kazakhstan (62.9), Brunei (62.8), Colombia (62.7), and Azerbaijan (62.7).

The average score in this ranking system is 60.7 and Romania is slightly above this point. Considering the participation of 141 economies, at a first glance we can say that the 51st position is not so bad. Taking into account that Romania is an emerging economy, an EU country, not a remote territory and it benefits of plenty of resources, we can say that the gap of competitiveness has to be quickly reduced. From this statement we conclude that a new strategy is needed, especially one where productivity and competitiveness are fully integrated.

We have to consider that these 12 pillars of GCI ranking system are grouping in 4 categories:

- Enabling environment – first 4 pillars – institutions, infrastructure, digitalization, macro-economic stability;
- Human capital – next 2 pillars – health and skills;
- Markets – next 4 pillars – product market, labour market, financial system, market size;
- Innovation ecosystem – last 2 pillars – business dynamism and innovation capability;

In order to prioritize several directions for improvement in a potential action plan, we have to analyse the Romanian performance by each pillar and every category considering Figure 5:

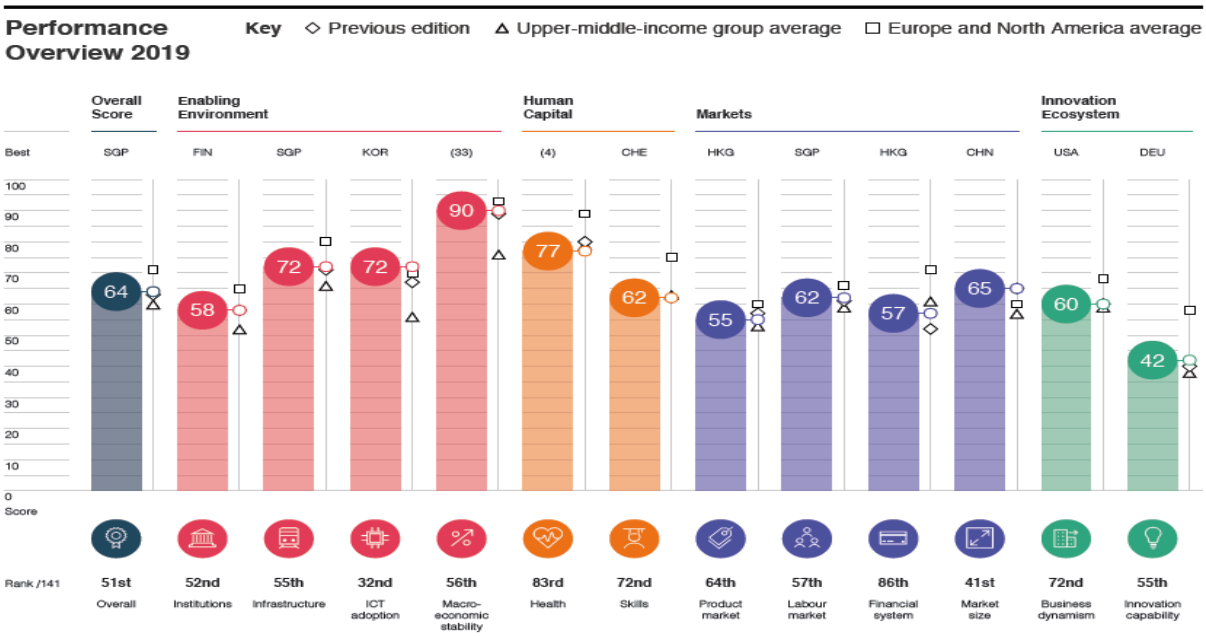


**Figure 5**. GCI Romanian performance in 2019 by pillars and categories

**Source:** The Global Competitiveness Report 2019 (WEF, 2019, p.478)

The lowest level is achieved by innovation (the 12th pillar). If we compare this measurement system with European Innovation Scoreboard, where Romania is constantly in the last position in the last years (Figure 6)), then we can conclude that there are necessary urgent actions to improve innovation system in Romania economy.

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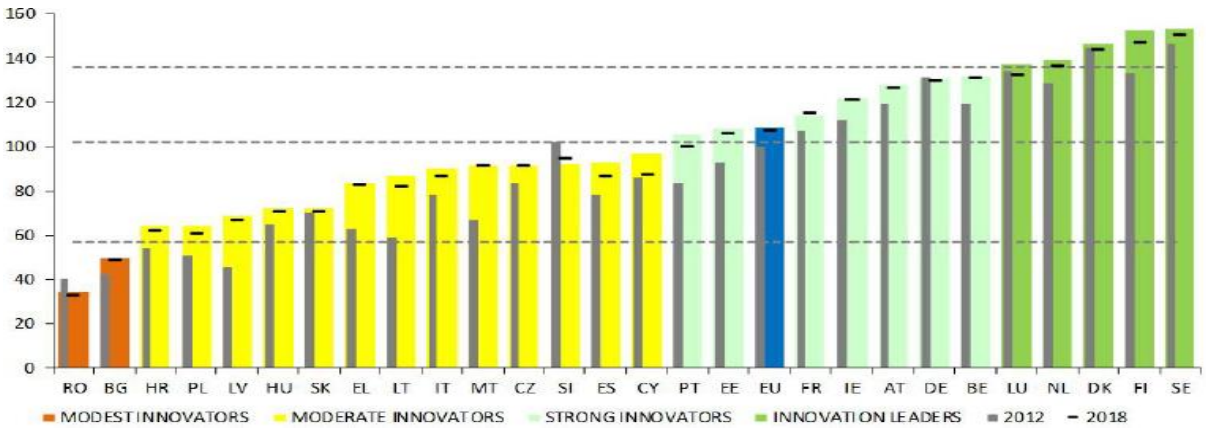


**Figure 6**. Romania performance in innovation, 2019

**Source:** European Innovation Scoreboard, (European Commission, 2019, p.2)

By comparing these two graphs, we remember the scope of this study to understand better the factors of contributing to productivity and competitiveness. Considering that big institutions – such as European Commission, World Bank, Asia Productivity Organization and many others – pays a lot of efforts to analyse huge amount of data from all the economies around the world and to develop composite indices, in our research we try to benefit of these reports and to overlap them in such a way to show the similarities and complementarities of measurement systems, even though they are performed with different methodologies by different institutions.

The conclusion at this point, for a country as Romania, is to take rapid action in order to improve innovation in this economy. From the perspective of this research work, the case of Romania is taken as an example of analysing the productivity and competitiveness issues and to provide a logical framework of analysis any other country performance.

Starting with 2007, the year of EU accession, in this ranking table of competitiveness around the world, the position of Romania was varied as followings (Table 2):

**Table 2.** Romania performance in competitiveness

| Year | Romania rank | Romania score | Highest score | Ratio: Romania score/highest score |
|---|---|---|---|---|
| 2019 | 51 | 64.4 | Singapore 84.8 | 76% |
| 2018 | 52 | 63.5 | USA 85.6 | 74% |
| 2017 | 68 | 4.28 | Swiss 5.86 | 73% |
| 2016 | 62 | 4.30 | Swiss 5.81 | 74% |
| 2015 | 53 | 4.32 | Swiss 5.76 | 75% |
| 2014 | 59 | 4.30 | Swiss 5.70 | 75% |
| 2013 | 76 | 4.32 | Swiss 5.72 | 76% |
| 2012 | 77 | 4.08 | Swiss 5.74 | 71% |
| 2011 | 67 | 4.16 | Swiss 5.63 | 74% |
| 2010 | 64 | 4.11 | Swiss 5.60 | 73% |
| 2009 | 68 | 4.10 | USA 5.74 | 71% |
| 2008 | 83 | 4.19 | - | - |
| 2007 | - | - | - | - |

**Source:** the author own representation based on the information from GCI Report series 2007-2019.

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In order to have the same reference along the entire series, considering the fluctuation of position and the fact that in 2018 the ranking values has changed, we compare as relevant the score of Romania with the highest score in that year and translate this as percentage.

The level for the performance of Romania is around 75% comparing with the best performer. At the first instance the performance seems to be pretty decent but considering that Romania is the EU member state and almost all the other EU countries are constantly in higher position than Romania, we consider this difference as a gap in competitiveness of Romania in the global market. Considering almost linear performance of Romania after accession to the EU, we can say that during the last 14 years, Romania didn't take any action to improve the competitiveness performance.

In order to underline the perspective of competitiveness in this work, it is necessary to underline that competitiveness does not seem to be competition in a narrow way, considering that the winner takes it all.

The reports, scorecards, rankings, and other international studies of main agencies are related to the following purposes:

- better measuring productivity, competitiveness, and innovation;
- standardization of measuring system;
- common definition of variables;
- validation of the algorithms for composite indices;
- conducting a benchmark system to describe the trends, formulate scenarios, and actions to take;
- better foundation for policymakers in order to draft related strategies in the field;

## 11. Conclusion

This is a signal for policymakers to change the entire framework for placing productivity and competitiveness at the core of the economic and social development. Developing the strategy of productivity and competitiveness is the result of several actions a country as Romania could take:

1. Regulatory level - Establishing a policy mix, based on the education, research, SMEs;
2. Strategic level - Formulate an unique, articulate and robust strategy considering innovation, research, (smart specialization) productivity and competitiveness;
3. Institutional level - Establish de capacity building to carrying this unique policy;
4. Organizational level - Define the functionality of this institution: mission, vision, objectives, performance, outputs;
5. Operational level - Design the programmes and projects to be implemented;
6. Integration level - Identify the channels to spread the activity, networking and dissemination;

There are several steps in order to create a new framework for development based on increasing productivity and competitiveness:

1. Innovation to be approached in the common ecosystem from different perspectives:
    - Industry
    - Academia
    - Government: increase allocation for R&D, facilitate innovation through public infrastructures, define regulation, integrate national strategy within EU framework
    - Technology
2. Build Intellectual Capital
    - Invest in people

- Raise knowledge at the level of national strategy
- Add more intangible value in the production process
- Promote meritocracy as public policy

3. Digitalization
4. Create the productivity and competitiveness system
    - National ranking system
    - P & C criteria
    - National Award
5. Create a powerful R&D infrastructure

Same as productivity, competitiveness plays a sensitive role in the development equation. Productivity contributes to the process of enhancing the level of production factors and competitiveness contribution in this process is to take the maximum of advantage for using these factors. By this correlation between productivity and competitiveness we underline the necessity to follow the efforts of productivity increasing by the efforts to come up with a set of competitiveness tools.

The more we understand the theory of endogenous growth, the most efficient will be the mechanism of understanding TFP. The main issue here is to get further the ability to measure the contribution of knowledge to the production function. The scope of this research is to enhance the capability to understand better the role of knowledge in the TFP approach and to underline the necessity for further studies to provide more accurate measurement tools or methodologies.

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*Bulus, G.C. , Bakirtas, I. pp.65-71*

# The relationship between public health expenditure and child mortality in next-11 countries

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## Abstract

This paper investigates the effects of public health expenditures on child mortality rates using dynamic panel data techniques for Next-11 countries (N-11) with data spanning the period 2000–2019. Among the dynamic panel data techniques, Pooled Ordinary Least Square (POLS) and Generalized Method of Moment (GMM) techniques were used. The findings of the study demonstrate that health expenditure has a positive effect on reducing child mortality in N-11. Moreover, according to the research findings increases in GDP per capita decrease child mortality. It is also found that an increase in fertility rate increases child mortality. The findings of this study suggest that policymakers should prioritize public health spending to achieve better health among children.

***Keywords:*** Public health expenditure, Child mortality, Panel data, N-11.

***Jel Codes:*** H51, I15, C23.

## 1. Introduction

Economic theory defines human capital as a main determinant of economic growth and development at both macro and micro levels (Becker, 1964). An essential component of human capital is undoubtedly health because health is one of the most important conditions both in ensuring sectoral success and the efficient running of the economy as a whole. In other words, for economic growth to be sustainable, people in society have to maintain healthy lives. From this point of view, it is expected that healthy children will become better educated adults and will be more productive in the labor market (Nyamuranga & Shin, 2019). Economies that give priority to the health of children will achieve better economic growth in the future (Amiri & Gerdtham, 2013).

On a global scale, the child mortality rate has decreased by 59%, from 93 deaths per 1,000 live births in 1990 to 38 deaths in 2019. In other words, the world has made remarkable progress in the survival of children in the last three decades. Whereas one out of every 11 children born in the 1990s died before reaching the age of five, one out of every 27 children born died in 2019. Despite this progress in child mortality, the number of children under the age of five who died in 2019 is estimated to be 5.2 million. Sub-Saharan Africa and South Asia are the regions with the highest rates of child mortality. In fact, child deaths in these two regions accounted for approximately 82% of total child deaths in the world (UNICEF, 2021). According to 2019 data from the World Bank (2021), 68 out of every 1,000 children died in the low-income group, 35 in the middle-income group, and only five in the high-income group. The same rate was 75 in the Sub-Saharan Africa region and just four in the European Union region. The countries where child mortality was most common in the world were Nigeria and Somalia, where 117 children per 1,000 died, whereas the countries with the lowest incidence were San Marino and Iceland, where two per 1,000 children died.

At Goldman Sachs, a financial advisory firm and investment bank, O'Neil et al. (2005) prepared a report claiming that a group of countries called Next Eleven (N-11) would be among the strongest and largest economies in the world in the future. N-11 countries include Bangladesh, Egypt, Indonesia, Iran, South Korea, Mexico, Nigeria, Pakistan, Philippines, Turkey, and Vietnam. O'Neil et al. (2005) claimed that these countries had high investment potential and could achieve rapid economic growth. By 2050, it is expected that N-11 countries will have a high majority of the world's population. When choosing the N-11 country group, they took into consideration criteria such as political maturity, trade openness, investment opportunities, and macroeconomic stability as well as demographic profile. Considering the expectation that N-11 will have a large majority of the world's population in the coming years and that it can realize sustainable growth, the importance of child mortality in N-11 countries emerges. The pattern of child mortality over time in N-11 countries, which is expected to be among the strongest economies in the world by 2050, is shown in Figure 1.

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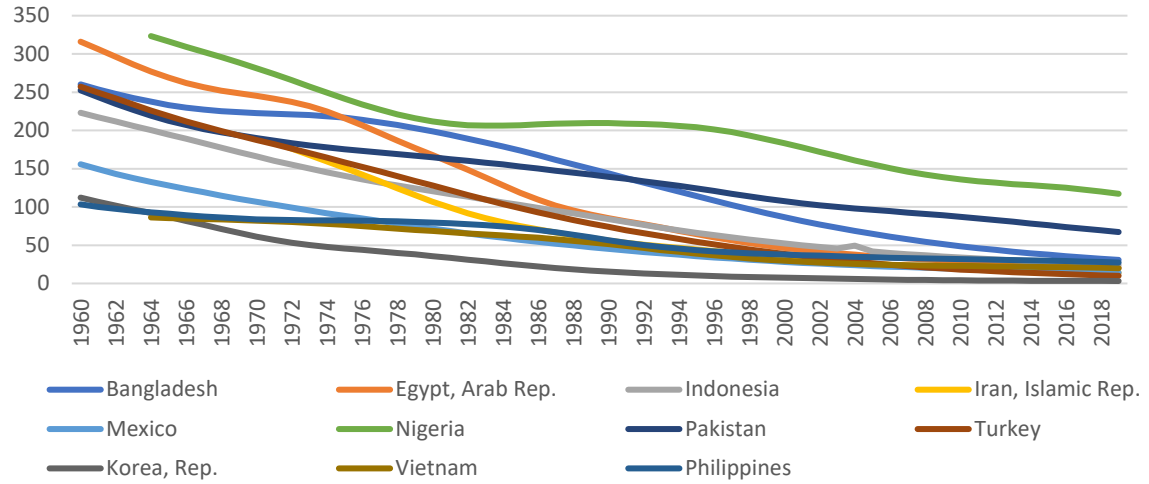


**Figure 1.** The Pattern of Child Mortality for N-11 Countries (1960-2019)

**Source:** Worldbank, 2021

Figure 1 shows that Nigeria had the highest child mortality rate through 2018 among the N-11 countries. The country with the lowest child mortality rate was South Korea. Child mortality was low in developed countries and high in developing and underdeveloped countries.

Figure 2 demonstrates the pattern of average child deaths over time for the N-11 countries as a whole.

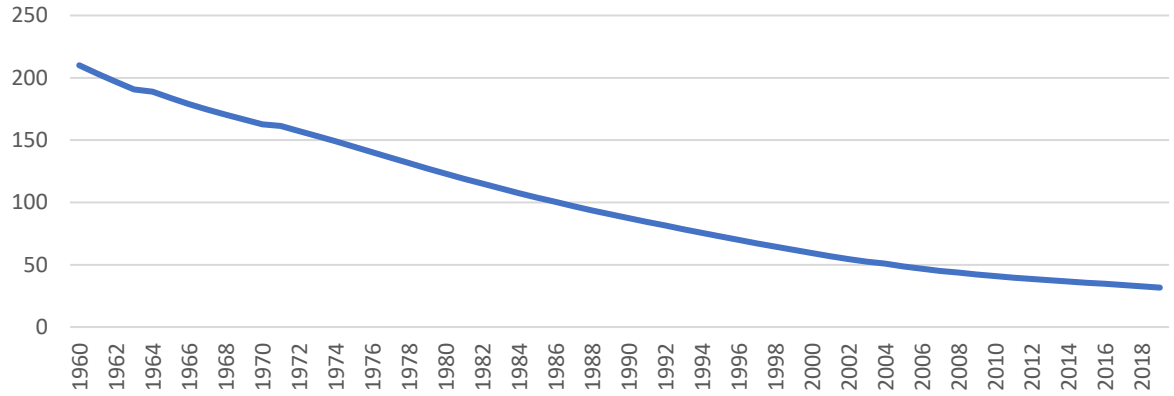


**Figure 2.** Pattern of Average Child Mortality for N-11 Countries (1960-2019)

**Source:** Worldbank, 2021

Figure 2 indicates that child mortality for N-11 countries has decreased significantly compared to the 1960s. In other words, whereas more than 200 children per 1,000 died in the N-11 group in the 1960s, this figure has fallen below 50 today.

N-11 countries should aim to protect their demographic characteristics as well as macroeconomic policies to reach their predicted power in the future. To this end, they should especially take initiatives to reduce child mortality. The share of the public sector in these initiatives is undoubtedly extremely important. The public sector should implement policies aimed at reducing child mortality, especially through public health expenditures. In this context, the aim of our research is to determine the relationship between public health expenditures and child mortality for N-11 countries.

The literature to date does not include any study that examines this research question for N-11 countries. We aim to contribute to the literature by determining the relationship between public health expenditures and child mortality in N-11 countries. In line with this purpose, our research is divided into the following four sections. The first section includes literature, the third section includes data and methodology, the fourth section includes analysis and empirical findings, and the fifth and final section includes conclusions and recommendations.

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## 2. Literature

Many studies have examined the relationship between public health expenditures and child mortality across country groups using different techniques and applying different variables and time periods. For instance, Adeosun and Faboya (2020) examined the relationship between health expenditures and child mortality for the Nigerian economy. According to their research findings, the increase in health expenditures reduced child mortality. Adua et al. (2017) examined the same research question and found that health spending reduced child mortality in Ghana. Similarly, Ang et al. (2017) examined the effect of public and private health expenditures on child mortality in 16 regions of the Philippines, finding that the increase in both public and private sector health expenditures reduced child mortality. Contrary to all these findings, Kumar et al. (2013) could not find a statistically significant relationship between health expenditures and child mortality in the Indian economy.

Novignon and Lawanson (2017) examined the relationship between both public and private health expenditures and child mortality in 45 countries in Sub-Saharan Africa. According to their findings, both types of health expenditures reduced child mortality. However, it has been found that the effect of health expenditures made by the public sector on child mortality is more effective than the health expenditures made by the private sector. Similarly, Nyamuranga and Shin (2019) examined the relationship between public health expenditures and child mortality for 98 developing countries. They found that public health expenditures had a statistically significant effect on reducing child mortality.

Dhrifi (2018) tried to answer the same question by using a data set covering 93 developed and developing countries, finding that health expenditures reduced child mortality only in upper-middle-income and high-income countries. In low-income and low-middle-income countries, he detected no effect of health expenditures on child mortality. In addition, it has been stated that public sector health expenditures have a stronger effect on child mortality when compared to private sector health expenditures in low-income countries. Contrary to this finding, in high-income countries, private sector health expenditures are more efficient than public sector health expenditures.

According to Ssozi and Amlani (2015), health expenditures in 43 countries in Sub-Saharan Africa had a slightly negative impact on child mortality. Finally, Yilmaz and Akdede (2016) examined the efficiency of public health expenditures for 149 countries. They found that public health expenditures remained less likely explanations for the child mortality rate compared to other socioeconomic and environmental health variables. They also concluded that the increase in public health expenditures reduced child mortality rates in countries where the quality of the public sector was high in regulating the market.

## 3. Data and Methodology

### *3.1. Data*

This research aims to empirically analyze the relationship between public health expenditures and child mortality for N-11 countries. In the empirical model, data from 2000 to 2019 are used annually. The most important reason for choosing this time range is that limits of the data on public health expenditures, which is the main explanatory variable of the research, started to be compiled in 2000. The names of the variables used in the research, the definitions of the data, and the sources are shown in Table 1.

**Table 1.** Definition and Sources of the Data

| Data | Definition | Sources |
|---|---|---|
| lnmr | Mortality rate, under-5 (per 1,000 live births) | Worldbank |
| lngdppc | GDP per capita (constant 2010 US$) | Worldbank |
| lnhe | Domestic general government health expenditure (% of GDP) | Worldbank |
| lnfr | Fertility rate, total (births per woman) | Worldbank |

### *3.2. Methodology*

The panel data method is used because the data related to the sample examined in this study includes both time and cross-sectional dimensions. Since the time dimension of the study is relatively small, the Generalized Method

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of Moments (GMM) method and the pooled ordinary least squares (POLS) method are used. The GMM method was first proposed by Hansen (1982) in order to eliminate the biased results due to autocorrelation and heteroscedasticity problems that arise in studies using traditional estimates methods such as, POLS and FE. However, the main contribution of the GMM method for the dynamic panel data analysis was made by Arellano & Bond (1991), Arellano & Bover (1995) and Blundell & Bond (1998) in the 1990s. The use of lagged variables as instrumental variables in dynamic panel data models is one of the advantages of the GMM method. In other words, GMM estimators, which can eliminate differences in unobserved individual effects, use all possible lags of dependent and independent variables as instrumental variables. Therefore, the GMM estimation technique is accepted as one of the techniques that offers the best estimation results in dynamic panel data analysis (Roodman, 2006). The basic regression equation of the research for both the GMM estimator and the POLS estimator can be written as in equation (1):

$$\ln mr_{it} = \beta_0 + \beta_1 \ln mr_{it-1} + \beta_2 \ln gdppc_{it} + \beta_3 \ln he_{it} + \beta_4 \ln fr_{it} + \varepsilon_{it} \quad (1)$$

An efficient and consistent result of the GMM estimator depends on the simultaneous realization of two assumptions. The first of these assumptions is that there is no correlation between the error terms in the model, while the second is Sargan test of overidentifying restrictions. In the first assumption, the existence of autocorrelation is tested with AR(2) which developed by Arellano & Bond (1991). With AR(2), the null hypothesis that "there is no second-order autocorrelation in the error terms" is tested. The validity of the GMM estimator, AR(2) must not be rejected. In the second assumption, the validity of overidentifying restrictions is investigated. In this context, the Sargan test has been employed. According to the Sargan test, the null hypothesis that "over-identification restrictions are valid" cannot be rejected, in other words, the instruments have to be valid (Roodman, 2006).

## 4. Analysis and Empirical Findings

In this section, the main research question of the study is investigated and empirical findings are reported in the context of methods previously briefly described in the data and methodology section. As a preliminary data analysis, the descriptive statistics and correlation matrix are reported in Table 2.

**Table 2:** Descriptive statistics and correlation matrix

| | Mean | Median | Max | Min | Std. Dev | Obs |
|---|---|---|---|---|---|---|
| lnmr | 3.41 | 3.39 | 5.21 | 1.19 | 0.88 | 209 |
| lngdppc | 26.55 | 26.49 | 28.00 | 24.83 | 0.87 | 209 |
| lnhe | 0.37 | 0.42 | 1.50 | -0.96 | 0.68 | 209 |
| lnfr | 0.95 | 0.89 | 1.80 | -0.02 | 0.41 | 209 |
| | lnmr | | lngdppc | | lnhe | lnfr |
| lnmr | 1 | | | | | |
| lngdppc | 0.56 | | 1 | | | |
| lnhe | 0.78 | | 0.54 | | 1 | |
| lnfr | 0.89 | | 0.40 | | 0.63 | 1 |

**Note:** This table shows the summary of statistics for all observations of the model over the period 2000-2019. Descriptive statistics values and correlation matrix were calculated with the help of the Eviews-10 program.

Before proceeding to the econometric analysis of the estimation model to be used in the analyses, the correlation matrix was calculated in order to control the possible multicollinearity problem between the explanatory variables. The fact that if the correlation coefficients between the explanatory variables are greater than 0.80 in absolute value which indicates the existence of a high degree of correlation between the two independent variables that might cause a multicollinearity problem (Kennedy, 2008). According to the correlation matrix table, no correlation between the explanatory variables is higher than 0.80 which implies that the multicollinearity problem possibility is quite low.

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*Bulus, G.C. , Bakirtas, I. pp.65-71*

Child mortality was used as the dependent variable in this study. Among the independent variables, increases in public health expenditures and per capita GDP are expected to decrease child mortality, while increases in fertility rate are expected to increase child deaths. Table 3 shows the results of the analysis performed with the GMM and POLS estimators to answer the main research question.

**Table 3:** Child Mortality and Public Health Expenditure: POLS and GMM Estimation Results

| **Dependent Variable: Child Mortality (lnmr)** | **POLS** | **GMM** |
|---|---|---|
| $lnmr_{t-1}$ | 0.976 | 0.956 |
| | (0.005)*** | (0.009)*** |
| lngdppc | -0.006 | -0.014 |
| | (0.002)*** | (0.004)** |
| lnhe | -0.007 | -0.013 |
| | (0.003)** | (0.004)*** |
| lnfr | 0.049 | 0.081 |
| | (0.008)*** | (0.016)*** |
| Constant | 0.172 | 0.425 |
| | (0.060)*** | (0.169)*** |
| $R^2$ | 0.99 | |
| Wald $chi^2$ | | 45477.29*** |
| Sargan | | 0.304 |
| AR(2) | | 0.276 |
| Observations | 198 | 198 |
| Number of Countries | 11 | 11 |

Note: Panel data tests were performed using the Stata 14 program. System Generalized Moments Estimator was used as GMM method. The results of Sargan test and AR2 test, respectively, indicate the p values expressing the validity of the instrument variables used and the absence of second-degree autocorrelation. * Indicates 10% significance level. ** Indicates 5% significance level. *** Indicates 1% significance level.

The estimation results of the GMM method are widely used in dynamic panel data analysis in the applied economics literature. Because it provides robust estimations and give reliable results against possible endogeneity problems. The reliability of the estimation method applied was tested with the help of two tests, Sargan and AR(2), suggested by Arellano & Bond (1991). According to the analysis results of the model, probability value of the Sargan test is higher than 0.05 suggesting that the instrumental variables used in the model are valid. Also, according to AR(2) test results, there is no second-order autocorrelation in the model.

According to the findings of this study, in which GMM and POLS estimators were used, it was concluded that GDP per capita, which is accepted as the most important indicator of economic development, negatively affects child mortality. Similarly, it was found that public health expenditures affect child mortality negatively. Finally, it was determined that the fertility rate had a statistically significant and positive effect on child mortality.

## 5. Conclusion and Recommendations

Using dynamic panel data techniques, in this study we examined the relationships among child mortality, public sector health expenditures, GDP per capita, and birth rate between 2000 and 2019 for N-11 countries. We used POLS and GMM estimation techniques as our research methods. According to our findings, increases in public sector health expenditures reduced child mortality. We have empirically validated a strict theoretical assumption of the common benefit of higher public health expenditures for children's health outcomes in N-11 countries.

In addition, we found that increases in GDP per capita decreased child mortality, whereas increases in fertility rate increased child mortality. These findings are in agreement with the vast majority of evidence in the literature. This is because in countries with high GDP per capita, which is considered the most important indicator of economic development, child mortality is relatively low, and in countries with low GDP, child mortality is high.

Finally, countries with high fertility rates are generally considered to be underdeveloped and developing countries compared to the rates in developed countries . In addition, it should not be forgotten that as the number of children born increases, some of these children suffer from illness, accidents, and neglect, causing them to lose their lives from noneconomic causes.

Our empirical findings are extremely important for the N-11 countries, which have the potential to become among the most powerful countries in the world. If these countries want to achieve success in the future, they should look for solutions to reduce child mortality. In this research, we suggest that policy makers should increase public sector health expenditures as a solution to reduce child mortality.

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*Clement, S. & Achim, M.V. pp.72-82*

# The impact of economic and financial development of countries on shadow economy[1]

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## Abstract

This study examines the impact of economic and financial development on shadow economy. In the analysis, the financial sector is divided into financial institutions and financial markets. The study uses a sample of 28 EU countries and an observation period from 1995 to 2019. The fully modified ordinary least square was applied to analyse the influencing variables. It was found that most economic, as well as financial determinants have a strong negative impact on shadow economy. On the other hand, the determinants tax burden, interest rate and direct investment represent a significant positive effect on shadow economy. Regarding the different impact of financial institutions compared to the financial market, financial institutions have a much higher impact on shadow economy in their actions than the financial market. Within the scope of the study, the factors influencing the shadow economy were explained in more detail and connecting factors for prevention were established. The results serve as an aid to countries, municipalities, and governments in reducing the shadow economy.

***Keywords:*** Shadow economy, financial development, economic development, Panel data, FMOLS.

***Jel Codes:*** E26, O16, D53.

## 1. Introduction

Fiscal revenue is the basic building block of any country and makes the government capable of acting. Dependent on this are the quality of its infrastructure, medical care, education system and the general quality of life. When financial or economic activities are not captured by tax, it is referred to as shadow economy, which affects a country's performance in form of state budget, the economic and sustainable development, the business development and performance and at least the poverty and social inequality (Achim et al., 2020).

The shadow economy is not a phenomenon of southern, eastern or western countries but it is a challenge that affects the whole world (Blackburn et al., 2012). In the past, measuring it through lost tax revenues, and thus the degree of the shadow economy, has been fraught with major hurdles (Torgler, 2009). With the help of Medina and Schneider's (2018) database, a comprehensive empirical foundation was set to explore the shadow economy, which makes the subject more topical.

The topicality leads us to take a closer look at the reasons for the shadow economy. The existing literature postulates two causes that favor the shadow economy. On the one hand, it represents the qualitatively weak institution (Torgler, 2009; Dreher, 2009; Berdiev et al., 2018; Enste, 2018) and the principle of tax evasion (Petersen, 2010; Schneider, 2015; Dell'Anno, 2019). According to Schneider (2012), Nguyen et al. (2018), Canh (2020) and Huynh (2020), qualitatively weak institutions lead to higher labor costs for official economic activities which results in incentives to choose the informal course of work.

In the case of tax evasion, potential increases within tax policy create increased incentives to favor the informal economy (Bittencourt et al., 2014; Schneider, 2015; Dell'Anno, 2019), in order not to support the increase. And thus, an evasion policy is created that relies on the informal sector.

In addition to the above-mentioned main causes to favor the informal economy, the changing times have shown, and the recent studies related to them, that other influencing factors are of interest. According to Goel et al. (2016), the decentralization of the treasury may have an impact on shadow economy. Foreign direct investment also shows a relationship with the shadow economy (Huynh et al., 2019).

[1] **Acknowledgments**: „This work was supported by a grant of the Romanian Ministry of Education and Research, CNCS – project number PN-III-P4-ID-PCE-2020-2174, within PNCDI III."

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The listed reasons motivate to deal with the influences of shadow economy in terms of economic and financial development. The study covers 28 European countries in the period from 1995 to 2019 and provided a more detailed explanation of the factors influencing the shadow economy and identified starting points for prevention.

The results serve as an aid for states, municipalities, and governments in curbing the shadow economy. The paper is divided into five sections. Section 2 highlights a summary of the literature. This is followed by the presentation of the methodology and data used. Then, the empirical analysis is described in more detail in section 4, followed by a summary of the study in the last section.

## 2. Literature Review

A summary of the relevant literature is presented in the following section.

The study of Achim et al. (2021) conducted on a sample of 27 European Union member countries, for the period 2005–2020 highlights that higher economic and sustainable development determines a reduction in the levels of shadow economy also in the levels of other form of crimes such as corruption and cybercrime. Economic development is estimated with GDP per capita (GDP). In the same view the study of Borlea et al. (2017) analyzed the relationship between the shadow economy and economic growth and found a strong negative correlation. The study covers European countries in the period from 2005 to 2014 and use GDP Per capita as proxy for economic development. Also, the study of Hoinaru et al. (2020) found a strong negative impact of shadow economy on economic and sustainable development. Economic development was considered in form of the LogGDP. The sample included cross-country database about 185 countries in the period from 2005 to 2015. Similar results are found by Ginevicius (2020) who highlight a strong negative relationship between economic development and shadow economy. He refers to an economic variable such as GDP per capita. The results show that factors influencing the shadow economy are mainly in the areas of tax burden, tax morale, institutional quality, and national economic development. The study covers the European Member States and the period 2006 to 2015

Regarding the financial development, there are various studies highlightig interesting relationships with the level of shadow economy. Thus, in the study by Blackburn et al. (2012) the authors find that the lower the stage of financial development, the higher the incidence of tax avoidance and the size of the shadow economy, respectively. Similarly, Bose et al. (2012) investigates the relationship between banking development and the level of shadow economy using a sample of 137 countries for the period 1995–2007. Their find that an improvement in the banking sector development is associated with a lower level of the shadow economy. In addition, the authors show that both the depth and the efficiency of the banking sector matter in reducing the size of shadow economies.

The study of Achim and Borlea (2020, p. 162) conducted on 135 countries for the period 2006–2015, confirms the hypothesis that a high quality of the banking system soundness leads to a decrease of the level of the shadow economy. The soundness of the banking system in different countries is calculated with *soundness of banks* indicator, provided the World Economic Forum in the Global Competitiveness Report and the level of the *shadow* economy is determined as a percentage in GDP, acording with Medina and Shneider (2018).

Berdiev and Saunoris (2016) studied with the help of the panel vector autoregression model the relationship between financial development and the shadow economy and found a negative relationship. The study covers 161 countries over the period 1960 until 2009. The authors note that financial development is multidimensional, so they use three different metrics to measure it: (a) Money to GDP ratio; (b) ratio of domestic lending by financial corporations to private sector to GDP; and (c) ratio of domestic financial sector credit to GDP. In the same view, Canh and Thanh (2020) examine the influence of financial development on shadow economy. Financial development is estimated for separately for two sub-sector such as financial institutions and financial markets, along three dimensions, namely financial depth, financial access and financial efficiency. The negative effects of financial development on the shadow economy were noticeable and the impact of financial institutions was also higher than those from financial market. The sample includes 114 economies in the period 2005 until 2015. Additionally to these studies, the work of Gharleghi and Jahanshahi, (2020) find a threshold value of US$33,600 GDP per capita. The study covers 29 developed and developing countries from 1975 to 2015. It was found that within countries with a level of GDP per capita below this threshold there is no impact of financial development on the level of shadow economy. On the other part, above this threshold the level of financial development significantly contributes to the reduction in size of the shadow economy. Financial development is estimated by using thre proxies namely liquid liabilities, private credit to deposit money banks, and stock market capitalisation.

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In other words, the authors find that that the financial development can influence (reduce) the level of shadow economy only from a certain level of economic development upwards.

Inflation is used as a proxy for financial development and its influence on the level of shadow economy is analysed in the study of Mazhar and Meon (2017). The authors find with a simple canonical model a positive effect of inflation on the shadow economy. In addition they find a negative relation between the tax burden and the size of the shadow economy. The scope of the study covers 153 developed and developing countries in the period from 1999 to 2007.

Based on the literature review aforementioned, the following working hypothesis is stated:

*Hypothesis 1: Economic and financial development has a negative impact on shadow economy*

For the most part, the approximations described above only provide an exclusion of the depth of financial institutions and are thus insufficient (Canh and Thanh, 2020). Svirydzenka (2016) therefore aims at a concept that includes not only depth, but also access and efficiency. At the same time, these approaches are divided into financial institutions and financial markets, covering the complete breadth of the financial market. The literature finds varying degrees of impact on financial institutions and financial markets (Botev et al., 2019). Particularly in the financial institutions sector, there is a strong emergence of the shadow economy, as access to services by means of economic agents is possible without major hurdles. Financial markets, on the other hand, act as an addressee for investments. The influence of financial institutions on shadow economy is thus likely to be more important than financial markets. Thus, the following hypothesis is stated:

*Hypothesis 2: The effects of financial institutions are stronger than those of financial markets on shadow economy*

## 3. Methodology and data

In the following section, an overview of the data used and the related descriptive statistics is given. In addition, the framework of the study and the chosen methodology are explained. The study covers the observation period 1995 to 2019 and the 28 EU countries are examined. The study refers to the influences of economic and financial development on shadow economy. In the context of economic development, the determinants GDP aggregates per capita, investment rate, tax burden and profitability are examined. Within the financial consideration, the financial development index, financial institutions depth and many others, are considered. The state, state government and municipalities are financed by regular tax revenues. If tax revenues are not received, a country is not able to invest in infrastructure, schools or politics, which reduces the attractiveness of a country. The study focuses on data on shadow economy, which is examined for influences and correlations. The development of the shadow economy is illustrated in Figure 1.

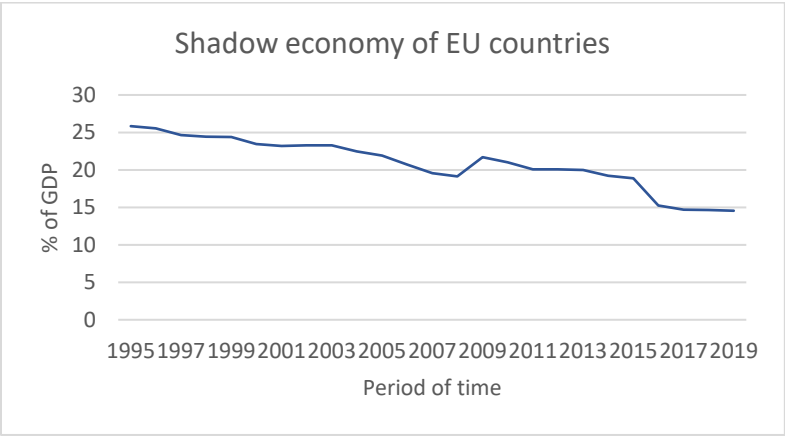


**Figure 1.** Shadow economy of EU countries

**Source:** Author's own composition based on database Medina, L., Schneider, F. (2018). "Shadow Economies Around the World: What Did We Learn Over the Last 20 Years?" IMF Working Paper, 18/17.

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The figure illustrates the average distribution of the shadow economy for the European Union countries. It can be seen that there is a downward trend. The financial and economic crisis of 2008 resulted in a significant increase in the shadow economy. Since 2015, a continuous trend can be observed.

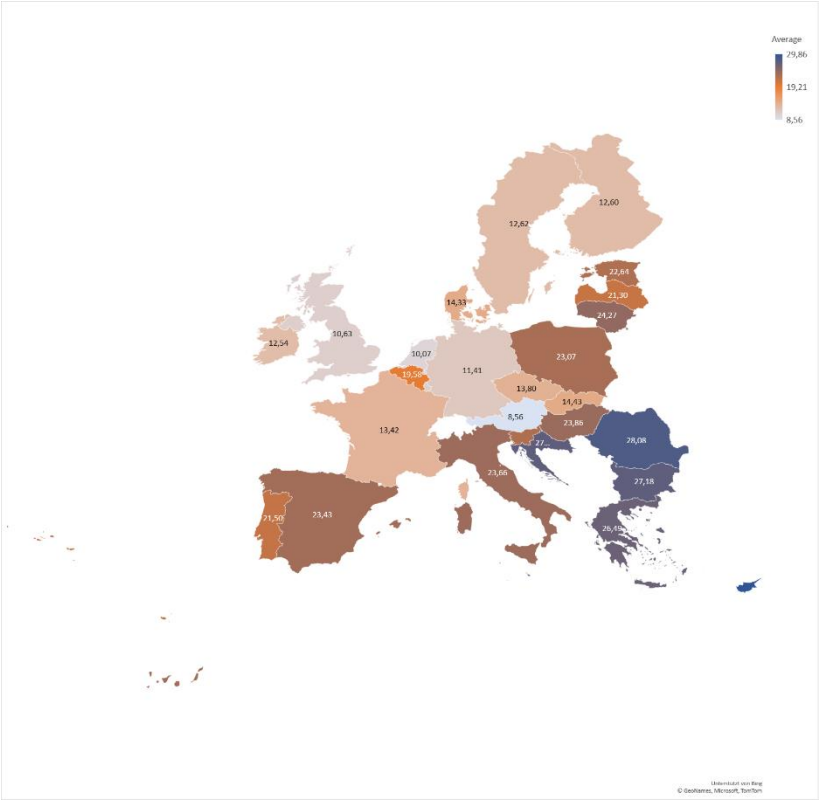


**Figure 2.** Shadow economy of 28 EU countries

**Source:** Author's own composition based on database of Medina, L., Schneider, F. (2018). "Shadow Economies Around the World: What Did We Learn Over the Last 20 Years?" IMF Working Paper, 18/17.

The second figure shows the different European Union countries and their distribution of the shadow economy. The blue colour represents the countries with the most shadow economy (29.86%). The orange countries are in the middle around 19.21% and the grey countries are having the less shadow economy about 8.56%. The value refers to the average of the last 25 years. Countries like Cyprus (29%), Romania (28%), Bulgaria (27%) and Croatia (27%) are countries with top values of shadow economy. This is in contrast to Austria (8%), Luxembourg (10%), the United Kingdom (10%) and the Netherlands (10%), which have the lowest levels of shadow economy.

The study aims to identify the way in which economic and financial factors may exert an influence on shadow economy. Panel data are used. In the following table 1 the dependent, independents and control variables for the study are described.

Some previous studies have relied on approximations when considering economic and financial development. Yang (2019) finds application in stocks and capitalization. Ibrahim and Alagidede (2018) use personal and domestic credit. Maskus et al. (2019) combines the ideas of Yang and Ibrahim and Alagidede and uses private credit and stock market capitalization. Berdiev et al. (2016) decided for a tripartite construct, which includes the following ratios: Money to GDP ratio, ratio of domestic lending by financial corporations to private sector to GDP, and ratio of domestic financial sector credit to GDP.

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**Table 1.** Dependent, independent and control variables

| Variable | Explanation | Source |
|---|---|---|
| **1. Dependent variable** | | |
| Shadow economy | Shadow economy, percent of GDP (SE) | Medina and Schneider, 2021 |
| **2. Independent variables** | | |
| **2.1 Economic variables** | | |
| Economic Growth | GDP aggregates per capita (GDPcap) | Eurostat, 2021 |
| Investment rate | Investment rate of non-financial corporations (INVRate) | Eurostat, 2021 |
| Profitability | Profit share of non-financial corporations (Profitab) | Eurostat, 2021 |
| Tax burden | Tax burden (Taxbur) | Heritage foundation, 2021 |
| **2.2 Financial variables** | | |
| Inflation | Inflation, GDP deflator (annual %) (Inf) | World Development Indicator, 2021 |
| Interest rate | Long-term interest rates total in % (InterestR) | OECD, 2021 |
| Foreign direct investment | Foreign direct investment, net inflows as ration in GDP) (FDIGDP) | World Development Indicator, 2021 |
| Financial development index | | |
| | Overall financial development index (FD) | FD IMF, 2021 |
| | Overall development of financial institutions – Financial institutions index (FI) | FD IMF, 2021 |
| | Financial institutions depth index (FID) | FD IMF, 2021 |
| | Financial institutions efficiency index (FIA) | FD IMF, 2021 |
| | Financial markets depth index (FMD) | FD IMF, 2021 |
| | Financial markets efficiency index (FME) | FD IMF, 2021 |
| **2.3 Controls** | | |
| Business Freedom | Business Freedom (BusFree) | Heritage foundation, 2021 |
| Trade | Trade openness (as percent in GDP) | World Development Indicator, 2021 |

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*Clement, S. & Achim, M.V. pp.72-82*

| | | |
|---|---|---|
| Governance quality | | |
| | Government Effectiveness (GE) | World Development Indicator, 2021 |
| | Voice and Accountability (VA) | World Development Indicator, 2021 |
| | Rule of Law (RL) | World Development Indicator, 2021 |
| | Regulatory Quality (RQ) | World Development Indicator, 2021 |
| | Political Stability and Absence of Violence/Terrorism (PS) | World Development Indicator, 2021 |
| | Control of Corruption (CC) | World Development Indicator, 2021 |
| Internet | Individuals using the Internet (% of population) | World Development Indicator, 2021 |

**Source:** Author's own composition

The descriptive statistics of variables are presented in Table 2 below:

**Table 2.** Descriptive statistics of variables

| Variable | Obs. | Arithm. mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| SE | 625 | 17.340 | 6.343 | 7.100 | 34.6600 |
| GDPcap | 625 | 26,226.61 | 10,595.89 | 10,509.00 | 74,597.20 |
| INVRate | 625 | 23.416 | 5.070 | 12.7400 | 59.360 |
| Profitab | 625 | 44.091 | 7.623 | 29.7400 | 42.4100 |
| Taxbur | 625 | 66.258 | 15.048 | 32.700 | 94.00 |
| Inf | 625 | 1.542 | 3.505 | -25.129 | 22.899 |
| InterestR | 625 | 3.537 | 2.810 | 0.000 | 22.5000 |
| FDIGDP | 625 | 10.931 | 33.980 | -39.545 | 280.13 |
| FD | 625 | 0.580 | 0.193 | 0.219 | 0.913 |
| FI | 625 | 0.680 | 0.136 | 0.403 | 0.937 |
| FID | 625 | 0.506 | 0.251 | 0.128 | 1.000 |
| FIA | 625 | 0.687 | 0.205 | 0.163 | 1.000 |
| FMD | 625 | 0.464 | 0.314 | 0.023 | 0.971 |
| FME | 625 | 0.4822 | 0.392 | 0.000 | 1.000 |
| BusFree | 625 | 79.226 | 9.854 | 53.700 | 99.900 |
| Trade | 625 | 115.843 | 56.900 | 45.418 | 408.362 |
| GE | 625 | 1.108 | 0.593 | -0.359 | 2.251 |
| VA | 625 | 1.094 | 0.337 | 0.311 | 1.674 |
| RL | 625 | 1.107 | 0.621 | -0.174 | 2.100 |
| RQ | 625 | 1.178 | 0.454 | 0.148 | 2.047 |
| PS | 625 | 0.704 | 0.379 | -0.318 | 1.512 |
| CC | 625 | 0.998 | 0.805 | -0.267 | 2.446 |
| Internet | 625 | 73.617 | 14.098 | 32.420 | 97.319 |

**Source:** Author's own composition

## 4. Empirical analysis

The idea of the study represents the impact of economic and financial development on shadow economy. The selected objective of the study is interesting because a country's financial revenues represent basic building blocks for action. The main source of revenue for countries is taxes. This means that individual countries depend on how much is generated in companies and thus taxed, and how much a private person pays in taxes in everyday life. If the individual does not contribute to the overall construct, the others are burdened with an amount of tax debt and the country suffers because no investments can be made. Thus, for example, the expansion of the highway, the renovation of schools or the construction of kindergartens do not take place. Without financial resources and the regular income, countries are destitute and thus cannot invest in the general public. Each country would like to keep its revenues at least stable, if not increase them appropriately. However, the shadow economy prevents countries from developing stable revenue policies and denies them funding.

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The model in this study will be presented in an estimation model, where the dependent variable is shadow economy, i is the country, t the time, $\beta$ the independent determinants and $\varepsilon$i,t an error term. In this study, economic determinants are understood as the GDP per capita, investment rate, profitability and tax burden. Financial determinants include the variables, inflation, interest rate, and different financial indices like financial markets index or financial institutions depth.

$$Shadow\_economy_{i,t} = \alpha + \beta Financial\_development + \varepsilon_{i,t}$$

$$Shadow\_economy_{i,t} = \alpha + \beta Economic\_development + \varepsilon_{i,t}$$

Panel data are tested using the fully modified least square method (FMOLS). The FMOLS technique developed by Phillips et al. (1990), ensures optimal estimation of cointegrating regression. In agreement with Hamit-Haggar (2012), we consider FMOLS to be the most appropriate technique for our panel methodology involving heterogeneous cointegration.

Using the FMOLS technique, 4 estimating equations were established for each of the control determinants. All equations have a high coefficient ($R^2$), which ranges from 68.7% to 80.0%.

**Table 3.** Regression of shadow economy depending on economic and financial determinants based on FMOLS for EU28

| Dependent variable Shadow economy | Equation (1) | Equation (2) | Equation (3) | Equation (4) |
|---|---|---|---|---|
| GDPcap | 0.0006*<br>(0.0004) | | | -0.0002***<br>(0.0005) |
| INVRate | 0.007<br>(0.049) | | | 0.040<br>(0.042) |
| Profitab | -0.061*<br>(0.046) | | | -0.0203*<br>(0.033) |
| Taxbur | 0.157***<br>(0.028) | | | 0.826***<br>(0.104) |
| Inf | | -0.086***<br>(0.011) | -0.986**<br>(0.011) | -0.031<br>(0.100) |
| InterestR | | 1.020**<br>(0.657) | 0.809***<br>(0.205) | 0.265***<br>(0.089) |
| FDIGDP | | 0.099***<br>(0.08) | | 0.047***<br>(0.006) |
| FD | | -31.438***<br>(2.597) | | -55.710***<br>(6.165) |
| FI | | -9.961***<br>(3.003) | | -13.397*<br>(9.022) |
| FID | | -8.615*<br>(1.084) | | -22.399*<br>(3.809) |
| FIA | | -2.698*<br>(0.102) | | -3.233**<br>(4.071) |
| FMD | | | -1.215* | -3.797** |

| | | | | |
|---|---|---|---|---|
| | | | (1.001) | (2.559) |
| FME | | | -6.598***<br>(0.989) | -10.772***<br>(1.244) |
| BusFree | 0.316*<br>(0.032) | 0.256**<br>(0.032) | 0.456***<br>(0.125) | 0.292***<br>(0.028) |
| Trade | 0.006***<br>(0.007) | 0.105***<br>(0.568) | 0.215***<br>(0.253) | -0.002*<br>(0.006) |
| RL | -1.936**<br>(0.949) | 3.001***<br>(0.368) | -2.598***<br>(0.745) | -5.799***<br>(1.209) |
| VA | 2.718*<br>(0.023) | 1.621**<br>(0.186) | 0.861***<br>(0.012) | 2.478*<br>(1.750) |
| PS | -0.174***<br>(0.033) | -0.861***<br>(0.685) | -0.658***<br>(0.053) | -0.043***<br>(0.267) |
| GE | 0.608**<br>(0.048) | 1.568**<br>(0.102) | 0.643***<br>(0.035) | -2.161*<br>(1.145) |
| CC | 0.426***<br>(0.021) | 1.193**<br>(0.264) | 0.611***<br>(0.036) | 1.876**<br>(0.979) |
| RQ | -0.837***<br>(0.048) | -1.615<br>(0.803) | -1.932***<br>(1.106) | -2.425*<br>(1.245) |
| Internet | 0.090***<br>(0.027) | 0.138***<br>(0.018) | 0.312***<br>(0.106) | 0.043*<br>(0.007) |
| R-squared | 0.689 | 0.768 | 0.697 | 0.800 |
| Observations | 585 | 585 | 585 | 585 |

Notes: () parenthesis value indicates the std. error. Probability significance:***p<0.01, **p<0.05, *p<0.1. Weighted estimation; Additional regressor deterministic: @TREND; Long-run covariance estimates (Bartlett kernel, Newey-West fixed bandwidth)

**Source:** Author's own composition

The results in table 3 show that all determinants of finance had significant and negative effects on shadow economy. Exceptions are interest rates and direct investments, which show a positive and significant impact. When looking at the economic determinants, a significant negative relationship is found in GDP and a slightly negative relationship is found in the profitability of a company. The tax burden, in turn, represents a strong positive significance to the shadow economy.

When analysing the influences of financial institutions compared to financial markets on the shadow economy, it becomes clear that in the framework of financial institutions significantly higher coefficients (FD: -55,710; FID: -22,399) than in the framework of financial markets (FMD: -3,233; FME -10,772). The result suggests that an increase in the development of the financial sector would result in a more pronounced reduction of the shadow economy in the financial institutions sector compared to the financial market.

The results obtained are reflected in the following studies. Torgler (2009) examine the ffect of institutional quality on shadow economy and found also that there is a strong negative relationship. Berdiev et al. (2016) analyse the relationship between financial development and the shadow economy and found a negative relationship. Mazhar

(2017) found also a positive effect between the economic component inflation and the shadow economy a negative relation between the tax burden and the size of the shadow economy. Borlea et al. analyzed the relationship between the shadow economy and economic growth and found a strong negative correlation. (2017), Hoinaru et al. (2020) and Ginevicius et al (2020) found a strong negative impact of shadow economy on economic and sustainable development. Gharleghi et al. (2020) examines the relationship between financial development and the shadow economy and found negative significance. And Canh et al. (2020) examines the influence of financial development on shadow economy. The negative effects of financial development on the shadow economy were noticeable and the impact of financial institutions was also higher than those from financial market.

## 5. Conclusion

This study contributes to the literature by examining the impact of financial and economic development on shadow economy. First, we made a distinction between financial and economic development. Within financial development, a distinction was made between financial institutions and markets. The study sampled 28 countries, which were analyzed during the period from 1995 to 2019.

It was found that most economic, as well as financial determinants has a strong negative impact on shadow economy. On the other hand, the determinants tax burden, interest rate and direct investment represent a significant positive effect on shadow economy. This means, if tax burden, interest rate or direct investment were rise, shadow economy would increase. In contrast, if, for example, the efficiency of the financial institution or the financial market, the depth of the institution or the depth of the financial market increases, then the level of the shadow economy decreases. Regarding the different impact of financial institutions compared to the financial market, the financial institutions have a much higher impact on shadow economy in their actions than the financial market.

Tax revenues are there to provide the country with funds to invest for the public good. Whether this is for schools, infrastructure, or stimulus funds. The shadow economy helps to reduce tax revenues and circumvent the levy. With this study, the factors influencing the shadow economy were explained in more detail and connecting factors for prevention were established. The results serve as an aid to countries, municipalities and governments in reducing the shadow economy.

In future studies, our results regarding the influence on the shadow economy, economic and financial development should be extended by the control factors that influence economic growth. The control factors can be, for example, public administration, tax burden, culture, religion, unemployment rate as well as some cultural variables.

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**22nd RSEP** International Economics, Finance & Business Conference – Virtual/Online
25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Bilgin, O. & Kaya, M.V. pp.83-88*

# Comparison of the monetary policy tools implemented by the European Central Bank and the Central Bank of the Republic of Turkey after the global crisis

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**Abstract**

As in many areas of the economy, the global crisis has led to radical changes in money markets, goals of central banks, and the tools they used. This study aims to examine the unconventional monetary policy tools and objectives of the central banks, which have started to be implemented in the last decade, especially in the European Central Bank (ECB) and the Central Bank of the Republic of Turkey (CBRT). In this context, zero interest rate policy and quantitative easing policy came to the fore in the ECB to stimulate the markets. In the CBRT, the interest rate corridor and reserve options mechanism came to the fore to eliminate the distorting effects of the capital coming from abroad. The policies implemented by the central banks in the post-crisis period were shaped depending on the dynamics of the countries.

***Keywords:*** CBRT, ECB, Monetary Policy, Monetary Policy Instruments

***Jel Codes:*** E52, E58

## 1. Introduction

Following the global crisis, central banks of developing countries, as well as developed countries, have designed and implemented a new monetary policy framework to combat the current problems faced by their economies. To alleviate the negative consequences of the crisis, interest rate cuts were made especially by the USA and the EU countries within the framework of conventional monetary policy. However, since the interventions did not produce the desired results, these countries tried a new tool called the quantitative easing policy. Within the framework of this policy, a large amount of liquidity was provided to the shrinking markets by using unconventional monetary policy measures. However, the quantitative easing policy caused to flow the capital to developing countries as well.

The changing conditions in the world economy after the crisis and the new policies implemented by the central banks of the developed countries caused the developing countries to act. In this context, the CBRT has designed and implemented a new policy strategy since the end of 2010 (Kara, 2012:2). However, before the global economic crises the CBRT experienced with an economic crisis based on Turkish banking system in 2001. Therefore, the CBRT was already directed to develop new tools for intervention to the economy. After the 2001 crisis, the CBRT made noteworthy progress in terms of the tools it used to achieve its monetary policy goals. The monetary policy instruments implemented by the CBRT have changed over time depending on local and global economic developments, and it has become one of the successful central banks of the world (Çetin, 2016).

One of the important consequences of the global crisis for countries is that central banks should not ignore the risks in the financial system and the inflation in asset prices. Today, central banks ensure not only price stability and also financial stability by using monetary policy tools. In this context, our study focuses on the new aims and policy tools implemented by the CBRT and the ECB. A descriptive and historical approach is followed in this paper. It examines the macroeconomic changes experienced after the crisis and the policy tools used by both organizations within the scope of their objectives and results.

## 2. Literature Review

In the pre-crisis period, it is seen that the comparison studies about the CBRT and the ECB focused on independency or transparency and accountability which are related to the communication policy of central banks. Bakır (2005) compared the CBRT with other central banks in terms of independency and transparency. In the study, it was concluded that the transparency of CBRT is lower than expected but the independence of the CBRT

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*Bilgin, O. & Kaya, M.V. pp.83-88*

is high. Baydur and Süslü (2007) compared the independence of the ECB and the CBRT and examined their effects on the economy.

As a result of the empirical analysis, a negative relationship was found between inflation and the independence of the CBRT, but no significant relationship was found in terms of output stability. Another important result of the analysis is that the increase in the independence of the ECB causes both price stability and increases output.

With the implementation of new policy tools by central banks to ensure financial and price stability in the post-crisis period, it is seen that tools and strategies have begun to be examined more in the literature. Kara (2012) states that the CBRT has designed and implemented a new policy framework since the end of 2010. He also concluded that this framework is quite effective in directing the Turkish economy to a balanced growth path without disturbing the medium-term inflation expectations. However, Gambacorta et al. (2012) examined the effectiveness of the zero-interest policy, especially in developed countries, with panel data analysis. According to the results of the research, the macroeconomic impact of the unconventional monetary policy is not at a significant level. Joyce et al. (2012) examined the effectiveness of quantitative easing. Similar to the results of Gambacorta, he argued that the European economy was still in a fragile structure as of 2012, even though quantitative easing was effective in stimulating the economy. Vural (2013) examined the rise of unconventional monetary policy practices in world economies after the global crisis. In his research by using GDP data of twenty-seven countries, he investigated the effect of the new implemented policy tools on GDP. He concluded that the quantitative easing policy affected the country's GDP by 91%, credit expansion policy by 74%, collateral diversification policy by 68%, maturity extension policy by 66% and interest rate corridor policy by 66%. In this context, he considers the use of quantitative easing, credit expansion, collateral diversification, and maturity extension policies as the most common policies.

Çetin (2016) analyzed the development of monetary policy practices by the CBRT in the historical process. He states that the unconventional monetary policy strategy determined by the CBRT after the crisis has a positive effect on foreign currency reserves and that the desired level of foreign currency reserves reduces the vulnerability of the country's economy to external shocks. Ersoy and Işıl (2016) investigated the effects of unconventional monetary policy practices applied in developed countries after the global crisis on the monetary policies and banking systems of developing countries and Turkey. As a result of the study, it was stated that the CBRT implemented new monetary policy instruments in response to the central bank decisions of developed countries. Emirkadı (2017) examined the interest rate corridor applied by the CBRT after the global crisis and emphasized the importance of new policy instruments.

Cengiz (2019) examined the communication and monetary policy of central banks. In his study, Cengiz states that the European Central Bank has established an effective structure in terms of communication with economic units through monthly press conferences, regular bulletins, speeches, interviews, academic conferences, and research. And the communication policy plays a key role in supporting the monetary policy and achieving its goals. This policy of the European Central Bank has also been supported by empirical studies that have concluded that the communication in the Euro Zone is clear and understood by the public and that it is decisive on expectations.

## 3. Comparison of policy instruments implemented in the post-crisis period

During and after the global crisis, central banks started to develop different monetary policies to minimize the negative effects of the crisis and to ensure price stability. It can be stated that the non-standard or unconventional policy tools implemented in this process are more innovative than the tools used in previous crises. The developed tools are subject to a dual classification in the literature as conventional and unconventional. The policy interest rate and foreign exchange transactions can be shown as the conventional tools of monetary policy. The unconventional ones can be listed as interest rate corridor, credit expansion, quantitative easing, commitment interest, maturity extension, collateral diversity, and reserve requirement ratio (Vural, 2013:34). In addition to these, the reserve option mechanism, which is a kind of reserve requirement ratio that the CBRT has recently put into practice, can be added to unconventional tools.

After global crises, developed countries have focused on solving balance of payments problems, while developing countries such as Turkey focused on managing fund transfers from foreign countries and related financial and macroeconomic risks. In this context, the CBRT changed the inflation targeting regime at the end of 2010 and determined a monetary policy strategy compatible with the current economic conditions. In the new strategy, financial stability has gained importance as well as price stability. In the implementation of the new monetary

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policy, it was necessary to provide a variety of instruments for more than one purpose. In addition to the conventional policy rate, a policy mix is designed in which the interest rate corridor, which expresses the gap between overnight deposit rates and lending rates, and required reserves are used together (Yücemiş et al., 2015). In this framework, "Interest Rate Corridor" and "Reserve Option Mechanism (ROM)" came to the fore as the new policy tools of the CBRT in the post-crisis period (Çetin, 2016).

In this structure, market rates are formed within the interest rate corridor. However, before 2011, the one-week repo funding rate was called the policy rate, since the CBRT funded through one-week repo. The policy interest rate and the interest rate corridor were reviewed and announced to the public at the Monetary Policy Committee meeting every month. In the new structure, the CBRT interest rate corridor is used as an active tool. Namely, the CBRT can adjust the width of the interest rate corridor when it deems necessary while creating the corridor asymmetrically around the policy rate. In this designed structure, the interest rate corridor not only provides a faster and more flexible response to the volatility in short-term capital movements but can also be used as an effective tool for loan growth when necessary (CBRT, 2012).

Figure 1 shows the overnight deposit rates and lending rates applied by the CBRT between 2006 and 2018.

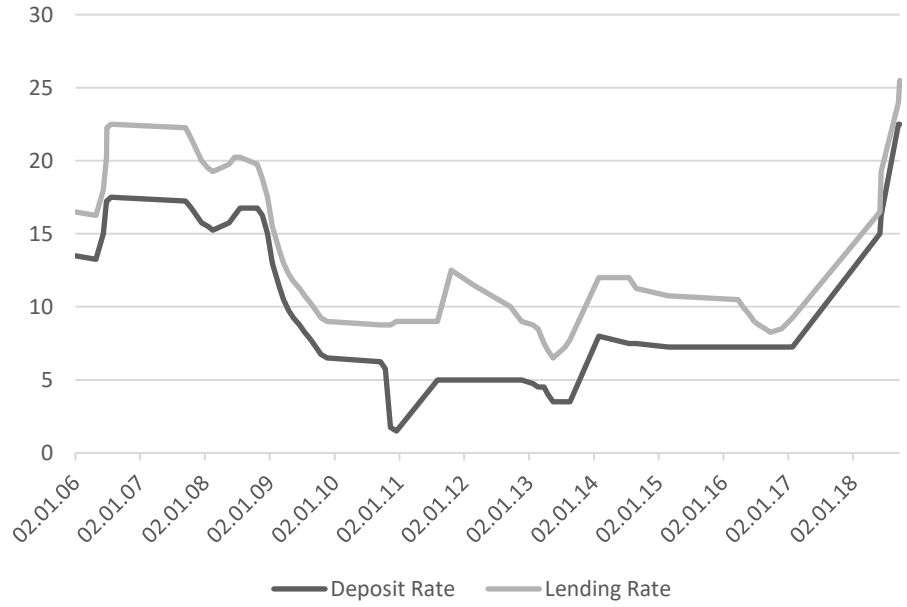


**Figure 1.** Interest Rate Corridor (2006-2018)

**Source:** (CBRT, 2019a)

Another policy tool is the Reserve Option Mechanism (ROM). The ROM aims to alleviate the negative effects of high volatility in capital movements on financial stability and macroeconomic factors. It is a method that allows banks to keep a certain ratio of Turkish Lira mandatory provisions in gold or foreign currency. The level at which the ROM can be used is determined by the reserve option ratio. The coefficients that determine the gold or foreign currency that can be maintained per unit Turkish lira required reserve are defined as the Reserve Option Coefficient (ROC). In a period when foreign fund transfer accelerates, banks will tend to use ROM more because banks have easier access to foreign currency or gold and the cost of these resources is low. In this way, the overvaluation pressure in TL and rapid loan growth, which may be caused by capital flows, will be prevented, especially in foreign currency loans. Similarly, if the foreign exchange costs of banks increase in a period when the capital leaves the country, banks will be expected to use this facility less (Küçüksaraç and Özel, 2012, 3). Figure 2 shows the ROM utilization rate graph for Turkish Lira required reserves since the ROM was introduced.

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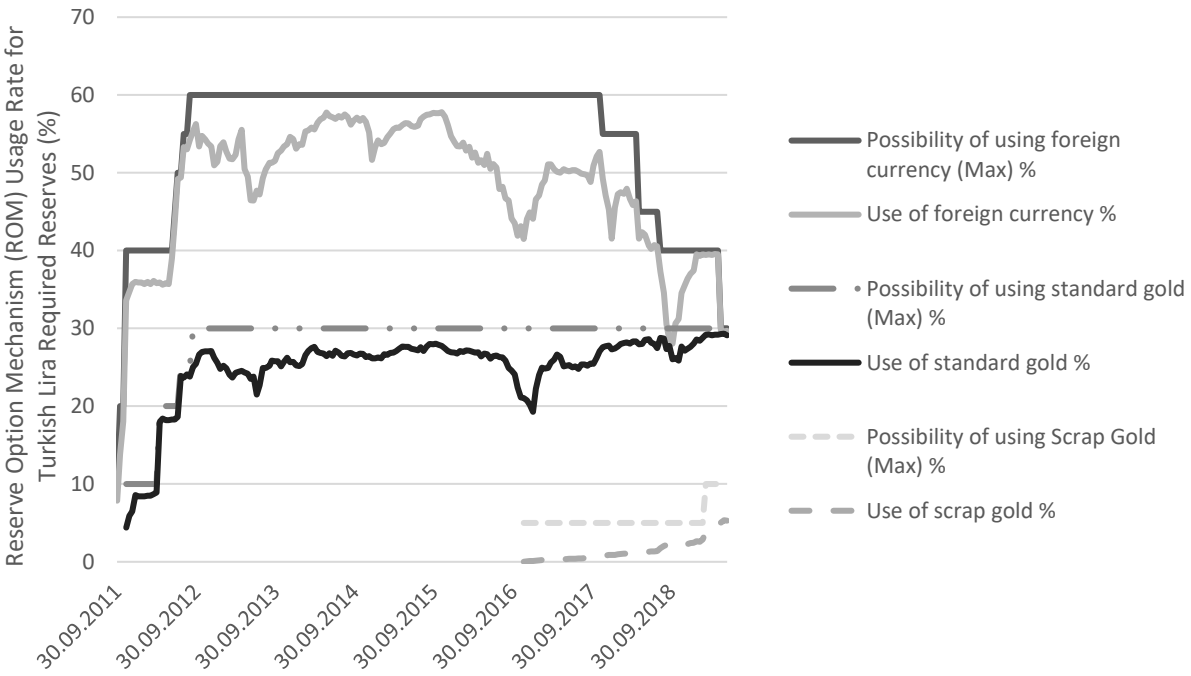


**Figure 2.** Reserve Option Mechanism (ROM) Usage Rate for Turkish Lira Required Reserves (%)

**Source:** (CBRT, 2019b)

The monetary policy of the European Central Bank is built on two pillars. The first pillar of the monetary policy strategy is to determine the appropriate interest rate that will ensure price stability. This rate is defined as the rate that will keep inflation "close to but below 2%" in the medium term. According to this definition of the ECB, not only the inflation above 2% but also extremely low inflation is incompatible with price stability. The second pillar is the operational framework, which is the set of tools and procedures that must be used to achieve the desired interest rate (ECB, 2019a).

Within the framework of this structure, the ECB;

1. Buying or selling within the framework of repo or reverse repo agreements. Also lend or borrow an instrument that can be traded in any currency, as well as precious metals.
2. Providing credit guarantees and performing credit operations to credit institutions and other market participants.

After the global crisis, unconventional policy tools were added to the ECB monetary policy structured in this direction. In the pre-crisis period, the main policy instrument of the European Central Bank was short-term interest rates and monetary policy rules, which were predicted by the markets and applied according to certain rules. However, during and after the crisis, the ECB, like the central banks of other developed countries, implemented new monetary policy tools. These; zero policy interest, measures to provide liquidity, credit facilities, securities purchases, and verbal guidance. With the zero-policy rate implementation, the ECB firstly reduced the policy interest rates to extremely low levels for the financial markets to continue to function. Figure 3 shows the policy interest rate applied by the ECB. As it can be seen in the figure, after the 2008 global crisis, the ECB has consistently followed policies to reduce interest rates.

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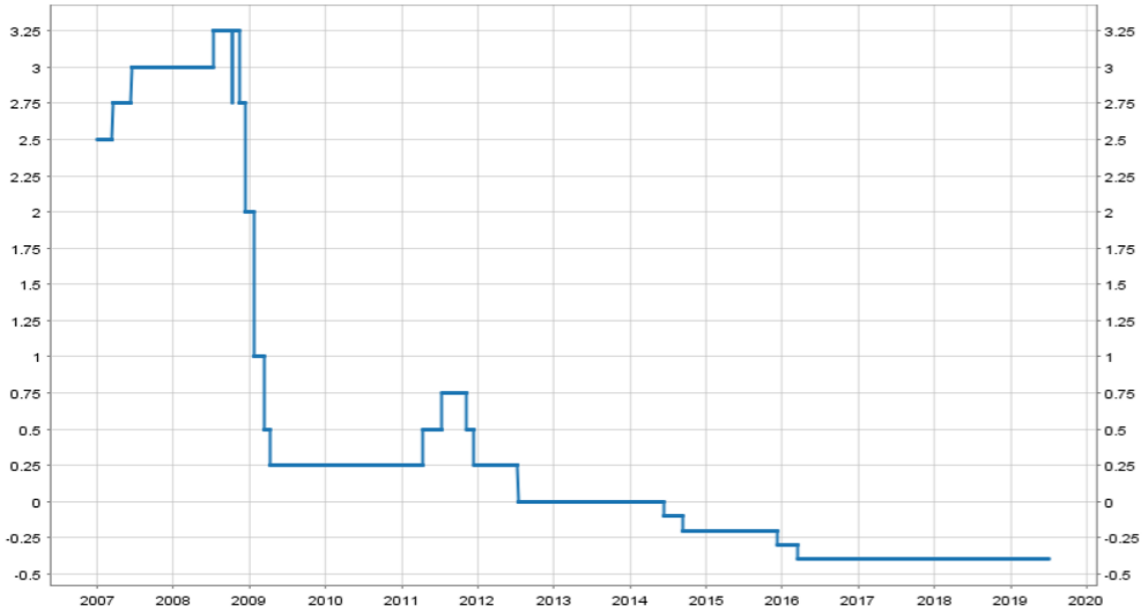


**Figure 3.** Change in policy rate implemented by the European Central Bank (2007-2019)

**Source:** ECB, 2019b

After the ECB reduced the policy rate to zero, it started to implement quantitative easing as another new monetary policy tool. Quantitative easing, also known as large-scale asset purchases programs, is a monetary policy in which a central bank purchases a predetermined amount of government bonds or other financial assets to inject money directly into the economy. However, although the applied quantitative easing policies provide relief due to providing liquidity to the markets, it also causes negative consequences for developing countries. For example, capital oriented towards developing economies with considerable risk and return due to low-interest rates may cause the appreciation of the national currency of the country it enters, resulting in negative results in foreign trade (Ersoy and Işıl, 2016: 352). In addition, as of December 2018, the ECB has terminated its asset purchase program.

In this context, it is seen that developed countries used policies and appropriate tools to ease the shrinking markets after the crisis but developing countries such as Turkey applied more tightly or in a contractionary way so that the funds coming from developed countries would not disturb the price stability.

## 4. Conclusion

The global crisis, which started in the USA and affected the entire world, has caused different effects in every country, depending on the internal dynamics of the countries. In the last decade, unconventional monetary policy tools have been developed and became the main tools applied. The basic foundations of the ECB and the CBRT to develop new policies and tools differed according to the economic dynamics of the countries. While the unconventional tools implemented by the ECB during and after the crisis were mostly used to stimulate the EU economy, the policies and tools developed by the CBRT were used to reduce the negative effects of the capital inflows to Turkey as a result of the economic recovery in developed countries. In this context, the new monetary policy designs and practices of Turkey and the European Union emerge depending on the dynamics of the countries and no policy design approach can be used as a solution for every country or at all times.

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*Anghel, M.A. pp.89-96*

# Factors of purchase behaviour in the context of cognitive neuroscience - meta-analytic study

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## Abstract

The explanatory paradigms regarding influencing factors of consumer behaviour explains at extensive length. The latest neuroscientific discoveries present the fact "The brains system of response can be compared to an algorithm where the mind is the software which runs on the brain's hardware" (Magrini, 2017). The research creates an influence of factor type of analysis over consumer behaviour, placed in specific conditions, directed by the external environment and its variables. The identified factors are being analysed accordingly to the context of their influence capability over consumer behaviour (defensive of offensive). Therefore, the purchase patterns are identified accordingly to specific psycho-emotional variables. Throughout the external environment it is to be understood the framework and context of sales, created for a better perception of the product. It is to be taken in consideration the fact that specific characteristics of the consumer environment influences the decision-making process: purchasing or rejecting the product and its variability. The multifactorial analysis will insert the derivate explanation from the context of cognitive neuroscience. The research type is metanalytic. With this scope, validated and ISI Thomson indexed scientific articles have been taken in consideration. The metanalysis has been conceived of specialty literature reviewing with the objective of identifying the main factor categories which can influence consumer behaviour presented by other authors. This approach was needed because the behavioural patterns are being analysed and described in the context of considering that the influencing factors are modelling the consumer behaviour. The metanalytic study has considered the way the process of "neurologic impulse-influx" works and influences consumer behaviour. The analysis and result interpretation were realized by the wight of the statistical data pattern.

***Keywords:*** neuromarketing, purchase behaviour, factors, metanalysis

***Jel Codes:*** D87, D90, D91

## 1. Introduction

Consumer behaviour represents a field of great interest for corporations, especially when they are pursuing influencing and changing the purchase behaviour of their customers with the purpose of increasing sales. Quoting the American Marketing Association, we define consumer behaviour as “an interaction between impression and perception, conduit and natural common events, through which human beings are guiding occurred changes in their own lives”. (Wilkie, 1990, p. 214), “a result of some received entries, evaluated and processed by individuals”. (Philipp, 2002, p. 570).

The Marketing research presents the fact that many researchers are preoccupied by. Identifying and explaining purchase patterns, identifying stimuli patterns to which consumers respond and the factors which influence product selection.

Cognitive psychology tries to explain the mechanisms through which, following a cortical stimulation, answers are being offered in various behaviour patterns. In this article, it is to be considered the following definition of the cognitive system: “a cognitive system it a physical system which owns two properties: representation and calculus. Representation is consisted of transposing the interior environment in the external field and calculus refers to manipulation of the respective representations based under fixed rules”. (Miclea, 2003, p.26). Representations and calculus can be rational – conscious analysis of information – or unconscious – unconscious analysis of information (e.g., perception, learning and memory, “conscious and unconscious analysis of information (cognitive unconsciousness) implies different structures and neurobiological projections”. (David, 2004).

In the Marketing research, it is brought in attention the concept of “modelling” of consumer behaviour. Marketing specialists are very interested in: understanding the responses offered by the human brain when encountering different stimuli, what are the reasons which influence the purchase decision of a product, how can Marketing

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campaigns be projected so that sales increase? Having these concepts displayed, the following question is being summoned: Can neuromarketing come in the help of Marketing researchers allowing them to understand how the brain offers answers to different stimuli which influence the purchase behaviour?

The research of different human mental processes and reactions are emotions, attention, memory, will, representation, imagination, learning and, following an interaction between two or more stimuli, the person generates specific behaviours. Having this in mind, there is a specific question which comes along: which are the factors that influence consumer behaviour and what are the specialists in neurobiology, psychology, marketing has to say regarding behavioural modelling?

Neuromarketing is a relatively recent filed of study (2002). According to some researchers (Fisher, Chin, & Kiltzman, 2010, pg. 230-237), the first reported usage of the term has been identified in 2002, in a press conference of the company BrightHouse from Atlanta which was announcing the creation of a division which was going to use MRI for Marketing research. From the point of view of the same authors, once with the technological development in psych medical research, neuromarketing has used numerous tools for monitoring and analysing different human stimuli. Therefore, the most common research tools used are EEG (electroencephalogram), MRI (magnetic resonance imaging), MEG (magnetoencephalogram), NIR (Near-infrared spectroscopy), EKG (electrocardiogram). Once with selecting the measurement instruments of different human body reactions under different stimuli it has been brought in discussion the factors which contribute to modelling behaviours under specific conditions. Such research has received numerous critiques (Fisher, Chin, & Klitzman, 2010, pg. 230-237). "Opponents say that neuromarketing limits the consumers and threats their civil rights. From a philosophical point of view, if a neuromarketing researcher can determine the purchase of a product, then the consumer's free will is affected, which in general is considered a fundamental right. On the other hand, people who are in the favour of neuromarketing usage claim the fact that the consumer's satisfaction is much higher. (Durdakova, 2016, p.118).

## 2. Brief review of literature

Searching withing the Web of Science Core Collection database, on August 17th 2020 of the word "neuromarketing" there were 568 results representing studies and articles with challenge directly the problematic status of neuromarketing. The first published and indexed article appears in 2004 and most papers were published in 2019 (87 indexed).

It has been observed that numerous researchers are attracted by explaining the process of modelling of consumer behaviour. According to Ries, (Ries, 2006, p. 9), psychology studies human behaviour and Marketing can be considered a systemic study of human behaviour in the market.

Accordingly, to the explanations from the social psychology field, purchase behaviours are "actions of social actors through which it is pursued the maximization of utility satisfaction" (Chelcea & Ilut, 2003, p.83).

Various researchers were preoccupied by stating series of theories which can explain purchase behaviour. It is to be mentioned in this case that "the theory of utility" (George Stigler 1950) according to whom "purchase behaviour is influenced by consumer's preferences, by the intensity of these preferences, the price level, the worth dimension and other factors". Also, the theory of rational selection says that "normal people are capable, based on their potential and capital, to choose the right decision in generating a preference". This theory has been analysed closely by researchers Deaton, A. and Meulhauer (Deaton, 1980).

Modelling the consumer behaviour has a list of explanations which belong to the following paradigms: psychological, sociological, cultural, anthropologic, economical, and cognitive neuroscience.

The psychological paradigm values the explanation regarding various perceptions, motivations, learning and behavioural capabilities. It is to be concluded the fact that modelling purchase behaviour will result in active internal and conscious selection under specific external stimuli which influence the person's satisfaction regarding the product and influences the purchase behaviour.

Purchase behaviour it is directly influenced by all the internal and external factors regarding a person. People can have positive, negative, or neutral attitudes regarding a product or service which can directly influence their behaviour. It is often questioning the fact if a characteristic of a product influences the perception, does it also create a behavioural pattern which the person will be memorising?

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*Anghel, M.A. pp.89-96*

Gordon Alloport (1897 – 1965) is the researcher which came with the following definition of "attitude" as "a mental and neuronal state, organised by experience which generates an influence over people's responses over all objects and situations with which they are in contact with". (Chelcea & Ilut, 2003). In the context of this description, it is to be understood that attitude is at the base of human behaviour. In its structure there are three components: cognitive, volitive, and conative, all of which contribute at explaining the work mechanisms of attitudes.

The sociological paradigm values a part of theories which explain the social functioning. According to Albert Badura, author of "Social Learning Theory" – 1971, people develop social behaviours based on imitation in four successive steps: the process of attention in which the individual observes specific learning behaviours (1), memory, to which behaviours are observed ad coded under sensorial or verbal representations (2), behavioural mirroring (3), and strengthening of cognitive confrontation (4). (Vlasceanu, 1998, p. 318).

The anthropological paradigm values the information gathered by understanding the individual with the direct influencing elements (geographical or historical). Modelling the consumer behaviour in the context of the anthropological paradigm explains the similar behaviours and attitudes of individuals which belong to the same social group or community for which they share the same values and cultural identity.

The economical paradigm focuses on the products' price and on the fact that the purchase behaviour is directly influenced by the price. The purchased need is satisfied only when the financial means are met (Remesovschi, 2018, p.59).

The cultural paradigm is placed in the centre between values, beliefs and social functioning patterns of a society or community. This cultural fingerprint inevitably modulates the social behaviour including the human behaviour.

The cognitive neuroscience paradigm offers explanations since the start of the 21st century when big neuromarketing movements are identified. It is to be appreciated the fact that the neuromarketing represents a field of study which has in its core the description of human behaviour and the purchase decisions which are explained by neurobiology. More specifically, it is to be considered that consumer psychology integrates elements from neuronal physiological research.

When a buyer wants to purchase a product, he is not emotionally attached to its advantages as much as he is connected by the benefits on the long-term which can be brought by the specific product. Therefore, the seller must understand and know very well the possible emotional benefits the product could bring to any consumer.

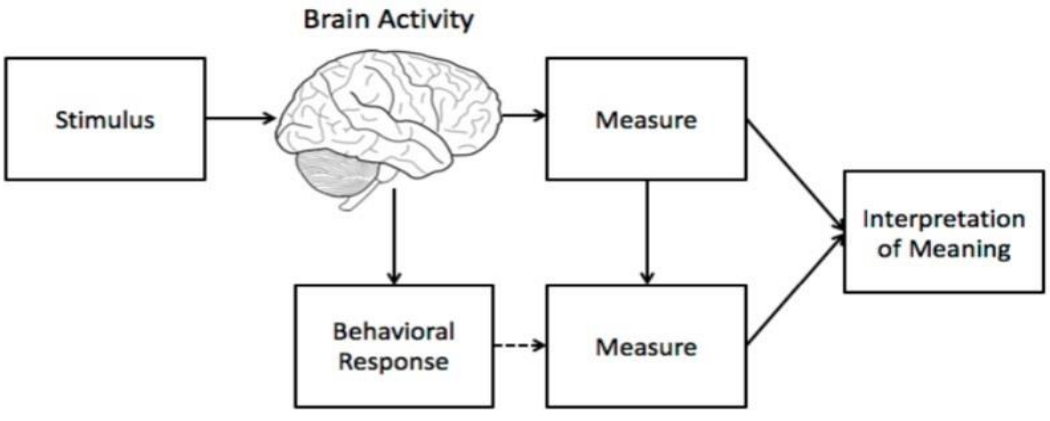


**Figure 1.** Conceptual schematic of neuromarketing research

**Source:** (Lee, Brandes, L, , & Chamberlain, L, 2017)

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In the B2C Business to consumer) fields corporations are in direct connection to the end user, therefore the sale methods and representation style are much cleared and direct. However, in B2B (business to business) transactions are being conducted in a more enclosed environment and the communication of the seller is adapted to its context. Considering the fact that these transactions are being conducted between corporations there are still emotional patterns to be identified in the sales speeches.

The purchase behaviour is influenced by a variety of stimuli: internal, external, social and symbolism. There are numerous tendencies in researching influencing factors of consumer behaviour, like individuals (consumers' personality, his capacity of understanding the product), social factors (the level of social influence), economical environment. (Dubois & Jolibert, A. 1992).

Concluding, it can be realised a classification of factors which influence the consumer behaviour. These are reported as characteristic data such as age, gender, education, motivation, satisfaction and perception level regarding the product and its price. When talking about Marketing there are mentioned a series of factors as objective attributes of the Marketing Mix, symbolic stimuli which are reporting the subjective perception of a product by its consumer and social stimuli which describe the gathered information received from other consumers who purchased the specific product.

## 3. Research Methodology

The purpose of the research is to obtain generalisations of the factors which influence the consumer behaviour described by the scientific research. The objective of these research is:

- Analysing scientific publications which follow the subjects of: neuromarketing, consumer behaviour, factors which influence the consumer behaviour and the neuromarketing tools through the bibliometric technique (O1).

Following up with this objective, there have been established a series of specific steps and ideas to be questioned and answered. Is there a fundamental criterion in Marketing in which neuromarketing impact can be traced so that the consumer behaviour can be explained (H 1.1); the research tools used in the neuromarketing field are identifying the evolution of cortical activity under its stimuli (H 1.2); the factors which influence the consumer behaviour are psychological (H 2.1); specific categories of factors can influence the purchase behaviour under specific conditions in the Marketing Mix (H 2.2). The research is focusing on the following key concepts: neuromarketing, consumer behaviour, neuromarketing research tools. The base unit of analysis is represented by scientifical publications indexed in the Web of Science data base and the research itself is mixed: quantitative and qualitative.

Therefore, the scientific publications were identified under the statistical methods using the Web of Science platform by filtering the articles by specific keywords, publishing year, field of study. The bibliometric analysis has been created by the data offered by the Web of Science platform on August 18th, 2021.

The established criteria for introducing specific studies are as following: studies and research reports published in articles, proceedings papers, which can be found in the Web of Science platform between 2010 – 2021.

## 4. Results

The analysis of scientific publications which talk about neuromarketing, consumer behaviour, influencing factors of consumer behaviour and neuromarketing research tool has been realised through the statistical and mathematical methods. The bibliometric study reflects the quantity of scientifical publications regarding the previous elements and offers the tendency of research in the neuromarketing field. In the following chart there is a series of indicators taken from the statistical values offered by the Web of Science platform.

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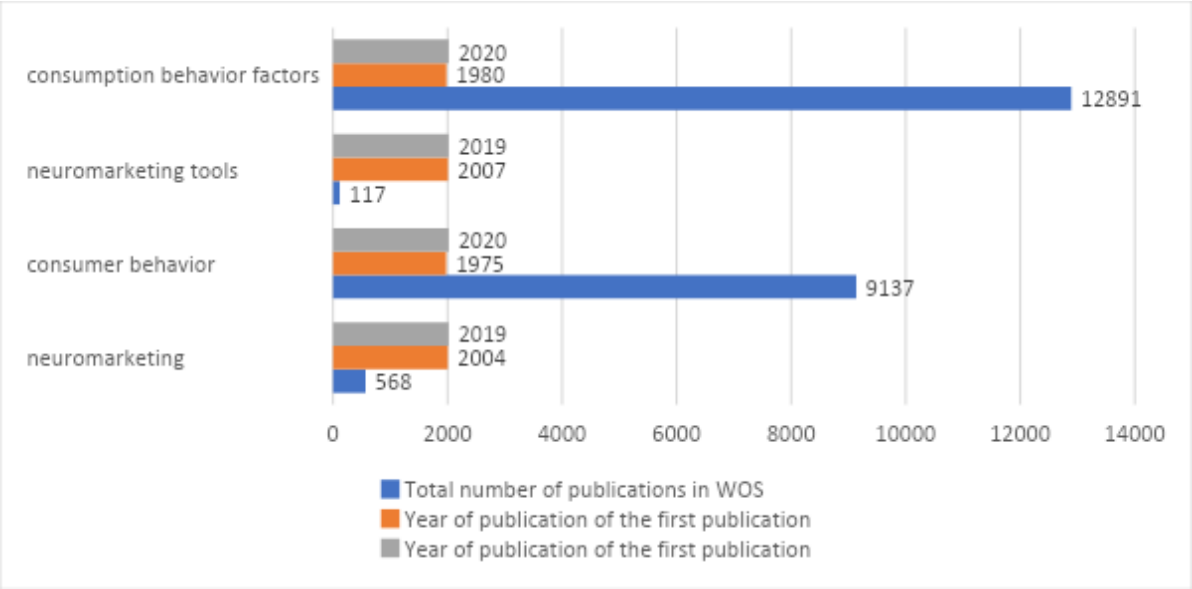


**Figure 2.** Statistics of scientific publications

**Source:** Authors' processing

It is to be understood the fact the topic of consumer behaviour represents already a long-term interest subject by researchers. Once with the big development of purchase market and the need of adapting the sales techniques, the interest in scientific paradigm explanations is rising in order to be able to understand and explain consumer behaviour. We can see this impact mostly in the year 2020 (with 1701 published articles and materials). It is to be taken in consideration the Covid-2 pandemic which might have had a contribution for the researcher's interest in the consumer behaviour elements and characteristics.

Neuromarketing is present in terms of published materials on Web of Science since 2004 which is considered to be quite recent. This perspective is also supported by the multiple achievements and discoveries of genetics and human brain characteristics. The scientifical investigation over cortical measurement instruments is rising especially after 2007. The biggest number of publications regarding this topic is found to be in the year 2019 and is describes the measurements realised by using specific research instruments (MRI and EEG mostly).

The interest in researching consumer behaviour is increasing in the past five years. This research will present a series of scientifical publications regarding key concepts. In order of these measurements to be made, the VOSviewer app was used in order to conduct a clean research. The bibliometric studies show that specific maps can be created (as shown in Fig. 3) in order to understand correctly the level of corelation between topics and published materials. In this case, fields like Marketing, Medicine, Cognitive Psychology and Sociology were searched together to find the common published articles which approach the subject of neuromarketing.

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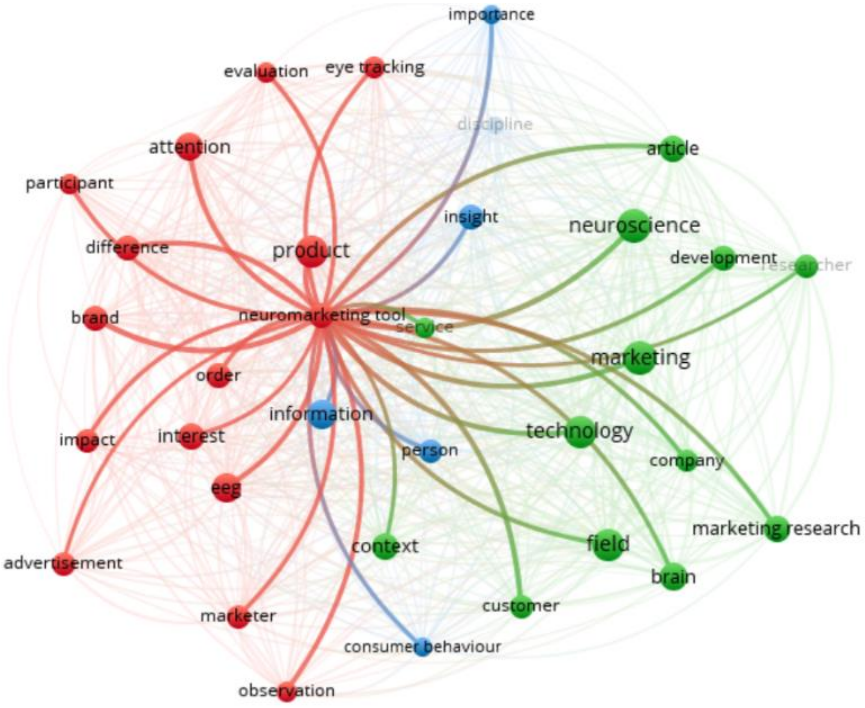


**Figure 3.** Neuromarketing tool analiza bibliometrică

**Source:** Authors' processing using Vosviewer

By analysing figure 3, the scientific research discovers the projection of neuromarketing tools in a scientific frame, especially regarding the following criteria: marketing context, technology, neuroscience, brain. Tracing the green lines, it is to be understood that they represent the neuroscience tools and the connection between marketing and neuroscience is demonstrated by the publications on neuroscientific instruments for cortical measurements. This map is consisted by dots and arcs. The bigger the dot, the higher the frequency of specific scientifical articles from that specific dot.

From the consumer behaviour point of view, the scientific research is being conducted by keywords. In the Web of Science there have been identified a number of 10 182 publications which had in their title or abstract at least once mentioned the term "consumer behaviour". In analysing the data, there were 266 terms were identified with the most relevant score. Also, only 60% of the selected terms were considered to be relevant for the analysis. Therefore, a final number of 160 terms were selected, generating the final map in figure 4.

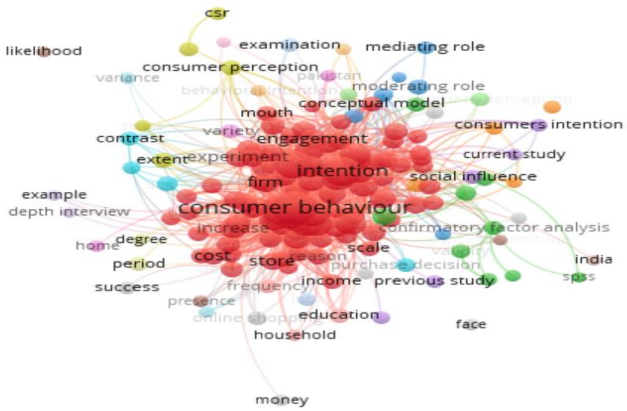


**Figure 4.** Consumer behavior-analiza bibliometrică

**Source:** Authors' processing using Vosviewer

Following the placement of the red dots it is to be considered that the research field of "consumer behaviour" is described following the indicators: cost, intention, engagement, firm. This means that the majority of studies are focused on describing the behavioural model from a psychological and sociological perspective. Analysing research and scientifical publications on the keyword "neuromarketing: and connecting scientific articles in bibliometric measurements, the map is as follows:

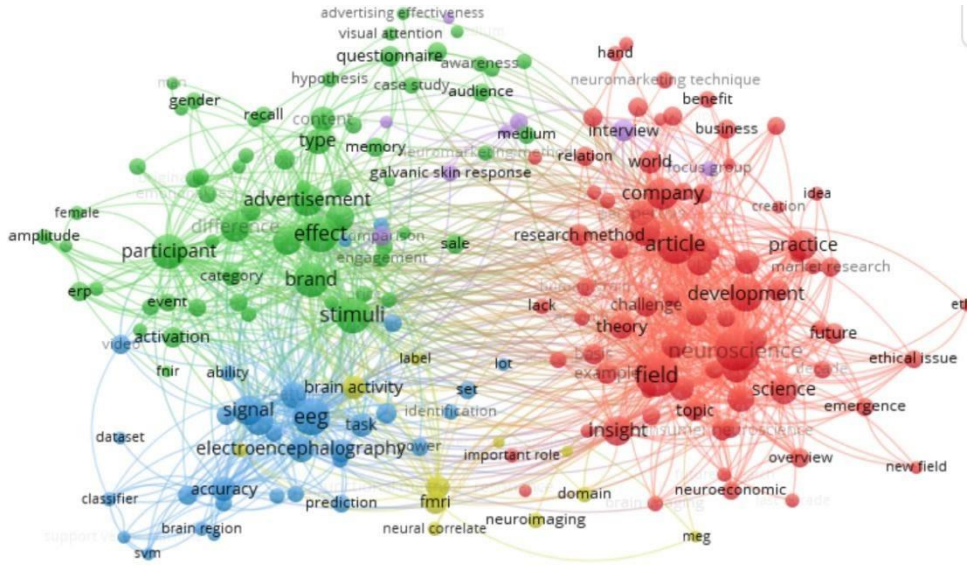


**Figure 5.** Neuromarketingl-analiza bibliometrică

**Source:** Authors' processing using Vosviewer

In creating this map there were 321 terms associated to neuromarketing with the highest score. From this list, 193 were identified to be with the highest and most relevant level. Based on the identified dots, it is clear to see that researchers have approached neuromarketing from three different perspectives: research tools (blue dots), stimuli and their categories (green dots), scientifical development (red dots). As mentioned before, the size of the dots indicates the frequency of occurrence. The smaller the distance between dots, the higher number of combinations between keywords. Regarding the research of consumer behaviour through cognitive neuroscience, the Web of Science platform has very few numbers of articles (57).

In conclusion, we appreciate the fact that the scientific literature creates an ample frame for documentation in the consumer behaviour field in measuring the cortical activities. Therefore, we can understand that the first hypothesis of the research has been confirmed. Also, we can observe that there is a big and important contribution to neuromarketing research from an ethical perspective. The purchase behaviour is realized from the following perspectives: economical, sociological, psychological and mathematical. Modelling the consumer behaviour (cristache, 2010, p. 12) is explained after the following hypothesis: phenomenology (reproducing states consumers have been through in the moment of the purchase decision), logical (type and sequence of decision a consumer takes when buying a product) and theoretical models (combining endogen and exogen variables resulting a specific purchase model).

## 5. Conclusions

Analysing the literature of speciality has demonstrated an intense care of researchers for consumer behaviour from a neuromarketing perspective and of cognitive neuroscience. It has been proven that specific topics of research like cognitive neuroscience and applications in the neuromarketing field are only starting now. Research is limited for the time being both quantitative and qualitative. The access for scientifical research in neuromarketing favours the research centres which have in their possession high values tools and instruments of cortical measurement.

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*Anghel, M.A. pp.89-96*

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*Demirel, Z.H. & Bakirtas, H. pp.97-108*

# Do entrepreneurship support programs empower women? An exploratory research

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## Abstract

The aim of this study is to examine effects on women empowerment and finance services of sample (such as age, education, marital status and number of children) and business characteristics (type of support, number of employee). The data was collected from 421 women entrepreneurship in Turkey. Results show that are statistically significance difference in between single and married regarding women empowerment. Similarly, there is a significance difference in terms of number of children. The results extend the literature on women entrepreneurship and also can help developing supportive environment of policy makers. Besides, limitations of the study are covered in the study. There are many studies on the women entrepreneurship. However, few examined effects on women empowerment and finance services of sample and business characteristics.

***Keywords:*** Women empowerment, women entrepreneurship, Turkey

***Jel Codes:*** J11, J16, M10

## 1. Introduction

Entrepreneurs are people who supply production factors such as natural resources, labor and capital, combine them in a proper way and produce goods and /or service to meet others' needs (Mucuk, 2016, p.6). In capitalist societies, entrepreneurship is regarded as a way of reducing unemployment and struggling with unemployment. Entrepreneurship is important in that it creates employment and contributes to economy of a country. It also needs to be promoted particularly as it opens alternative fields in which groups such as women and immigrants who are exposed to work power and social discrimination can produce and work (Alund, 2003: 79).

Women's entrepreneurship, has initially grown unnoticed worldwide, has made a great contribution to the development of global economy (Afza et al., 2010, p.111). For instance, in the USA the number of women entrepreneurs increased five times faster than that of men in the 1980's (Loscocco et al., 1991, p.66). However, this progress lasted for a short time. In the following years enterprising firms turned into male -dominant form (Ughetto et al., 2019, p.305). According to the World Bank and OECD data of 2019, the rate of women employers in OECD member countries is 2.1% ( www.stats.oecd.org; www.data.worldbank.org). Furthermore, businesses of women are much smaller than those of men and are intense mostly in retail and service industries in a limited number of industries (Aldrich et al., 1989: 339). Women own 36 % of worldwide small businesses as of 2019 ( www.legaljobsite.net ).When this case is evaluated as regards to Turkey, men constitute 91.3 of every 100 employers, 8.7 of them are women as of 2018. In 2010 the rate of women employers was 6.9 for every 100 people ( www.tuik.gov.tr ).This rate indicates that the rate of women entrepreneurs in Turkey has risen over years. The women entrepreneurs in Turkey own micro businesses. All of the businesses owned by women entrepreneurs operate as family companies (Kagider, 2020).

Entrepreneurs encounter numerous challenges in work life. Nevertheless, women entrepreneurs face these challenges more frequently than men entrepreneurs due to female perception of society and since they have various expectations from them (Batı & Armutlulu, 2020, p.1). Therefore, it is necessary that women should be empowered so as to encourage women in work life and make them participate in active and productive population. In this study, it is aimed to examine whether the support programs provided for women to start a business empower them in various aspects or not. Although various studies were performed on women entrepreneurs in the literature, it is seen that the studies examining the subject within the framework of support programs in terms of women empowerment are limited. Besides, this study will provide proofs related to women entrepreneurship from a developing country like Turkey.

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## 2. Frameworks for women empowerment.

Empowerment is defined as the capacity of a group's or an individual's making effective choices, turning these choices into actions and results (Alsop et al., 2006, p.10). Women's empowerment can be defined as women's having control over their own lives, having equal right to speak as their husbands about issues concerning themselves and their families, having control over financial and other sources, the right to access to knowledge and information, the competence to make independent decisions, getting free from restrictions for physical mobility, the ability of forming equitable power relations within the family (Jejeebhoy & Sathar, 2001, p.688). Malhotra et al., (2002, p.74) proposes that women 's empowerment should be realized in economic, political and psychological dimensions. Still, these dimensions are very wide and there are a range of subfields as coverage in each dimension in which women can be empowered. However, many studies advocated that women could be empowered in only one field, not in the other fields (Hashemi et al., 1996; Beegle et al., 2001; Malhotra & Mather, 1997; Kishor, 1995). In this study women 's empowerment will be handled with its economic, social, political, external communication and network dimensions.

The economic dimension of women's empowerment is their having control over financial sources. This control includes their having a bank account and the right to speak about their own money as well as their financial supports to home by working (Allendorf, 2010, p.266; Furuta & Salway, 2006, p.17; Lawoka et al., 2007, p.776). The level of women's empowerment will vary depending on criteria such as their age, family status, social class they belong to and welfare. Equality and social justice are important factors upon which economic empowerment depend (Golzard, 2020, p.2).

The social dimension of women 's empowerment is generally defined as the access to social sources. Also women's social power can not be separated from the larger structures in the society supporting or restricting women's status or access to sources needed (for instance; husband's occupation, social support networks) (Simon et al., 2002, p.194). The social power of women can be gained through the participation in economic life, social status or social relations with others. For example, the control over the production process or its output protects women 's social power from arbitrary demands and it enhances their roles at the stages of household decisions (Hashemi et al., 1996, p.636).

In the political dimension of women's empowerment, women 's inclusion in political processes and their taking more part in political organisations is the subject. (Stromquist, 2002, p.26). For instance, the ratio of women voters in a region or country or women 's relative representation ratio in local administration councils or the country's political representation bodies (Uphoff, 2002, p.220). In connection with political dimension, it is the arrangement of women rights with the way of reflection to law in the legal dimension. Women 's being entitled with the right of holding a land title deed, inheriting her husband's assets and their ownership as heiress after his death are the first things that come to mind (Stromquist, 2002, p.26; Schuler et al., 2010, p.842).

External communication and forming network in the empowerment dimension are associated with a joint solidarity with other women via networks and partnership, attending the activities supporting the participation of women in work power, acting as a role model for other women (Karki & Xheneyi , 2018, p.531). When networks are investigated in terms of economy and entrepreneurship, they are regarded as a significant defining trait of industrial regions, they connect the firms to the system of consistent and innovative relational commitment, product improvement depending on cooperation and multi-level interorganisations alliances (Staber, 2001, p.537).

**$H_1$:** There is difference between *married and single* in terms of dimension empowerment, women empowerment and finance services: a) economic b) social c) political d) external communication and network e) women empowerment f) finance services.

**$H_2$:** There is difference among *number of children* in terms of dimension empowerment, women empowermen and finance services t: a) economic b) social c) political d) external communication and network e) women empowerment f) finance services.

**$H_3$:** There is difference among different *age* of participation in terms of dimension empowerment, women empowerment and finance services: a) economic b) social c) political d) external communication and network e) women empowerment f) finance services.

**$H_4$:** There is difference among *different education level* of participation in terms of dimension empowerment, women empowerment and finance services: a) economic b) social c) political d) external communication and network e) women empowerment f) finance services.

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*Demirel, Z.H. & Bakirtas, H. pp.97-108*

**H5:** There is difference between *few and much employees* in terms of dimension empowerment, women empowerment and finance services: a) economic b)social c) political d) external communication and network e) women empowerment f) finance services

**H6:** There is difference *between loan and other support type* in terms of dimension empowerment, women empowerment and finance services: a) economic b)social c) political d) external communication and network e) women empowerment f) finance services.

## 3. Research Method

This study was carried out between dates of January 2019 and September 2019. The data have been collected through survey method. To test the hypothesis, a sample of 421 Turkish women entrepreneurship from 39 cities in Turkey were completed the survey.

The study was used finance services and women empowerment measures whose latent indicators are economic, social, political and external communication and networks. Women empowerment and its dimensions were adapted from Chatterjee et al. (2018). Finance services measure was adapted from Salia et al. (2018). Empowerment has 19 items which it is economic (4 items), social (4 items), political (3 items), and external communication and network (8 items) dimensions. Women empowerment factor has 3 items. Finance services have 4 items. All latent indicators was measured using a five point Likert Scale (1= Strongly disagree to 5 = Strongly agree). Cronbach Alpha (α) of all the scales were greater than 0.60 (Bagozzi and Yi, 1988, Hair et al., 1998). The Cronbach Alpha score ranged from 0,63 to 0,87, thus were supported internal consistency of the scales.

**Table 1.** Reliability Analysis

| **Variable** | **Cronbach Alpha** |
|---|---|
| **Economic** | 0,68 |
| **Social** | 0,63 |
| **External communication and network** | 0,67 |
| **Political** | 0,85 |
| **Women empowerment** | 0,67 |
| **Finance services** | 0,87 |

## 4. Data Analysis and Results

*General Statistics*

Sample and business characteristics are reported in Table 2. Of the 421 survey participants, 71% were married. 37 % of sample was 35 and under age. With respect to education, 39% of sample graduated from high school. 45% of respondents have 1 and/or 2 children. 59% participants used other support type for business. 59% of participants have employed 1 and/or 2, 65% are knowledge on internet using and 69% were not used online.

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**Table 2.** Sample and Business Characteristics

| Sample Characteristic | Items | Freguency | *Percentage (%)* |
|---|---|---|---|
| **Marital Status** | Single | 124 | *29* |
| | Married | 297 | *71* |
| **Age** | 35/- | 154 | *37* |
| | 36-42 | 140 | *33* |
| | 43 and over | 127 | *30* |
| **Education** | Primary and secondary school | 125 | *30* |
| | High school | 166 | *39* |
| | University | 130 | *31* |
| **Number of children** | 0 | 113 | *27* |
| | 1-2 | 190 | *45* |
| | 3 and over | 118 | *28* |
| **Type of support** | Loan | 174 | *41* |
| | Others | 247 | *59* |
| **Number of employees** | 1-2 | 249 | *59* |
| | 3 and over | 172 | *41* |
| **Internet Using Skills** | Knowledgeable | 273 | *65* |
| | Less Knowledgeable | 125 | *30* |
| | I do not know | 23 | *5* |
| **Online sales** | Yes | 131 | *31* |
| | No | 290 | *69* |

*Hypotheses Testing*

An independent samples t-test was conducted to explore dimension of empowerment, women empowerment and finance services by comparing the means of marital status, number of employees, type of support. As seen Table 3, there was no significant difference in the scores between two groups for dimension of empowerment and finance services. However, there was a significant difference in the scores between two groups for women empowerment, two-tailed with single scoring higher than married scoring. Only $H_{1e}$ is supported.

As seen Table 4, there was no significant difference in the scores between two groups for dimension of empowerment. However, there was a significant difference in the scores between two groups for women of empowerment, 3 and over number of employees scoring higher than 1 and/or 2 number of employees; for finance services, 1 and/or 2 number of employees scoring higher than 3 and over number of employees. $H_{5e}$ and $H_{5f}$ are supported.

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*Demirel, Z.H. & Bakirtas, H. pp.97-108*

**Table 3**. T-Test Analysis Results according to Marital Status

| Variable | N | Mean | SD | t-value | p-value |
|---|---|---|---|---|---|
| *Economic* | | | | | |
| Married | 297 | 0,27 | 0,16 | 0,353 | 0,72 |
| Single | 124 | 0,28 | 0,17 | | |
| *Social* | | | | | |
| Married | 297 | 0,16 | 0,14 | -0,728 | 0,47 |
| Single | 124 | 0,17 | 0,15 | | |
| *Political* | | | | | |
| Married | 297 | 2,95 | 1,24 | 0,245 | 0,575 |
| Single | 124 | 2,92 | 1,21 | | |
| *External communication and network* | | | | | |
| Married | 297 | 2,48 | 0,63 | -0,186 | 0,85 |
| Single | 124 | 2,49 | 0,75 | | |
| ***Women empowerment*** | | | | | |
| Married | 297 | **0,20** | **0,17** | **-4,128** | **0,00** |
| Single | 124 | **0,27** | **0,16** | | |
| *Finance services* | | | | | |
| Married | 297 | 0,30 | 0,23 | -1,341 | 0,18 |
| Single | 124 | 0,33 | 0,24 | | |

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**Table 4.** T-Test Analysis Results according to Number of Employees

| Variable | N | Mean | SD | t-value | p-value |
|---|---|---|---|---|---|
| *Economic* | | | | | |
| 1 and 2 | 249 | 0,28 | 0,17 | 0,633 | 0,52 |
| 3 and over | 172 | 0,27 | 0,15 | | |
| *Social* | | | | | |
| 1 and 2 | 249 | 0,16 | 0,15 | -0,898 | 0,370 |
| 3 and over | 172 | 0,17 | 0,14 | | |
| *Political* | | | | | |
| 1 and 2 | 249 | 2,97 | 1,27 | 0,561 | 0,575 |
| 3 and over | 172 | 2,90 | 1,17 | | |
| *External communication and network* | | | | | |
| 1 and 2 | 249 | 2,53 | 0,72 | 1,687 | 0,09 |
| 3 and over | 172 | 2,42 | 0,59 | | |
| *Women empowerment* | | | | | |
| 1 and 2 | 249 | 0,20 | 0,17 | -2,073 | 0,04 |
| 3 and over | 172 | 0,24 | 0,17 | | |
| *Finance services* | | | | | |
| 1 and 2 | 249 | 0,38 | 0,23 | -3,291 | 0,00 |
| 3 and over | 172 | 0,25 | 0,23 | | |

As shown Table 5, there was a significant difference in the scores between two groups for external communication and network, other scoring higher than loan scoring, and for finance services, loan scoring higher than other. $H_{6d}$ and $H_{6f}$ are supported.

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*Demirel, Z.H. & Bakirtas, H. pp.97-108*

**Table 5**. T-Test Analysis Results according to Type of Support

| Variable | N | Mean | SD | t-value | p-value |
|---|---|---|---|---|---|
| *Economic* | | | | | |
| Loan | 174 | 0,27 | 0,15 | 0,742 | 0,45 |
| Other | 247 | 0,28 | 0,17 | | |
| *Social* | | | | | |
| Loan | 174 | 0,17 | 0,14 | -0,521 | 0,60 |
| Other | 247 | 0,16 | 0,14 | | |
| *Political* | | | | | |
| Loan | 174 | 2,87 | 1,23 | 1,025 | 0,31 |
| Other | 247 | 2,99 | 1,23 | | |
| ***External communication and network*** | | | | | |
| **Loan** | | | | **3,232** | **0,00** |
| **Other** | **174** | **2,36** | **0,60** | | |
| | **247** | **2,57** | **0,70** | | |
| *Women empowerment* | | | | -0,717 | 0,47 |
| Loan | 174 | 0,22 | 0,16 | | |
| Other | 247 | 0,21 | 0,18 | | |
| ***Finance services*** | | | | | |
| **Loan** | **174** | **0,40** | **0,17** | **-8,043** | **0,00** |
| **Other** | **247** | **0,24** | **0,25** | | |

ANOVA was conducted to determine differences of dimension of empowerment, women empowerment and finance services according to age, education, number of children of participants. The factors of external communication and finance services were statistically different according to age. The results of the ANOVA analysis showed significant differences between Group 1 and Group 3 in terms of external communication and network. A significant differentiation was found between Group 1 and other groups (Group 2 and Group 3) in terms of finance services. The ANOVA results, support $H_{3d}$ and $H_{3f.}$

**Table 6.** Anova Analysis Results of Age

| Factors | Group 1<br>35 and under<br>Mean/SD | Group 2<br>36-42 age<br>Mean/SD | Group 3<br>43 and over age<br>Mean/SD | *F*-value | *p*-value | Differ |
|---|---|---|---|---|---|---|
| Economic | 0,25 (0,23) | 0,28 (0,22) | 0,29 (0,24) | 2,021 | 0,134 | - |
| Social | 0,17 (0,14) | 0,16 (0,14) | 0,17 (0,14) | 0,309 | 0,734 | - |
| Political | 2,95 (1,19) | 2,92 (1,32) | 2,95 (1,76) | 0,015 | 0,985 | - |
| **External communication and network** | **2,41 (0,66)** | **2,43 (0,64)** | **2,62 (0,70)** | **4,094** | **0,017** | **Group 1 and 3** |
| Women empowerment | 0,23 (0,15) | 0,21 (0,18) | 0,21 (0,18) | 0,679 | 0,508 | - |
| **Finance services** | **0,35 (0,23)** | **0,29 (0,22)** | **0,27 (0,24)** | **5,217** | **0,006** | **Group 1 and 2**<br>**Group 1 and 3** |

As shown Table 7, there was a significant difference between Group 1 and other groups in terms of economic, external communication and network and finance services. A significant differentiation was found between Group 1 and Group 2 in terms of political dimension. The ANOVA results, Table 7, support $H_{4a,c,d,f}$.

**Table 7.** Anova Analysis Results of Education

| Factors | Group 1<br>Primary and secondary school<br>Mean/SD | Group 2<br>High school<br>Mean/SD | Group 3<br>university<br>Mean/SD | *F*-value | *p*-value | Differ |
|---|---|---|---|---|---|---|
| **Economic** | **0,31 (0,17)** | **0,26 (0,16)** | **0,26 (0,16)** | **3,336** | **0,038** | **Group 1 and 2**<br>**Group 1 and 3** |
| Social | 0,17 (0,14) | 0,16 (0,14) | 0,17 (0,14) | 0,067 | 0,936 | - |
| **Political** | **3,18 (1,18)** | **2,77 (1,34)** | **2,91 (1,14)** | **4,196** | **0,016** | **Group 1 and 2** |
| **External communication and network** | **2,69 (0,72)** | **2,73 (0,65)** | **2,30 (0,59)** | **11,805** | **0,000** | **Group 1 and 2**<br>**Group 1 and 3** |
| Women empowerment | 0,22 (0,17) | 0,21 (0,17) | 0,22 (0,16) | 0,040 | 0,961 | - |
| **Finance services** | **0,24 (0,23)** | **0,30 (0,23)** | **0,38 (0,22)** | **12,372** | **0,000** | **Group 1 and 3**<br>**Group 2 and 3** |
| Poor family cohesion | 0,21 (0,18) | 0,22 (0,19) | 0,19 (0,17) | 0,743 | 0,476 | - |

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*Demirel, Z.H. & Bakirtas, H. pp.97-108*

As seen Table 8, there was a significant difference between Group 1 and other groups in terms of women empowerment. $H_{2e}$ is supported. The findings indicate that they have more empowerment, no children of participants.

**Table 8.** Anova Analysis Results of Number of Children

| Factors | Group 1<br>0<br>Mean/SD | Group 2<br>1-2<br>Mean/SD | Group 3<br>3/+<br>Mean/SD | *F*-value | *p*-value | Differ |
|---|---|---|---|---|---|---|
| Economic | 0,27 (0,16) | 0,28 (0,16) | 0,27 (0,16) | 0,123 | 0,884 | - |
| Social | 0,18 (0,15) | 0,16 (0,14) | 0,16 (0,13) | 1,237 | 0,291 | - |
| Political | 2,97 (1,18) | 3,05 (1,27) | 2,78 (1,20) | 1,726 | 0,179 | - |
| External communication and network | 2,47 (0,69) | 2,50 (0,64) | 2,46 (0,69) | 0,129 | 0,884 | - |
| **Women empowerment** | **0,29 (0,15)** | **0,20 (0,17)** | **0,17 (0,17)** | **16,426** | **0,000** | **Group 1 and 2**<br>**Group 1 and 3** |
| Finance services | 0,35 (0,24) | 0,30 (0,23) | 0,28 (0,24) | 2,657 | 0,071 | - |
| Poor family cohesion | 0,21 (0,13) | 0,21 (0,20) | 0,21 (0,19) | 0,052 | 0,949 | - |

**Table 9.** Correlation Matrix

| | Marital status | Number of employees | Type of support | Education | Number of children | Finance services | Women empower-ment | Social | Economic | External com.and network | Political | Age |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marital status | 1 | | | | | | | | | | | |
| Number of employees | 0,067 | 1 | | | | | | | | | | |
| Type of support | 0,05 | ,137** | 1 | | | | | | | | | |
| Education | ,211** | ,249** | ,142** | 1 | | | | | | | | |
| Number of children | -,635** | -,098* | -0,026 | -,367** | 1 | | | | | | | |
| Finance services | 0,067 | ,159** | ,333** | ,241** | -,111* | 1 | | | | | | |
| Women empowerment | ,150** | 0,094 | 0,039 | 0,004 | -,214** | 0,04 | 1 | | | | | |
| Social | 0,027 | 0,056 | 0,034 | -0,004 | -0,047 | -0,008 | ,377** | 1 | | | | |
| Economic | 0,011 | -0,044 | -0,042 | -,125* | -0,01 | -,210** | ,315** | ,432** | 1 | | | |
| External com. and network | -0,018 | -,098* | -,147** | -,229** | 0,009 | -,405** | ,276** | ,336** | ,484** | 1 | | |
| Political | -0,015 | -0,023 | -0,056 | -0,09 | -0,038 | -,166** | ,180** | ,273** | ,289** | ,436** | 1 | |
| Age | -,325** | -,160** | -0,093 | -,420** | ,484** | -,150** | -0,025 | -0,007 | ,119* | ,138** | 0,003 | 1 |

** Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level

## 5. Conclusion and Implications

This study has examined whether the support programs provided for women to start a business empower them in various aspects or not. The support programs help women to get better economic status and the programs are their empowerment. The study demonstrates that level of education, finance services, economic, external communication and network are interlinked. Also, there is a relationship type of support and level of education. Moreover, there is a positive relationship between women empowerment and marital status. However, there is a negative relationship between women empowerment and number of children. The study has shown that type of support, finance services and external communication and network are interlinked.

The study has some limitations. First, the study carried out in Turkey. Second, questionnaire was applied to women entrepreneurship. Third, data was no collected longitudinal research. Lastly, this study is not to examine cultural context.

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25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Terziev, V. & Klimuk, V. pp.109-112*

# Evolution of the concept of innovative youth entrepreneurship development

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**Abstract**

This research proposes a developed format of a survey of young people about innovative youth entrepreneurship. It provides mechanisms used for the development of youth start-up movement. Based on the interpretation of the obtained results from the respondents, certain proposals were defined to solve the identified problematic issues and improve measures of stimulating innovative youth entrepreneurship in the country.

***Keywords:*** evolution, innovation, entrepreneurship development.

***Jel Codes:*** P00, I20

## 1. Introduction

Studying theories about entrepreneurship and, in particular, innovative youth entrepreneurship helps determine main factors that influence the performance of economic and social potential of the country`s regions, engage young people to solving economic issues of the country, implement innovative potential of scientific and educational institutions in cooperation with the business sector and the real sector of the economy in order to enhance competitiveness of the country.

## 2. Evolution of the concept of innovative youth entrepreneurship development

English economist R. Cantillon (1680-1734) was the first person to describe entrepreneurship in his works. Entrepreneurship, according to him, is any activity aimed at making a profit and the one that involves risk. The main feature of an entrepreneur is willingness to take risk.

English economist A. Smith (1723-1790) introduced the idea of free enterprise system. He characterized the entrepreneur from the standpoint of an economist, i.e. a rational, selfish person whose plans are guided by the principle of obtaining maximum benefit. Such "economic selfishness" forces manufacturers to produce goods that consumers need at the lowest possible price (producing more and better quality goods at lower prices) (Paevskaya, 2014).

French scientist J.B. Say (1767-1832) defined entrepreneurship as the process of operating with the factors of production - extracting them from a place or area where they give little income, then moving and combining them in another place or area where they give the greatest income.

A. Marshall (1842-1924) used the concept of a combination of factors within the framework of the principle he developed – substitution of one combination of factors for another. In other words, the former, less productive combination of factors, at a certain stage, would be replaced by a more perfect one, which would result in competitiveness, profitability, and sustainability.

F. Hayek (1899-1992) and L. Mises (1881-1973) considered entrepreneurship as one of the main resources of the economy, together with land, capital, labour, information and time. They expressed the idea of entrepreneurial activity as a way towards balance. F. Hayek and L. Mises considered entrepreneurship as a process of developing ideas.

J. A. Schumpeter (1883-1950) also reached important conclusions in his studies of entrepreneurial activity. His concept focused on the innovation in the activity of an entrepreneur. The results of entrepreneurial activity are the changes in the material content, forms and methods of labour not only in production, but also in other spheres. In his theory of economic development J. A. Schumpeter emphasizes the role of an entrepreneur-innovator as a creator of new combinations of factors of production, new products, markets and technologies.

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Peter F. Drucker (1909-2005) points out the specific peculiarity of the entrepreneurship - to accelerate economic processes. According to him, business is constantly changing, looking for something new to meet the needs of various market segments. On the one hand, based on their activity, initiative, competitiveness, diversification and specialization entrepreneurs strive to disturb the existing equilibrium on the market, but on the other hand, they try to achieve a new balance between demand and supply, positive feedback from buyers and partners and sustainable development.

Some European scholars studying the issues of entrepreneurship, in particular youth entrepreneurship, who deserve to be mentioned are V. Terziev, A. Lazdinsh, A. Zvirble, J. Timanovsky, O. Prokopenko, and others; and some Asian scholars include Zhao Feng, Wu Pute, Wei Feng, etc (Terziev and Klimuk, 2021b; 2021c; 2021d; 2021e; 2021f; 2021g).

There are also prominent national economists who study entrepreneurship, such as L.I. Abalkin, N.N. Zarubina, T.I. Zaslavskaya and others (2021a).

Some of the prominent Belarusian scientists researching the essence of entrepreneurship, incl. innovative entrepreneurship, its mechanisms for effective implementation, entrepreneurial culture, are Shimov V.N., Baynev V.F., Khatskevich G.A., Pelih S.A., Yasheva G.A. and etc.

Thus, studying entrepreneurship from different points of view allows us to systemize the conceptual aspects by the peculiarities of entrepreneurship development within the main economic theories that reflecting the tendencies of transition to a new direction in entrepreneurship - innovative youth entrepreneurship (French, English, German, American economic theories: from 1680 to 2005, national theories: from 1930 to present).

The concept of "entrepreneurship" is defined in the laws of many countries, incl. in Belarus and Russia: in the Law of the Republic of Belarus about Entrepreneurship in the Republic of Belarus, in the Civil Code of the Russian Federation (Fig. 1).

The period of research of J. Schumpeter, P. Drucker mark the beginning of innovative entrepreneurship. It is considered that the application of the principles of innovative development started with the introduction of legislative acts in the United States: Bayh-Dole Act (Federal law No. 96-517) and Stevenson-Weidler Act (Federal law No. 96-418), enacted in 1980. Both these acts aimed at stimulating commercialization of research and developments that were financed or developed by the government.

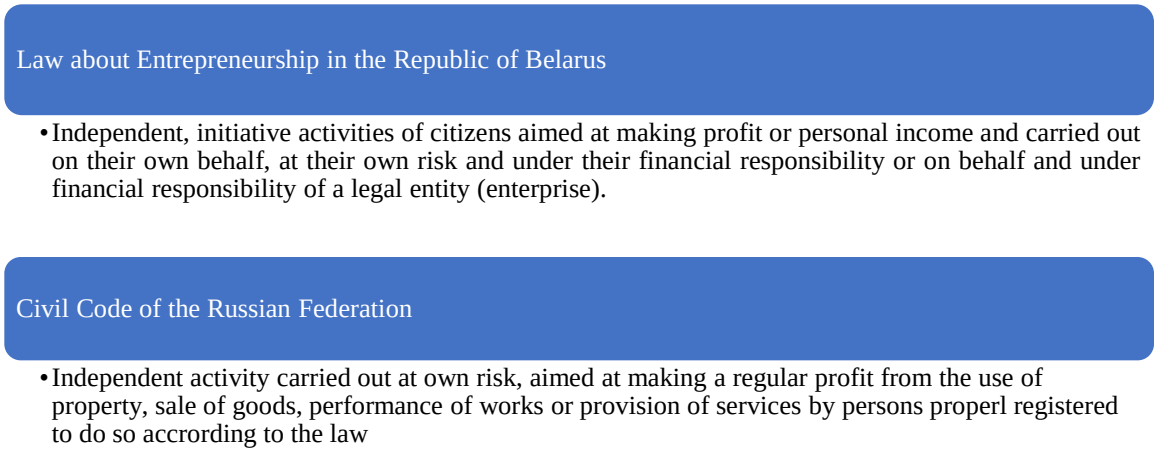


**Figure 1.** Definition of "entrepreneurship" in legal documents

**Source:** Authors

It is important to point out a separate area in the study of entrepreneurship, innovative youth entrepreneurship that determines the effective use of the scientific and technological innovative potential of young people in solving the social and economic issues of the country. Officially, it is considered that the development of youth

entrepreneurship began in 2009 with the introduction of a legislative act about the creation of small enterprises at the universities and scientific institutions - federal law of the Russian Federation No. 217-FZ dated 2 August 2009 about amendments to certain legislative acts of the Russian Federation concerning creation of economic societies by budgetary scientific and educational institutions for the purposes of practical application (implementation) of intellectual activity results. In Belarus the innovative youth entrepreneurship officially began in 2017, in accordance with the Ordinance of the Minister of Education No. 757 dated 1 December 2017 about improving activities of higher education institutions based on the University 3.0 Model.

For the development of entrepreneurship, in particular innovative youth entrepreneurship, Belarus since 2012 is actively implementing plans for startup events, the successful realization of which is coordinated by the Ministry of Economy.

The results of the Global University Entrepreneurial Spirit Students' Survey of entrepreneurial potential carried out in 2018, show that there are positive changes in the development of entrepreneurial education comparing to the results of 2016. The answers of the respondents - young people of Belarusian universities - demonstrated an increase of the indicators of business education - increase from 10,2% in 2016 to 16,6% in 2017; special entrepreneurship programmes - increase from 4,1% in 2016 to 4,3% in 2018).

Development of innovative entrepreneurship, including youth innovative entrepreneurship, dictates the need to create a unified approach to the definition of the concept itself, which both in the country and abroad is not legally enshrined. Also, this concept is not described in scientific research of national and foreign scientists. We have an idea of only some of its components, like "innovative entrepreneurship", "youth entrepreneurship" and "student entrepreneurship".

## 3. Conclusion

Therefore, this research helps draw the following conclusions (Terziev and Klimuk, 2021h; 2021i):

- The development of entrepreneurship is presented in an evolutionary way.
- There is no official accepted definition of a concept "innovative youth entrepreneurship". An attempt has been made to define the concept.
- A flexible regulatory framework has been developed to stimulate the implementation of youth initiatives, which requires further development of entrepreneurial innovative initiatives of young people, taking into account international cooperation.
- A new direction of development of innovative youth entrepreneurship focused on start-up projects has been initiated.

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*Zahariev, A. & Simeonov, S. & Zaharieva, G. pp.113-120*

# Management motivation and capital creation through employee stock options - International evidences under covid-19 circumstances[1]

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## Abstract

Successful corporate management requires rational coherence between financial management and human resource management, where the ability to skilfully apply the tools of motivational policy is important. Under COVID-19, companies faced the danger of losing valuable employees due to leaving. Therefore, in search of new methods for motivating and retaining staff, the research question of this study is to justify the benefits of implementing Employee Stock Options (ESO) as a technique for staff motivation in a pandemic environment based on capital formation rules. The results of a survey in the pandemic year 2020 among employers in Romania, Bulgaria and Kosovo confirm the interest in innovations in motivating staff to counter the increasing employee exiting and staff turnover trends.

***Keywords:*** Capital creation; Employee stock options; Management motivation; Covid-19.

***Jel Codes:*** E24, G32, J24, O15

## 1. Introduction

The remuneration policy in a company can be considered as a central among the activities of HR management. Wages together form the total cost of human resource and the natural goals of economic efficiency. Profit maximization is seen as an incentive to minimize labour costs. At the same time, attracting competent employees and capable workers, raising their qualifications and retaining specialists require attractive pay and investment in human capital. Motivational policy occupies a key place among this set of decisions. Covid-19 created a huge problem for many companies to retain their qualified employees in conditions of declining sales and cash flow shortages. Against this background, the ability to reduce staff turnover through alternative motivation techniques is the right solutions for corporate management. Therefore, the research problem is linked to the benefits of Employee Stock Options (ESO) as a technique for staff motivation in a pandemic environment. The aim of the study is to investigate the relationships between staff motivation and turnover combined with share capital formation and profit maximization.

## 2. Literature review and development hypothesis

### *2.1. The concept of financial management of human resource*

Among the methods for permanent (long-term) engagement of employees with the prosperity of the company is the well-known in corporate practice and financial theory method of paying bonuses in shares. Employee Stock Options (ESO) can be defined as an advanced motivational tool for providing staff with call options on the company's shares.

In a study of labour market processes in the United States, and in particular the phenomenon of "wage-puzzle" in the last decade of the twentieth century, Hamid Mehran and Joseph Tracy analyse the relationships between a series of events, including: economic growth accompanied by accelerated demand for higher salaries, the preconditions for inflationary growth created by these processes, the changes in the nominal compensation per

[1] **Acknowledgements:** This research was financially supported by the Academic Foundation "Prof. Dr. Minko Rousenov", Svishtov, Bulgaria (Grant No. 1001007) and the Institute of Scientific Research at D. A. Tsenov Academy of Economics, Svishtov, Bulgaria.

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hour (CPH), etc., emphasizing the importance of bonuses in call options (Mehran & Tracy, December 2001, p. 17). In a critique of the theory „principal-agent" (McColgan, 2001) both authors argue that "in their present form, most ESOs (including indexed ESOs) are not an efficient method of compensating or motivating employees"!? Notwithstanding, cash bonuses remain the most traditional technique. The method is simple, measureable and based on popular accounting approach for calculation and distribution among the staff of cash as an extra remuneration. Obviously, staff motivation is a territory where financial management and HR management could complement each other in the name of common objectives. Thus, the relation between company wealth maximization and the available plans for HR motivation is much clearer and more defensible (Fig. 1).

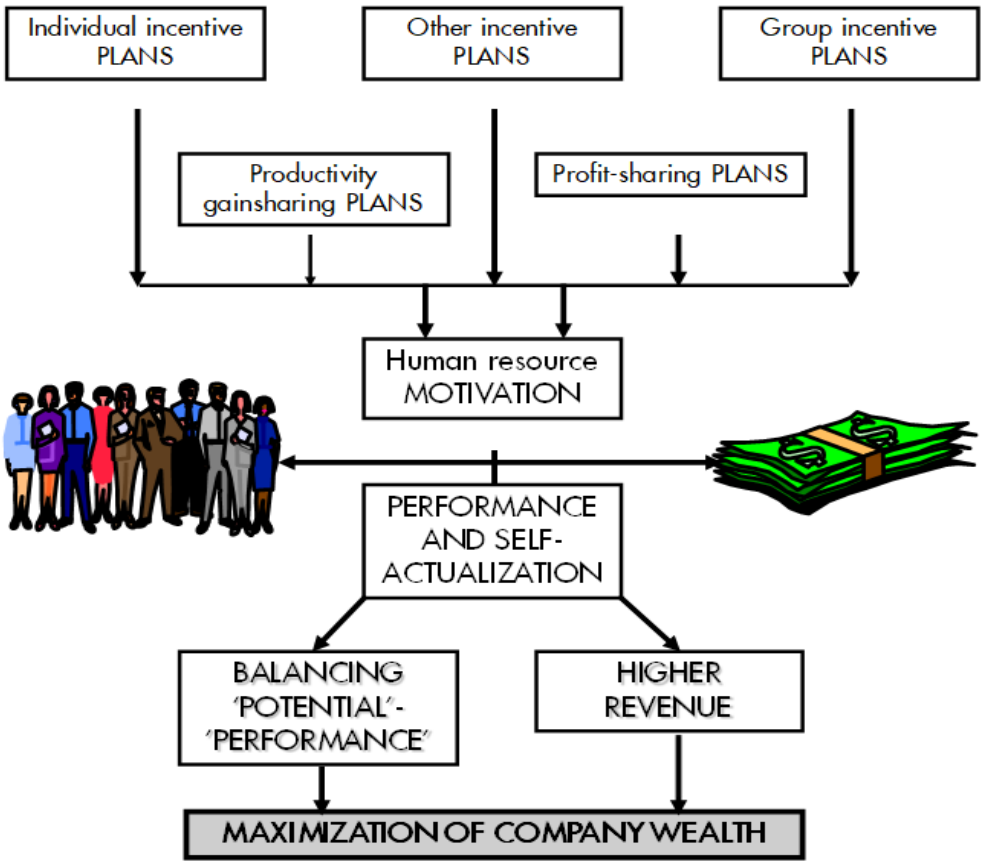


**Figure 1.** Human resource incentive plans in the company

**Source**: (Zahariev, 2012, p. 198)

The logic of the author is based on a new financial approach to HR management known as "Financial management of human resources". It is based on the concept that "…*the financial management of human resources in the company aims to develop and propose a rational system of interlinking between the costs and contributions of personnel to source formation by identifying the cost of human resources and their sources of finance*." (Zahariev, 2012, p. 129). In this respect, the opportunities to counter the employee turnover factors seems more closely related to capital formation. (Zhang, 2016) It is the change of status from employee to owner that is key to overcoming the traditional principal-agent conflict. The combination of the employee's role of payroll beneficiary with the role of shareholder, who works both for his dividends but also for a higher stock value of the shares is fundamental for establishing a stable attitude for positive motivation among staff. In this way, companies acquire a new role in society. (Terziev, 2019) The employees of the company are also its owners, stockholders, and members of the General Shareholders' Meeting. Of course, the acquisition of shares and stock options as a technique to motivate staff and combat turnover has its objective limitations as well. Some of them are related to the degree of development of the capital market, the regulatory framework, but especially to the desire of the current owners to allow their employees to become owners, be it of minority shares.

**www.rsepconferences.com CONFERENCE PROCEEDINGS/FULL PAPERS ISBN: 978-605-70583-3-1/September 2021**

*Zahariev, A. & Simeonov, S. & Zaharieva, G. pp.113-120*

*2.2. Prerequisites for the application of call options in motivating staff*

The application of call options in the motivational policy requires the prior fulfilment of several conditions, most of which are in the field of financial management of the company. The existence of a developed financial market with an option exchange is also an inevitable condition. In particular:

First, the company must be of the joint-stock type.

Second, the company must also be public - i.e. its shares must be traded on an official market - stock exchange.

Third, there should be a need and opportunity to increase the company's capital, as well as a planned SPO (secondary public offering) of shares.

Fourth, there should be an organized and functioning exchange or over-the-counter (OTC) derivatives market, and in particular options. This includes the existence of an established market organization: option exchange, option segment or OTC market, clearing system. This condition is available for a large number of companies in developed economies and their financial markets. Romania also has two well-functioning derivatives exchanges - in Bucharest for financial derivatives and in Sibiu for commodities. Unfortunately, the Bulgarian investment community still fails to gather enough investment interest and organizational potential for the establishment and operation of an exchange or over-the-counter option or other derivative market. This important condition applies to traditional options, but Mehran and Tracy point out that the options in the staff bonus tool are not tradable (Mehran & Tracy, December 2001, p. 19).

Fifth, in order to issue and trade options based on the shares of a particular company, the option exchange sets a number of requirements (minimum number of shares in the issue, minimum free-float percentage, financial reputation, etc.), which generally represent the corporate conditions to ensure a good market liquidity of the shares. In case the options are not tradable, they are not essentially derivative instruments and hence they may not meet these requirements.

Once these basic conditions are in place, we can look at the specifics of the scheme for using call options to motivate staff.

*2.3. The motivational mechanism of providing call options*

As is well known, call options are a derivative instrument that gives its holder the right to purchase an asset (in this case shares) until a certain date at a certain price. Zahariev, A. points out that “the incentive scheme includes the granting of all or only a certain category of them (in most cases referring to the management of the company) the right to purchase after a certain date, a certain number of ordinary shares below a certain price. The researcher further adds that "the number of shares that are provided for purchase depends on the individual status and the real contribution of the respective employee to the prosperity of the company") (Zahariev, 2012, p. 198).

The application of call options as a motivational tool can be considered as a "set" of three main components. First, this is the possibility itself - a right, but not an obligation (contained in the option as a contingent derivative) to acquire shares - i.e. a share of the company's capital. Second, the price of this acquisition is announced as preferential due to the expectation that the spot price of the shares after the new issue will be higher than the purchase price offered to the staff - through the exercise price of these call options. Third, the option as a derivative, i.e. a marketable instrument, provides its holder with a convenient opportunity to sell.

The amount of the bonus provided in call options is directly measurable through the option premium - the price of the option contract, which is formed in exchange or OTC trading.

In the practice of motivational tools for staff, call options are known as "Employ Stock Options" (ESO). Gregory Vermeychuk notes two varieties: Non-Qualified Stock Option (NQSO) or an Incentive Stock Option (ISO) (Vermeychuk, 2013).

In addition to these key aspects of call option motivation, some key differences between traditional options and options used as incentive tools, as well as the associated benefits for the staff and the employer and the potential risks, should be pointed out.

**www.rsepconferences.com CONFERENCE PROCEEDINGS/FULL PAPERS ISBN: 978-605-70583-3-1/September 2021**

*Zahariev, A. & Simeonov, S. & Zaharieva, G. pp.113-120*

*2.4. Differences between traditional options and staff motivation options*

Long before the Covid-19 pandemic, a distinction was made between traditional options and ESO. In practice, ESOs have characteristics that lose their essence as a derivative instrument, which is why they differ significantly from traditional options. Mehran and Tracy point to the following significant limitations (Mehran & Tracy, December 2001):

- The Employ stock options are not a market traded instrument;
- „The employee stock options are subject to vesting requirements and tend to have a significant time period until expiration … over two to five years". Gregory Vermeychuk adds, the deferral period can be 2 or three years, and the exercise period can reach 10 years. (Vermeychuk, 2013);
- „An employee must exercise any vested in-the-money options prior to leaving the firm";
- „Any nonvested or out-of-the-money options must be forfeited upon termination of employment.

As can be seen, the options in the staff incentive mechanism have very limited characteristics compared to traditional options, which deprives them of the most essential characteristics of derivative instruments. However, Hiroki and Okuma note that marking (marking-to-market value) uses traditional options from the same or the nearest option series traded on the market. (Hiroki and Okuma, 2009, p. 7). Given this, their advantages and risks are of interest both to their holders and to the publishers - the employer.

*2.5. Attractiveness of ESO for employees and workers*

A key point in the application of call options in the incentive mechanism is their characteristics as a financial derivative, which makes the options significantly more attractive than the direct provision of shares.

- Employees get the opportunity to acquire the status of shareholders (co-owners) in the company at a preferential price, if they already own shares, this increases their position - respectively commitment;
- Derivatives, and especially exchange traded, are characterized by the highest degree of market liquidity among all investment instruments. As a result, the right to purchase shares at a preferential price can be easily and immediately redeemed by selling the relevant option contracts - in case the holder has a preference for liquidity over acquiring the underlying shares. As mentioned above, this feature is omitted if corporate options are non-tradable.

*2.6. Advantages for the company when motivating through call options*

When applying motivation through call options, the management team and the main shareholders of the company achieve several goals simultaneously:

First, the acquisition of shares by employees makes them empathize in the long run with the main goal of financial management - the maximization of corporate wealth, whose direct measure (though not the only one) is the stock market value (i.e. market capitalization).

Second, the issuance of call options based on an upcoming issue of shares is an established advertisement for the increase of the company's capital, which contributes to the successful placement of the issue. Good investor interest leads to a higher issue price. The increased issue price in the process of primary placement in turn increases the price of call options.

Third, the payment of direct cash remuneration is an expense that reduces the company's net profit. On the other hand, the unallocated and reinvested cash resources increase the company value, which is reflected in the capitalization of its shares. All shareholders benefit from the latter (Lang, Poulsen and Stulz, 1995).

Fourth, the known leverage effect when investing in options in this case will be beneficial to the issuer - i.e. the company applying this bonus instrument. The company provides an option whose price is a small part of the value of the underlying shares in the contract. At the same time, when exercising the call option, its holder pays the exercise price (exercise / strike price) multiplied by the respective number of shares, thus making his contribution to the increase of the company's capital. This element of motivation through options contains the significant advantage for the employer company to provide shares directly, which is a reinvestment of already formed monetary resources (retained earnings) whose share is provided to employees.

**www.rsepconferences.com CONFERENCE PROCEEDINGS/FULL PAPERS ISBN: 978-605-70583-3-1/September 2021**

*Zahariev, A. & Simeonov, S. & Zaharieva, G. pp.113-120*

*2.7. Risks related to the application of call options in the motivational policy*

Applying the bonus instrument by handing out call options also contains some risks that should not be overlooked.

For call option holders, the only possible risk is the possibility that at maturity (or until maturity - in the American style options) the spot price of the company's shares will be lower than the exercise price. In this case, the call option has no value and expires useless. Mehran and Tracy emphasize that this creates a motive for early exercise of call options, which can be attributed to underlying stocks with greater volatility (Mehran and Tracy, 2001).

As for the company or its majority shareholders, where the call options used are a full-fledged derivative instrument (and not non-tradable according to the characteristics of Mehran and Tracy), there is a real risk of distraction when selling the option which can be exercised by an investor who is not an employee of the company. The secondary sale of shares by employees through the stock exchange has the same effect and can be avoided when issuing registered shares (which also has its advantages and disadvantages for their holders).

## 3. Research Methodology

The Covid-19 pandemic has created problems for companies, but it also created opportunities. In virtually all countries, social solidarity and support have taken precedence over the danger of loss of life and disability of the workforce. In this situation, the traditional methods of motivating staff were left in the background, incl. and due to objective reasons - lack of funds for the payment of motivational bonuses, threat to the very survival of the company due to broken supply chains (Laktionova and others, 2019) or shrinking markets. In many countries, government policies have been implemented to directly support businesses in their job retention requirements (Sabitova and others, 2020b). The European Commission has derogated the rules on financial discipline and allowed deficit financing and public debt issue (Zahariev and others, 2020a) above the pandemic limits (Zahariev and others, 2021a). The corporate financial planning standards (Deneva and Grasic, 2020) and the annual objectives of the general meetings of shareholders before the financial management in terms of share price, profit and related P/E ratios were also adapted to the crisis situation (Terziev and others, 2021b). Just several sectors of the economy improved their performance and continued to growth (as pharmaceuticals, insurance (Zahariev and others, 2020d), digital education (Zahariev and others, 2021c) and training (Zahariev and others, 2021d), deliveries by couriers, data processing, etc.).

In this complex situation for businesses, households and governments, a survey was conducted among companies from Romania, Bulgaria and Kosovo. The aim was to establish the relationship between staff turnover in Covid-19 conditions and staff motivation policies, including the issue of rights to acquire shares/equity units. The study period was during the first wave of Covid-19 with the onset and development of the pandemic - late 2019 and early 2020. The sample included 134 companies from Bulgaria, 101 companies from Kosovo and 135 companies from Romania (Table 1).

**Table 1.** Survey results of staff incentives techniques: Bulgaria, Romania, Kosovo

| Incentives technique | Bulgaria | Romania | Kosovo |
|---|---|---|---|
| Bonuses in cash | 62.65% | 74.07% | 70.58% |
| Shares and/or stocks | 1.84% | 3.70% | 1.96% |
| Recurrent training | 26.72% | 18.52% | 2.94% |
| Team building | 28.56% | 44.44% | 9.80% |
| Food vouchers | 34.09% | 51.85% | 0.98% |
| Sport passes | 9.21% | 14.81% | 0.98% |
| Certificates for appraisal | 12.90% | 7.41% | 6.86% |
| Flexible working hours | 31.32% | 48.15% | 7.84% |
| Supplementary health insurance | 9.21% | 44.44% | 0.98% |
| Other | 0.92% | 0.00% | 4.90% |
| Average percentage of positive answers | 21.74% | 30.74% | 10.78% |

**Source:** Authors

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*Zahariev, A. & Simeonov, S. & Zaharieva, G. pp.113-120*

The results of the survey confirm the leading position of "Bonuses in cash" compared to all other incentive techniques. For Bulgaria and Romania "Food vouchers" ranks second with 34.09% and 51.85%, respectively, while in Kosovo the second best choice is "Team building". For all three countries, motivation through the provision of "Flexible working hours" ranks third. When calculating the arithmetic mean of all given positive answers for the ten defined motivational techniques Romania ranks first with 30.74%, followed by Bulgaria with 21.74% and Kosovo with 10.78%. This corresponds to the ranking of the three countries in terms of GDP per capita and shows that the variety of techniques for motivating staff increases in parallel with the degree of economic development (Table 2).

**Table 2.** GDP per capita in Euro of EU27, Bulgaria, Romania and Kosovo (2019-2020)

| | 2019 | 2020 |
|---|---|---|
| European Union - 27 countries (from 2020) | 31.250 | 29.810 |
| Bulgaria | 8.770 | 8.740 |
| Romania | 11.490 | 11.280 |
| Kosovo | 3.946 | 3.828 |

**Source:** (Eurostat, 2021), (Central Bank of the Republic of Kosovo, 2021) (The World Bank, 2021)

Nevertheless, the three surveyed countries remain far from the examples of the United States, where it was through the assessment of rights to buy shares in the worst days of the pandemic that Elon Musk was ranked by Forbes as the richest man on the planet. At the beginning of 2021, the wealth of the entrepreneur connected with Tesla and SpaceX reached 188 billion USD (annual growth of 548%) thanks to his landmark 2018 compensation package (Theo, 2021).

## 4. Conclusion

The results of a survey in 2019-2020 among employers in Romania, Bulgaria and Kosovo confirm the interest in innovations in motivating staff to counter the process of losing human capital and staff turnover. The leading positions of "Cash bonuses" as incentives techniques is complemented by other motivational techniques of different intensity. The moderate frequency of application in the sample logically corresponds to the level of economic development of Romania, Bulgaria and Kosovo in terms of GDP per capita. In conclusion, we can emphasize that ESOs are characterized by some elements that lose their essence as a derivative instrument and differ significantly from traditional options. At the same time, the application of call options as a tool of motivational policy in personnel management is an opportunity with many advantages, which benefit a large number of companies operating in today's financial markets. Under Covid-19 circumstances the attractiveness of staff motivation through ESO logically will advance positions at the expense of the historically most popular incentive plan – the cash bonuses.

**www.rsepconferences.com CONFERENCE PROCEEDINGS/FULL PAPERS ISBN: 978-605-70583-3-1/September 2021**

*Zahariev, A. & Simeonov, S. & Zaharieva, G. pp.113-120*

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*Zahariev, A. & Simeonov, S. & Zaharieva, G. pp.113-120*

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**22nd RSEP** International Economics, Finance & Business Conference – Virtual/Online
25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Savu, N. A. pp.121-129*

# Creative accounting: Inside and outside the fiscal rules

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## Abstract

The disadvantage of using government balance as a budget target systems from the major negative impact of investment spending on the government balance, even if by definition, investments will be able to generate revenue in the future. The analysis of government deficit and debt data over the last 20 years has shown that government deficit and debt targets have often been exceeded in Romania, either because of the financial crisis or as a result of inefficient fiscal policies. Therefore, Romania has been constrained by the excessive deficit procedure to generally implement budgetary austerity measures to comply with the fiscal criteria on government deficit and debt stipulated in the Treaty on the Functioning of the European Union. As revenues were limited and the deficit had to be reduced immediately, expenditures were reduced and capital expenditures were most affected, especially gross fixed capital formation. Eurostat accounting rules (ESA 2010 methodology) were not only the basis for EU Member States reporting in the context of fiscal surveillance, but also behind national fiscal policy decisions taken by the government due to fiscal constraints imposed by Maastricht fiscal criteria. In this paper are included some proposals in the context of Romanian economy on how to use national accounts methodology (ESA 2010) in order to avoid fiscal impact of some fiscal policy measures.

***Keywords:*** National accounts, European System of Accounts (ESA 2010), government deficit and debt, investments, fiscal policy.

***Jel Codes:*** H3, H5, H6, E62

## 1. Introduction

Statistics are data, and the best decisions are made based on information. Article no. 126 of the Treaty on the Functioning of the European Union (TFUE) obliges Member States to avoid excessive deficits (government deficit higher than 3% of GDP and government debt higher than 60% of GDP). It also stipulates the creation of the "excessive deficit procedure" (EDP) to identify and correct the excessive deficit and debt in the Member States. The TFUE also stipulates the possibility of financial sanctions for Member State in excessive deficit procedure. In 1999, the Stability and Growth Pact (SGP) entered into force, which makes fiscal rules more flexible and promotes economic growth through medium-term sustainable public finances. The Excessive Deficit Procedure (EDP) Notification reflects data and correlations between the two most important indicators of public finance statistics, the government deficit and the government debt, respectively. Although the 2008 sovereign debt crisis highlighted the importance of the quality and transparency of statistical reporting for better monitoring and assessment of fiscal discipline, Schumesch et al. (2012) note that at the same time in the context of fiscal rules in place at European level, the financial crisis has pushed governments to use various accounting tricks (to hide loans or defer payments) to reduce the government deficits and debt, improving therefore only apparently fiscal indicators in the absence of a fiscal consolidation in essence.

## 2. Fiscal and accounting rules on government finance statistics at European level

Government Finance Statistics (GFS) contain key indicators for determining the health of the public finance of EU Member States. The importance of the general government sector in the economy could be measured by the total revenue and expenditure of general government as a percentage of GDP. The difference between government revenue and government expenditure shows either a surplus when revenues are higher than expenditures or a deficit when expenditures exceed revenues.

The TFUE indicates the System of National Accounts (ESA) as the statistical methodology behind the compilation of the government deficit and debt. Fiscal monitoring at European level could not be performed without consistent and comparable data, and national accounts are the best accounting framework, internationally comparable with the System of National Accounts (SNA 2008) issued by the United Nations. European GFS are currently compiled

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in accordance with ESA 2010, a common system of concepts, definitions, classifications and accounting rules, included in Regulation (EU) no.549 of 2013. Therefore, ESA methodology has direct and obligatory application in EU Member States, Eurostat being the guardian of its implementation. The GFS are the radiography of the implementation of the government's fiscal policy and the result of the economic activities carried out by the government sector. Eurostat issued in 1970 for the first time the ESA standards. ESA 2010 is the forth edition of the European standard for compiling the national accounts, including the GFS.

Eurostat decisions clarifying or setting out the conditions for the recording of entities or assets outside the general government have influenced Member States to create real engineries, schemes and prototype entities to avoid the impact of various expenditures on the government deficit or of various forms of financing on public debt.

A conclusive example is the decision on recording the Public Private Partnership (PPP) within or outside the government sector (since 2004). Member States subsequently modelled PPP contracts taking into account Eurostat specifications so as to have a minimal impact on the government deficit and debt. Two methodological guides were issued, one in 2016 regarding the recording in national accounts of PPPs contracts In 2016[1] and another methodological guide in 2018 regarding the contracts for improvement of the energy performance of the buildings[2]. Therefore, Eurostat has brought a certain note of flexibility to the accounting rules on investment recording.

Of particular importance are both the decisions and official letters of Eurostat on the classification of development banks and funds, including national promotional banks. They are a means of supporting public investments in the context of the European Investment Plan (Juncker Plan (2015))[3]. It is generally observed in the EU both types of entities, classified in the government sector due to government influence, control and risk-taking (all activities impact the government deficit and debt of the Member State), but there are also development banks classified outside the government sector for which only the activities carried out in favour of the government are rearranged in the general government accounts.

## 3. Government finance statistics of Romania

Romania participates in the transmission of national accounts data to the European Commission (Eurostat). The National Institute of Statistics of Romania, the Ministry of Finance of Romania and the National Bank of Romania are the institutions responsible for elaborating Romania the fiscal notification of the government deficit and the debt in the context of the EDP Notification.

*EDP notification, more than a reporting of government deficit and debt*

At European level, the Stability and Growth Pact and the Stability Program for the Eurozone and the Convergence Program for the Emerging Countries respectively, support the role of fiscal policy as a priority tool for adjusting macroeconomic imbalances, with each Member State committing itself to a medium term objective. (the next three years) to maintain a budgetary position close to balance or even in surplus, in line with the objective of stability of public finances.

At the national level, the government defines the country's fiscal policy within the medium- and long-term fiscal-budgetary strategy, using government revenues and expenditures to influence the course of the economy. On the one hand, it directly manages the allocation of resources between the public and private sectors, influencing consumer behaviour, savings and investments, and on the other hand, it intervenes indirectly on the economic cycle by stimulating production.

[1] A Guide to the Statistical Treatment of PPPs
https://ec.europa.eu/eurostat/documents/1015035/7204121/epec-eurostat-statistical-guide-en.pdf

[2] A Guide to the Statistical Treatment of Energy Performance Contracts
https://ec.europa.eu/eurostat/documents/1015035/8885635/guide_to_statistical_treatment_of_epcs_en.pdf/f74b474b-8778-41a9-9978-8f4fe8548ab1

[3] The European Fund for Strategic Investments (EFSI)
https://wayback.archive-it.org/12090/20191231194721/https://ec.europa.eu/commission/priorities/jobs-growth-and-investment/investment-plan-europe-juncker-plan/european-fund-strategic-investments-efsi_en

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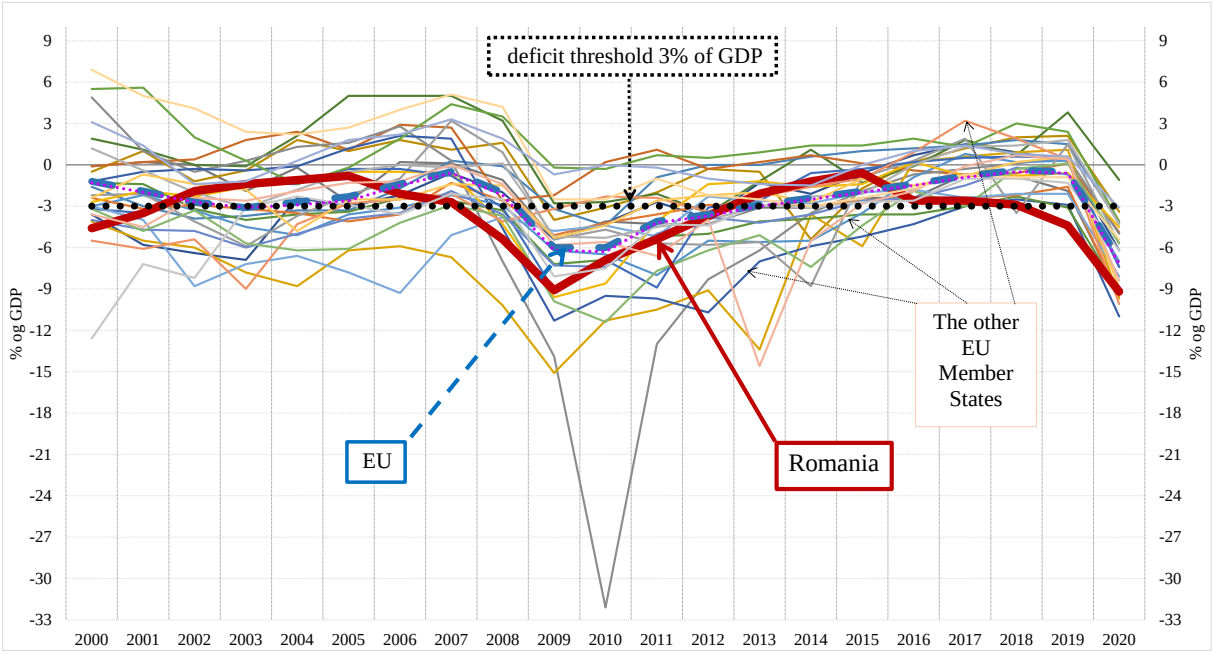
*Savu, N. A. pp.121-129*

*Fiscal policy of Romania over the last 20 years*

Targeting of the government deficit was the main concern of the fiscal policy in Romania, both before the entry into the European Union and after 2007. Complying with the Maastricht fiscal criteria before the EU accession in 2007, as well as maintaining the fiscal indicators below the threshold after the 2007, forced the authorities to take measures with immediate impact on the government deficit and debt. However, related budgetary decisions have not always led to the best results on a long-term for the national economy as a whole. Therefore, the ad hoc nature of budgetary measures had proved that the fiscal policy of Romania had pro-cyclical nature affecting negatively the development of the economy.

From the graph below it can be seen that in the period 2000-2020, in Romania the budget balance calculated according to the ESA 2010 methodology was negative in all years, the lowest level being recorded in 2009 (-9.1% of GDP) and 2020 (-9.2% of GDP), closely linked to economic crises. In the period 2008-2012, the general government sector exceeded the deficit threshold of 3% of GDP, which triggered the launching of the EDP procedure for Romania. In 2013, analysing the fiscal notification data and the Convergence Program, confident in maintaining the deficit below the 3% of GDP threshold in the coming years, the Council of EU closed the EDP for Romania.




**Graph 1.** Government balance (ESA 2010) in Romania and in the other EU Member States in 2000-2020

**Data source***:* Eurostat, online database

In addition, in April 2011, Eurostat expressed reservations[4] (doubts) about the fiscal data submitted by Romania in the context of the EDP Notification due to the uncertainty regarding the correct classification of public companies in the government sector (S.13) after the application of the market/non-market test (if more than 50% of the company's expenses are financed by the government, therefore the companies should be classified in the government sector instead of non-financial corporation sector) for the period included in the notification (2007-2011), but also due to incorrect application of the "accrual" principle on specific government revenues and expenditures accrual accounting (according to ESA methodology). Fortunately, in October 2011, reservations on the quality of Romania's EDP notification were withdrawn by Eurostat based on the revision of fiscal data according to the SEC methodology and Eurostat recommendations on the above-mentioned issues.

[4] Eurostat news Release no. 60/2011 - 26 April 2011 on Government Deficit and Debt of EU Member States
https://ec.europa.eu/eurostat/documents/2995521/5036122/2-26042011-AP-EN.PDF.pdf/11e08a70-1b0d-41be-9dc317e99c3585e5?t=1414682871000

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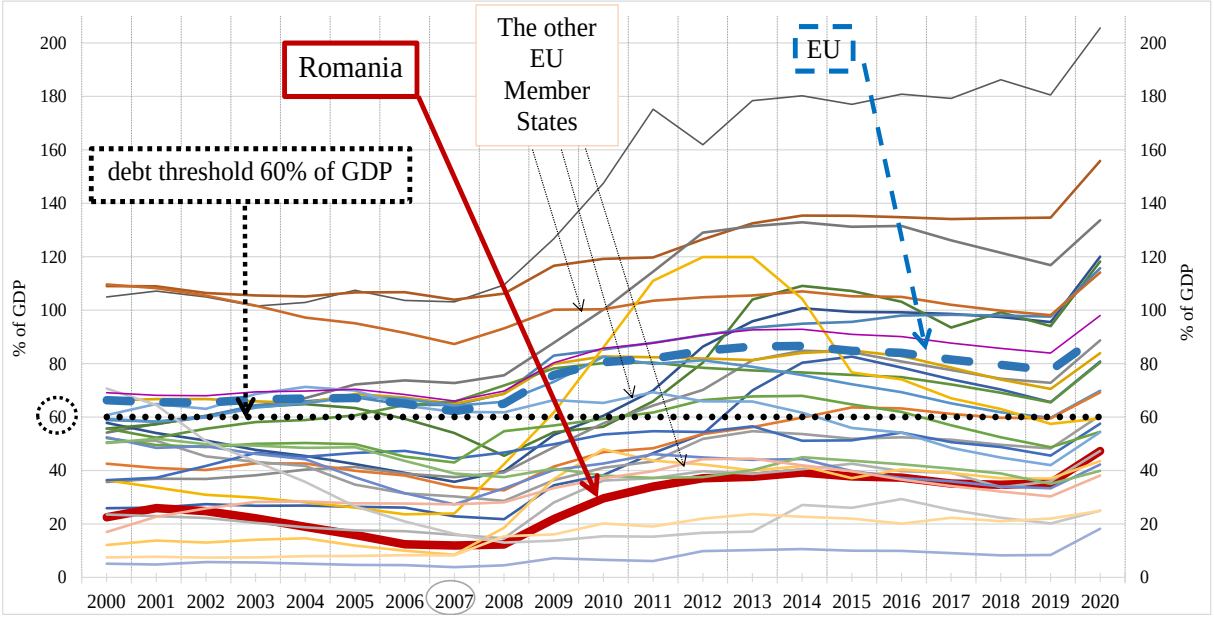
In the period 2013-2018, the government deficit of Romania was within the deficit threshold of 3% of GDP, 2015 being the year in which the lowest level was registered (-0.6% of GDP). Due to the excessive deficit reported for 2019 (-4.4% of GDP) and the unfavourable projections concerning the fiscal consolidation, the Council, on the recommendation of the European Commission, decided in 2020 to launch a second excessive deficit procedure for Romania. In both 2019 and 2020, Romania's excessive budget deficit was structural in nature (induced by tax cuts and increased permanent spending) and less generated by the COVID-19 pandemic crisis. The pro-cyclical fiscal policy practiced by Romania in the period 2017-2019 led to the exhaustion of the fiscal space necessary to stimulate the economy in times of recession and budgetary policy during the crisis generated by the COVID-19 virus in 2020. If at the previous crisis almost all the states of the European Union were in the process of excessive deficit, now only Romania was in this situation.

However, in 2020, given the persistent exceptional uncertainty created by the COVID-19 pandemic and its extraordinary macroeconomic and government impact, the novelty introduced at European level was the suspension for the first time in history of the Stability and Growth Pact in terms of correcting government deficit and debt of the Member States in EDP status (only Romania) and in terms of launching new excessive deficit procedure for the EU Member States. In 2020, all but one EU Member States recorded a government deficit[5] above the 3% of GDP (Denmark -1.1% of GDP), the highest levels in the EDP data series.




**Graph 2.** Government debt (ESA 2010) in Romania and in the other EU Member States in 2000-2020

**Data source:** Eurostat, online database

The graph above illustrates that in Romania, in the period 2000-2020, the government debt registered levels well below the nominal convergence criterion of 60% of GDP. However, since the beginning of 2008 financial crisis, government debt began to accumulate the results of pro-cyclical fiscal policy, reaching a peak of 39% of GDP at the end of 2014, three times higher than the level observed at the end of 2008 (12% of GDP), when the financial crisis began. However, it should be noted that after 2009, when it increased by 9.5pp, the annual increase in government debt relative to GDP slowed down almost every year until 2014, with the lowest increase observed in 2013 (+ 0.5pp). Since 2015, the trend changed direction, the level of government debt starting to decrease from 39% of GDP recorded at the end of 2014 to 35% of GDP at the end of 2018. In 2019, the government debt of Romania started to increase again (+ 0.6pp), rising sharply to 47% of GDP at the end of 2020 (+ 12pp), the highest level in the last 20 years.

[5] Eurostat News Release 48/2021 - 22 April 2021 on Government Deficit and Debt of EU Member States
https://ec.europa.eu/eurostat/documents/2995521/11563047/2-22042021-AP-EN.pdf/19f07f1a-49dd-29be-fbf0-857dc423519f?t=1619026271193

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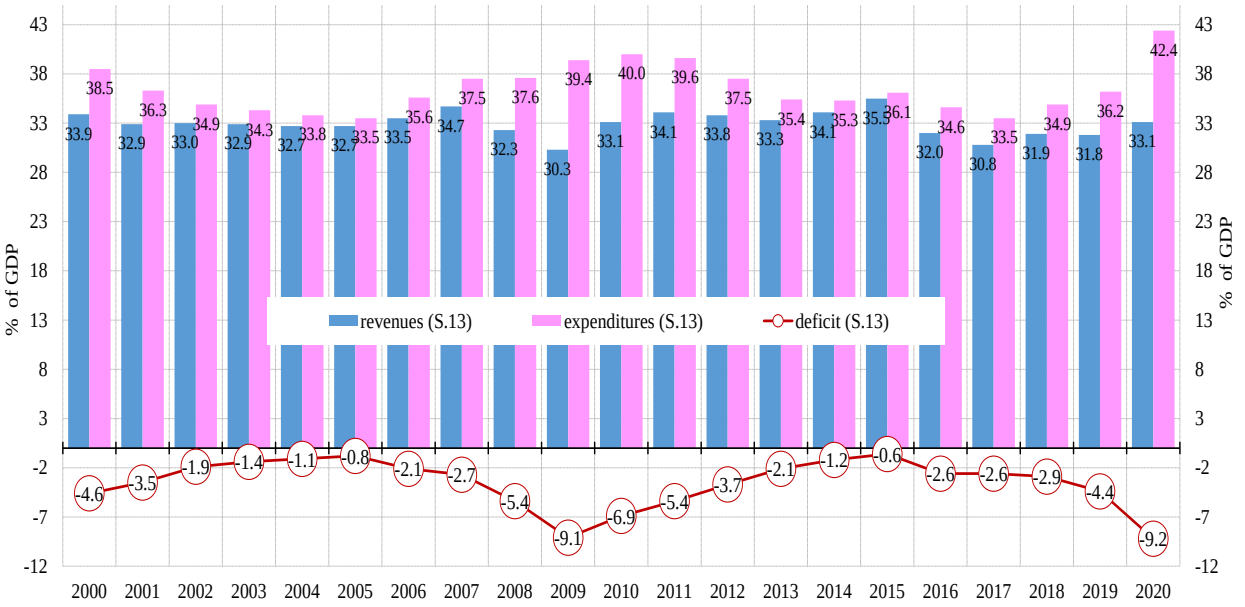
*Government deficit: the ad-hoc target of fiscal policy*

While government revenues remained relatively stable over the last 20 years, in average at 33% of GDP, reaching a maximum of 36% of GDP in just one year (2015), government expenditures fluctuated sharply between 34% of GDP and 42% of GDP, rising in periods of recession and declining during periods of economic boom. If in the period 2016-2017, in the conditions of the unexpected decrease of the budget revenues in relation to the GDP, the authorities were forced to adjust certain budget expenditures to comply with the government deficit target, in the period 2018-2019 the government expenditures increased much more than the budget revenues, given that the economy was in full economic growth. Therefore, the constant level of government revenues (% of GDP) and the fluctuating evolution of expenditures led to an increase of government deficits, with revenues being always lower than expenditures each year.




**Graph 3.** Revenues, expenditures and deficit of government sector (S.13) of Romania in 2000-2020

**Data source:** Eurostat, online database

Fiscal policy was built on spending programs based on an optimistic forecast of tax collections to the state budget, without taking into account the state of the business cycle. Fiscal policy proved to be procyclical almost throughout the analyzed period 2000-2020 due to the measures implemented. The main budgetary policy instruments used to combat these imbalances have been based on a package of austerity measures, generally aimed at reducing public spending, in particular the investments expenditures (gross fixed capital formation) and social spending (as example, reducing by 25 % the public sector wages and by 15% the social transfers in the context of the first EDP procedure).

Therefore, one of the disadvantage of using the government deficit as a fiscal target in the fiscal policy rises from the significant negative impact of investment on government deficit.

## 4. Investments and government deficit: Is there a conflict?

In order to meet the government deficit targets, the GFCF were mainly diminished in Romania. From the graph below it can be seen how the deficit level decreases when the GFCF level decreases, especially in the period and 2009-2013 when Romania was in the excessive deficit procedure. In the period 2006-2008 and 2018-2020 there was an increase in both the level of government deficit and the level of GFCF in relation to GDP. In the period 2012-2014, the decrease of GFCF expenditures was slowed down by the use of EU grants, the use of which does not affect the government deficit level (neutrality principle of ESA 2010).

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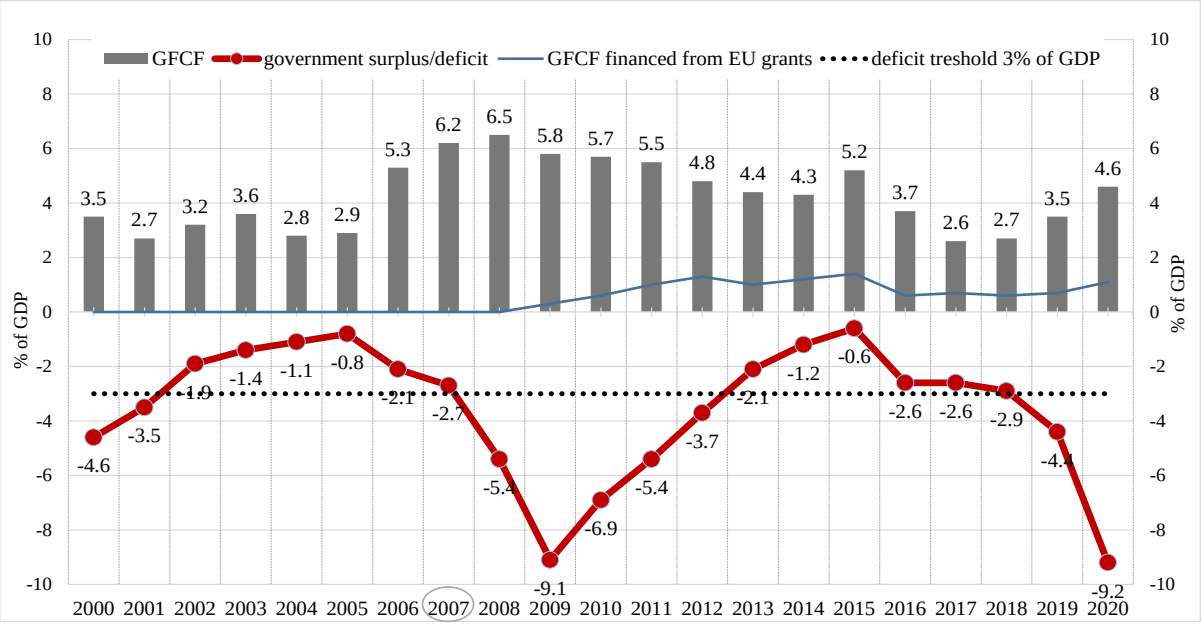


**Graph 4.** Government deficit and GFCF of Romania in the period 2000-2020 (% of GDP)

**Data source:** Eurostat, online database

Reuter (2020) is of the opinion that it is easier to postpone the start of a new investment project than to reduce the salaries of public administration employees or to reduce the social benefits that are regulated by the legal framework. However, due to the effects on economic growth, the reduction of investment spending has more negative effects on economic growth than the reduction of other categories of expenditure.

In 1992, when the Maastricht Treaty was signed and in 2005 when the Stability and Growth Pact was first updated, the possibility of introducing the *"golden rule"* as a fiscal criterion was discussed (deficit and debt could happen only for investment expenditures) However, this was not accepted due to the difficulties of clear separation and definition between current and capital expenditure (mainly investments).

Buti et Franco (2005) highlight also the risk for exponential increase of government debt on behalf of public investments.

Reuter (2020) also argues that future generations do not participate in the current decisions on investment projects and proposes to prioritize current spending by adapting the "golden rule" to each category of spending.

Milesi-Ferretti G. M. (2004) warns about the risk of "creative accounting" in the context of applying the *"golden rule"* for investments, because the state could try to hide current expenditures in capital expenditures.

The TFUE considered that fiscal discipline imposed at European level by fiscal rules and bans on government intervention in the economy (such as bail out or issuing money) is essential in EMU, as monetary policy and financial stability could be adversely affected by fiscal imbalances. The financing of the general government deficit by the central bank is prohibited in the EU (Article 125 TFEU).

However, Kelton (2020) wonders if the fact that the government can no longer issue currency (coins and banknotes) but has total freedom to issue debt securities, do not have a higher negative effect on the economy than the money issuance would have had? The state usually finances its current expenditures by issuing securities on the market on advantageous terms for investors, who prefer government securities and give up private investments in the economy due to the higher rate of return on securities. Thus, the state seems to influence the decrease of private investment in the economy and therefore negatively affects economic development.

Considering that in Romania, the apparent average cost of gross government debt recorded the highest level in the EU in 2020 (according to data published by Eurostat on the structure of public debt in the Member States), one could conclude that the government bonds –which is the main debt instrument of government debt - have an attractive rate of return.

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*Savu, N. A. pp.121-129*

On the one hand, the Maastricht criteria calls for austerity measures, which have resulted in reduced public investment spending, and on the other hand, the policy of financing the current government deficit also influences the decline in private investment in the economy.

## 5. Creative accounting following the SEC 2010 rules: Some proposals for Romania

Von Hagen et Wolff (2006) and Milesi-Feretti (2004) demonstrate that the fiscal rules set out in the Protocol on the excessive deficit procedure annexed to the Treaty on the Functioning of the European Union and in the Stability and Growth Pact stimulate governments to use „creative accounting", the effects of fiscal distortions depending on the degree of transparency of the budget".

From the analysis presented in the previous chapters, it looks like Eurostat rules (ESA 2010) have been the basis for the elaboration of government deficit and debt in the context of EDP Notification reporting and also behind the ad hoc fiscal policy measures in order to comply with the Maastricht fiscal criteria.

Frej-Ohlsson (2007) describes the concept of "creative accounting" and emphasizes the importance of the legal statistical framework, accounting rules and the role of the European Commission and Eurostat in monitoring the implementation of the European System of National Accounts.

However, Eurostat rules are not so rigid, but policy makers need to know and understand ESA 2010 rules, which could be too technical for a politician and in general.

*Some proposals for increasing the investments*

Unlike the business accounting, where there is the concept of investment depreciation, in public accounting (IPSAS) and in the government finance statistics, the gross fixed capital formation (GFCF) are recorded in full at the time of transfer of ownership of fixed assets to the institutional unit that intends to use them in production (ESA 2010 paragraph 3.134). Given the significant values of investment, this rule of FBCF recording in national accounts and in GFS affects greatly the government decision to carry out investment projects due to the immediate impact on the government deficit.

This rule is amended for financial leasing contracts, in which case a gradual transfer of ownership from lessor to lessee is imputed and for the gross formation of fixed capital for own use, which is recorded at the time of production. According to ESA 2010 paragraph 3.134, gross fixed capital formation is recorded in stages if the construction takes place over several years and the contract was signed before the fixed asset existed. Thus, the impact on the government deficit can be recorded over several years. In terms of impact on government debt, the state guarantee for the construction loans could be a good reason to record the related debt in the general government accounts and not just in the private company accounts. However, the details of contract must be assessed carefully for an appropriate recording in Government accounts.

Therefore, it is noted that the ESA 2010 has strict rules but also flexible provisions depending on the particularities of the situation. The case presented is a good example on how to "build" contracts for public investments that impact gradually over several years the government deficit and debt.

A second example is a PPP contract. From a simple analysis of an hypothetical contract, it seems that the total cost incurred by the government for an investment via a PPP contract is higher than the cost incurred via a direct acquisition. But, if the PPP contract is written well, following Eurostat guide on PPP issued in cooperation with European Investment Bank, what the government could win is avoiding the recording of related financing in the government debt and also recording gradually the expenditure in the government accounts, depending on the government presence, control, risks and rewards.

In all Member States, except Romania and Cyprus, there are banks or public development funds. Many of them were initially public banks involved in import-export operations, which developed their object of activity to carry out activities generally specific to development banks and more recently, activities specific to national promotional banks in the context of the Investment Plan for Europe (Juncker Plan).

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Regarding the sectoral classification of a development bank (or a national promotional bank) and the impact of its activities on the general government deficit and debt, in the European Union these entities were classified both:

- within the government sector (Eximbank[6] case in Hungary, the TEKE[7] case in Greece and other existing cases in Belgium, the Czech Republic, Ireland, Latvia, Luxembourg, Portugal) due to the influence of government policy, state control and risk-taking,
- outside the government sector, for which only the activities carried out on behalf of the government were rearranged in the government accounts (the case of SID Bank[8] in Slovenia, the case of Gospodarstwa Krajowego in Poland, KFW in Germany and other cases in Austria, Bulgaria, Denmark, Estonia, Finland, France, Italy, Lithuania, Spain, Latvia, the Netherlands, Slovakia, Sweden) for which there are Eurostat methodological decisions, advice letters or other bilateral consultations between Eurostat and the Member States during the EDP dialogue visits carried out every two years.

For the purpose of sectoral classification according to the ESA, the legal act establishing the entity should provide clear provisions on the independence of the decision-makers of the newly created entity (members of the board and their relationship with the government), clear activities of the entity, setting parameters for risks/rewards (as performance indicators) and whether or not the entity would benefit from government guarantees.

ESA 2010 and the Manual on Government Deficit and Debt 2019 clearly stipulate the situations in which financial corporations are financial intermediaries (S.12) or would become captive financial companies of general government (S.13). To be a financial intermediary, an entity should conduct market transactions with the general public on both sides of the balance sheet (assets and liabilities) and should ensure that the main customer is not the government. The entity must have decision-making autonomy, for example there must be no constraints from the part of the government when contracting loans.

Public financial corporations having the role of development agency could be a solution for managing the financial assets of the public administration in Romania and beyond. These financial institutions can play the role of a development bank or an intermediary financial institution dealing with projects financed from EU funds or also the role of a business partner in Public-Private Partnership contracts or with direct participation in the risk capital of companies according to the regulations on state aid.

Therefore, the third proposal is the establishment in Romania of a public development bank taking as an example the regional financial institution from Italy or the development banks classified outside the government sector in the other Member States, as previously presented. Thus, by involving the private sector in public projects, efficiency could be improved, stocks of shares and other government participations could increase and EU funds could be used at their potential for strategic investment projects (such as infrastructure for example) thus increasing gross capital formation and the stock of non-financial assets of general government.

## 6. Conclusions

In 1992, representatives of the Member States and major economists met in Maastricht and concluded that, according to statistical evidence and detailed calculations, a country's public finances are stable if the government deficit does not exceed 3% of GDP, and public debt is lower than 60% of GDP. The regulations according to which all the values included in the analysis are calculated must be harmonized at the level of all countries, so as to reflect comparable realities. The ESA seemed the most appropriate statistical standard, being already used in the preparation of national accounts by the EU member states.

In Romania, the fiscal-budgetary policy targeted in the last 20 years only the two fiscal indicators, 3% for the government deficit and 60% for the government debt. As revenues were limited and the deficit had to be reduced

[6] Decision of Eurostat on government deficit and debt on the statistical classification of the Hungarian Export-Import Bank Plc (Eximbank) https://ec.europa.eu/eurostat/documents/1015035/2041337/ESTAT-decision-Statistical-classification-of-Eximbank.pdf/4c1822ed-c586-6591-c6f8-9a4dc8e7c670

[7] Decision of Eurostat on government deficit and debt The statistical classification of the Hellenic Deposit and Investment Guarantee Fund (TEKE) https://ec.europa.eu/eurostat/documents/1015035/2041337/ESTAT-decision-Statistical-classification-of-TEKE.pdf/d452cd9e-d550-73e2-8e99-3a2cda851e4d

[8] Sector classification of the Slovenian Export Bank according to ESA 2010 https://ec.europa.eu/eurostat/documents/1015035/6761701/Advice-2015-SI-Sector-classif-SI-Export-Bank-accord-to-ESA-2010.pdf

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immediately, expenditures were reduced and capital expenditures were most affected, especially gross fixed capital formation. In this article, some proposals for increasing public investments were presented via a smart implementation of the accounting rules of ESA 2010 concerning the recording of investments expenditure in the government accounts (via smart leasing contracts, PPPs, through new established entities classified outside the government sector such as financial intermediaries or public development banks. Thus, fiscal policy could primarily target ESA 2010 rules as a fiscal policy infrastructure in order that the government deficit and debt could be the policy outcomes and not the fiscal policy tools.

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**22nd RSEP** International Economics, Finance & Business Conference – Virtual/Online
25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Vukovic, K. & Vugrinec, D. pp.130-139*

# The social representations of women entrepreneurs in the Croatian media

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## Abstract

The media has an important role to play in transmitting and transforming entrepreneurial culture because through the representation of female and male entrepreneurs in the media the transformation of social objects (people, context) into symbolic categories (values, beliefs) takes place. In this paper we analyse the content of the media articles of the five most read Internet portals in Croatia (Indeks.hr, 24sata.hr, Jutarnji.hr, Net.hr and Dnevnik.hr) which deal with entrepeneurship topics. A discourse analysis of 945 articles, from 2013 to 2019, has been conducted. This paper explores how media-created content affects the desirability and feasibility of entrepreneurship for women. We identified four main categories of discourses: the normative discourse, the motivational discourse, the accesability discourse and the cultural-cognitive discourse.

***Keywords:*** Woman entrepeneur, entrepreneurial intention, media discourse, Croatian context

***Jel Codes:*** L26

## 1. Introduction

In this paper we discuss the impact of representation of women entrepreneurs in the media. Women-owned companies make up only a fifth of companies in Croatia, which is almost twice as much as in the European Union (a third of companies owned by women entrepreneurs) (Filković, 2020). This reality of female entrepreneurship is complexly related to the media representation of women entrepreneurs. Media representations shape what people believe women entrepreneurs usually do and how they experience it. Above all, they affect the notion of female entrepreneurship as something that is desirable and achievable and thus affect the strength and direction of their entrepreneurial activity. They also shape the way in which key actors, such as credit institutions, business partners or clients, will observe and communicate with companies owned by women, which affects the business relationships and opportunities of women entrepreneurs. Publicly expressed gender inequalities and stigmas in media representations of women entrepreneurs not only reflect existing gender inequalities in entrepreneurial activities, but also provide an interpretive framework for reproducing these gender inequalities and stereotypes. That is why it is important to connect the media presentation of women entrepreneurs with their real image.

This research is based on an in-depth understanding of the process of transformation of social objects such as context and situation into symbolic categories such as values, beliefs, ideology. The aim of the research is to analyze the content of the Croatian media and identify the main categories of discourse and assess the real impact of public discourse on the entrepreneurial intention of women in the Croatian context. This paper empirically analyzes the media presentation of women's entrepreneurship in texts published on the most widely read Croatian portals. The impact that these representations could have on women's entrepreneurial intentions is critically discussed. The theoretical framework consists of models of entrepreneurial intention as the most significant models with the help of which the propensity for entrepreneurial behavior is predicted.

## 2. Entrepreneurial intention and the impact of public discourse on desirability and feasibility

Theory of planned behavior has been developed as a product of research in the field of social psychology, with the aim of predicting and explaining human behavior in any situation, not necessarily in the context of entrepreneurship. On the other hand, Shaper's model of entrepreneurial event was developed as an application of Eisen's model to entrepreneurial behavior specifically with the aim of clarifying entrepreneurial behavior (Landini, Arrighetti, Caricati, and Monacelli, 2016). Although the motives for the emergence of these models are different, today both models are often used as a theoretical framework when researching entrepreneurial intention.

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*Vukovic, K. & Vugrinec, D. pp.130-139*

Kruger et al. (2000) observed a link between these two models of intent. As with the theory of planned behavior, so with Shaper's model of entrepreneurial event exogenous influences do not directly affect intentions or behavior. Researchers (Landini, Arrighetti, Caricati, and Monacelli, 2016) have found that there is some similarity in the way these models control the effects of external variables. Consequently, perceived behavioral control (in the Eisen model) and perceived behavioral feasibility (in the Shaper model) are conceptually related to perceived self-efficacy. These two determinants, each within its own model, measure a similar construct. In other words, it refers to an individual's perception of their own abilities and an individual's perception of whether he or she possesses the skills needed to start an entrepreneurial venture. Perceived behavioral control is a combination of locus of control and self-efficacy (Ajzen, 2002). While self-efficacy is contextually conditioned, the locus of control functions universally in all situations and represents an individual's belief that his or her behavior and the outcomes of his or her activities are causally related.

According to Radu and Redien-Collot (2008), Krueger singles out three main predictors of behavior as the main predictors of behavior: (a) personal desirability of entrepreneurial behavior - refers to the attitude towards behavior, and expresses beliefs about behavior that has positive or negative consequences; (b) perceived social norms of entrepreneurial behavior - refers to the perception of the desires and expectations of important people and / or groups; (c) perceived collective efficiency and self-efficacy of entrepreneurial behavior - reflects the belief in the feasibility of behavior (a significant predictor of effective involvement of people in various social issues).

Discourse is an omnipresent way of valuing, knowing, and experiencing the world (McGregor, 2003). The term discourse "primarily implies the social context in which language is used" (Fairclough, 2013). The question is in what way and to what extent can public discourse influence an individual's entrepreneurial intent? When an individual reads a text, i.e. a description of something in a broader social context, he interprets that text and acts according to it in accordance with the rules, norms and mental models of behavior that he considers socially acceptable (Thompson, 2002). To understand this, the method of critical analysis of discourse is of great importance, which will be explained in more detail in the methodological framework. It is important to understand that each word has its own weight, both spoken and written. With this in mind, the fact that different words can be used to describe the same event or the same person should also be considered, and the choice of words to describe something depends on the language user (Fiske and Hancock, 2016).

The news is seen through a cognitive "window" whose parameters are set by a structured set of sign elements. It follows that the intended meaning of news has the ability to direct attention and limit the perspective available to the audience (Pan and Kosicki, 1993). The interaction between the reader and the text conveys the meaning that exists in the mind of the reader of that text. The press plays an important role in discourse because everyday newspaper articles reflect, but also shape, attitudes, perceptions and interests of society about the entrepreneurial phenomenon (Anderson and Warren, 2011).

According to the literature, the factors that influence the entrepreneurial intention are divided into micro-level and macro-level. At the micro level there are individual factors that include individual characteristics, psychological characteristics of the individual, education, experience, knowledge and abilities, while at the macro level there are environmental factors, which include social norms, culture, political environment, economic level, personal social network, family background and entrepreneurship education (Hou, Su, Lu and Qi, 2019). Radu and Redien-Collot (2008) suggest that the perception of appriateness is influenced by environmental factors (macro levels) that relate to prescribed values such as social and cultural norms. In other words, the perception of appropriateness refers to the social rules that are applied on a daily basis. According to Sen, Östlin and George (2007) social norms govern people's behavior, and what a community or organization considers normal is shaped by the practices and values they nurture. Consequently, when a significant number of people begin to challenge a norm (a pattern of behavior that is widespread and accepted), public discourse about it begins to change.

On the other hand, the belief in feasibility (Radu and Redien-Collot, 2008) is related to accessibility assumptions, so they may be influenced by environments related to ease and behavioral control. Consequently, an individual's individual and collective beliefs about whether something is feasible are greatly influenced by the presence of role models, moral support, mentors, and the like (Nguyen, 2017), and an individual's ability to identify with some of them positively affects learned feasibility and personal selects the individual (Yamina and Benachenhou, 2019). Also, Radu and Redien-Collot (2008) suggest that the perception of desirability could be related to assumptions of legitimacy in relation to the origin, behavior, and consequences of a particular behavior. Suchman (1995) interprets legitimacy as the general perception that an individual's actions are desirable, correct, and appropriate within a socially constructed system of values, norms, and beliefs, and refers to stable reactions caused by shared beliefs, reactions, and consistent behaviors. Furthermore, Lounsbury and Glynn (2001) argue that legitimacy arises

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*Vukovic, K. & Vugrinec, D. pp.130-139*

from the harmonization of institutionalized rules, norms, and practices, and the very purpose of entrepreneurial identity is manifested in the harmonization of the aforementioned. Namely, legitimacy, but also reputation and identity are transmitted through stories, and reinforced by mediatization (Ben Tahar and Mussol, 2017), ie social change that is associated with the action of the media (Hepp, 2013).

## 3. Methodological framework

The data for the analysis consists of a series of newspaper articles from the five most read Croatian online portals according to the Reuters Institute for 2020. The top five most read portals according to this digital report are: Index.hr (41%), 24sata.hr (38%), Jutarnji.hr (31%), Net.hr (22%), Dnevnik.hr (19%) Digital News Report for Croatia, 2020). The texts found under the keyword entrepreneurs for the last seven years were analyzed on the mentioned portals. All texts that were available in the online format at the time of the research, published in the period from 1 January 2013 to 31 December 2019 and classified under the keyword entrepreneurs were analyzed. Data were collected and then grouped in the period from February 28, 2020 to June 18, 2020. During the research, it was noticed that certain links became inaccessible to the general public over time. After a certain time, the texts are stored in the digital archives of daily newspapers, which makes their links "dead" and thus frees up space for new texts. The collected data were classified into Excel spreadsheets, each spreadsheet contained the following data: ordinal number, topic, title of the text, announcement (description below the title), content of the text, year of publication, newspaper type, gender and name of the author, link, quotes, month and date of publication of the text. Depending on the content, each text is grouped under meaningfully named thematic categories. Furthermore, for each text, a newspaper type of text was identified according to certain rules that apply in journalism to classify texts. This research included a total of 954 texts, of which 132 articles were analyzed from Index.hr, 306 articles from 24sata.hr, 173 articles from Jutarnji.hr, 73 articles from Net.hr and 266 articles from Dnevnik.hr.

In the process of analyzing empirical data, we used critical discourse analysis as the most appropriate method for our research. Critical discourse analysis (CDA) emerged in the late 1980s as a programmatic development in European discourse studies and has since been one of the most influential branches of discourse analysis (Blommaert and Bulcaen, 2000). Most importantly, CDA considers language a social practice (Amerian and Esmaili, 2015 according to Wodak 2001) and as such a discourse implies a dialectical relationship between a particular discursive event and situation, the institution and the social structure that frame that social practice (Zienkowski, Östman and Verschueren, 2011). A critical discourse analysis suggests that discourse is socially determined and socially conditioned. Moreover, in modern societies, discourse manifests itself as an object of power, so critical discourse analysis seeks to make it more transparent and visible (Blommaert and Bulcaen, 2000). Given the power of the written and spoken word, a critical analysis of discourse is necessary to analyze, interpret, describe, and critique the social life reflected in the text (Luke, 1997). According to Carvalho (2008), the CDA is "the only most authoritative line of research related to the study of media discourse," and journalism is a typical discursive reconstruction of reality. It also suggests that this framework exists primarily for the analysis of journalistic texts in which written language is dominant, by focusing first on the unit of analysis (individual text) and then on the broader context. The social context contains (McGregor, 2003 according to Huckin, 1997) different environments in which discourse takes place (e.g. conference, church, market), each environment with a set of established rules of conduct that determine expected and permissible behaviors. Accordingly, text becomes more than words written on a page because it reveals the context in which words are used in a particular social context. According to Ahl and Nelson (2014). discourse analysis views the observed data as productive rather than as representative, in that it (the way the text is examined) differs from content analysis.

## 4. Emprirical findings and discussion

The ways in which different characteristics of social acters, such as age, gender, or ethnicity, are presented to an audience are called media representations. Entrepreneurs' media representation has a strong influence on entrepreneurial aspirations, so an increasing part of the literature turns to discussions on how media representations of entrepreneurs shape the perception of society and the business world and what are the typical characteristics of entrepreneurs represented in the media (Eikhof, Carter and Summers, 2013). Strong positive representation is known to help break down stereotypes that can be harmful to individuals and limiting to society. In order to establish the media representation of women entrepreneurs in the Croatian press, discursive practices that the Croatian press creates on a daily basis were identified. We identified four main discourses: normative discourse, motivational discourse, accessibility discourse and cultural-cognitive discourse.

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*Vukovic, K. & Vugrinec, D. pp.130-139*

*4.1. Normative aspect of media discourse*

The general problem arising from prejudice, tradition and lack of self-confidence in women is so-called "glass ceiling", which is why women must be more persistent and make much more effort to progress or earn as much as men (Jovanović, 2018a). Often, fear also appears as a big brake on women in their entrepreneurial endeavor. Women always play it safe, so when entering entrepreneurial waters, there is fear and concern for the existential issue of their family. Also, women have expressed fears that their idea will not be well accepted by others. Unfortunately, women live in the belief that "they are not good enough or capable of the job they do and that good things happened to them by accident" (Dnevnik.hr, 2016), and the society we live in is largely responsible for this, because "people doubt that they possess skills and abilities that are usually associated with entrepreneurship (Bertović Skračić, 2015), therefore they themselves become suspicious". It becomes harder for women as soon as they become mothers because, apart from the fact that people are of the opinion that mothers cannot give 100 percent of themselves in work, that they will be absent due to frequent sick leave, etc. (Dokler, 2015), they also feel "like someone who neglects family"(Jovanović, 2018b) if they do not manage to go to a parents' meeting, groceries or something else due to work.

The family often plays a crucial role in a woman's decision to realize her entrepreneurial intention. The unconditional support of loved ones and the realization that she is not alone provides support to the woman and gives her the courage to face the challenges that lie ahead. Each family member can contribute either in the form of getting involved in the business, doing household chores or talking, helpful advice, even criticism. In the analyzed texts, women entrepreneurs often state that they would not have succeeded without the help and support of their partners: "Without the help of their husbands, they would not have succeeded. That's exactly it, one of the most important links so a woman can have both a family and a career. "He has to take on certain roles" (Knežević Barišić, 2013), "He was a huge support to me when I opened the salon and he showed me great confidence. This was during the greatest crisis and everyone considered the decision reckless, except him - he persuaded me to do so "(Burazer, 2019)." I must thank my wife who holds a large part of the organization and is a real motivator in the most difficult moments "(Vukašinović, 2018b). The role of friends is not negligible either. They usually help with product testing, reviews, and tips on how to improve something. The analyzed texts suggest the importance of understanding and supporting those closest to you. If this is not done, an imbalance is created and the entrepreneur remains torn between the family and her business venture.

Entrepreneurial orientation is significantly influenced by the environment, for this reason the circle of people with whom a woman is surrounded is important. The problem arises when a woman is under the constant negative influence of the same people "who more or less complain, it is difficult for everyone and no one sees a way out of the current situation" (Župan and Mušura). The media, too, play an important role in shaping the subconscious. The way reality is presented sometimes plays a decisive link in creating positive or negative perceptions of possibilities. The analysis showed that the media have the wrong approach to the observed topic. Emphasizing negativity gives the impression that opportunities do not exist and that entrepreneurship is an activity reserved only for individuals. Upbringing is another link that has a strong impact on an individual's preferences. Women raised in entrepreneurial families show more propensity for entrepreneurial activities. We can often hear: "I was raised in a family where parents did not differentiate between us as children, so I grew up believing that I can do everything I receive just as well" (Jutarnji list, 2017), "My parents are entrepreneurs too, so thanks to somehow I always went in the direction of opening something of my own "(Piskać, 2019a). "My parents themselves have been private entrepreneurs for many years, ... in that entrepreneurial spirit, they raised us, their four daughters. Along with our mothers, we learned what organization means, what our obligations are and how to organize them "(Domitrović, 2016a)," I grew up in an entrepreneurial family and got into the habit of fulfilling the obligations they gave me "(Matković, 2019). "The beginning and the first step in entrepreneurship started for me from a young age, I come from an entrepreneurial family, and I was raised in the culture of entrepreneurship "(Jutarnji list, 2018). According to the most common statements from the analyzed texts, it can be concluded that entrepreneurship is not something that happens by accident. It is the result of upbringing, culture, tradition, ingrained values and beliefs.

*4.2.Motivatonal discourse*

Entrepreneurial ventures initiated by women are important not only because of gender equality, strengthening regional economic activity and long-term impact on changing the system of social values, but also because by creating new jobs they act as a powerful generator of economic growth, emphasize research around the world. Discourse analysis has shown that women most often dare to start an entrepreneurial venture when an important life event interrupts their established lifestyle. Interruption of the routine is a characteristic shock due to which the

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whole situation is viewed from a different angle. In the analyzed discourses, the reason for entering an entrepreneurial venture is often negative events such as job loss and struggle for existence, and some of the reasons include the birth of a child with disabilities, the desire to end the uncertainty of working for a private employer and positive events such as gaining a positive experience of joining an association and obtaining an inheritance. From the ratio of positive and negative factors mentioned in the texts, it can be concluded that far more women enter the entrepreneurial venture out of necessity.

Building wealth for women is not the primary motivation for embarking on an entrepreneurial venture. In the first place, they enter entrepreneurship in order to earn a living, and at the same time a strong motivator is the desire to give their contribution to the wider community in the hope that they will make a difference. In addition to the reasons mentioned, another strong motivator for women to become entrepreneurial is the family tradition they want to continue (most often these are crafts) (Singer et al., 2021). Women-owned companies are not exclusively profit-oriented, and the following quotes support this: "Money is not a priority for me. ... My goal is much bigger than the earnings themselves "(Bekavac Šuvar, 2018)." I am not motivated by money, not even my own success, but by the work and personal development of Abracadabra "(Bauman, 2013). Women strive for a greater goal, the achievement of a greater good. Money is one of the motivators, but it is not the most important. They attach more importance to intrinsic rewards because they give them a sense of inner satisfaction that money cannot buy.

Women in the business environment and employment relationships are generally more socially oriented than men, sociologists claim. Despite traditional views on the role of women in society, less credibility and a number of obstacles, they always find a practical solution (Vukašinović, 2019a). Employees are more important to them than the money they will earn, and in return they expect the will and desire to learn. Also, they are more sensitive to employee problems, they try to "be supportive if an unexpected situation arises" (Vukašinović, 2019a). "Accountability, initiative and consistency, openness and trust, fairness and reliability" (Gruden, 2014) are the principles that guide women entrepreneurs to be fair and consistent in their decisions. Based on the analyzed texts and identified discourses, it can be noticed that the media do not emphasize enough the importance of women entrepreneurs and their contribution to society.

A common reason for women to enter entrepreneurship is the impossibility of finding a job, which over time raises an existential question. Negative factors such as bankruptcy, divorce, death of a close family member or long-term and unsuccessful job search also affect the propensity to act that indirectly affects the entrepreneurial intention and acts in the direction of making a decision to start an entrepreneurial venture. Emergency start-ups are more often less prepared for a business venture and have a shorter horizon, and it is believed that an unemployed person does not bring personal emotional energy into that venture. However, it is better to have an entrepreneur who is self-employed out of necessity, than an unemployed woman who is at risk of poverty (Blašković, 2017).

In Croatia, there are a number of interrelated influences that act restrictively on the recognition of opportunities. Many restrictions in Croatia nullify the attractiveness of the perceived opportunities (Blašković, 2017). But despite this, many women have succeeded. By noticing shortcomings in the market, such as entrepreneur Magdalena Bešker from Sv. Nedjelja who decided to make a case to protect her passport from falling apart. In doing so, she encountered a number of positive criticisms that ultimately pushed her on an entrepreneurial path. Furthermore, in addition to the above, it turned out that hobbies and additional activities that women engage in to shorten time, relieve stress or express their creativity, often grow into a lucrative business. The representation of these positive examples in the Croatian media is still relatively small. By presenting the content of this character, the media can influence the formation of a positive perception of the desirability of female entrepreneurship.

### *4.3. Accessibility discourse*

In addition to the challenges characteristic of women's entrepreneurship, women also face problems that equally plague all entrepreneurs in the Republic of Croatia. The Entrepreneurship Initiative project implemented by the Center for Public Policy and Economic Analysis in cooperation with entrepreneurs pointed to numerous regulatory obstacles and administrative burdens that hinder business in Croatia. Problems do not bypass well-established entrepreneurs, as well as those who are just trying to step into that world, so already at the start of the venture entrepreneurs are burdened with high costs, procedural permits and solutions, bureaucracy, various parafiscal and other charges, as well as insufficient information on regulations. The analysis of the texts found that women most often suffer from the following structural problems: "What makes their work difficult is the administration in Croatia, which urgently needs digitalization" (Žgela, 2017), as well as "unsettled state situation, administration, division, different laws, poor communication" (Domitrović, 2016b), "unfortunately in our country it is all very slow and sluggish" (Repecki, 2016), and "giving to the state is really too great" (Forjan, 2018), "levies are unbearable" (Mikola, 2018), " paperwork and the whole bureaucracy can be tedious and vague "(Matković, 2016).

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*Vukovic, K. & Vugrinec, D. pp.130-139*

Consequently, it can be concluded that the state creates numerous obstacles for entrepreneurs and thus creates an anti-entrepreneurial climate and makes entrepreneurship a risky activity. Because of the aversion to excessively risky behavior, women try to avoid entrepreneurial activities, so the state should do everything in its power to change that.

According to women entrepreneurs, perseverance, patience and a willingness to give up are the qualities that adorn successful women. Women are no less capable than men, they are just afraid that they will not meet all expectations, which consequently they have less self-confidence. By recognizing and becoming aware of the existence of feelings of inferiority, women can work to develop a sense of personal worth and autonomy that is associated with efficiency, generosity, cooperation, and helping each other. It is also "important to be aware that there are ups and downs in the business, and that this is normal" (Piskać, 2019b). According to some entrepreneurs, "success depends 90 percent on it, meaning how we see ourselves, what we believe, what we say to ourselves" (Tomić, 2015), the key to success lies in the mental structure and positive thinking. Looking for opportunities will open up new opportunities, after all, entrepreneurship is a "lifestyle that requires constant investment in yourself and lifelong learning" (Jutarnji list, 2018).

*4.4. Cultural-cognitive discourse*

A fast-paced lifestyle accompanied by daily commitments causes stress. After working hours, work does not stop, it just moves to the private sphere, where a woman is expected to unconditionally take on a number of private obligations. By entering an entrepreneurial venture, the boundaries between private life and work are almost non-existent, so good organization is the key to success. The analysis of the texts found that women are most difficult to neglect their family due to business obligations - "My family gave me great support, but there were frequent moments of guilt due to obligations" (Matković, 2018), I came home after 6 pm, I don't know when we are as a family all had lunch together. It is exhausting and very stressful (Gruden, 2014). Therefore, they often try to reach a compromise by trying to spend the evening hours during the week and weekends with their families. All family members can contribute to the balance by evenly distributing duties and responsibilities, so that the woman is not forced to sacrifice a large part of her private time.

Media messages create recognizable, mostly stereotypical images of individuals, and this has not been avoided by women entrepreneurs either. The analysis showed the connection of women entrepreneurs with the entertainment industry and the private sphere of their lives. The word entrepreneurs is mostly mentioned in the thematic category of entertainment and show business, and they are most often presented as a kind of entertainer or performer. Celebrity, supermodel, reality star, singer and the like are descriptions that most often stand next to the word entrepreneur, as an example, a few quotes: "Coco T - starlet, entrepreneur, model, silicone beauty" , “reality star, entrepreneur, fashion muse and mother of daughter North”. The emphasis on the family and marital role of the entrepreneur was noticed during her presentation in the text - "rich divorcee and entrepreneur BR", "VH, Zagreb dentist, entrepreneur and ex-wife of ZM". In addition to the above, it has been observed that the media focuses on unimportant details such as clothing combinations, fashion details, physical appearance, love relationships, and addressing the word entrepreneurs is used more for the purpose of attracting and raising reader engagement.

## 5. Conclusion

The media are central sources of public discourse, and provide more than an agenda topic because they direct attention to specific actors. Thus, the media transmit social representations that both reflect and influence the public's perception and assessment of what is desirable and feasible in society. Consequently, media content explicitly or implicitly conveys value messages about what is right, desirable, valuable, or the opposite. With the advent of the Internet, the media have been able to reach crowds of people with ease, so they have great influence and power to shape the perception of the masses. The research found that the media adversely influence the opinion and behavior of an individual regarding women entrepreneurs and their involvement in entrepreneurial activity. First of all, they do not present themselves in the media as capable and skilled to do something on their own or to change the economic situation. Unfortunately, they are still not seen as actors acting as a driver of the economy. In this paper, portals are viewed as a medium of wide reach, and therefore of great influence. Taking into account all the collected data from the portals Index.hr, 24sata.hr, Jutarnji.hr, Net.hr and Dnevnik.hr, it was determined that by far the most represented topic is Beauty, appearance, fashion, followed by the thematic category Entertainment and show business. These facts indicate that the situation in Croatia is unfavorable. Although there are affirmative texts that favorably affect the perception of desirability and feasibility of an entrepreneurial career,

normative and cultural-cognitive influences still give women roles that create the impression that entrepreneurship is a more appropriate choice for a man than for a woman.

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**22nd RSEP** International Economics, Finance & Business Conference – Virtual/Online
25-26 August 2021, Kadir Has University, Istanbul, Turkey

**www.rsepconferences.com** **CONFERENCE PROCEEDINGS/FULL PAPERS** **ISBN: 978-605-70583-3-1/September 2021**

*Babangida, J.S. & Cankaya, S. pp.140-148*

# Determinants of dividend policy: Evidence from Africa

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## Abstract

This study examines the determinants of dividend payout policy of some samples of firms listed on the Nigerian, South African and Egyptian stock market for the year 2005 to 2019. We found evidence of tangibility, profitability, leverage, growth opportunities, age, and size to be significant factors that influence the dividend decision of firms in the market. Among these factors, tangibility, leverage, and dividend volatility are shown to be insignificant for the Nigerian stock market. Profitability, dividend volatility and age to be insignificant for South Africa and the Egyptian stock market. In view of these findings, the study concludes that the growth opportunity and size of firms are the most significant in the African stock market. The implication of this study suggests that before investing in any firm in Africa for return, the investor should assess a company size and growth opportunities.

***Keywords:*** Africa, corporate governance, dividend Policy, financial market.

***Jel Codes:*** G11, G35

## 1. Introduction

Dividend policy in the emerging market has continued to get attention from investors and policy makers due to its importance in determining the value of firms. This is underpinned by the argument of Gordon (1963) and Lintner (1962). Dividend is referred to as a distribution paid to shareholders on the number of shares they own in a company (Clayman, Fridson, & George, 2012). The distribution is done with the approval of the management to the public at regular or irregular intervals (quarterly, semi-annually, annually). That is, the decision to pay or not to pay dividend and what quantity is decided by the managers. Despite contributions to the understanding of dividend policy, it has remained to be a puzzle in finance. Indeed, the harder we look at the concept of dividend policy, the more it seems like an ending with pieces that just do not fit together (Black & Scholes, 1974). Miller & Modigliani (1961), Lintner (1962) and Black & Scholes (1974) were among the first contributors to this puzzle. Miller & Modigliani (1961) argued that dividend policy of a firm has no effect on the firms' rate of return, cost of capital, shareholders' wealth and market value under the assumption of perfect market, no taxation, no asymmetric information, no conflict of interests (Clayman, Fridson and George H. Troughton, 2012). On the other hand, Lintner (1962) showed that market value of a firm is positively affected by dividend policy of firms. This proposition is supported by the fact that markets are characterised by imperfections and uncertainties. Under this, investors to the firm desire dividend that is certain to an uncertain capital gain (Kumar and Sujit, 2016). Therefore, dividend are good signals for the firm and increase the value of a firm. Despite the development of several theories to give explanation on why firms pay dividends to their shareholders, the dividend policy decision remains a puzzle that has remained unfixed yet. Empirical studies have failed to completely confirm the validity of theoretical proposition on the factors that determine the decision of firms to pay dividends to their investors.

The African economy's capital markets have important features for the dynamism of dividend policy. Companies on the African stock exchange market have engaged in practices to make their shareholders smile with some dividend payment. Therefore, understanding dividend is crucial for shareholders. Hence, to understand the determinants of dividend policy for firms in Africa, some factors exert influence on the decision of firms to pay or not to pay dividend to their shareholders. A sample of such factors include profitability, size, leverage, ownership, risk, volatility in dividend, age of firm, growth, liquidity, etc. Most of these evidence are based on data from both developing and developing economies (e.g., Ahmad, Barros, & Sarmento, 2018; Barros, Matos, & Sarmento, 2019; Jabbouri, 2016; Kaźmierska-Jóźwiak, 2015; Kumar & Sujit, 2016; Denis & Osobov, 2008; etc.).

These empirical studies have shown dividend policy of firms vary across countries and that it remains a puzzle yet to be fixed. Our evidence reveals common determinants of dividend across countries in Africa.

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*Babangida, J.S. & Cankaya, S. pp.140-148*

In view of this puzzle, the study seeks to examine the determinants of dividend policy of firms in some selected African countries. Like the findings of Fama and French (2001), we found result in favour of size and growth opportunities to be the most significant determinants of firms. Specifically, the likelihood of firms paying dividend is associated with age and profitability among the extra factors in Nigeria. While tangibility and leverage are the other significant factors that influence the decision of firms to pay dividend. The remainder of the paper is structured as follows. Section 2 discusses past empirical studies. Section 3 reports the sample selection and methodology. The discussion of the result is done in section 4 while section 5 concludes the paper.

## 2. Past Evidence

The macroeconomic operations on the stock market and the decision of dividend policy have remained unclear. This empirical evidence suggests that dividend policy is affected by numerous factors. Several of this research both in developed and developing economies have not solved the dividend policy puzzle. This has made research in dividend policy inconclusive. In this section, the past empirical evidence is documented with a view to identify the literature gaps.

Kajola, Desu, & Agbanike (2015) using data for Nigeria found evidence of profitability, size, leverage, growth opportunities and dividend volatility to be exert significant effect on dividend policy of firms. Their result support the agency cost and signalling hypothesis. Using data for Ghana, Agyemang (2013) revealed that ratio of cash to net asset and age are the only determinant dividend. Conversely, in an earlier study, Marfo-Yiadom & Agyei (2011) found evidence in favour of profitability, dividend volatility, collateral capacity, leverage and age to have significant effect on dividend policy. This is similar to the findings of Kaźmierska-Jóźwiak (2015) and Yusuf (2019) for the Polish and Nigerian stock market respectively. In an extended study for Abu Dhabi, Manneh & Naser (2015) confirm the finding for profitability and leverage with the addition of size, ownership, risk, free cash flow as important determinant of dividend. In a recent study, Nkrumah, Ofori, & Anaba (2018) showed profitability, free cash flow and inflation to be the significant determinants of dividend in a positive way. While leverage and nonperforming loan to asset and policy rate have negative impact on dividend policy. Putting several economic factors into consideration, Livoreka, Hetemi, Shala, Hoti, & Asllanaj (2014) found that firms decide to retain large part of their profit in the form of retained earnings to avoid future uncertainty. They also revealed that legal and contractual agreements also have significant effect on dividend policy of firms.

Furthermore, cash flow and current earning are also argued to be among factors that influence decisions of firms to pay dividend (Fodio, 2009). The multiple country study of Denis & Osobov (2008) on the peculiarities of firms to pay dividend revealed that firm size, profitability, earned equity and growth opportunities affect the propensity of firms to pay dividend. Using data for 10 MENA emerging economies, , Jabbouri (2016) show similar result for size, growth and leverage. Advancing further in their study, the revealed that firms under civil laws face pressure to pay dividends irrespective of a firm's profit. Moreover, Obayagbona & Ogbeide (2018) revealed the role of institutional ownership, foreign ownership and share prices on the dividend policy of firms. Interestingly, engagement in social responsibility of firms is shown to affect dividend policy by Benlemlih (2019). The component of social responsibility like corporate governance, employee relations, diversity, community, and environment are positively associated with dividend payment.

From recent studies on the determinant of dividend policy, it is obvious that large body exist on the factors that affect the dividend policy of firms with varying findings. The literature on dividend policy remains far from being clear. The more we look at dividend picture, the more it looks like a puzzle with pieces that just do not fit together Black (1976). The determinant of dividend ranges from country to country, industry to industry depending on the financial system and economic conditions. In view of this, this research extends the analysis of dividend determinant for Africa by introducing firm specific variables.

## 3. Data and Methodology

For this research, data from 2005 to 2019 is used. The study sample make use of 54 firms out of 161 firms listed on the Nigerian stock market; 18 firms out of 30 for Egypt; and 32 out of 250 firms listed on the South African stock exchange market. All data were sourced from Thomson Reuters database. The nature of the data for this study will be panel data with the number of listed companies (N) observed for the 15 years period. The Nigerian stock exchange market has 161 firms listed on its stock exchange market. Only 54 firms were selected due to data

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shortcomings. For Egypt, 18 companies were selected out of 30 companies listed on the EGX30. South Africa has only 32 companies selected out of 250 companies listed on the JSE.

The choice of variables selection for this study is driven by theory and past empirical literatures (see. e.g., Denis & Osobov, 2008; Ranti, 2013; Kajola et al., 2015; Jabbouri, 2016). The study focuses on the African stock markets. Three performing stock market were selected due to data availability. The rest of the stock market data are not up to date and incomplete. Nigeria, South Africa, and Egypt are the only selected countries for the study. The central thrust of this research filling the research gap in the corporate finance literature by examining and analysing the factors that determine dividend policy in Africa. The research has significant implications for both "theory and practice" for three stock exchange market in Africa, namely, Nigeria, South Africa, and Egypt.

Panel data analysis is argued to generate a relatively higher level of validity and reduces omitted variable bias (Baltagi, 2005). This gives a more robust result by eliminating the time-invariant unobserved errors. Furthermore, panel data controls for individual heterogeneity. Compared with time series, panel gives more information and more efficiency. It controls for collinearity and tests more complicated behaviour models (Gujarati, 2003). The estimation method leads to the two classification of panel data in this study, namely, pooled OLS and random effect model. The thrust of this work is to examine the determinants of dividend policy in some selected countries in Africa. Therefore, to ascertain the factors that determine dividend policy for firms. The dividend theorical and empirical studies and data availability guide the variable selection for this study. The model of this study is specified in the longitudinal form as stated below.

$$DVP_{it} = \beta_0 + \beta_1 ROE_{it} + \beta_2 TANG_{it} - \beta_3 GOP_{it} + \beta_4 SIZE_{it} - \beta_5 LEV_{it} + \beta_6 DVOL_{it} + \beta_7 AGE_{it} + \epsilon_{it} \;..\; 4$$

**Table 1.** List of Variables

| Variable | Description | Expected Relationship |
|---|---|---|
| DVP | Dividend payout ratio | |
| ROE | Return on equity used to proxy profitability | Positive |
| TANG | Tangibility calculated as $\frac{Fixed\ Tangible\ Assets}{Fixed\ Asset}$ | positive |
| GOP | Growth opportunities calculated as change in natural log of sales | Negative |
| SIZE | Firm size calculated as log of sales | Positive |
| LEV | Leverage calculated as $\frac{Total\ Debts}{Total\ Debts + Total\ Equity}$ | Negative |
| DVOL | Volatility of dividend calculated as changes in dividend payout ratio | Positive |

**Source:** Author's computation

## 4. Results

### *4.1. Descriptive Statistics*

This section presents and analyses the result starting with descriptive statistics. Table 2 below shows the summary statistics for all the variables. We observe that the average firm's dividend payout ratio are approximately 6%, 7% and 5% for Nigeria, South Africa, and Egypt respectively. The profitability of the firms for Egypt is shown to be the minimum with a value of 11%. While the average value for Nigeria and South Africa is 18% and 27% respectively. Asset tangibility maintains an average value of 0.33, 0.45 and 0.34 for Nigeria, South Africa, and Egypt. This is the ratio of fixed asset to total assets. This implies that about 33%, 45% and 34% of the total asset of the firms s represented by fixed assets for the respective countries. The averaged debt to total firm values of the firms dented as leverage for the firms in the countries are 35%, 31% and 27% for Nigeria, South Africa, and Egypt. They are classified as low geared firms due to the low value of leverage on average. The average growth

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opportunities of the firms for the countries are low. The mean growth opportunities for Nigeria are 2%, 0.7% for South Africa and 4% for Egypt.

**Table 2.** Descriptive Statistics

| | Nigeria | | South Africa | | Egypt | |
|---|---|---|---|---|---|---|
| Variable | Mean | Std. Dev | Mean | Std. Dev. | Mean | Std. Dev |
| Dvp | 6.084 | 2.789 | 6.833 | 2.063 | 4.511 | 2.164 |
| Liq | 0.997 | 0.805 | 1.354 | 0.922 | 3.038 | 20.451 |
| ROE | 17.689 | 77.74 | 26.511 | 31.761 | 11.121 | 144.184 |
| Tang | 0.331 | 0.329 | 0.447 | 0.35 | 0.34 | 0.294 |
| Gop | 0.015 | 0.043 | 0.007 | 0.05 | 0.039 | 0.225 |
| Size | 9.865 | 1.909 | 10.031 | 1.363 | 7.337 | 1.913 |
| Lev | 0.35 | 1.565 | 0.312 | 0.222 | 0.274 | 0.319 |
| Dvol | 0.991 | 9.535 | 0.411 | 3.893 | 0.145 | 1.626 |
| Age | 52.926 | 26.387 | 52.156 | 42.768 | 53.00 | 34.311 |

**Source:** Author's computation using Stata14

*4.2. Unit Root Test*

It is required that variables to be stationary before proceeding to regression analysis. The table below shows the results for LLC, IPS and Hadri. The result shows that the null hypothesis of unit root for LLC and IPS is rejected for most of the variables in all the countries. The results indicate that the variables are stationary at different order. Although, there are some variables that show mixed findings. This mixture of finding is inherent in the panel unit root test. This is inherent in panel unit root test. Overall, the result support that the variables are all stationary.

**Table 3.** LLC Unit Root Test

| Variable | Nigeria | | South Africa | | Egypt | |
|---|---|---|---|---|---|---|
| | Level | 1st Dif | Level | 1st Dif | Level | 1st Dif |
| Dvp | -12.94*** | | -9.1081*** | | -0.3608 | -3.2982*** |
| Liq | -11.3697*** | | -4.0518*** | | -1.8286** | -9.3889*** |
| ROE | -5.0024*** | | -18.2576*** | | -1.9887** | |
| Tang | -2.0167** | | -1.9612*** | | -59.5109*** | |
| Gop | -18.7734*** | | -10.8385*** | | -9.098*** | |
| Size | -13.3835*** | | -6.0161*** | | 0.399 | -8.2228*** |
| Lev | 10.7915 | 10.8024 | -0.8232 | -5.4412*** | -1.4362 | -8.4033*** |
| Dvol | -11.392*** | | -15.5456*** | | -4.0927 | -10.7455*** |

**Source:** Author's computation using Stata14

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**Table 4.** IPS Unit Root Test

| Variable | Nigeria | | South Africa | | Egypt | |
|---|---|---|---|---|---|---|
| | Level | 1st Dif | Level | 1st Dif | Level | 1st Dif |
| Dvp | -9.3458*** | | -6.7427*** | | -1.3735*** | -8.2208*** |
| Liq | -5.1123*** | | -1.83*** | | -0.7479 | -7.4555*** |
| ROE | -3.2452*** | | -6.0283*** | | -1.5566* | -5.5699*** |
| Tang | ----- | ----- | ----- | ----- | ----- | ----- |
| Gop | -11.7161*** | | -8.3903*** | | -8.6315*** | |
| Size | -6.3306 | ***-10.4337 | -1.5599* | | 2.447 | -7.745*** |
| Lev | ----- | ----- | -0.0373 | -6.74*** | -0.2483 | -6.2695*** |
| Dvol | -8.9607*** | | -10.3703*** | | ----- | ----- |

**Source:** Author's computation using Stata14

**Table 5.** Hadri Unit Root Test

| Variable | Nigeria | | South Africa | | Egypt | |
|---|---|---|---|---|---|---|
| | Level | 1st Dif | Level | 1st Dif | Level | 1st Dif |
| Dvp | 16.1698*** | -4.8298 | 18.6739*** | -2.3233 | 11.1311*** | -2.6934 |
| Liq | 24.101*** | -2.7175 | 13.863*** | -3.4924 | -0.2829 | -3.7945 |
| ROE | 2.7556*** | -6.1367 | 14.6254*** | **1.71 | 16.7124*** | -3.5279 |
| Tang | 25.7403*** | -2.7761 | 13.7118*** | -0.9084 | 9.672*** | -3.0322 |
| Gop | 3.204*** | -6.094 | -0.5914 | -4.995 | -3.4025 | -3.9582 |
| Size | 48.4166*** | 3.4362*** | 17.3*** | -4.8483 | 18.8452*** | -3.4103 |
| Lev | 6.7223*** | 5.0929*** | 24.4252*** | -0.6412 | 6.7963*** | -2.9292 |
| Dvol | 2.8356*** | -4.1862 | -2.6292 | -5.0662 | -2.2491 | -3.7446 |

**Source:** Author's computation using Stata14

*4.3. Regression Results*

The table below shows the result for pooled OLS. The result indicated the significant role of profitability, tangibility, age, growth opportunities and size in dividend payout policies of firms in Nigeria. Profitability of firm proxied as ROE is shown to have a positive significant effect on dividend payment of firms. This is in support of the pecking order theory and some empirical findings (e.g., Kajola et al., 2015; Manneh & Naser, 2015; Marfo-Yiadom & Agyei, 2011). Firm size and growth opportunities calculated from the sales level of firms are shown to have significant impact on dividend from the table below. The positive relationship between size and dividend indicates that the bigger a firm, the more likely it is to pay dividend to shareholders to reduce the agency cost problem. This finding is consistent with the agency cost hypothesis that firms with a larger management pay higher dividend to mitigate the agency cost problem. The negative impact growth opportunities have on dividend implies that firms with high investment opportunities for expansion are more likely to pay dividend to shareholders for all the countries. The negative relationship between growth opportunities supports the pecking theory and life cycle hypothesis that firms with higher growth opportunities pay lesser dividend in favour of their investment for growth. This also reveals that firms change their dividend payment depending on the financial need of their current state with old firms paying more dividend to their investors. This result is similar in both South Africa and Egypt. Unlike other countries, age of firm is shown to have a significant impact on the dividend of firms in Nigeria. Also,

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tangibility is shown to have a positive (negative) significant impact on the dividend payment of firm in Nigeria (South Africa).

Firms' leverage has a significant effect on dividend payout in both South Africa and Egypt. This suggests that firms make use of debt to generate more profit to offset the cost of capital as well as pay dividend to its shareholders. This contradicts the trade-off theory of capital structure and many studies for emerging markets that found a negative relation between leverage and dividend payout (e.g., Benlemlih, 2019; Jabbouri, 2016; Kaźmierska-Jóźwiak, 2015; Manneh & Naser, 2015; Nkrumah et al., 2018). The finding implies that highly levered firms need less internal finance. This finding suggests the important role of leverage as a determining factor of dividend payout of firms during the sample period.

**Table 6.** Pooled OLS Result

Pooled OLS Result

| | Nigeria | | South Africa | | Egypt | |
|---|---|---|---|---|---|---|
| Dvp | Coefficient | Prob-value | Coefficient | Prob-value | Coefficient | Prob-value |
| ROE | 0.003*** | 0.005 | 0.003 | 0.192 | -0.0002 | 0.802 |
| Tang | 0.462* | 0.062 | -0.713*** | 0.002 | -0.627 | 0.103 |
| Gop | -3.218* | 0.092 | -9.931*** | 0.000 | -0.747 | 0.122 |
| Size | 0.784*** | 0.000 | 0.911*** | 0.000 | 0.643*** | 0.000 |
| Lev | 0.039 | 0.444 | 0.798** | 0.03 | -2.164*** | 0.000 |
| Dvol | 0.003 | 0.711 | 0.004 | 0.852 | 0.081 | 0.225 |
| Age | 0.008*** | 0.009 | -0.0003 | 0.885 | 0.004 | 0.254 |
| Constant | -2.26*** | 0.000 | -2.235** | 0.001 | 0.421 | 0.342 |
| Mean dep var | 6.084 | | 6.833 | | 4.511 | |
| SD dep var | 2.789 | | 2.063 | | 2.164 | |
| R-squared | 0.336 | | 0.351 | | 0.36 | |
| F-test | 58.102 | | 36.459 | | 21.033 | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | |
| BIC | 3680.633 | | 1899.321 | | 1106.535 | |
| AIC | 3643.056 | | 1864.931 | | 1077.748 | |
| Obs | 810 | | 480 | | 270 | |

*Note*. *** p<0.01, ** p<0.05, * p<0.1

The study procced by estimating the random effect model regression. The result for the random effect is presented in the table 7 below. The result is in some extent in conformity to the findings of the pooled OLS. This suggests that growth opportunities, size and tangibility are the important factors of dividend payout policy of firms in Nigeria. This finding conforms to life cycle, agency cost and pecking order theories. The random effect model confirms the finding of the pooled OLS with the omission of profitability among the determinants of dividend payout of firms in South Africa. This reveals the significant role of tangibility, growth opportunities and size. The empirical finding from the random effect corroborates the importance of firm size and growth opportunities as significant determinants of dividend policy of firms quoted in Egypt.

In sum, growth opportunities and firm size happen to have the significant power in determining the decision of firms to pay dividend in all the countries. The direction of the relationship conforms to life cycle, pecking order and agency cost hypotheses respectively. One plausible explanation for this finding is that as most companies have investment opportunities, this reduces their residual income available to them to pay dividends to the shareholders. The result for size indicates that the larger the size of a firm, the larger its management. A large management

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indicates a possibility of agency problem, a positive relationship indicates that there are little resources available to managers for their perquisites. This result confirms the richly available evidence based on the theoretical proposition of the pecking theory.

**Table 7.** Random Effect Results for Nigeria

Random Effect Result

| | Nigeria | | South Africa | | Egypt | |
|---|---|---|---|---|---|---|
| Dvp | Coefficient | Prob-value | Coefficient | Prob-value | Coefficient | Prob-value |
| ROE | 0.001 | 0.284 | 0.004 | 0.113 | 0.001 | 0.17 |
| Tang | 0.755* | 0.09 | -1.468*** | 0.000 | -0.101 | 0.842 |
| Gop | -2.656* | 0.068 | -12.341*** | 0.000 | -0.756* | 0.066 |
| Size | 0.839*** | 0.000 | 1.058*** | 0.000 | 0.618*** | 0.000 |
| Lev | 0.051 | 0.203 | -0.47 | 0.322 | -0.649 | 0.113 |
| Dvol | 0.003 | 0.696 | 0.005 | 0.79 | 0.051 | 0.328 |
| Age | 0.007 | 0.39 | -0.003 | 0.43 | 0.003 | 0,753 |
| Constant | -2.825*** | 0.001 | -0.003*** | 0.007 | 0.003 | 0.753 |
| Mean dep var | 6.084 | | 6.833 | | 4.511 | |
| SD dep var | 2.789 | | 2.063 | | 2.164 | |
| Overall R^2 | 0.332 | | 0.333 | | 0.306 | |
| R^2 within | 0.143 | | 0.211 | | 0.15 | |
| R^2 between | 0.461 | | 0.524 | | 0.416 | |
| Chi-square | 168.067 | | 139.021 | | 57.232 | |
| Prob | 0.000 | | 0.000 | | 0.000 | |
| Obs | 810 | | 480 | | 270 | |

*Note.* *** p<0.01, ** p<0.05, * p<0.1

## 5. Conclusion

The purpose of the study is to examine the major determining factors of dividend policy of firms in Africa. Based on the empirical results from the pooled OLS, the study reveals the significant role of profitability, tangibility, growth opportunities, age of firm and size on dividends policy in Nigeria. Interestingly, tangibility, leverage, growth opportunities, and size are found to be the most significant determinants of dividend policy in South Africa. The pooled OLS for Egypt shows that leverage and size are the significant factor of dividend policy. On the flip side, under the random effect, the results reveal evidence that tangibility, growth opportunities and size are the important factors determining the decision of firms to pay dividend in Nigeria. In south Africa, the random effect result show that tangibility, growth opportunities, size are the factors determining whether firms pay dividend to investors or not. While growth opportunities and size are shown to be the only determinants of dividend for Egypt. Considering the majority findings, the study supports the conclusion that growth opportunities and size are the most significant among the factors that determine dividend payment in Africa. As stated by Jabbouri (2016) that the payment of dividend is an effective tool of firms with large management structure to signal good faith to its shareholders. This result support the agency cost, life cycle and pecking order hypothesis of dividend since they all associated to revenue of the firm.

The results are interesting and intuitive with remarkable similarity across all the countries. Since growth opportunities and size relates to sales, it is concluded that the size of firm's sales revenue determines the decision of firms to pay dividend. The magnitude of sales of firms comes with their age and size. This study has significant

implication for shareholders, policy makers and academicians. Identifying that size and growth opportunities are the main determinants across the countries with different investing environment and economy will improve an investors and policy makers understanding of dividend policy. It can help investors to build up their dividend predictions and make selection of the right valuation models. This helps investors in enhancing their confidence in the market, improve their market activities as they know what drives firm's dividend policy decisions.

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25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Ertan, A. pp.149-158*

# Social network analysis of publications from Turkey regarding infectious diseases

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## Abstract

Due to the emergence Covid-19 pandemic, infectious diseases became globally important issue which has been seen how much it threatens public health and economy. Therefore, it is important to have multidisciplinary approach towards science, technology and innovation policy in order to overcome obstacles regarding infectious diseases. The primary aim of this study is to conduct social network analysis over the papers from Turkey in the field of infectious diseases in the last 5 years (between 2016 and 2021) at the level of researchers and institutions. Results were drawn from the analysis of networks of both researchers and institutions with regard to degree and betweenness centralities in the level of national and international collaboration. Unexpectedly, researchers with diverse connections in the larger component have papers with low citation score compared to the ones in discrete small components. Another finding is that most of the institutions have publications resulted from in-house collaboration so in order for institutions to benefit from the diversity of information, they need to collaborate with institutions in the hub positions. Within the framework of these results, the suggestions are developed to enhance collaboration in both national and international level for publications of Turkish institutions.

***Keywords:*** Social network analysis, infectious diseases, structural holes, information flow, citation score.

***Jel Codes:*** L14, I18, D83, O33

## 1. Introduction

Social network analysis (SNA) methodology has a huge potential to enrich the literature on analyzing citation and disease networks. The purpose of this research is to analyze characteristics of the collaboration network of researchers and institutions based on their publications of infectious diseases. The research data was gathered by searching papers from Turkey on Web of Science (WoS) between 2016 and 2021. SNA methodology is used to analyze the structure of researcher and institution networks to detect hubs in collaboration by using SNA metric. The analytical direction of this study was determined by the research questions, including the SNA methodology.

Below listed research questions (RQs) were identified for this study:

- RQ1: Exploring key institutions playing crucial role to boost collaboration network

- RQ2: What are the recommendations for developing collaboration in research network of institutions based on the results obtained?

The rest of the paper is organized as follows: section 2 reviews the literature review on analysis of publications of infectious diseases section 3 describes the data analysis and methodology to drawn results on network analysis; section 4 presents suggestions to boost collaboration in knowledge networks by addressing necessary strategies based on the identification of inferences and results followed by a conclusion.

## 2. Literature Review

In recent years, it has been observed that there has been an increase in the number of papers on infectious diseases. Central to these papers, many studies have focused on analysis of papers related to infectious diseases. For example, Yıldız Gülhan and Kuruthan (2021) conducted a study in order to analyze performance of papers retrieved from WoS on COVID-19 by using co-occurrence network map analysis and co-citation analysis. They analyze relationships between keywords, authors and journals to discover the journals that have the highest number of these papers and the universities that has the highest number of papers.

Moreover, a current strand of research in scientific papers regarding outbreaks of infectious diseases has been drawn to address solutions to the public health issues by comparing evolution patterns of different disease types. On this regard, Chiu et al. (2020) investigate the pattern between the coronavirus papers and coronavirus-related

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infectious diseases and discover that There are two sharply increasing of number of papers between 2002 and 2013 because of Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome Coronavirus (MERSCoV). Similar patterns were also found in the paper of SARSCoV, MERS-CoV, and 2019-novel CoV. Chiu et al highlights that there is an accelerated trend of papers with high impact after emergence of SARS disease. Likewise to the research of Chiu et al. (2021), Ipekci et al. (2021) analyze the distribution of the global reported cases of Zika virus and Sars-Cov-2 epidemics by months was examined. For papers of original research, the proportion of basic research papers increased over time for Zika virus, but decreased for SARS-Cov-2 research.

In contrast to the findings of researches above, Kumar and Aravinda (2012) found that despite the increase in the number of diseases and patients, the contribution in infectious diseases did not increase because of the lack of interest in pursuing training in this field by physicians. In the study of Kumar and Aravinda (2012), research productivity in the infectious diseases from Journal of the Association of Physicians of India (JAPI) was examined and the results show that the contribution of infectious diseases to the JAPI remains around %15. This discrepancy is difficult to explain; however, one possible explanation might be due to the differences in the study design. International collaboration of Indian physicians on papers of infectious diseases might be attributed as another explanation.

Previous studies mainly concentrate on the link between increased rate of infectious diseases and the papers size of it. However, Penfield et al. (2019) articles reviewed on idjournal.club by selecting fields which are publishing journal, subfield, study type, nation and degree of the lead author, and sample size to apply multivariate analysis with these fields and audience engagement. Scimago Journal Rank (SJR) was associated with study type and sample size, and Altmetric score was associated with ID subfield, journal, and sample size. Interestingly, degree of the lead actor did not appear to affect any of the fields, this result contradicts to most of the studies in SNA which used degree centrality as a significant metric. The lack of this significance may be attributed to the cultural characteristics in collaboration (Bernald et al. 2011).

Hayman and Baker (2018) scanned infectious disease papers over 100 years in top ranked four journals to find out whether scientific endeavors have covered the ever-evolving infectious diseases. Promisingly, scientific efforts have become self- corrective and adaptive to the emerging threats since Hayman and Baker (2018) addressed that there is little evidence of underrepresentation of important infectious diseases among these top ranked journals.

In addition to the infectious diseases, Aleskerov et al (2019) examined network analysis of patent and papers on Parkinson's disease, although not an infectious disease, with a methodology similar to this study. They found out mainstream key topics by distinguishing core and periphery nodes in the papers' citation and patent networks. Based upon the findings, Aleskerov et al. (2019) draw the scientific groups attention to the paper findings and patents on key topics different from the mainstream because they proposed that these papers may have findings that differ from the mainstream or mainstream scientists are unaware of these issues.

There are differences between study designs in social network approach for analyzing infectious diseases which are compatible with characteristics of them. For instance, Nunes and Rahman (2018) investigate key factors responsible for transmission of Tuberculosis disease and suggests network logistic regression as a promising tool for identifying key factors of infectious diseases. They claim that identification of risk factors is the first step to contribute control the rapid spread of any infectious diseases. Another study of Klovdahl (2005) emphasized the importance of social network research in relation to the its potential contributions to design of better strategies for the control of infectious disease outbreaks. It is claimed that spread of infectious diseases can be controlled by social network analysis by gathering individual attributes and personal network attributes within the framework of "Common Rule" (pg.127).

Although research on infectious diseases'' publications largely concentrated on identifying the factors of dissemination of these diseases, the study of Abrutyn et al. (1998) examined the impact of these publications in reaching the audience. The researchers analyzed the development from the oldest journal in the field of infectious diseases up to 1998 and found out the evolution moves quickly toward all-electronic review and production but they only look from the angle at which quality of paper. Thus, it is found that there is a lack of analysis of information on the impact distribution of subject fields or rate of reaching audience.

Recent studies have begun to acknowledge the important role played by network structure of infectious diseases. In this regard, Jo et al (2021) conducts a recent research on structural network characteristics of COVID-19 and found evidence that infectious network represents characteristics of scale free networks as the size of networks gets higher by connecting to the nodes with the highest outdegree. On the other hand, Broido and Clauset (2019) claim that scale free networks mostly undermine real life networks since they are lack of representing the indicators

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*Ertan, A. pp.149-158*

that express the infectious power of the network change according to governmental measures. Accordingly, it is argued that network structure change depending on time and policy.

Bearing these arguments in mind, this study will focus on the researchers and institutions in key positions in the network to identify mechanisms to boost information flow and collaboration.

## 3. Data and methodology

The papers from Turkey in the field of infectious diseases in the last 5 years (between 2016 and 2021) are retrieved from WoS database. The search was done by selecting topic field as "infectious disease" and country field as "Turkey". An important aspect of the data collection of this study is to avoid duplication of data, the authors and the publications were combined by matching Orcid ID of authors and publication ID of papers. In the last 5 years, there are 193 papers from Turkey on infectious diseases was found. The WoS Citation number of 91 of these papers is greater than 1 so the rest of the papers with no citation count are eliminated raw dataset. Figure 1 shows the number of papers and overall received citations numbers between 2016 and 2021. Although excluding papers with less than 1 citation from review is to ignore new papers, this limitation has been applied as the citation score is an important criterion for examining the effects of papers from national and international collaborations. The final dataset contains 475 different researchers from Turkey and 857 researchers from different countries. When the papers are examined on the basis of institutions, there are 761 different institutions in total, 132 of these institutions based in Turkey.

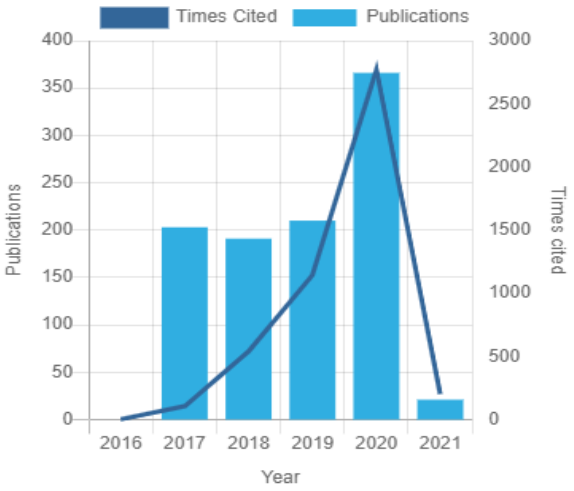


**Figure 1.** The relationship between the number of papers and the number of citations by year

**Source:** Author

The starting point the methodological section of this study is analyzing network diagrams of researchers and institutions in twofold. Table 1 summarizes the key network metrics used in this study with providing brief explanation.

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**Table 1**. A Summary of the key network metrics used in this study

| SNA | Explanation |
|---|---|
| Node | A node (or vertex) is the smallest unit in a network, it represents an actor (De Nooy et al. 2018)<br>In this study, a node represents author, paper, institution. |
| Component | Components are portions/subgroups of the network that are disconnected from each other. (Keller& Zheng 2017) |
| Hub | Connecter of peripheral and core of the network (Breschi et al. (2009)) |
| Degree Centrality | The number of connections a node has in the network.<br>A higher degree means more connection to other nodes in the network |
| Betweenness Centrality | The number of times a node occurs on the shortest path between two other nodes in the network (Silk et al. 2018)<br>Metric used to quantify a node's control over the information flow within a network (Marquetoux et al., 2016). |

**Source:** Author

*3.1 SNA of Researchers*

2-mode network is constructed where first set consists of authors, the second set consists of articles/papers, and the connection is a relation if authors collaborate in the same paper. Figure 2 displays the 2-mode network visualization of papers and authors. In SNA, component are portions of the network that are disconnected from each other (Silk et al (2018), pg.246). The network diagram in Figure 2 consists of several disconnected components. This indicates that it is unlikely to observe high information flow among authors due to the loosely connections within discrete groups.

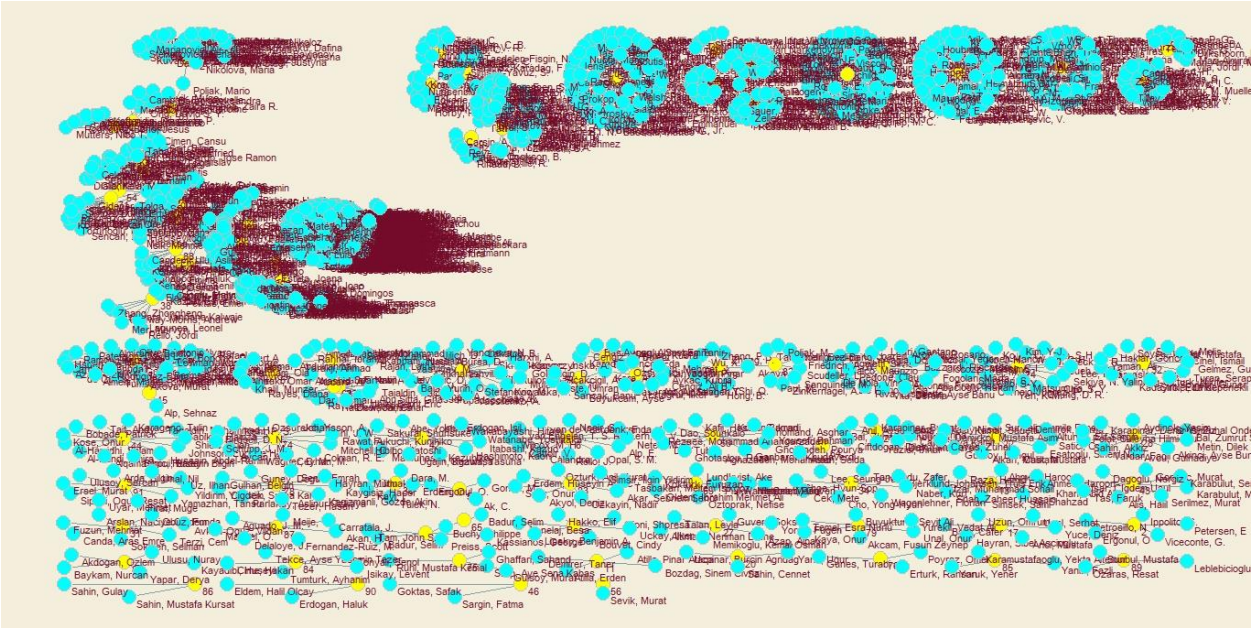

**Figure 2.** 2-mode Network of Papers-Researchers Network (Yellow nodes: papers, blue nodes: researchers)

**Source:** Author

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*Ertan, A. pp.149-158*

Moreover, Figure 3 shows the 2-mode network of Papers- Researchers with respect to the citation score of papers. As the size of nodes gets bigger, it means researcher has a paper with a higher citation score. As it is seen in Figure 3, researchers have diverse connections in the larger component in the top left hand side. However, citation scores of these papers are not higher than the ones in discrete groups. Therefore, it seems that being in a diverse big component may not be resulted in having a paper with high citation score index.

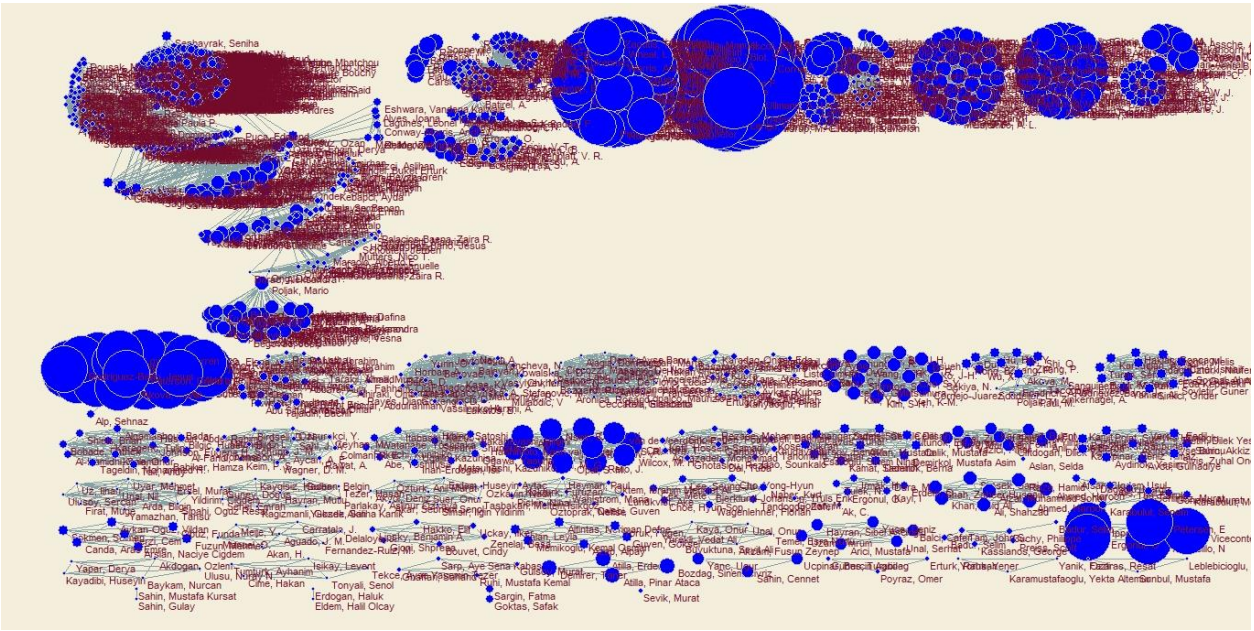

**Figure 3.** 1-mode Network of Researchers (Size of the node: the citation score of researcher's paper)

**Source:** Author

As can be seen in Figure 4, researchers from Turkish institutions who collaborate internationally located in the shortest path of information flow in the largest component. These researchers have the highest degree and betweenness centrality metrics compared to the ones in discrete groups. According to Ortega and Aguillo (2010), nodes tend to connect to the ones that have highest degrees which is explained as preferential attachment like in scale free networks. This argument attribute crucial positions to the nodes with high degree and betweenness centralities.

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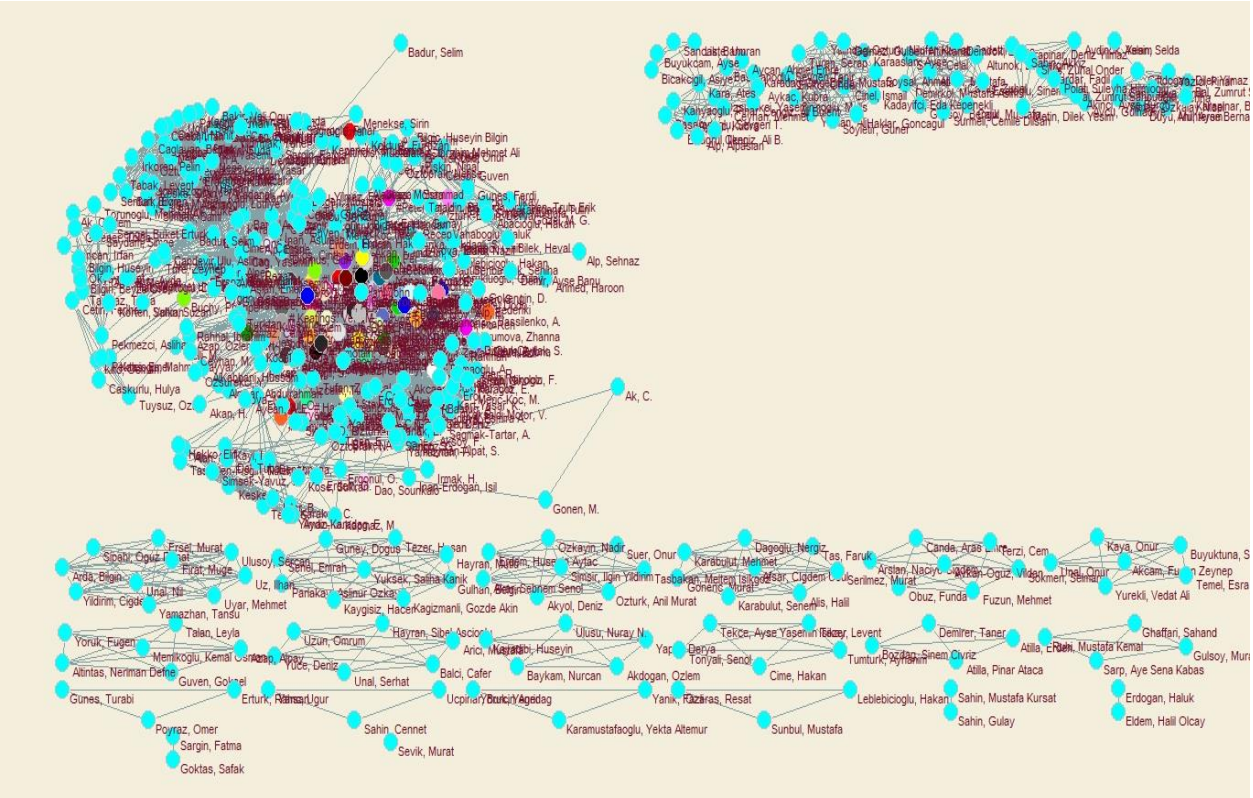


**Figure 4.** 1-mode Network of Researchers (Blue nodes: Researchers from Turkey, The nodes in other colors: International Researchers)

**Source**: Author

Furthermore, Figure5 illustrates that there is no significant relationship between researcher's number of papers and average citation index of the papers. It is also observed that there is no link between author's citation score and position in the network previously. Therefore, there is strong possibility of another factor such as quality of paper may affect the citation score so future qualitative studies may be conducted for the subject matter.

*3.2 SNA of Institutions*

Furthermore, as researcher network analysis is created above figures, the network can be drawn based on institutions. Figure 8 illustrates national and international collaboration network analysis of institutions in Turkey. To the extent that the network diagram can compile a full picture of most of the institutions in Turkey publish papers internally so they did not join to the both national and international collaboration networks.

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*Ertan, A. pp.149-158*

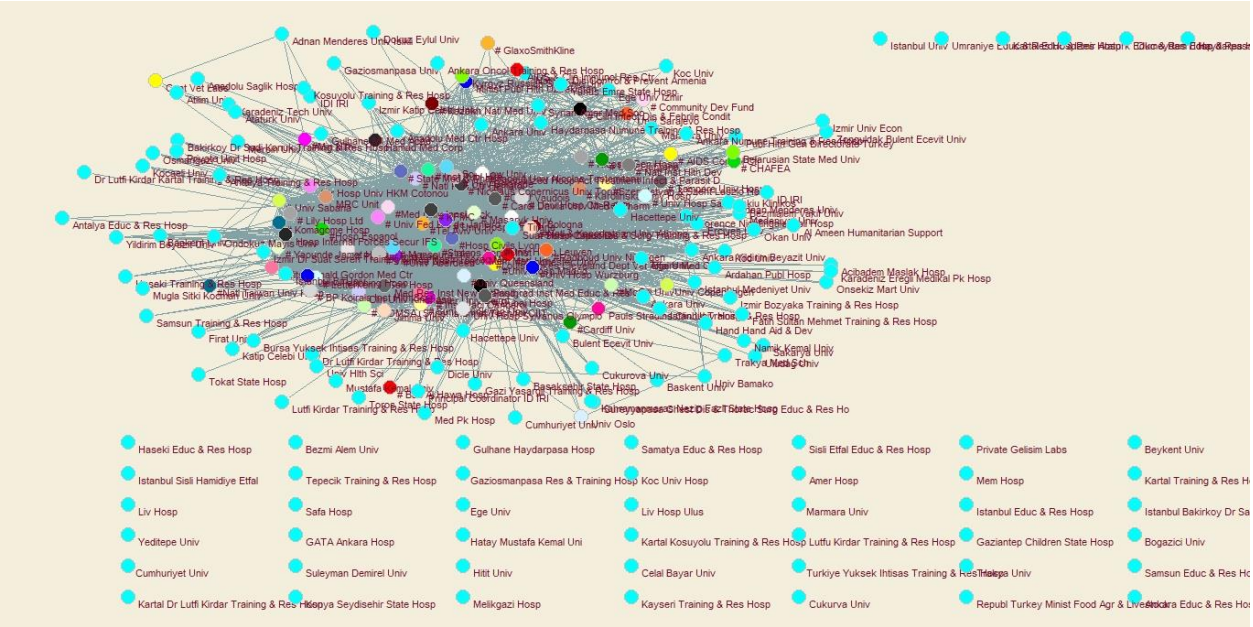


**Figure 5.** National/ International collaboration network analysis of institutions in Turkey (Blue nodes: Institutions in Turkey, The other color of nodes: International Institutions)

**Source:** Author

In addition, the institutions with top degree and betweenness centrality metrics are listed in Table 2 below. As it is stated in Table 1, having high degree centrality means having the highest number of connections with other nodes in the network. More than %36 of Institutions in Turkey published papers on infectious diseases without collaborating nationally nor internationally. In addition to degree centrality, betweenness centrality is a measure of a node's control over information flow and if a node has high betweenness centrality it lies between pair of shortest paths to reach other nodes. It is clear from the ranking of institutions in both columns, that having a high value in one column does not necessarily mean having a high value in other column. However, those with a relatively high value in both degree centralities have a high probability of being hub in the network. Likewise, Breschi et al (2009) captured hubs with using degree and betweenness centrality metrics in order to suggest policy for strengthening knowledge diffusion within networks in the field of ICT. Thus, it could be suggested that since there are many institutions in periphery separated from connected component, policy suggestions shall be drawn for identifying institutions in hub position and promoting them to collaborate with institutions in periphery position.

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*Ertan, A. pp.149-158*

**Table2:** Institutions with high degree and betweenness centralities

| **Degree Centrality** | **Betweenness Centrality** |
|---|---|
| Hacettepe University | Koc University |
| Istanbul University | Medeniyet University |
| Suat Seren Chest Dis & Surg Training & Res Hosp | Ege University |
| Ankara University | Marmara University |
| Ege University | Sakarya University |
| Ankara Yildirim Beyazit University | Istanbul University |
| Florence Nightingale Sisli Hospital | Istanbul Medeniyet University |
| Anadolu Medical Center Hospital | Ondokuz Mayis University |
| Yunus Emre State Hospital | Istanbul Training Res Hospital |
| Erciyes University | Erciyes University |
| Ondokuz Mayis University | Haydarpasa Numune Training Res Hospital |
| Koc University | Bulent Ecevit University |
| Istanbul Training Res Hospital | Cumhuriyet University |
| Gulhane Military Medical Academy | Dokuz Eylul University |
| Haydarpasa Numune Training Res Hospital | Izmir Katip Celebi University |
| Bulent Ecevit University | Haseki Training Res Hospital |
| Public Health General Directorate Turkey | Gulhane Mil Med Academy |
| Bezmialem Vakif University | Dicle University |
| Ardahan Public Hospital | Baskent University |
| | Kocaeli University |
| | Hacettepe University |
| | Adnan Menderes University |
| | Bezmialem Vakif University |
| | Bursa Yuksek Ihtisas Training Res Hospital |
| | Izmir Bozyaka Training Res Hospital |
| | Mersin University |
| | Katip Celebi University |
| | Dr Lutfi Kirdar Training Res Hospital |
| | Ankara Numune Training Res Hospital |
| | Ankara Yildirim Beyazit University |

**Source:** Author

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## 4. Results and conclusion

The findings of this study show that most researchers in Turkey publish papers on infectious diseases through national collaboration which is mostly in-house institution and there seems to be a small number of researchers in Turkey in the network of international institutions. This could be resulted in exposure to opposing same information. Within this regard, this study suggests that institutions in hub position should be identified to eliminate gaps between separate components in the network in order to maintain information flow from different channels.

These findings can be used to extend identification of policy suggestion in elimination of distances in information transfer in the following:

- Providing research grant, incentives and other support mechanisms to the institutions lack of national/international collaboration for capacity building
- Establishment and effective operation of research centers/technology transfer offices for guiding researchers to collaborate
- Promoting collaboration and awareness raising of researchers and institutions

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**22nd RSEP** International Economics, Finance & Business Conference – Virtual/Online
25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Zahariev, A. & Prodanov, S. & Ivanova, P. & Kichukov, I. pp.159-166*

# The lower danube tourist destination – From the heritage of the Roman Empire to a new infrustructure of tourist routes in the cross-border region Bulgaria-Romania[1]

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## Abstract

The sector of tourism is a leading service sector according to the BoP methodology. Nowadays, not only has Covid-19 put the sector to the test, but many economic operators claim that they need for government support measures. Therefore, a strategic transformation of the tourism sector during and after the Covid-19 pandemic is logical and necessary. The main goal of this study is to endorse ideas for projects and tourist routes in the "Lower Danube" destination within the process of strategic transformation of tourism due to Cocivd-19 taking into account the cultural, historical and archaeological findings from the time of the Roman Empire in the cross-border region Bulgaria-Romania, its natural resources and the newly developed infrastructure in the Danube plain between the Carpathians and the Balkan Range.

***Keywords:*** Lower danube, tourist routes, Covid-19, cross-border region Bulgaria-Romania.

***Jel Codes:*** L83, O18, R58, Z32

## 1. Introduction

Tourism is a major sector in the economies of Bulgaria and Romania. Its development over the years, significant private and public investments and capacity to offer year-round tourist products, the rich cultural and historical heritage, spa resources, mountains, sea and river resorts are a solid foundation for attainment of a strategic advantage over competitive destinations in the region. The Covid-19 crisis put the whole sector to the test and drastically reduced the demand for tourist services. In fact, the sector will have to adapt to operate in an ex-post Covid-19 environment but it must first find solutions for survival during the pandemic. The negative impact of Covid-19 on the economic entities in the sector and the related industries is devastating and requires a strategic transformation of the offered tourist product. It should be adapted to the new requirements with adequate investments in tourism superstructure and infrastructure in compliance with the safety and health requirements set out in EU documents.

## 2. Conceptualization, literature review and development hypothesis

### *2.1. The concept of a cross-border tourist and road infrastructure*

The force majeure effect of the global pandemic caused by Covid-19 is a logical basis for conducting theoretical and empirical/field research to review and reassess the existing solutions for financing and investments in the tourism industry with a view of the operational adaptation and strategic transformation of the entire tourism sector during and after the Covid-19 pandemic. The aim of this research paper is to present a financial and economic analysis and propose solutions for an operational adaptation and strategic transformation of the entire sector that would keep it viable during and after the Covid-19 pandemic. This should be done taking into account the country's competitive advantages and the health and safety requirements of acquis communautaire. The large-scale investments in the transport infrastructure of northern Bulgaria created many new opportunities for logistics and

[1] **Acknowledgements:** This research was financially supported by the Academic Foundation "Prof. Dr. Minko Rousenov", Svishtov, Bulgaria (Grant No. 1001008) and the Institute of Scientific Research at D. A. Tsenov Academy of Economics, Svishtov, Bulgaria.

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*Zahariev, A. & Prodanov, S. & Ivanova, P. & Kichukov, I. pp.159-166*

intermodal services on the territory of Bulgaria and Romania. The completion in 2030 of the TEN-T network motorways and connecting roads parallel to the Danube River (e.g. the A6 motorway in Romania and the A2 in Bulgaria) is a key factor for the Lower Danube region as a tourist destination. The construction in Romania and Bulgaria of expressways along the lines Bucharest – Giurgiu/Ruse (Danube Bridge 1) – Veliko Tarnovo – the tunnel under Shipka – Turkey/Greece and Budapest – Calafat/Vidin (Danube Bridge 2) – Sofia – Southern Bulgaria – Greece/Turkey will make the region more easily accessible and attractive.

To the road infrastructure we add the implementation of engineering projects in the common Bulgarian-Romanian section of the Danube River for development of the port infrastructure through public investments and public-private partnerships, which include construction of new bridges over the Danube between Bulgaria and Romania. These projects will enhance the integrated development plans of the border municipalities in northern Bulgaria and southern Romania by including new ideas for regional tourism products. Some of these ideas cover tourist routes in the interior of the country while others are related to the Danube River and may become the foundation of a "Danube Limes"/"Lower Danube" destination. Such strategic projects include: Ecological routes in the Danube plain between the Carpathians and the Balkan Mountains; Destination "Moesia" for wine and culinary tourism; the cultural tourism route "The Way of the Roman Emperors and the Danube Wine Route" located in Croatia, Serbia, Bulgaria and Romania with 12 wine regions and 20 archaeological sites;

The "Danube Border" route as a UNESCO World Heritage Site (Danube Limes - UNESCO World Heritage) and a common tourist route "Roman border on the territory of the cross-border region Romania-Bulgaria" provide many opportunities for adventure tourism in the form of discovery, extreme, urbex exploration tourism in the Danube municipalities of Bulgaria and Romania; fishing tourism, on floating pontoons on the Danube near the islands of Belene, Vardim and Batin, and the Danube Delta in Romania; river tourist route with municipal boats "The three islands: Belene, Vardim and Batin" for small groups and transport and tourist route from Vidin / Calafat to Silistra / Calarasi with the restoration of fast river transport lines by hydrofoils. In the new conditions, the offer of a tourist product in the Lower Danube region should be more virtual, adaptable to abrupt changes, economically viable and protecting the health of customers.

*2.2. Literature review*

Covid-19 pandemic had a very strong negative impact on the business operating in the tourism industry and the related sectors. In many tourist destinations the cultural and creative industries are the most negatively affected sectors of the economy in the Covid-19 circumstances (Flew & Kirkwood, 2020). The imposed social distancing measures, travel restrictions, etc. brought many economic operators to the verge of going bankrupt.

In many areas, tourism is a key determinant of economic development, in others it allows for diversification of the economic structure, and in still others it is an economic multiplier. This is why governments and public authorities take measures to develop this sector, both within specific regions and country-wide. The efforts of decision-makers at national and regional level are aimed at using the available tools for strategic management, aimed at building competitive advantages in the receiving (host) tourist areas. In order for this process to be successful, it should be a complex, systematic, continuous combination of formulation and implementation of effective strategies raising the level of coherence between the industry and the public authorities to achieve the set goals.

European planning and strategy documents often emphasize that tourism policy is also a means to achieving common goals in the field of regional development. The expectations that tourism will be a structure-determining branch of Bulgaria's economy were widely proclaimed. Its contribution to gross domestic product, exports and employment is emphasized.

The term destination comes from the Latin word "destinatio" and means destiny, direction. The term "tourist destination" was studied in detail by Medlik and can be defined as "a country, region, city or other place that attracts tourists, is the main location of tourist activity and focuses on themselves most of the time and expense of tourists. It is the main concentration of tourist attractions, accommodation and other amenities and services for tourists, where the main impacts of tourism - economic, social and physical (Medlik, 1996). Therefore, a tourist destination is a geographical area with various features, characteristics or attractions that are characterized by their capacity to attract tourists.

In the specialized literature on tourism, the use of the term "tourist destination" does not have a long history. At the beginning of the 20th century, the terms "tourist place" and "resort" were used, followed by the term "tourist destination". The resort is a place, village or complex that has natural healing and climatic qualities and is used for

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*Zahariev, A. & Prodanov, S. & Ivanova, P. & Kichukov, I. pp.159-166*

temporary accommodation related to recreation, treatment, sports, tourism and other forms of recreation and pleasure.

Certain researchers define tourist destination as a geographically distinct area with certain tourist features, characteristics and attractive places, which are distinguished by their ability to attract tourists. The emphasis of the authors here falls on the very attractiveness of the tourist destination, as a set of natural and anthropogenic resources, which are territorially differentiated and are a factor in generating tourist demand as an economic activity (Terziev, 2019).

The definition of a tourist destination as a spatial quantity can vary on a much larger scale: uniting several tourist areas or to one resort or to a separate site, but is always chosen by the respective visitor as a "destination of the tourist trip" (Vodenska, 2006) and it is necessary to have the necessary accommodation and catering facilities as well as means for entertainment and other tourist activities. It can be added that this is the area offering favourable conditions for recreation, where tourists will spend their holidays.

A pragmatic definition of a tourist destination is given by Bukhalis, who defines it as "a geographical area that is perceived by its visitors as a unique entity and has a political and legal framework for tourism marketing and planning." (Marinov, 2006). Without supply chains (Laktionova and others, 2019), transport infrastructure, marketing and advertising, any tourist destination can be considered doomed.

*2.3. Development hypotheses*

The creation of a tourist destination is a process of precise analysis of supply, demand and competition. The foundation of an economic model in a cross-border territory, such as the "Lower Danube" between Bulgaria and Romania, requires an initial assessment of tourist flows from both countries and identification of a number of trends. Secondly, credit and debit entries for both the services sector and the transport and tourism sectors should be analysed on the basis of balance of payments data in order to show trends. Thirdly, the accessibility of the destination should be assessed by transport infrastructure (TEN-T network) and meridional cross-border facilities across the Danube - bridges and ferries. Fourth, the potential of the Danube itself as a tourist attraction for water transport should be identified and short, medium and long tourist routes identified, which can be financially justified as profitable. Fifth place should be given to the competitive advantage of the destination from the point of view of its cultural and historical heritage connected with the history of the Roman Empire in the lands of the Danube Limes (Fig. 1).

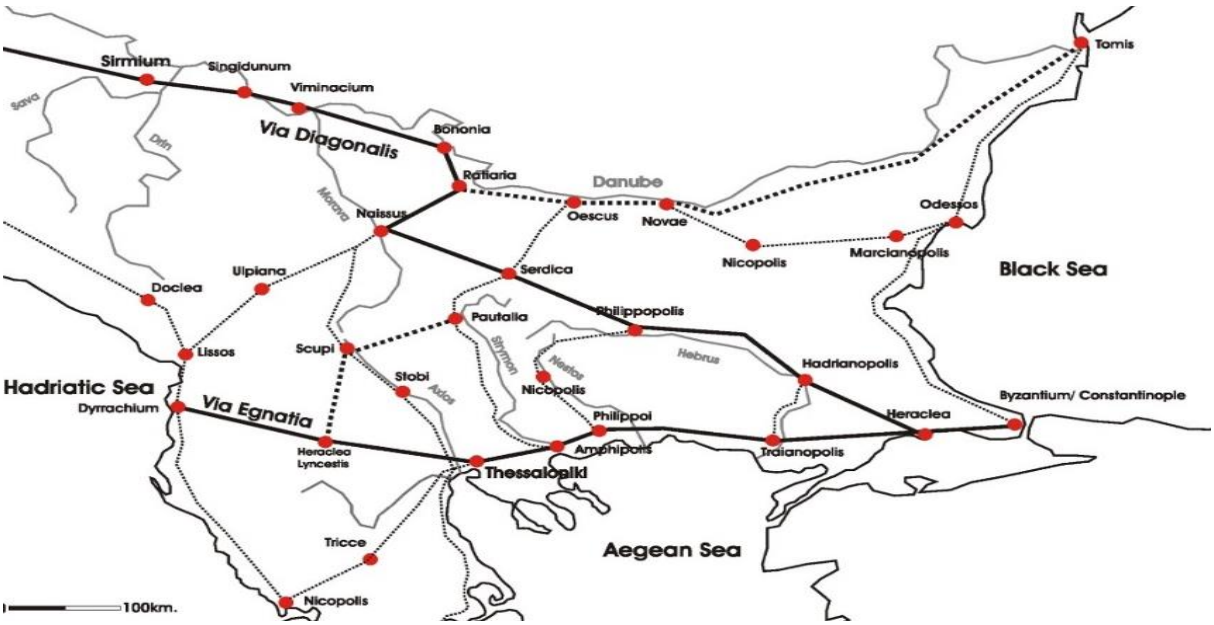


**Figure 1.** Network of Roman roads in the Balkans (1-4 century AD)

**Source**: (Evangelidis, 2015)

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*Zahariev, A. & Prodanov, S. & Ivanova, P. & Kichukov, I. pp.159-166*

The sixth step is the preparation of an action plan endorsed by the Ministries of Tourism of both countries, where by branding the destination, determining a list of the top 10 sites to visit on both sides of the Lower Danube, local governments support and staff training (Zahariev et al, 2021d), the destination will become attractive for domestic tourism, and also for short and long destination visiting tourists. The support by the government must be part of the state policy for GDP growth through the sector of tourist services, in favour with the current status of fiscal sustainability (Zahariev et al, 2021a). The recent studies for the most popular tourist destinations in Europe as Italy and Greece proves that the fiscal problems and high indebtedness (Zahariev et al, 2020a) of both countries are generating lack of funds for state support of tourist sector and that logically lead to economic recession or very slow economic growth.

## 3. Analytical findings

The first step for both neighbouring countries is the analysis of the data related with flows of numbers of arrivals by international tourism (Fig. 2) and the numbers of departures for the purposes of international tourism (Fig. 3).

The period of analysis is 20 years from 2000 to 2019 based of the statistics of the World Bank. The main conclusion from linear regression functions from Fig. 2 is that both countries have a steady trend of annual growth of the flows of arriving tourists, which for Bulgaria is 465 thousand tourists per year $R^2 = 0.945$, and for Romania is 413 thousand tourists at $R^2 = 0.876$. Otherwise main conclusion from linear regression functions from Fig. 3 is that both countries have a steady trend of annual growth of the flows of departure tourists, which for Bulgaria is 267 thousand tourists per year $R^2 = 0.621$, and for Romania is 357 thousand tourists at $R^2 = 0.829$.

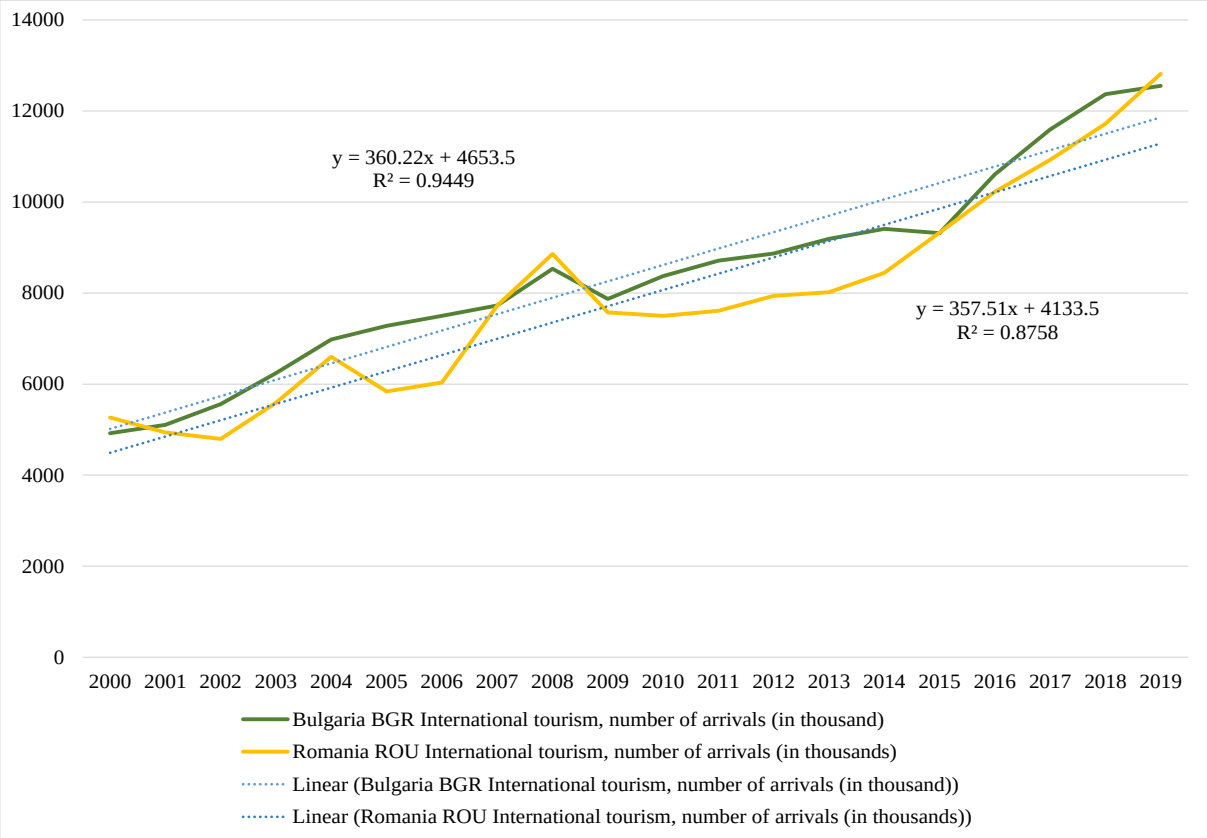


**Figure 2.** Bulgaria and Romaine international tourism, number of arrivals (2000-2019)

**Source:** (The World Bank, 2021a)

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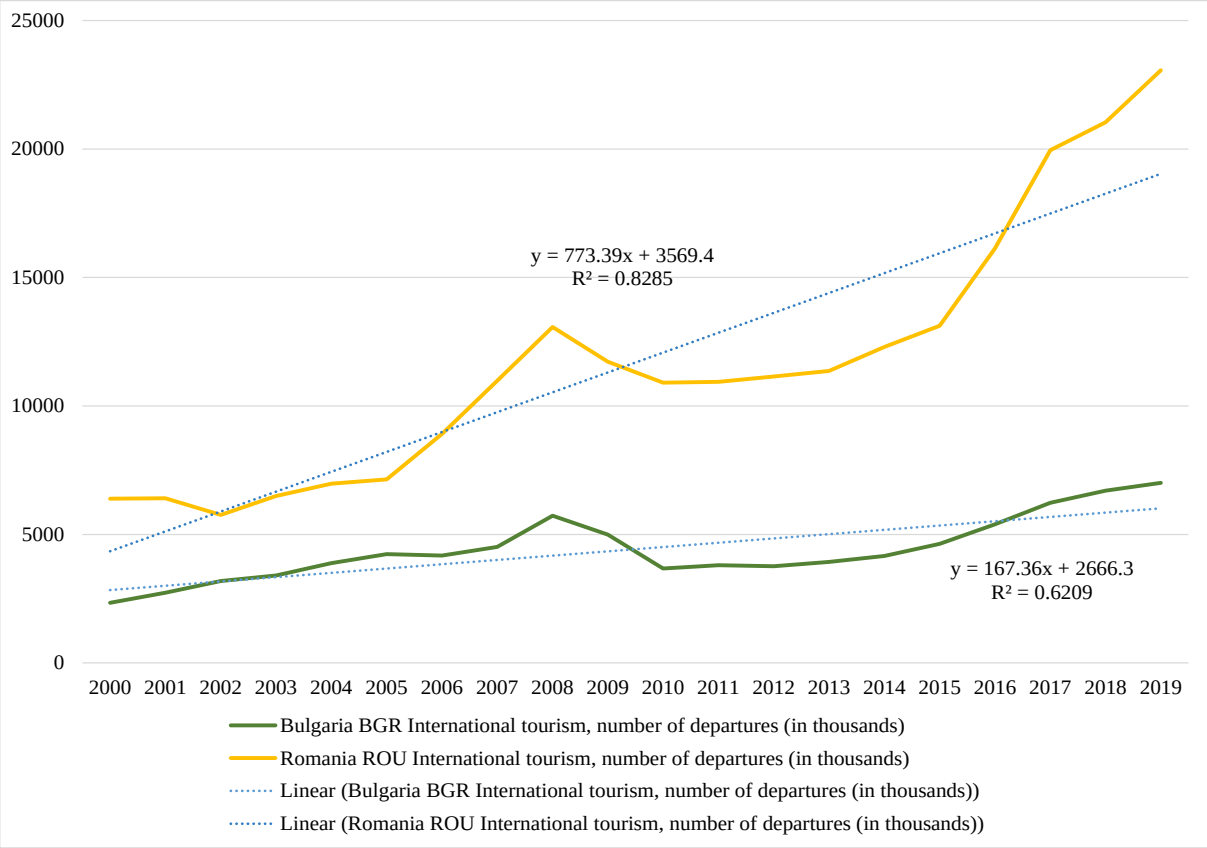


**Figure 3.** Bulgaria and Romaine international tourism, number of departures (2000-2019)

**Source:** (The World Bank, 2021b)

According to balance of payments data, Bulgaria reports a steady growth of the surplus on the Balance of Services, which at the end of the period 2000-2020 reached 5.45 billion USD for 2019 and 3.37 billion USD in 2020 in the context of the pandemic of Covid-19 (Fig. 4).

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*Zahariev, A. & Prodanov, S. & Ivanova, P. & Kichukov, I. pp.159-166*

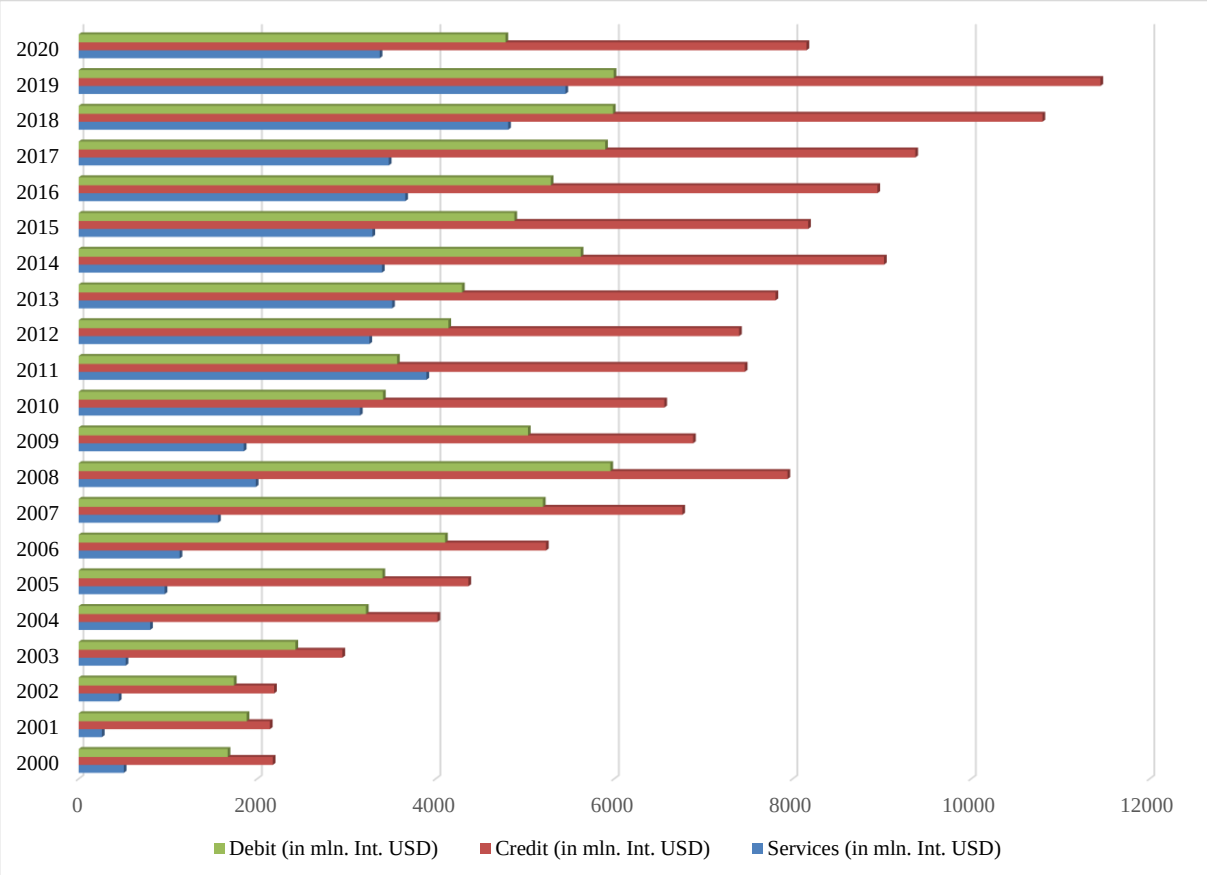


**Figure 4.** The Balance of Services of Bulgaria (2000-2020) in mln. Int. USD

**Source:** IMF


**Figure 5.** Official tourist logos of Romania and Bulgaria

**Source:** Ministry of Tourism of Bulgaria; Ministry of Tourism of Romania

The tourist logos of both countries share the idea of natural attractiveness such as mountains, sea, rivers (Fig. 5). As relatively bigger economy, the analytical data from the BoP or Romania proves the same trend for Romania as it is for Bulgaria (Fig. 6). Romania marks a steady growth of the surplus on the Balance of Services, which at the end of the period 2000-2020 reached highest ever level of 10.78 billion USD in 2020 regardless of the Covid-19 pandemic.

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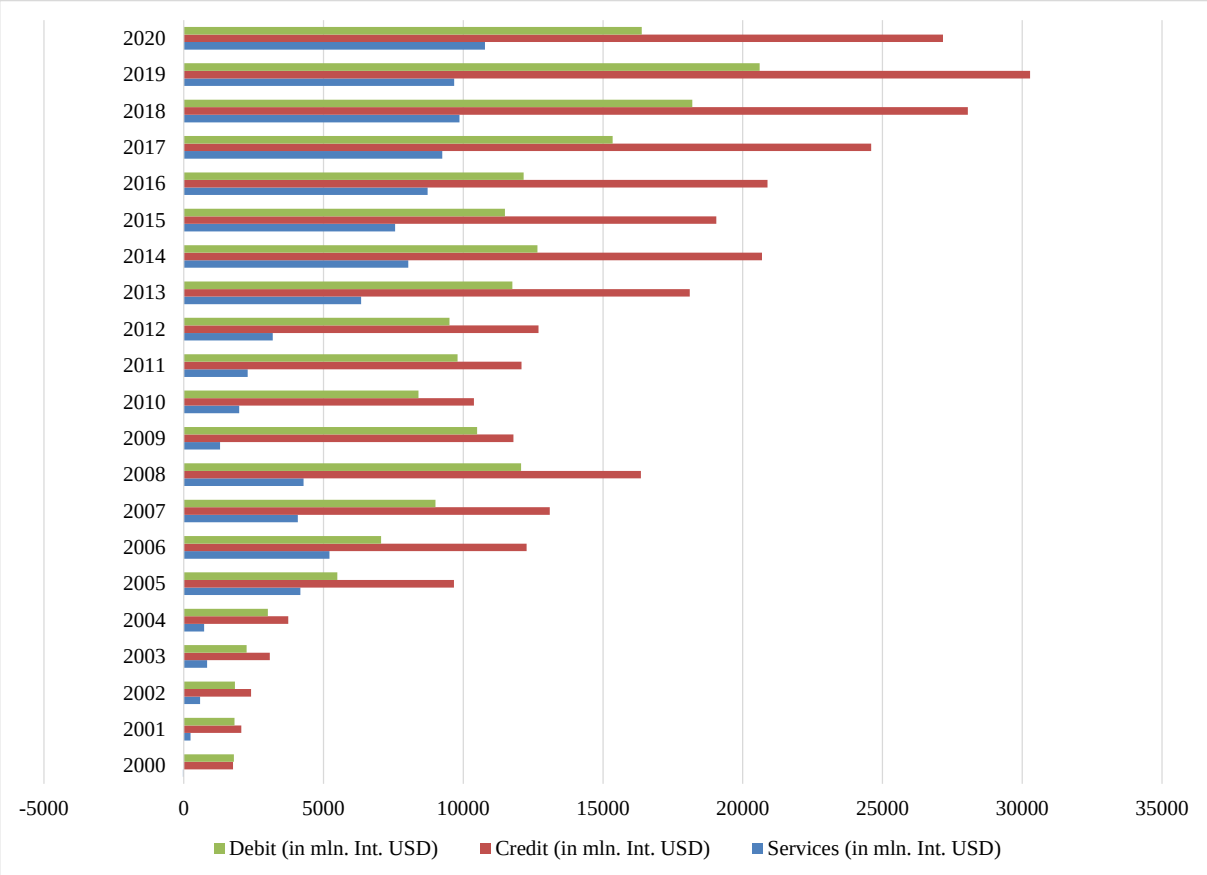


**Figure 6.** The Balance of Services of Romania (2000-2020) in mln. Int. USD

**Source:** IMF

The main macroeconomic indicator are bases for development of the rest upper described stages of the introduction of the tourist destination Lower Danube (Ivanova, V., & Zaharieva, G., 2017). It should be based of the heritage of the Roman Empire and supported with a new infrastructure of tourist routs in the cross-border region Bulgaria-Romania (Fig. 7).

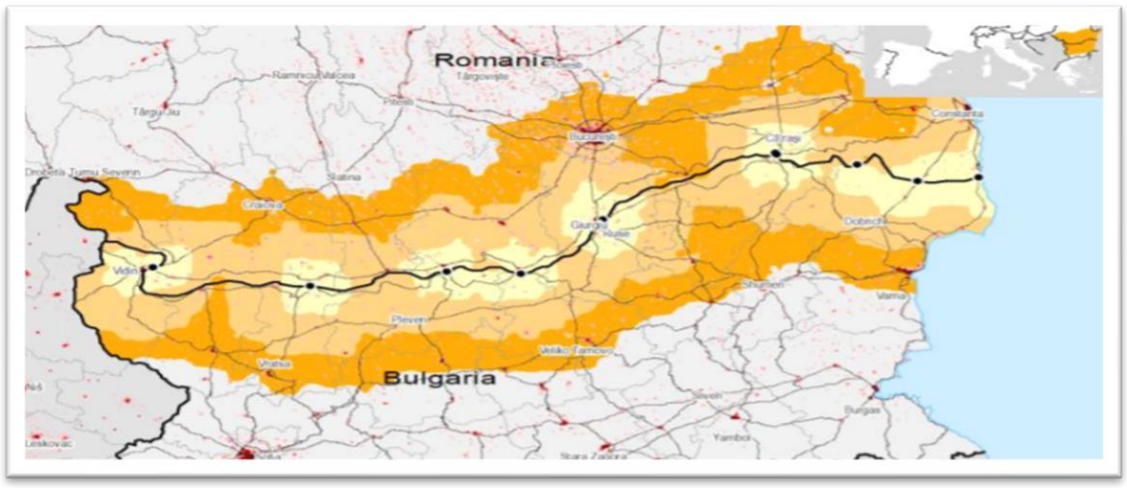


**Figure 7.** Geographical location of Lower Danube: Bulgaria – Romania

**Source:** https://www.interregrobg.eu/

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*Zahariev, A. & Prodanov, S. & Ivanova, P. & Kichukov, I. pp.159-166*

## 4. Conclusion

The tourist destination "Danube Limes" should be based on the sites included in the candidacy of Bulgaria for participation in the indicative list of UNESCO World Heritage Sites. This can be achieved by creating a management system for these sites, investments to provide physical transport links between them on the Danube, incl. through cycling, narrative formulation and product marketing. The priority axes with their strategic goals of the CBC program "Bulgaria-Romania" 2021-2027 should be considered as the main opportunity for grant support for the restoration of tourism in the Danube Limes in the period after COVID-19. This in turn will support the economies of the poorest regions in the EU, such as the Bulgarian and Romanian Danube regions, by improving their GDP per capita indicators.

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*Terziev, V. & Klimuk, V. pp.167-173*

# Study of the factors stimulating the youth innovative startup movement

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## Abstract

The development of the innovation potential of countries is possible due to the improvement of R&D and innovation infrastructure that enables promising scientific research, innovative developments, their implementation and scaling in similar industry complexes (regions). Innovative products create a foundation for the export growth of products (services) and the development of national brands.

***Keywords:*** development, innovation, education system.

***Jel Codes:*** P00, I20

## 1. Introduction

Global challenges faced by the education system and related to the growing speed of scientific and technological development, the environmental changes, the growing demands of society for the quality of products (services) and respectively the quality of recruitment process dictate the need for flexible education system that would adapt to the modern conditions of social and economic system. The education system should provide each student (learner, listener) with basic set of competences that will help them easier adapt to their first workplace and working regime.

## 2. Study of the factors stimulating the youth innovative startup movement

It is important to find ways of stimulating R&D and innovation by the educational institutions, to develop various forms of partnerships and collaborations at the interregional and international levels between educational institutions, business organizations, entities of the real sector of economy, government authorities and public organizations.

One of the significant directions for modern social and economic system development is the stimulation of youth entrepreneurship that is aimed at solving at least 2 main objectives:

- Stimulation: aimed at encouraging the innovation among young people, reward for the results (above all, for an innovative product);
- Socially-oriented: aimed at engaging young people in solving the most important social tasks of a region, country.

Innovative ideas should correspond to the needs of potential users, provide a solution to emerging problems, improve certain activities of business organizations and other entities. For the implementation of youth entrepreneurship initiatives, the Republic of Belarus creates the necessary conditions in terms of financial incentives, communications infrastructure, solution of organizational and managerial matters.

In the international ranking of the World Bank "Doing Business" 2020 the Republic of Belarus ranked 49th with a result of 74,3 points (in 2019 - 74,4 points). To compare, Bulgaria ranked 72nd (71,8 points), Russia – 78,2 (77,4 points), China – 77,9 (74 points), Germany – 79,7 (79,3 points) (Fig. 1) (2021).

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*Terziev, V. & Klimuk, V. pp.167-173*

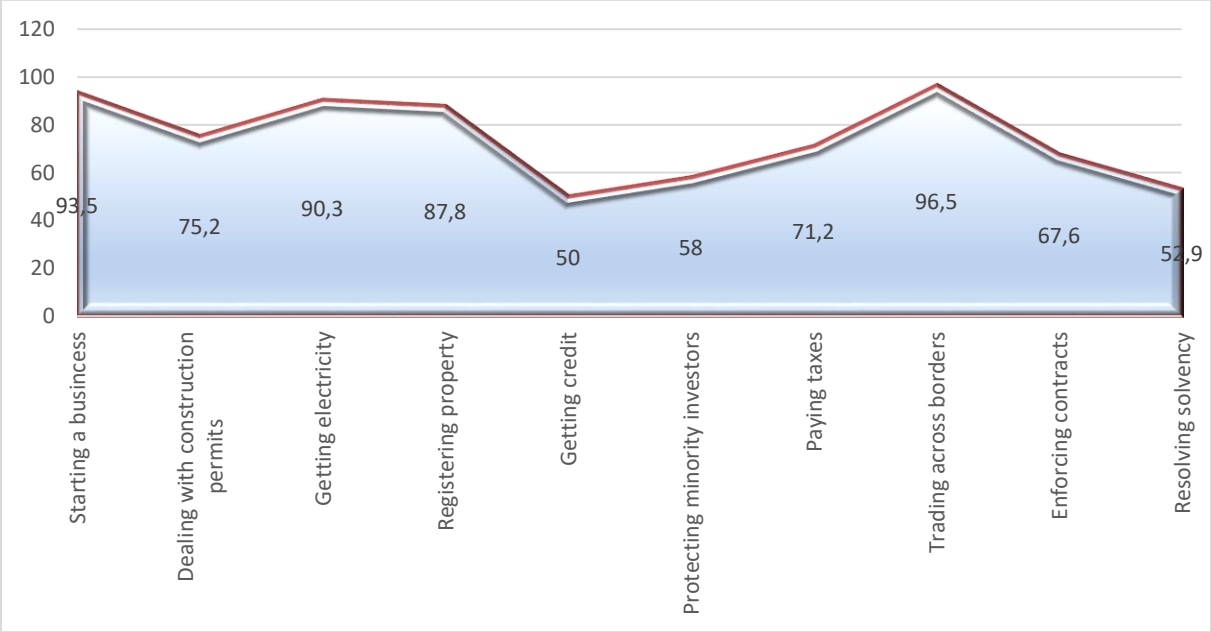


**Figure 1**. Indicators evaluating the conditions for starting a business in the Republic of Belarus in 2020, %

**Source:** Authors

The Republic of Belarus started actively implementing a complex of startup events in order to stimulate the development of business competences of young people, to increase the financial literacy, help young people implement their innovative ideas with the prospect of transforming into an innovation startup (plans for startup events are approved by the regional executive committees) (Terziev and Klimuk, 2021a; 2021c; 2021d; 2021e; 2021f; 2021g).

In order to study the existing problematic issues in the contemporary system of training future specialists, identify the tendencies in the development of small and medium sized enterprises, primarily innovative, a survey was prepared. It included 13 questions related to youth startup movement (2021b).

The survey contained the following questions:

- Do you wish to start your own business?
- What type of activity does your planned business correspond to?
- What type of products (services, works) will your business specialize in?
- Does your programme of study (in university, vocational secondary school) correspond to the specifics of your future planned business?
- Do you work in the field that matches your educational qualifications (for graduates)?
- Does (did) your programme of study in university include courses (disciplines) related to entrepreneurship, development of entrepreneurial skills?
- What, in your opinion, are the problematic issues in the educational institution(s) in the direction of training and development of business competencies among young people?
- Considering the competition, what is (will be) the main advantage of your business for the clients (regarding staff, equipment and facilities, quality of service, innovations, etc.)?
- What motivated you to start your own business?
- What, in your opinion, is the social effect of your planned business?
- What obstacles do (did) you meet (your fears) to start your own business?

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*Terziev, V. & Klimuk, V. pp.167-173*

- How do you understand "business"?

The survey engaged 205 respondents from Belarus and Russia aged from 16 to 33 years. 56,6% of them were men and 43,4% women.

54,1% of the respondents expressed their desire to start their own business and 31,7% were still doubting (Fig. 2).

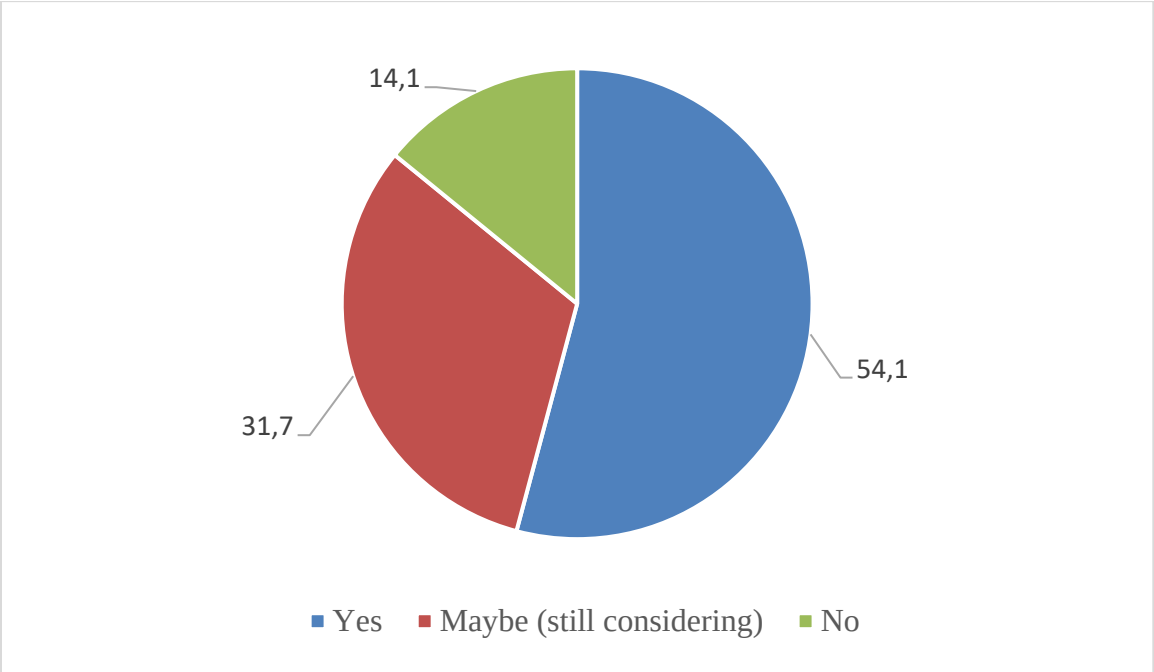


**Figure 2**. Answers of the respondents on whether they want to start their own business

**Source:** Authors

Thus, only 14,1% of the respondents have no intention of starting a business at the moment, while the rest are ready to do it.

The respondents chose the following as the main types of activities of their planned business:

Public services – 32,2%, information technologies – 21%, public catering – 18%, real estate – 15,6%, construction – 12,7%.

The obtained data indicate the focus of small businesses and startups on providing services to the population, which is determined by the scale of their activity. Digital transformation of social and economic systems is dictated by the desire and ideas of young people in the field of information technology. The need of communication, reducing the monotony of work of the employees, spending time together determines the high demand for services in the field of public catering.

Based on the answers of the respondents the main types of products (services), nature of the planned business, were identified. They included the following:

Advertising and information services – 24,4%, software development – 20,5%, food sales – 17,6%, handmade items – 13,2%.

The specifics of the planned business for 63,9% of the respondents matched their educational qualifications, which indicates the desire of young people to realize their potential and creative thinking, to implement their ideas in practice.

Out of 115 respondents who graduated from universities 67,8% do not work in the field they were qualified for, which indicates the problem of flexibility and adaptation of educational programmes to practical training, changing conditions of the development of the country and the world in general.

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*Terziev, V. & Klimuk, V. pp.167-173*

The previous conclusion is confirmed by the respondents' answers regarding the existence of disciplines related to entrepreneurship and the development of business skills during their studies: 81% of respondents answered that they did not have such disciplines at all / there was 1-2.

The answers of the respondents helped analyse the main problems in educational institutions regarding acquiring and developing business competences among young people (Fig. 3).

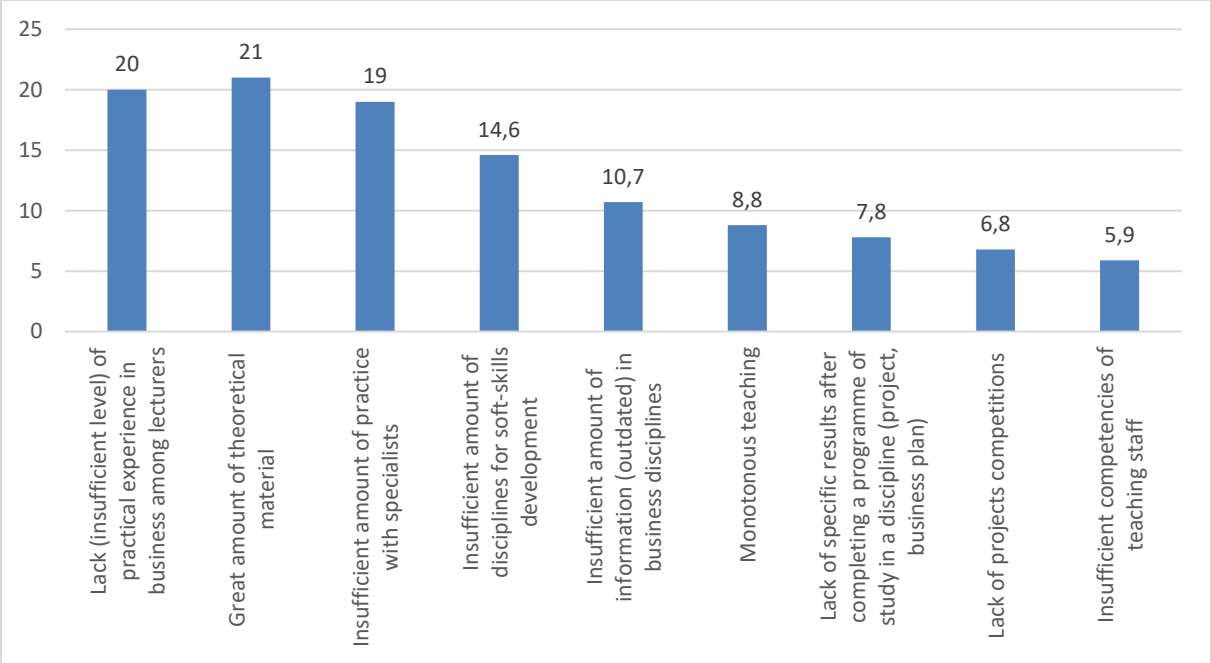


**Figure 3**. Problems in educational institutions regarding developing business competences

**Source:** Authors

The following are the main problematic issues defined:

- Lack (insufficient level) of practical experience in business among lecturers – 20% rated this factor with a maximum score of „5“;
- Vast amount of theoretical material – 21%.
- Insufficient amount of practice with specialists (incl. at their sites) – 19%.
- Insufficient amount of disciplines for soft-skills development (communicative, leadership, management, etc.) - 14,6% rated this factor with a maximum score;
- Insufficient amount of new (original) information in business disciplines – 13,7%;
- Insufficient amount of practical events held for business students – 10,7%;
- Monotonous teaching – 8,8%;
- Lack of specific results after completing a programme of study in a discipline (project, business plan, prototype, etc.) – 7,8%;
- Lack (insufficient amount) of competitions of youth business initiative projects – 6,8%;
- Insufficient competencies of teaching staff – 5,9%.

The respondents pointed out originality (novelty) and quality (of processes) as possible competitive advantages of the planned business.

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*Terziev, V. & Klimuk, V. pp.167-173*

Apart from this, based on the answers of the respondents the main incentives for starting a business were identified (Fig. 4).

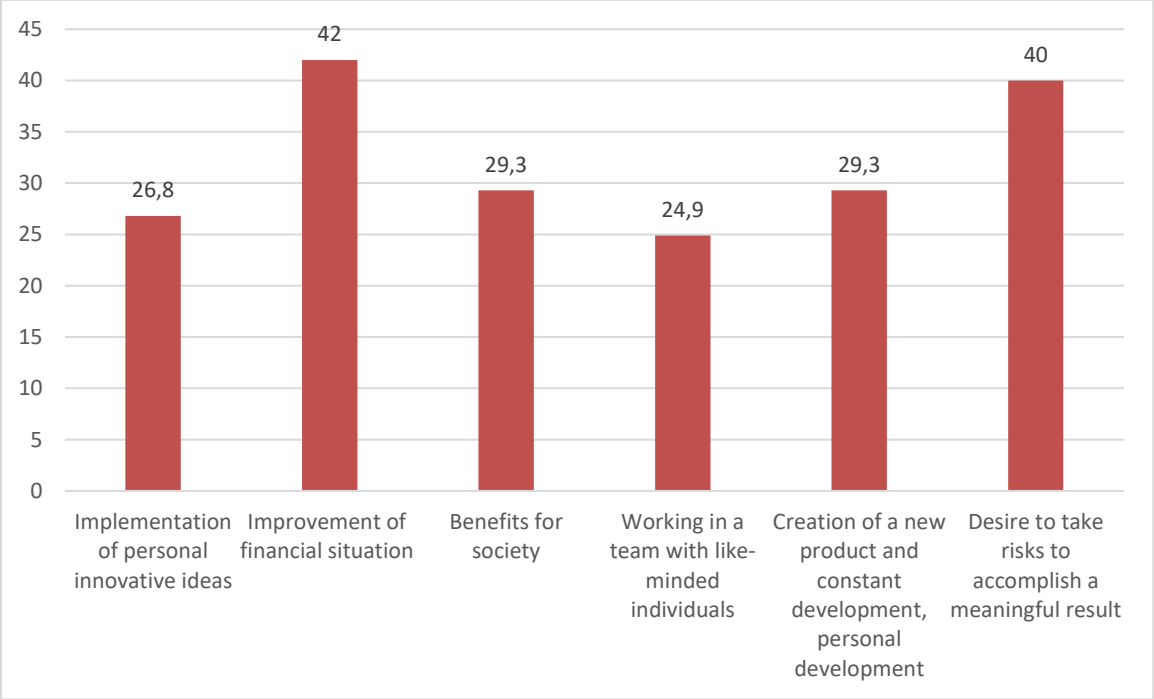


**Figure 4**. Main incentives for starting a business

**Source:** Authors

The main incentives for starting a business include:

- Implementation of personal innovative ideas – 26,8%;
- Improvement of financial situation – 42%;
- Benefits for society – 29,3%;
- Working in a team with like-minded individuals – 24,9%;
- Creation of a new product and constant development, personal development – 29,3%;
- Desire to take risks to accomplish a meaningful result – 40%.
- The respondents find that social effect of the planned business ideas is also a very important aspect (mainly their "benefit to society" answer).
- The respondents also identified the obstacles to starting a business. Some of the include:
- Lack of necessary financing – 42,4%;
- Lack of an idea itself for business – 8,3%;
- Lack of motivation – 6,8%;
- Risk of failure – 7,8%;
- Long procedure of preparing documents for starting a business – 12,2%;
- Lack of people who share your ideas (partners) – 9,3%;
- Lack of support from the family and friends – 8,8%;

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- Lack of experience of running a business– 25,4%;
- Lack of knowledge in business organization -19,5;
- Lack of specific business skills – 17,6%;
- Lack of potential investors – 23,9%;
- Limited funding options for youth business ideas – 17,1%.

The conducted survey helped identify the need to take certain financial, economic, organizational and managerial measures aimed at stimulating youth entrepreneurship:

- Financial and economic measures:
  - subsidies for youth innovation startup projects;
  - venture capital funds (alliances) for funding youth innovative startup;
  - the use of crowdfunding platforms to find sources of funding for innovative ideas;the use of equity financing (in case of a research and innovation startup: equal financing by the developer and the customer);
  - flexibility and mobility of distribution (redistribution) of funds allocated for the development of entities of innovation infrastructure.
- Organizational and managerial measures:
  - expanding the functions of business accelerators (incubators), coworking spaces (including international ones);
  - introducing the disciplines aimed at developing business competencies among young people in university programmes of study;
  - organizing systematic educational, scientific and practical events with the participants of educational, scientific sectors, real sector of the economy, government authorities, business organizations and public organizations.

## 3. Conclusion

The implementation of the proposed financial, economic, organizational and managerial measures aimed at stimulating youth entrepreneurship would help (Terziev and Klimuk, 2021h; 2021i):

- Develop cooperation between scientific, educational institutions, business organizations, government authorities, public organizations and provide a logical and structural approach to creating a high-quality innovative product based on a step-by-step process of generating an innovation;
- Ensure the growth of production volumes of innovative products (services), taking into account regional peculiarities, innovative, intellectual potentials, resource base and infrastructure;
- Enhance the social effect of the business projects being implemented, focusing on solving existing problematic issues in the social sphere, ensure a high level of employment, first of all, among young people for the development of the social and economic system of the region and the country.

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**22nd RSEP** International Economics, Finance & Business Conference – Virtual/Online
25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Kolesova, M. & Gainetdinova, A. & Mariev, O. pp.174-178*

# Socio-economic inequality and crime rate nexus in the context of Russian regions[1]

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## Abstract

Socio-economic inequality causes a number of problems in the society. Particularly, lower segment of society is more prone to committing crimes worsening living standard and quality of life. In our study we employ panel data for the period from 2005 till 2015. We investigate the socio-economic inequality and crime rate nexus in the context of 77 Russian regions by applying fixed effect method. The main feature of this method provides unbiased and consistent estimators in the presence of correlation between individual effects and independent variables. We measure socio-economic inequality by taking indicators reflecting the level of social tension, for example, income, poverty and unemployment rates. Thus, the distinct feature of our study is the inclusion of additional factors affecting the crime rate, which have been overlooked in the empirical literature. The results demonstrate that crime rate increases with an increase in the population share having income less than living wage, as well as with a decrease in average per capita income. Therefore, we justify the relationship between socio-economic inequality and crime rate. Our study can be a theoretical basis for the implementation of real economic policy measures in the context of Russian regions.

***Keywords:*** Socio-economic inequality, crime rate, fixed effects, Gini coefficient.

***Jel Codes:*** D63, D69, D60

## 1. Introduction

Nowadays the problem of inequality in terms of differences in income remains relevant in many countries. Social and economic stratification exists in every society. This is the division of various groups of the population into hierarchical levels that create dominant and subordinate groups in society. Dominant social and economic groups share have such privileges that subordinate groups do not have. Therefore, subordinate groups must face difficulties and inequalities. Since certain groups of the population have to live in the conditions of social and economic inequality, crime is becoming more common among these groups of the population. Often people with lack social and economic privileges cannot change their social status and many of them become criminals.

Russia also has encountered this problem being a large country with 11 time zones, combined with a heterogeneous cultural and ethnic composition of the population and different climatic conditions. Russia has more than 80 regions, which differ in population density, income levels and other socio-economic indicators. In particular, in 1999, more than half of the criminals in Russia were unemployed. They did not have an official source of income, hence, crime was a way to earn money. Nowadays areas with a high crime rate are often characterized by a weak economic situation, a lower standard of living and increased social tension. Nevertheless, the relationship between economic performance and crime rates still is a subject for investigation.

Therefore, we state the research question, if there is a connection between the socio-economic inequality of the region and the level of crime. The crime rate is one of the most important indicators of human capital, affecting the indicators of the quality of life in the country. Hence, this study contributes in the existing literature as a background for the implementation of regional policies in the Russian Federation.

[1] **Acknowledgement:** Research was supported by the grant of the Russian Science Foundation № 19-18-00262 "Empirical modelling of balanced technological and socioeconomic development in the Russian regions".

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## 2. Literature review

Many studies focus on socioeconomic inequality and crime rate nexus. For example, the scientific group of the Russian Academy of Science studied 1900 people and discovered that poverty negatively influences the psychoemotional status of the Russian population (Lezhnina et al., 2013, pp. 8-18). Mental deviations can change a person's norms and values in such a way that they can harm society (Shutochkina and Fastovich, 2019, pp. 1-3). Therefore, one can conclude that poverty affects crime. Poor young generation strive to the power and large incomes using illegal ways (Lezhnina et al., 2013, pp. 8-18). This also can lead to an increase in the crime rate.

Golubnichaya (2011) investigates the influence of the level of education and Gini coefficient on crime rate for the period of 1960-1980. The results show that inequality does not cause crimes in Japan. In the same time, the study documents that one of the main causes of crime in Russia is income inequality (Golubnichaya, 2011, pp. 35-48). Fedotov (2019) conducts a correlation analysis for the regions of Russia for the periods of 2005, 2008, 2010-2016. In order to test the impact of socio-economic inequality on the crime rate (Fedotov, 2019, pp. 208-2011). The author employs the Gini coefficient and the fund coefficient as indicators of social inequality. Unlike the study of Golubnichaya (2011), Fedotov (2019) obtain a significant relationship between the socioeconomic inequality and the crime rate for Russian regions. The study on the dynamic links between poverty, inequality, crime and social spending for 16 countries confirmed a strong correlation between socioeconomic factors and crime rates (Muhammad, 2020, pp. 1-25). By applying a two-step GMM method, the study emphasizes the need for strong policy frameworks to reduce crime worldwide. Crime rates and income polarization raised from 1988 to 2006 in China. Jing Li et al (2019) investigated the relationship between these indicators. The results demonstrate that income inequality is a positive, reliable and important determinant of crime rate. On the other hand, Gini and Theil indices as indicators of inequality are less significant or even insignificant in determining crime rate (Jing Li et al, 2019, pp. 51-72). Using state-level data, Chintrakarn and Herzer (2012) examined the impact of income inequality on crime rate in the United States. By applying panel cointegration methods, they found a strong crime reduction effect. Chintrakarn and Herzer, 2012 argue that rising income inequality might relate to the increased demand for protection from crime, thus decreasing crime rates (Chintrakarn and Herzer, 2012, p.p. 389-391). Kelly (2000) investigate the relationship between inequality and crime using data from urban counties. The study considers how inequality affects property crime and how it affects violent crime. The results show that the impact of inequality is paramount for violent crime, even after accounting for the effects of poverty, race, and family composition. However, property crime is not affected by socioeconomic inequality (Kelly, 2000, p.p. 530-539). Enamorado et al (2016) obtained similar result by examining the impact of income inequality on violent crime in the context of Mexico's drugs war. They found that an increase in income inequality on 1 unit leads to an increase of homicide rates on 36% (Enamorado et al, 2016, p.p. 128-143). Scorzafave and Soares (2009) select the state of São Paulo in Brazil to identify the linkage between income inequality and monetary crime. The study reveals that higher income inequality has a positive effect on crime rate. The study proposes to improve the state's police and legal system, which are important factors in reducing crime rate (Scorzafave and Soares, 2009, p.p. 40-42). Fajnzylber, Lederman and Norman (2002) explore the causal relationship between income inequality and crime across different countries. The study examines the correlation between the Gini coefficient and homicide and robbery rates within countries and between them. The article uses panel data for 39 countries for the period of 1965-1995 for homicides and 37 countries for 1970-1994 for robberies. The results demonstrate that crime rates and inequality are positively correlated within countries and between countries, and this correlation still holds, even after controlling for other determinants of crime (Fajnzylber, Lederman and Norman, 2002, pp.1 -39).

In contrary, the link between income inequality and violent property crime might be insignificant (Neumayer, 2005, p.p. 101-112). Neumayer (2005) argue that income inequality is likely to be highly correlated with country-specific fixed effects, such as cultural differences. A big number of articles overlook the poverty rate, although it is one of the main factors influencing the homicide rate. If poverty is added in the model, the relationship between inequality and homicide becomes insignificant in two out of three models (Pridemore, 2011, p.p. 739-772).

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*Kolesova, M. & Gainetdinova, A. & Mariev, O. pp.174-178*

## 3. Description of data

We use panel data for 77 regions of Russia for the period from 2005 to 2015. All variables are represented in Table 1.

**Table 1.** Description of variables

| Variable | Description | Unit | Source |
|---|---|---|---|
| *Dependent variable* | | | |
| Crime | Number of registered crimes per 100,000 people | Index | The portal of legal statistics of Russia |
| *Independent variables* | | | |
| Gini | Measurement of income inequality | Index | EMISS |
| Income | Average per capita income | Rubles | Rosstat |
| Unemployment | Unemployment rate | % | Rosstat |
| Poverty | The number of the population with monetary incomes below the subsistence level | % of the total population | Rosstat |
| Population | The size of the region's population | Number of people | Rosstat |

**Source:** Compiled by authors

## 4. Methodology

We develop our model as follows (1):

$$crime\_rate_{it} = \alpha + \beta_1 gini\_coef_{it} + \beta_2 income\_per\_capita_{it} + \\ + \beta_3 unemployment_{it} + \beta_4 poverty_{it} + \beta_5 population_{it} + \varepsilon_{it} \quad (1)$$

We employ OLS method and fixed and random effects approaches. Fixed effects (FE) method allows to provide unbiased and consistent estimators in the presence of the unobservable effects which can be correlated with independent variables. In addition, a panel data model with random effects (RE) is applied if unobservable effects do not correlate with the regressors. Usually for regional panel data, a model with FE is used, since each of the objects in such a sample has its own individual characteristics. Thus, one of the reasons to employ this approach to obtain a forecast for a specific object in the sample.

In order to choose the model among OLS, FE and RE we apply the Breusch-Godfrey test and the Hausman test.

## 5. Results and discussion

According to the results, the FE and RE approaches describe socioeconomic inequality and crime rate nexus better than the OLS. According to the results of the Hausman test, FE approach describes the relationship better than the RE, which confirms our assumption about the presence of individual effects which correlate with independent variables.

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The results obtained by applying FE approach are presented in the Table 2.

**Table 2.** The result of FE method.

| Crime rate | Coefficient | Standard error. | p-value |
|---|---|---|---|
| income | **-0.0466463** | **0.0023285** | **0.000** |
| gini | **15.5635** | **5.26231** | **0.086** |
| unemployment | **-14.45677** | **6.593958** | **0.029** |
| poverty | **11.83415** | **5.130822** | **0.021** |
| population | **0.0015387** | **0.0003214** | **0.000** |

**Source:** Based on authors' calculations in Stata 14.

The results of our estimation demonstrate that the per capita income and population are significant at all levels of significance, whereas unemployment, poverty, gini coefficient are significant at the 5% level.

The coefficients show that with an increase in per capita income by 100 rubles, the crime rate decreases by 5 crimes committed per 100 thousand people. With an increase in Gini coefficient, the crime rate also increases. An increase in the population with an income below the living wage by 1% leads to an increase in the crime rate by 11 committed crimes. An increase in the population of the region by 10,000 people leads to an increase in the crime rate by 15 committed crimes.

Surprisingly, unemployment rate influences crime rate negatively. An increase in the unemployment rate by 1% leads to a decrease in the crime rate by 14 committed crimes. We argue that negative sign of unemployment rate is explained by the fact that various amendments in the Criminal Code of the Russian Federation improved legislation quality what eventually resulted in a decrease in crime rate. The obtained result is also in line with some historical facts. For example, during the Great Economic Crisis of the 1930s, when unemployment reached 25%, crime in the United States was also decreasing. Similar effect was observed in the US, when the decline in crime and rising unemployment was partly due to the "Obama effect." According to criminologist Al Bloomsteen, the election of the first Afro-American president in history prompted a significant number of young African Americans to break with crime, lowering unemployment.

## 6. Conclusion

In our study, we examined the impact of socio-economic inequality on the crime rate in the context of Russian regions. By applying fixed effects method, we find that that increase in crime rate is associated with an increase in the share of the population with income below the living wage, as well as with an increase in the population and with a decrease in average per capita money income. We also confirm that with an increase in the Gini coefficient (which indicates income inequality), the crime rate increases. Therefore, we can conclude that there is a positive relationship between socioeconomic inequality and crime rate among Russian regions.

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*Yapilcan, H.E. & Bakirtas, H. pp.179-185*

# Determination of biogas potential from cattle waste in Aksaray[1]

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## Abstract

The increasing energy need of human beings with the developing technology has directed energy policies to renewable energy sources on a global scale. Our country has rich potential in terms of energy resources such as solar, geothermal, wind, and biogas due to its location. In this respect, especially the prevalence of agriculture and livestock sector shows that biogas energy production from agricultural and animal wastes can be a usable energy source to cover the energy demands. The purpose of the present study was to examine the biogas potential from cattle waste of Aksaray. The data were provided by TUIK and R. T. Ministry of Agriculture and Forestry in the study. In Aksaray province and its counties for 2020, the total number of cattle is 345809 heads. The total amount of cattle manure is 1891575.23 tons. As a result of the calculations, it was found that the biogas production amount of Aksaray that originates from cattle manure is 62421983 $m^3$/year, and the total electrical energy potential, which can be obtained from animal manure, is 293 383 318 kWh/year.

***Keywords:*** Renewable energy, biogas, animal waste.

***Jel Codes:*** Q42, Q29

## 1. Introduction

The increasing population of the world, industrialization, and the desire of the society to eliminate traditional living conditions and enhance living standards increase the requirement for energy with each passing day. As in all developing countries, our country also needs to produce its own energy to reach the level of developed countries. The tendency of fossil fuels to run out has caused that researchers look for inexhaustible renewable energy sources in our present day (Topaloglu and İmren, 2011).

Today, the use of renewable energy sources is inevitable for our country, which has high foreign dependency rates in terms of energy production. It was determined in the present study that Turkey is a suitable country for biogas production with its intense agricultural and livestock activities. However, considering the number of biogas power plants in our country, it is seen that the importance given to this type of energy is insufficient (Ergisi, 2019). The present potential must be determined on the basis of cities in our country to reduce foreign dependency in the energy sector and to ensure that animal wastes are evaluated without harming the environment (Aksu, 2019).

The purpose of this study was to uncover the biogas potential that could be obtained from cattle wastes in Aksaray, which has predominantly rural areas. Biogas potential assessment was made on the basis of Aksaray center and its counties. Also, the energy equivalent of the biogas potential on the basis of each county was examined. When the relevant literature was reviewed, the lack of any study examining the biogas potential of Aksaray and the fact that 70% of the population make a living from agriculture and animal husbandry were the driving forces of this study. This also shows the importance of the study.

## 2. Biogas Concept and Its Characteristics

According to future energy scenarios, renewable energy sources will play important roles in achieving sustainability targets. A total of 80% of the global energy demand is covered by fossil fuels in our present day. It was reported in previous studies that the use of fossil fuels will continue until 2035, and the use of renewable energy sources will increase after 2035 (IEA, 2018). Renewable energy sources play important roles in the policy of reducing the amount of carbon dioxide in the atmosphere. In this respect, the energy obtained from biogas is considered one of the most dominant renewable energy sources in the future (Appels et al., 2011). Producing

[1] This study is produced from master's thesis.

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biogas from wastes has been known for years, and many studies have been conducted on this issue. As long as life continues, biogas is an endless energy source. Being able to make use of this resource at adequate levels is important both in environmental and economic terms (Sorgulu, 2020).

The gas mixture of carbon dioxide, methane, and a small amount of hydrogen sulfide, which forms as a result of the decomposition of organic materials in an airless (oxygen-free) environment, is called biogas. The methane gas in the biogas has a critical importance for natural gas (Yilmaz et al., 2018). The rates of the gases in the biogas are shown in Table 1 (Sethi, 2018). Biogas is similar to natural gas because it has mainly $CH_4$. For this reason, it has the flexibility to be used in many areas where natural gas is used. In general, it can be used as a fuel for heating, electricity generation, and for vehicles (Yılmaz, 2019).

**Table 1.** Main components of biogas

| Biogas Component | Weight Percentage |
|---|---|
| Methane | %50 - %75 |
| Carbon dioxide | %25 - %50 |
| Nitrogen | %0 - %10 |
| Hydrogen Sulfur | %0 - %3 |
| Hydrogen | %0 - %1 |
| Oxygen | %0.5 |
| Water | %5 - %6 |

**Source:** Sethi, 2018

Many organic waste materials can be used for biogas production. These items are food wastes, vegetable wastes, animal wastes, and sewage wastes (Sethi, 2018). In biogas production, liquid fertilizer and solid fertilizer production are also provided in addition to energy. Obtaining these fertilizers is achieved by keeping the raw materials in reactor for 28-45 days in biogas plants and separating them into solid and liquid phases at the end of this period with equipment such as a separator at the exit line. The fertilizer produced in this way is a rich product considering the amount of N, P, K[2] and organic matter, which are very beneficial for the soil (Kaplan, 2020). When the biogas production process is examined, it is seen that by-products are obtained at various stages of the production process.

## 2. Biogas Production

In Turkey, on the way to sustainable development, the efforts to cover the energy requirements must be performed in the framework of the principle of "think globally, act locally" without harming natural resources. As a result of the examination of the development of energy resources in the past decade, it was found that the energy types obtained from wastes were not given adequate importance. In our present day, there are 122 renewable waste power plants established since 1963 and new installation works are continuing (Yılmaz, 2019). Our country needs large-scale biogas production facilities. In general, power plants differ according to the type of raw materials used in them. There are 3 biogas plants that have a total capacity of 8.89 MW in Aksaray.

The European Union reported that biogas production provides benefits to society and the industry, and for this reason, it provides support to government institutions, companies, research institutes, and financial institutions meticulously (Euverink and Achinas, 2019).

In this respect, 80% of the facilities in the world are located in China, 10% are in India, Nepal, and Thailand. If the number of biogas plants in Europe is considered, Germany is the country that has the highest production with 2200 plants.

[2] N: Nitrogen
P: Phosphor
K: Potassium

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*Yapilcan, H.E. & Bakirtas, H. pp.179-185*

## 3. Material and Method

In the study, the purpose was to calculate the biogas potential that can be produced in the city of Aksaray and its counties. Firstly, the amount of animal husbandry that makes up the agricultural production activities of Aksaray and its counties was determined. The data were obtained from the Ministry of Agriculture and Forestry and the Turkish Statistical Institute.

Aksaray has 8 counties, which are Center, Eskil, Agacoren, Sarıyahsi, Sultanhanı, Ortakoy, Gulagac, Guzelyurt (Aksaray Provincial Directorate of Culture and Tourism, 2021). Counties are shown in Figure 1 (Aksaray Municipality, n.d.).

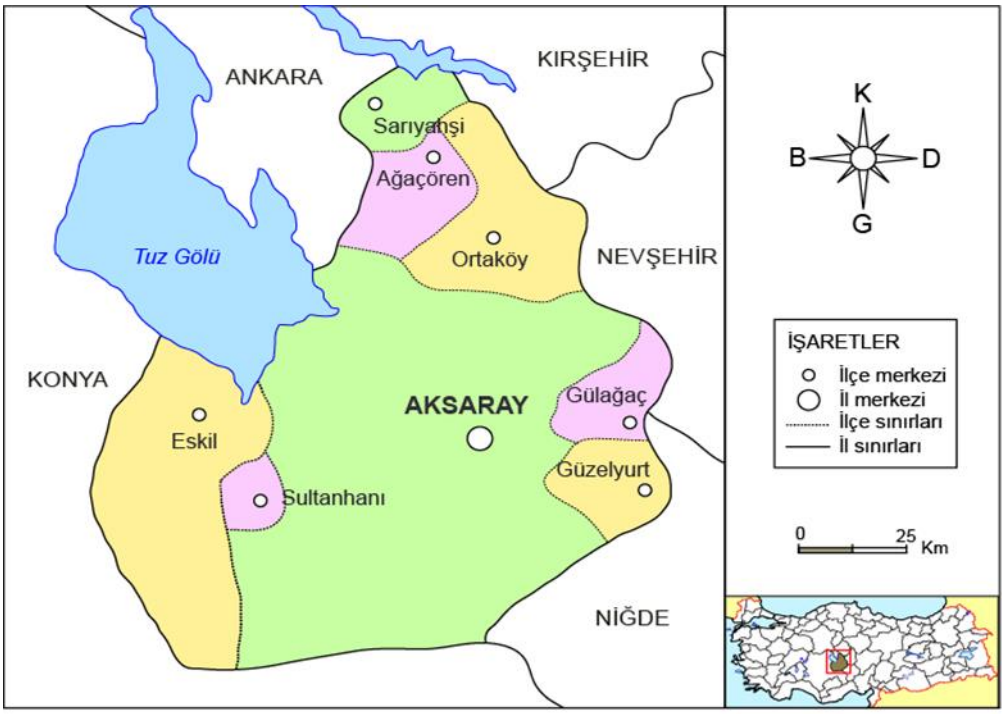


**Figure 1.** Location of Aksaray and counties in Turkey

**Source:** Aksaray Municipality, n.d.

According to the data obtained from the Turkish Statistical Institute, an increase was detected in the number of cattle bred in Aksaray over the years. The number of cattle, which approached 200 thousand in 2016, increased steadily over the years and approached 350 thousand in 2020 (**Figure 2**) with the effect of the incentives provided.

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*Yapilcan, H.E. & Bakirtas, H. pp.179-185*

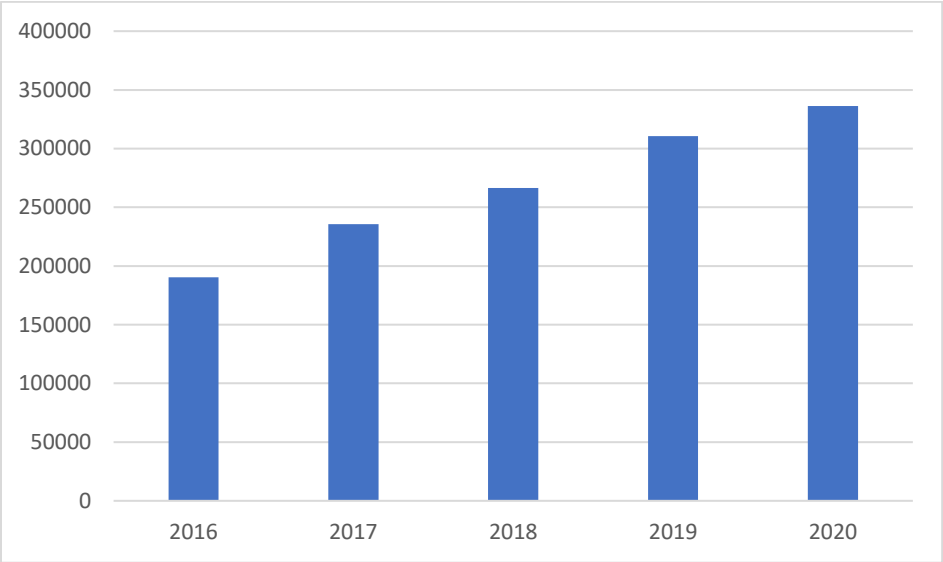


**Figure 2**. Distribution of the number of cattle bred in Aksaray according to years

**Source:** TUIK, 2021

According to the data obtained from the Turkish Statistical Institute, the total number of cattle in Turkey was 18 million 615 thousand as of 2020 (TUIK, 2021). In the light of the data obtained from the Ministry of Agriculture and Forestry, the number of cattle in Aksaray was 345 809 for the same period (Table 2); and 1.92% of cattle in Turkey were bred in Aksaray.

**Table 2.** Distribution of the number of cattle in Aksaray according to counties

| City | County Name | Number of Cattle | Number of Buffalos | Total Cattle |
|---|---|---|---|---|
| AKSARAY | Agacoren | 6 354 | 27 | 6 381 |
| | Eskil | 90 502 | 0 | 90 502 |
| | Gulagac | 10 453 | 1 | 10 454 |
| | Guzelyurt | 8 868 | 0 | 8 868 |
| | Centrum | 183 669 | 1 266 | 184 935 |
| | Ortakoy | 21 774 | 0 | 21 774 |
| | Sarıyahsi | 2 435 | 5 | 2 440 |
| | Sultanhani | 20 450 | 5 | 20 455 |
| **Total** | | **344 505** | **1 304** | **345 809** |

**Source:** R. T. Ministry of Agriculture and Forestry, 2021

Turkey has the necessary potential to cover social needs with the high energy potential of livestock products and the intense activities in the field of livestock. This shows that Turkey is quite rich in terms of biogas energy equivalent obtained from animal products. Statistical values obtained from the literature were used while making the calculations. These are:

• 5.47 tons/year of manure is obtained from cattle (Ocal, 2013). The usability rate of animal manure was accepted to be 50%, and the dry matter rate was taken as 15% (Ozturk, 2019).

• 33 $m^3$ biogas is obtained from 1 ton of cattle waste (Ergisi, 2019).

• 4.7 kWh electrical energy is obtained from 1 $m^3$ of biogas (Ocal, 2013).

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*Yapilcan, H.E. & Bakirtas, H. pp.179-185*

• 17 L biogas is required for electrical energy produced in 1 minute (Kadam, 2021).

In this case, the amount of manure to be obtained per cattle is calculated as follows.

| **Total number of cattle X Manure to be obtained from 1 cattle ton/year** |
|---|

To determine the amount of biogas to be produced:

| Manure obtained per cattle (tons/year) X Biogas obtained from 1 ton bovine waste |
|---|

If biogas is converted into electrical energy:

| The amount of biogas produced X 1 $m^3$ electrical energy obtained from biogas |
|---|

It was determined that 1 $m^3$ biogas has an energy of 5500-6000 kcal depending on the components in the caloric value (Yılmaz et al., 2018). When compared to other fuels, 1 $m^3$ Biogas equals 4.70 kWh electricity (Gumuscu and Uyanık, 2010).

## 4. Results

Firstly, the amount of waste must be determined according to the animal species to determine the biogas potential to be obtained from animal wastes. The number of cattle in Aksaray, the amount of manure to be obtained from these animals, and the amount of biogas to be obtained are shown in Table 3.

**Table 3.** Amount of biogas to be obtained from cattle manure

| **County Name** | **Number of Cattle** | **Manure to be Obtained (tons/year)** | **Amount of Biogas to be Obtained ($m^3$)** |
|---|---|---|---|
| Agacoren | 6 381 | 34 904.07 | 1 151 834.31 |
| Eskil | 90 502 | 495 045.94 | 16 336 516.02 |
| Gulagac | 10 454 | 57 183.38 | 1 887 051.54 |
| Guzelyurt | 8 868 | 48 507.96 | 1 600 762.68 |
| Centrum | 184 935 | 1 011 594.45 | 33 382 616.85 |
| Ortakoy | 21 774 | 119 103.78 | 3 930 424.74 |
| Sarıyahsi | 2 440 | 13 346.80 | 440 444.40 |
| Sultanhani | 20 455 | 111 888.85 | 3 692 332.05 |
| **Total** | **345 809** | **1 891 575.23** | **62 421 982.59** |

**Source:** R. T. Ministry of Agriculture and Forestry, 2021 (first column) & created by authors (others)

The total number of cattle in Aksaray is 345 809. Assuming that 5.47 tons/year of manure is obtained from cattle, the annual total amount of manure available for Aksaray was found as follows:

(345 809 x 5.47) = 1 891 575 tons/year.

Again, assuming that 33 $m^3$ biogas is obtained from 1 ton of cattle manure, the amount of biogas that can be produced in Aksaray was found as follows.

(1 891 575.23 x 33) = 62 421 982.59 ≅ **62 421 983 $m^3$/year.**

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*Yapilcan, H.E. & Bakirtas, H. pp.179-185*

If all of the obtained biogas is converted into electrical energy, the electrical energy to be produced will be as shown below.

(62 421 982 × 4.70) = 293 383 318.20 ≅ 293 383 318 kWh/year.

The average electricity consumption per capita is 3 709 kWh/year (Ministry of Energy and Natural Resources, 2018). The electrical energy that can be obtained with the total cattle manure is 293 383 318 kWh/year. For this reason, the electricity consumption of 79 100 people can be covered with the cattle-derived biogas potential of Aksaray, as shown below.

(293 383 318 / 3 709) = 79 100.38) ≅ 79 100 people. This figure corresponds to approximately 19% of the population of the city (the population of Aksaray according to 2020 data was 423.011).

## 5. Conclusion and Recommendations

Making use of the biogas energy from renewable energy sources has specific importance for our country, which has abundant organic wastes, not only for agriculture but also for animals. Biogas production enables more efficient use of animal and agricultural wastes. The biogas production potential on the basis of the counties of Aksaray was examined in this study by considering the animal wastes in Aksaray,

The amount of biogas to be obtained from cattle manure in Aksaray was found to be 62 421 983 $m^3$/year. The heat values of biogas to be obtained from cattle manure equals 293 383 318 kWh electric energy. When the potential for biogas production with cattle manure was investigated for Aksaray, it was found that it corresponds to approximately 19% of the population (the population of Aksaray was 423 011 according to 2020 data).

This study had some limitations. The first is the fact that the study was limited to the province of Aksaray. Future studies can examine the biogas potential of different cities in our country. Secondly, the biogas potential was investigated in the present study. The subject of biogas can be investigated from different dimensions in future studies (i.e. technical problems faced during production, employment of personnel, machinery parts, etc.). Finally, biogas potential was investigated on the basis of bovine wastes in this study. Biogas potential can be examined considering other wastes in future studies (i.e. agricultural, small cattle, and poultry wastes).

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*Terziev, V. & Klimuk, V. pp.186-193*

# Factors affecting the development of R&D and Innovation infrastructure in business acceleration system: National and foreign experience

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**Abstract**

The improvement of R&D and innovation infrastructure that provides the possibility of carrying out promising scientific research, mostly applied research aimed at obtaining economic and social effects, significantly influences the development of innovation potential of countries.

***Keywords:*** factors, innovation, development, R&D.

***Jel Codes:*** P00, I20

## 1. Introduction

Research and innovation activity of organizations contributes to the development of technological potential of the country`s regions, ensures the most beneficial use of resources within the cooperative business model that combines scientific, education, real sector of the economy, business, government authorities and public organizations to increase the competitiveness of the national social and economic system. The improvement of R&D and innovation infrastructure that provides the possibility of carrying out promising scientific research, mostly applied research aimed at obtaining economic and social effects, significantly influences the development of innovation potential of countries.

## 2. Factors affecting the development of r&d and innovation infrastructure in business acceleration system: national and foreign experience

The level of innovation development of countries is determined in an international format by an integral index - Global Innovation Index that provides metrics about the innovation performance of countries in 7 categories: institutions, human capital, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, creative outputs (intangible assets). Innovation potential of Belarus in 2016 sharply decreased (from 38,23 to 30,39 points) and until 2020 we could observe its gradual recovery, approaching the level of 2020 (Fig. 1) (2021a).

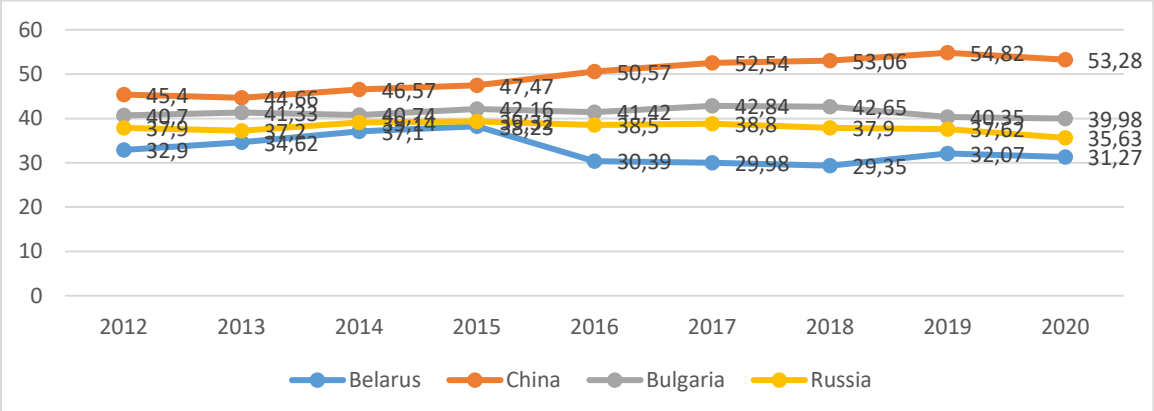


**Figure 1.** Dynamics of the Global Innovation Index: comparative tendencies in Belarus, Russia, China and Bulgaria for 2012-2020, points

**Source:** Authors

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Such recession, according to the data collected in Belarus, may be caused by the implementation of a new programme for social and economic development, programme of innovation development for the next five years with new priority areas.

The Global Innovation Index of China had been increasing annually since 2014, however in 2020 its value dropped by 1,54 points compared to the previous year which, in particular, may be caused by the pandemics that influences negatively the business activity and the development of innovation and market infrastructure, decreases international trade and economic activity. In Russia and Bulgaria the Global Innovation Index had been gradually decreasing since 2016 and in 2020 it reached 35,63 and 39,98 points respectively.

Based on the analysis of statistical data by components of the Global Innovation Index for the period 2011-2020 the matrices of correlation coefficients showing the dependence of the level of the global innovation index on the component variables have been created. This will make it possible to effectively manage the implementation of innovation policy in the country, quickly adapt to the changing conditions of the social and economic system (Table 1).

**Table 1.** Correlation coefficients: China, Belarus, Russia

| **Correlation coefficient** | | **Value** |
|---|---|---|
| China | | |
| | Institutions | 0,8734 |
| | Infrastructure | 0,8784 |
| Global Innovation Index | Intangible assets (creative outputs) | 0,9459 |
| | Human capital | 0,8709 |
| Institutions | Market sophistication | 0,8386 |
| | Intangible assets (creative outputs) | 0,8389 |
| Belarus | | |
| | Market sophistication | 0,7697 |
| Global Innovation Index | Technology outputs | 0,9259 |
| | Intangible assets (creative outputs) | 0,8837 |
| | Institutional analysis | 0,7651 |
| Infrastructure | Human capital | 0,7694 |
| Technology outputs | Intangible assets (creative outputs) | 0,7782 |
| **Russia** | | |
| Global Innovation Index | Intangible assets (creative outputs) | 0,6186 |
| | Institutions | 0,9200 |
| Market sophistication | Infrastructure | 0,7338 |
| Infrastructure | Human capital | 0,6563 |

**Source:** Authors

Based on the analysis of statistical data about the development of science and technology parks in China, we obtained indicators that assess the performance of the innovation infrastructure entities (Table 2) (2021b).

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**Table 2**. Indicators of the performance of China's technoparks form 2013 to 2019

| Indicators | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Rate of change 2013-2019, % |
|---|---|---|---|---|---|---|---|---|
| Number of national science and technology industrial parks | 114 | 115 | 146 | 146 | 156 | 169 | 169 | +48,2 |
| Number of residents per 1 technopark | 191 | 215 | 214 | 266 | 314 | 371 | 471 | +146,3 |
| Operating income per 1 technopark, mln. U.S. dollars | 282,78 | 320,97 | 278,96 | 285,19 | 291,51 | 309,59 | 330,67 | +16,9 |
| Production volume of 1 technopark, mln. U.S. dollars | 214,40 | 240,55 | 204,57 | 202,98 | 192,56 | 198,99 | 206,06 | -3,9 |
| Net profit of 1 technopark, mln. U.S. dollars | 17,62 | 21,30 | 17,70 | 19,11 | 20,33 | 21,12 | 22,38 | +27,0 |
| Export of products (services) of 1 technopark, mln. U.S. dollars | 36,25 | 37,83 | 32,41 | 30,06 | 30,64 | 33,32 | 35,48 | -2,1 |

**Source:** Authors

Comparison of science and technology parks of China (only national technoparks were taken into account) and Belarus demonstrates a positive change of basic indicators that characterize the performance of innovation infrastructure entities: export of products, production volume, number of residents, net profit (Fig. 2) (2021b).

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*Terziev, V. & Klimuk, V. pp.186-193*

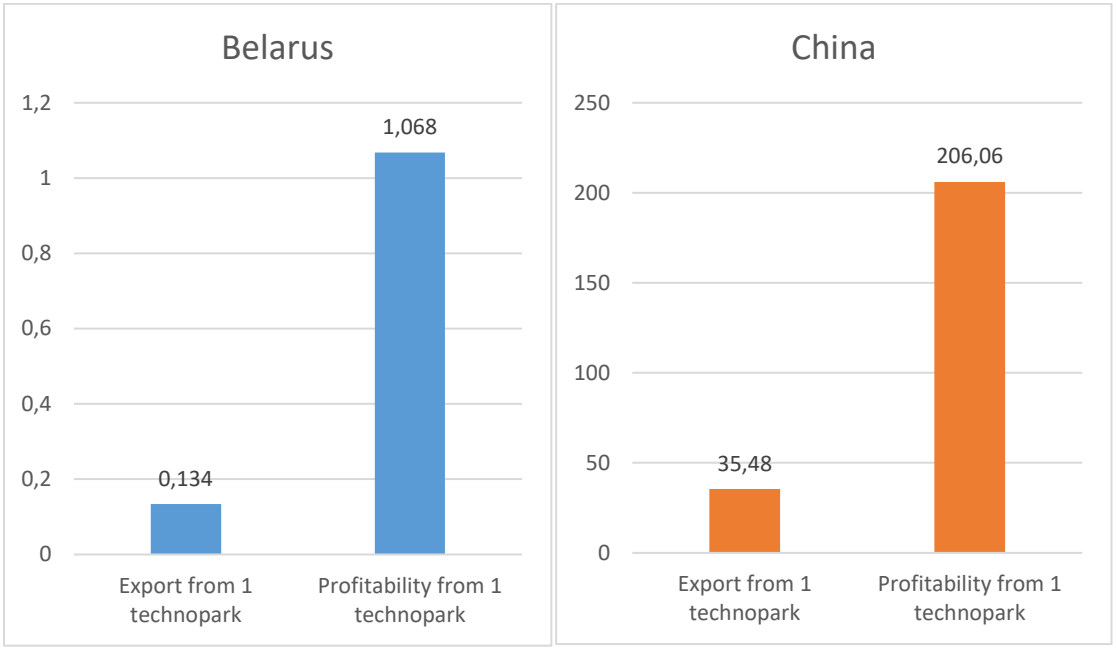


**Figure 2.** Performance indicators of technoparks in China and Belarus in 2019, mln. U.S. dollars

**Source:** Authors

The development of the country`s innovation infrastructure is influenced by the pace of changes of research and development, the growing potential of the country's scientific and educational sector. The scientific achievements are the object of the transfer of valuable propositions to end users (customers). The system of stimulating the scientific activity of organizations in the country, which provides for the economic and social return of the invested resources, represents an important direction in the development of scientific activity.

Based on the statistical analysis of indicators of the development of scientific activity in China, we are able to calculate performance indicators that characterize the dynamics of indicators of research infrastructure. It is noteworthy that during the period from 2013 to 2019 there was an annual increase in the number of research institutes, the average number of employees in one organization became 48-75 people and the development of high-tech products was growing (Table 3) (2021b).

**Table 3.** Indicators of the development of scientific activity in China

| Period | Number of research institutions | Number of employees per 1 research institute | Balance (high-tech products), mln. U.S. dollars |
|---|---|---|---|
| 2013 | 8972 | 75 | 102137 |
| 2014 | 9785 | 72 | 109159 |
| 2015 | 11265 | 65 | 106006 |
| 2016 | 13741 | 53 | 80450 |
| 2017 | 15696 | 48 | 84082 |
| 2018 | 16052 | 53 | 77523 |
| 2019 | 17969 | 48 | 102137 |

**Source:** Authors

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However, the excess of the rate of expenditure (investment) over the income during the implementation of scientific and technical projects represents a problem in research activity (Fig. 3-5).

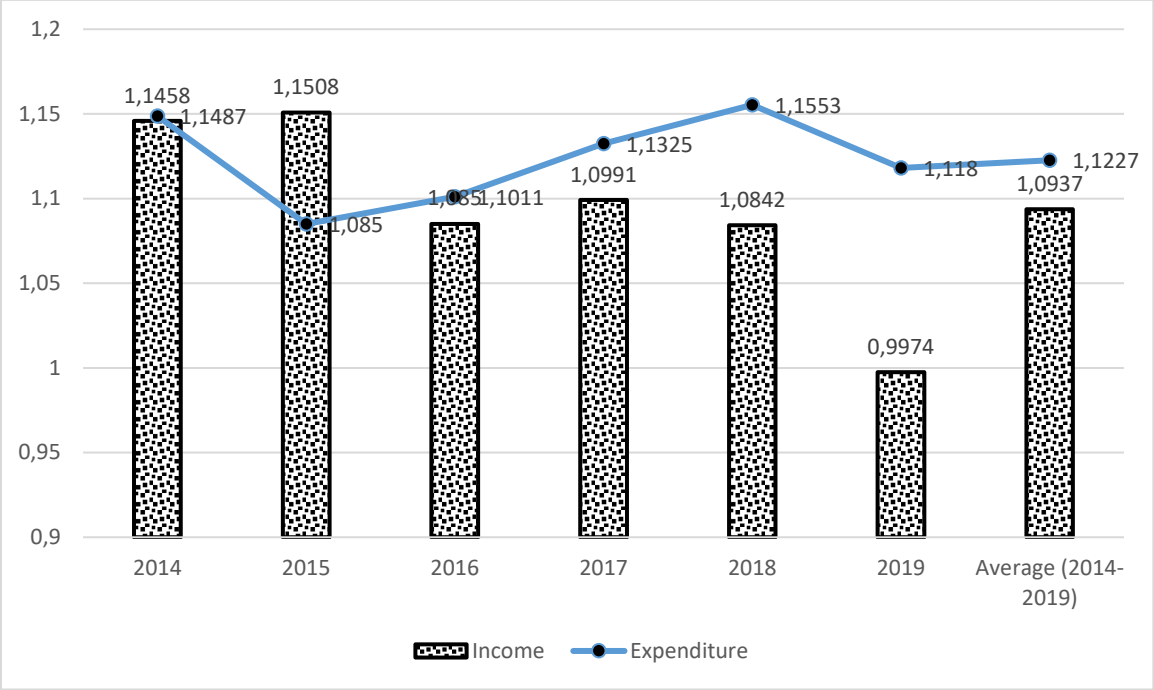


**Figure 3.**The rate of change in expenditures on research and developments and income from the sale of the results of these activities in the People's Republic of China for 2014-2019, coefficients

**Source:** Authors

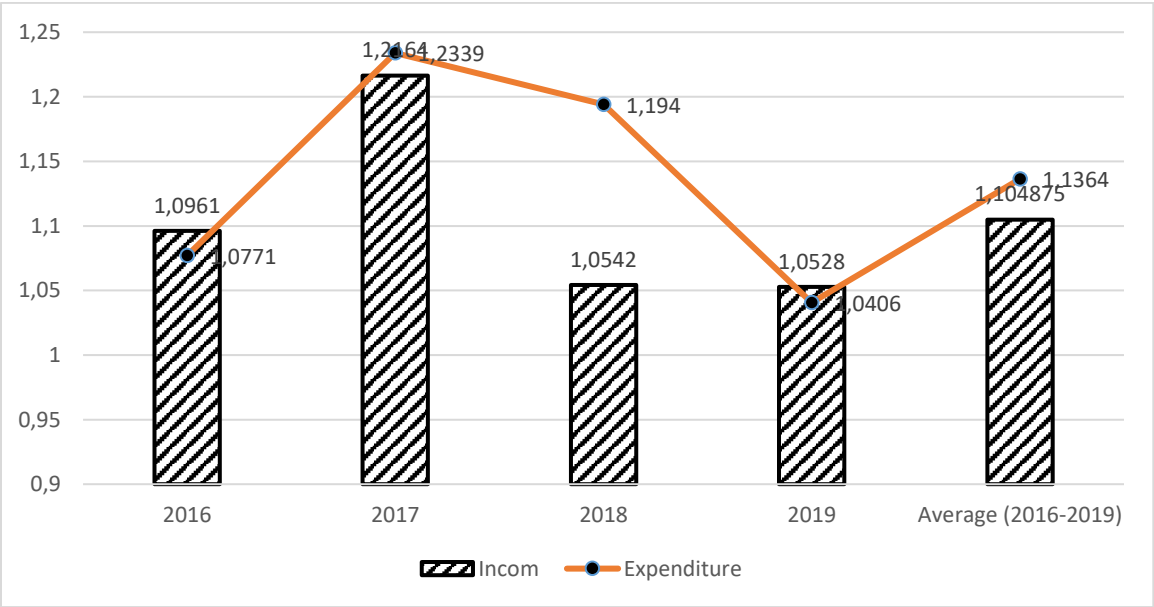


**Figure 4.** The rate of change in expenditures on research and developments and income from the sale of the results of these activities in the Republic of Belarus for 2016-2019, coefficients

**Source:** Authors

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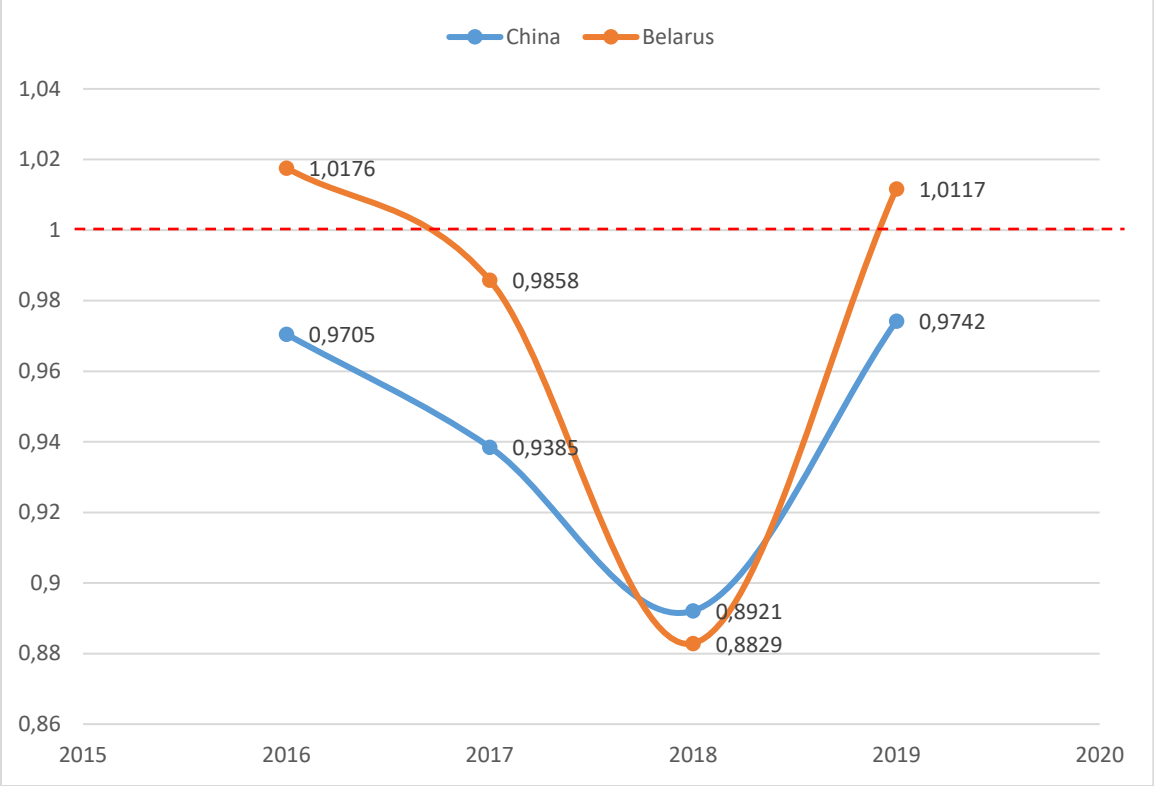


**Figure 5.** Index of the rate of change of income compared to the rate of change of expenditure on research and development in China and Belarus for 2016-2019

**Source:** Authors

The index of the rate of change of income compared to the rate of change of expenditure on research and development both in Belarus and in China is characterized by positive changes. The return on financial investment in research and developments tends to increase (in 2019, the index in Belarus was 1.0117 and in China – 0.9742).

The analysis of the performance indicators of research activities in the Republic of Belarus indicates an annual growth in the period from 2015 to 2019 by an average of 13.6% of internal costs for research and development per organization that carry out this type of activity. The volume of scientific and technological work performed during this period is represented by an annual growth of an average of 10.5% in general by organizations that carry out research and development (Fig. 6) (2020).

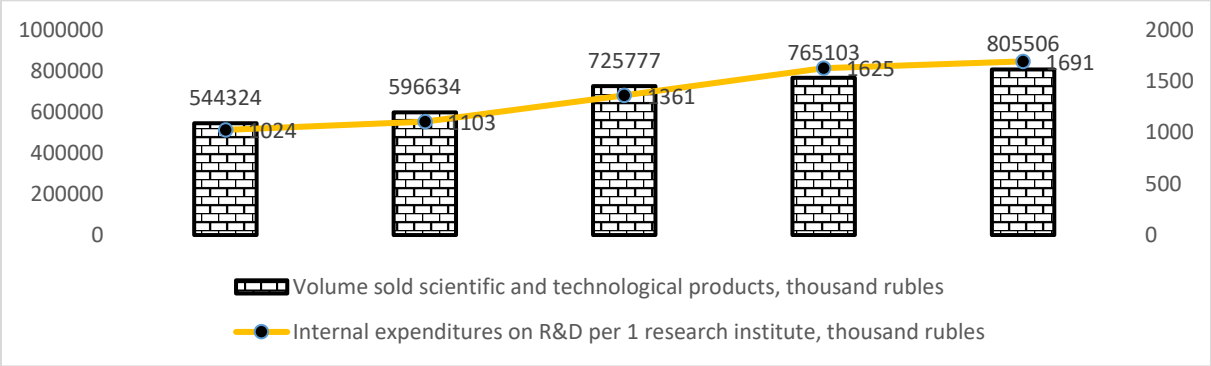


**Figure 6.** Economic performance indicators of the scientific activity in the Republic of Belarus for 2015-2019

**Source:** Authors

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Average number of researchers and scientists from 2015 to 2019 was between 58-60 people per organization carrying out this type of activity. However, the level of profitability of sold scientific and technological products has been decreasing since 2017 (from 34.6% in 2017 to 19.3% in 2019) (Fig. 7) (2020). This may be due to the growth of costs for research and development over the growth rate of production of scientific and technological works (Terziev and Klimuk, 2021c; 2021d; 2021e).

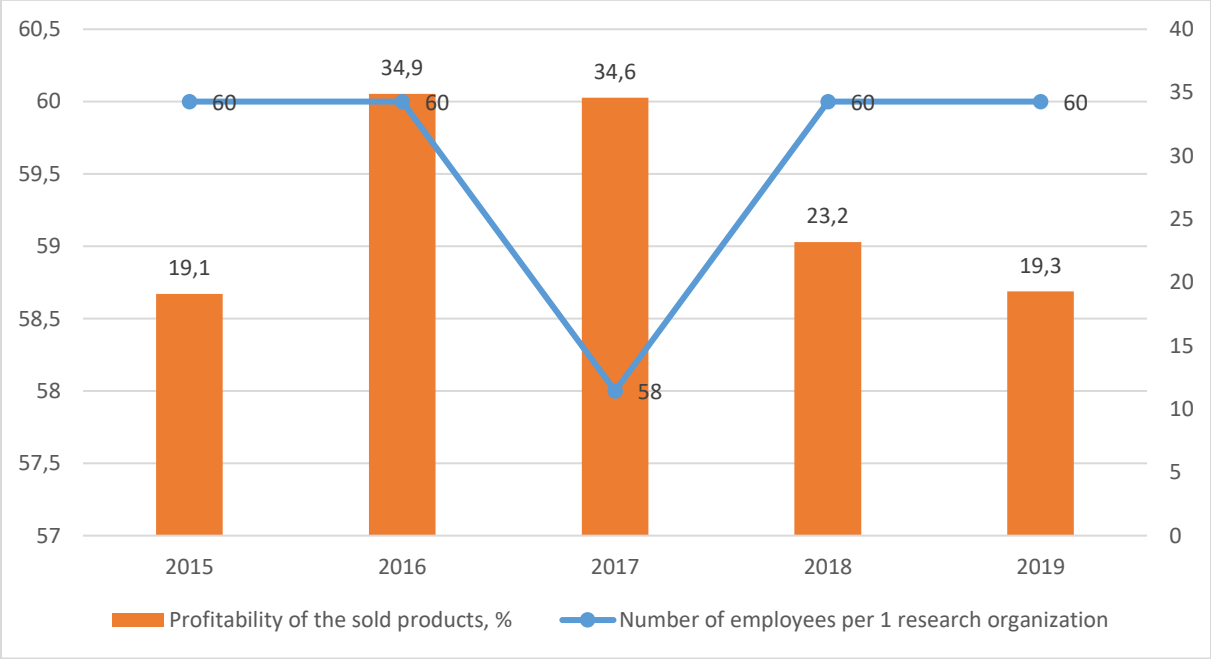


**Figure 7.** Performance indicators of scientific activities in the Republic of Belarus for 2015-2019

**Source:** Authors

The analysis of R&D and research in Belarus and China dictates the need for the development of directions for these activities (Fig. 8) (Terziev and Klimuk, 2021f).

**Joint scientific and technological projects**

- Organization and implementation of projects in promising scientific and technological areas on the basis of collaboration of international partners (on the basis of a private initiative or within the framework of state and other programmes, for example, the Silk Road programme)

**Creation of joint R&D and innovation infrastructure**

- Creation of international thematic centres, laboratories to transfer innovative technology
- Engaging young people to implement innovation projects

**Measures to stimulate cooperation between science, education, business and real sector of the economy**

- Stimulating venture capital financing, supporting startup projects, preferential terms for starting an innovative business, providing support for social entrepreneurship

**Figure 8.** Directions for the development of R&D and innovation infrastructure

**Source:** Authors

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*Terziev, V. & Klimuk, V. pp.186-193*

## 3. Conclusion

Thus, the R&D and innovation development of the country should be determined by stimulating the interaction between the scientific and education, real sectors, business, government and public organizations in order to ensure the economic and social effect of each innovative product (technology, service) for each participant in regional (country) development.

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*Davoyan, A. pp.194-197*

# Frugal innovation and its use

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## Abstract

This article studies frugal innovation and how consumers can benefit from its use, illustrated by examples of frugal innovation products and services. The article shows why frugal innovation has increased importance during economic downturns, especially recessions or depressions, which make countries apply austerity measures and adapt to a new reality where frugal living is the new normal. The concept of frugal innovation has its origins in India but it has gained popularity not only in other emerging markets but also in the industrialized world. Frugal innovation assumes the simplification of products and services to lower costs for the final products and services. Companies developing frugal innovation products and services can reap great benefit, considering that they can sell their products in emerging as well as industrialized markets.

***Keywords:*** Economic downturn, frugal innovation, frugal products.

***Jel Codes:*** M21, L52

## 1. Introduction

The idea of frugal innovation revolves around scarcity and aims to create value for consumers who wish to spend less and get more. As we can see below, the global economy has suffered from numerous recessions and crises starting from the 19th century (Ayhan Kose, 2020). The COVID-19 pandemic and financial and economic crises like the one in the USA during 2007 and 2008 are relatively recent downturns. As we can see below, the financial and economic crisis of 2007–2008, which gradually spread across the globe, resulted in the fall and growth stagnation of the gross domestic product (GDP) across most developing and developed countries. Although most countries' economies recovered from the crisis, there is now a high level of instability in the global economy again due to the COVID-19 pandemic, which rapidly spread across the world, limiting financial and economic activities. Consequently, the global GDP fell sharply, negatively impacting profits, wages, investment and trade. According to World Bank estimates, due to the COVID-19 pandemic, the global GDP has fallen more than twice compared to the 2007–2008 economic and financial crisis.

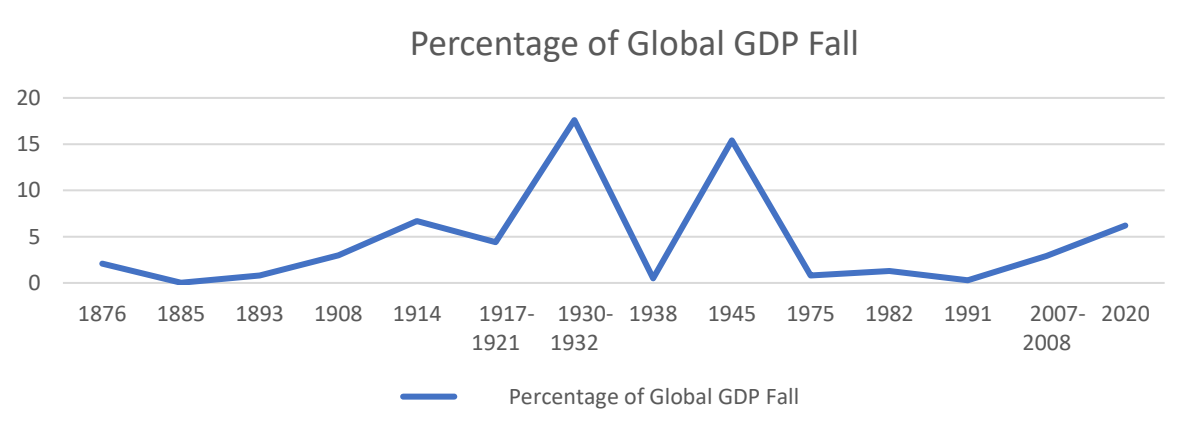


**Figure 1.** Percentage of Global GDP fall

**Source:** World Bank blogs (Ayhan Kose, 2020)

Crises make countries apply austerity measures and adapt to a new reality where frugal living has become the new normal. Frugal innovation is an effective corporate answer to this new normal. It uses less resources and creates more value for customers. It requires companies to maximise value and minimise use of resources.

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Frugal innovation is aimed at customers in developing as well as developed countries who desire to consume quality products at low prices. The efficiency of frugal innovation is measured in the following way: created value / used resources. The higher the value we create and the fewer the resources we spend, the higher the intensity of frugality. Frugal innovation is still a new idea in business, political and academic circles. Thus, future research on frugal innovation can contribute to making this a notable concept.

Frugal innovation in the West is characterised by the following movements:

1. Recycling, which is the path to a circular economy. In opposition to a linear economy, where companies design and produce goods for consumers once only, under a circular economy, companies recycle and reuse products to produce goods for customers.
2. Sharing instead of buying. The cooperative consumption model is on the rise across different industries and geographies. Zipcar is a very illustrative example. This company allows customers to find and drive cars, and charges them by the used hours and minutes.
3. Companies are inclined to develop fast, reliable and inexpensive innovation ecosystems that involve frugal innovation, where efficiency is measured by the intensity of frugality.

Basically, there are six principles companies need to follow while adopting frugal innovation (Prabhu, 2015):

1. Engaging and repeating is the first principle that assumes to change the way R&D works. R&D is usually the department where new products and services are designed in isolated environments. The principle requires building a bridge between customers and R&D by studying consumers in their everyday life and projecting it onto the prototypes.
2. Showing off assets is a principle that follows the frugal innovation trend. In the past, companies were used to producing the same product at a low cost for as many customers as possible. This approach was fruitful since the structure of demand was limited and sufficient resources were available. However, this does not work today due to resource scarcity and changes in the demand structure as a result of globalisation. New trends demand mass customisation and agile internal environments using small and productive equipment.
3. Sustainable solution is the creation of solutions that will win the hearts and minds of environment-conscious customers.
4. Shaping customer behaviour is a principle that allows companies to increase customer loyalty and market share based on understanding them better and enabling them to enjoy life with frugal products and services.
5. Creating value in cooperation with customers. This principle describes how prosumers – consumers involved with designer products through DIY – can help marketing and R&D managers design cheaper and better products. General Electric runs a website where customers are not only involved in suggesting new ideas but also designing new products.
6. Making innovative friends refers to established companies' connection with start-ups. For example, the UK-based Barclays Bank organises accelerators in several major cities to attract fintech start-ups and provides successful ones with an opportunity to become part of the bank. This is an effective way for established companies to innovate and stay on top of business.

## 2. Frugal innovation products and services

Many companies have adopted the strategy of frugal innovation. Examples include TATA Nano, Renault Logan, Nokia, ADAPT Egypt and Idram. In 2009, Tata Motors launched the Nano model automobile, hoping not only to attract the Indian market but foreign ones as well.

The Tata Nano's production was frugal because of the following factors:

- Innovatively designed high-quality plastic panels to save weight.
- A distance of 100 km requires only 5 litres of fuel. The Nano is equipped with a 24-litre fuel tank despite its small size.

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- The use of as few parts as possible.

The company segmented customers into middle and low classes. The price tag was impressive at that time, with the price for one Tata Nano being $2,400, which was the lowest in the global car industry (MIT Technology Review, 2011). However, the volume of sales did not satisfy the producer. Tata expected to sell more than 200,000 units every year but it sold only 7,591 units in 2017. Sales were low because most customers did not like the idea of buying 'the cheapest car in the world' as it was marketed. Thus, the positioning of Tata Nano as a cheap car played a negative role in terms of its success.

Renault, one of leading European car producers, is another example of frugal innovation. Once, Louis Schweitzer, former CEO of Renault, visited AVTOVAZ factory in Russia, where he noticed that Lada, a Russian car model priced at $6,000, had a tremendous sales volume, while analogue models of Renault, despite their high quality, had a lower sales volume (Prabhu, 2015). Schweitzer asked Jean-Marie Hurtiger, one of company managers and an engineer by background, to think about a new model that would cost the same as the Lada. According to the CEO, the new model should be affordable, reliable and modern, while the other aspects could be negotiated. Western car industry companies are used to a 'more for more' approach instead of a 'more for less' approach. Indeed, every year they spend billions of dollars on R&D to be capable of producing advanced models. The 'more for less' approach assumes to adapt to a new reality where more value should be created with limited resources. This requires one to not only adopt a different strategy but also to have engineers with different mindsets. Renault mainly served the Western middle class, and company engineers were used to the 'more for more' approach. Thus, Renault decided to move production to Romania, where it already owned Dacia, a previous leading Romanian car-producing company. A mixture of intercultural engineers caused a synergy effect for Renault's new model. This model was called Logan and it cost the same as the Lada's. Logan was successful not only in emerging markets but also in the US and West European ones.

The 1100 model of the Nokia mobile phone is another illustrative example of frugal innovation. Nokia developers were on a business trip to India when they noticed that workers in hot plantations had difficulties dialling numbers on old-style mobile phones. The Nokia 1100 was initially developed only for the Indian market but was later exported to other markets. The number of Nokia 1100 buyers in India amounts to 170 million, and up to 7 million new one are added each year (Knowledge@Warton, n.d.). The Nokia 1100 was designed and built considering consumer behaviour in India and other emerging markets. The mobile phone was simple; functionally, it was limited to making and receiving calls and text messages. Its price ranged from $15 to $20. Nokia managed to sell more than 250,000,000 units, making it the bestselling portable phone of all time. Due to limited functionality, its power lasted longer compared to other mobile phones. This increased demand, especially among populations in rural areas of emerging markets.

If one ever walks around Cairo, the capital of Egypt, they can see luxury buildings next to miserable houses. The city is in deep need of affordable and nicely designed accommodation. Currently, construction companies do not target poor communities due to the high cost of building materials and low margins. ADAPT Egypt is a vertically integrated project that aims to bring affordable housing to poor communities by involving members of those communities as the labour force. Such communities live in inhumane conditions not only in rural areas but also in cities. ADAPT uses know-how and locally available construction materials to build affordable housing as well as to transform old-fashioned and useless buildings into high-quality housing.

Idram, an Armenian payment system, is another illustrative example of frugal innovation. This company has operated in Armenia since 2004 and employs more than 50 employees (ITisArmenia, n.d.). It allows unbanked workers to receive and make payments to various merchants and service providers online and through street terminals. Through the Idram payment system, unbanked customers can pay for utilities, internet, paid TV services, loans, domain registration and hosting services, and make state payments and payments for the activation of electronic signatures, etc. Idram lies at the intersection of technological and social innovation and overcomes institutional dysfunctions by encouraging entrepreneurship among creative youth.

## 3. Conclusion

The article presented frugal innovation and its use in economy. Frugal innovation transforms products and opens vast opportunities for companies to sell them not only in developed countries but also in developing countries, where more than one-third of the global GDP is generated. Companies that embrace frugal innovation tend to move from a 'more for more' to a 'more for less' philosophy to make consumers happy. Frugal innovation can be

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*Davoyan, A. pp.194-197*

especially effective during economic downturns when consumers tend to spend less than usual but expect high value from what they spend their money on. Thus, with the rise of frugal innovation, consumers have access to quality products and services at affordable prices. Frugal innovation assumes the simplification of products and services in order to lower costs for the final products and services. Companies developing frugal innovation products and services can benefit from it by considering that they can sell them not only in emerging markets but also industrialised ones.

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25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Mukherjee, S. pp.198-205*

# Challenges to Indian micro small and medium enterprises during the post covid era

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## Abstract

Micro, small and medium enterprises (MSMEs) play an important role in the economic and social development, contribution to employment, exports and revenue for the country. A large proportion of labour force depends on the MSMEs operating in the country for their daily livelihood. In other words, it is said to be the backbone of the nation., modernisation, better infrastructural facilities and appropriate training facilities etc. The onset of Covid-19 pandemic has called for lockdown as a safety measure in all the states of the country. This has led to dampening of the overall economic activity in the country. With respect to Indian MSMEs, generating cash for businesses is next big challenge. Delayed payments have further created problems for small companies as they have to pay the GST in a timely manner. If payments are delayed, the capital cost adds to the inefficiency and threaten their survival. To handle the Covid-19 related problems, the Indian MSMEs have to adopt a wider market-is oriented strategy. The Government of India (GOI) has already announced a number of stimulus package for the MSMEs to provide temporary relief through short-term liquidity infusions and other fiscal packages. In addition to this, more steps need to be taken to address the current challenge. New digital tools and platforms can help the MSMEs to revive their demand in the global market. However, the MSMEs, face numerous barriers and problems in matters of digital adoption and innovation.

Taking the background in mind, the study the objective of the study is to examine the problems and challenges faced by the Indian MSMEs, the role of E-commerce and digital platforms in the coming months (post Covid-19), the future development of digital tools and e-commerce in matters of improving competitiveness. Lastly, the study uses a theoretical insight model to show the positive impact of digital transformation on export performance (i.e., a measure of competitiveness of MSMEs followed by discussions and suggestions to resolve the current challenges posed in the post-pandemic times.

***Keywords:*** MSMEs, E-commerce, Digital platform, Challenges, COVID-19 pandemic

***Jel Codes:*** F14, F15, L25, D24

## 1. Introduction

In a country such as India, Micro, Small and Medium Enterprises (MSME) sector has a vital role to play. For example, it helps in fostering entrepreneurship, and it also has the potential to provide livelihood opportunities to the large section of the population. MSMEs help in matters of earning export revenue and also helps in solving the problem of disguised unemployment which is prevalent in the Indian agricultural sector. Lastly, MSMEs can also be categorized as complementary to the medium and large industries and plays an important role in the secondary and tertiary sector.

With the onset of the Covid-19 pandemic, there has been change in the definition of MSME on the foundation of investment limit. According to the new definition, the investment limit has been reviewed upwards and an added criterion of revenue has been announced. The government has removed the distinction between manufacturing and services sector.

As per the new definition, a firm with an investment up to 1 crore and income under Rs. 5 crores will be termed as “Micro”. A firm with investment till Rs. 10 crore and income up to Rs. 50 crores as “Small” and a firm with investment till Rs. 20 crore and income under Rs. 100 crores as “Medium”.

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**Table 1.** Existing and Revised Definition of MSMEs

| **Existing MSME Classification** | | | |
|---|---|---|---|
| **Criteria: Investment in Plant and Machinery or Equipment** | | | |
| **Classification** | **Micro** | **Small** | **Medium** |
| **Mfg. Enterprises** | Investment <Rs. 25 lac | Investment <Rs. 5 cr. | Investment <Rs.10 cr. |
| **Services Enterprise** | Investment<Rs.10 lac | Investment <Rs. 2 cr. | Investment <Rs. 5cr. |
| **Revised MSME Classification** | | | |
| **Composite Criteria: Investment and Annual Turnover** | | | |
| **Classification** | **Micro** | **Small** | **Medium** |
| **Manufacturing and Services** | Investment < Rs. 1cr<br>And<br>Turnover <Rs.5 cr. | Investment < Rs. 10 cr<br>And<br>Turnover <Rs.50 cr. | Investment < Rs. 20 cr<br>And<br>Turnover <Rs.100 cr. |

**Source:** Annual Report MSME (2020-21)

## 2. The Need of Digital transformation

Micro, small, and medium sized enterprises (MSMEs) industry is the support of our economy. Due to Covid-19 pandemic, a number of these industries are stressed to continue the rough time, facing novel adversities, and dealing with liquidity problems.

There is a vital need to restructure the ways by which MSMEs will more easily be able to rebuild and relaunch their businesses. Here, digital transformation can play the vital role. Post Covid-19 trades are looking for novel ways to implement the new usual and toughen their origins to kick start again. Here digitization is even more helpful in case of adapting accounting software. With its help, industries can contest the inopportuneness more professionally.

Digitization have supported the MSMEs at a greater scale by submitting tax filing dates at a later date, dropping the interest amounts, etc. Hence, the essential thing of the hour is to accept digital alteration as key to survival of the MSMEs in the long run. In addition, it can help to reduce their costs, regulate the present work edifice and mechanize business procedures by reducing the dependence on work force. Digitization process will also improve attractiveness in the global market and recognize customer behaviours.

The process of digitalization makes it likely for the bookkeeper to have a record of all the receipts from a sole cloud space. It becomes stress-free for him to accept other work, plus the calculation and filing of tax revenues.

Digitization of operations is not only beneficial for those working within the organization, but also for the clients. The company can instantly connect with its customers in the greatest suitable ways and attend more customers due to quicker and more well-organized procedures. By introducing this digitization transformation to your commercial activities, your squad can emphasis on other responsibilities that need physical attention. The emergent digital know-hows are easier for dealings to be able to use their operations and assist their clienteles more professionally. Remaining business firms will have to grip digital alteration in order to reconstruct and thus improve.

With the coronavirus affecting their money cycles, MSMEs, who are the mainstay of India's comprehensive growth story, have felt severe disturbances. A survey by Endurance International Group displays that about 50 percent of them included video conferencing and WhatsApp for commercial purposes. The study found a 50 percent upsurge in income role and contribution from e-commerce platforms in the initial months of the lockdown. Digital tools can also be useful in helping MSMEs in various ways in the form of reshaping the business and updating their enterprises

MSMEs is capable of streamlining payments, obtain financing, and skilled advice, completely assisting their development, and essential to tie to the Government's vision. A Cisco India SMB Digital Maturity Study 2020

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concluded that the digitization transformation of SMEs might improve and include $158-216 billion to India's GDP by the year 2024.

## 3. Role of Digital platform and E-commerce in the Post-Covid times

With the onset of the pandemic and successive lockdowns, the phenomenon of digitalization has opened the gates for many businesses to support their procedures and manage during the difficult times. The local grocery stores have started embracing the doorstep of online delivery tendency and use of 'google sheets for maintaining data of orders received and supplied. Digital payment modes became popular with the social distancing norms. Physically consultation with doctors was an outdated sales procedure in the dispensary. Nevertheless, this was substituted instantaneous through digital technology and digital communication networks.

Agribusiness chemical suppliers are using online interacting channels like Facebook and Zoom videos to join with agriculturalists in countryside areas. Many of the technologies have become essential to the industries. MSMEs are using latest digital technology for their ventures and bound back post-pandemic. E-commerce or electronic commerce mainly includes digital trading practices for commodities and services. Hence, there is a requirement for digital equipment's, devices and strong internet networks and connectivity. This swift switchover from traditional to digital trading is also significantly dominating the current business climate and trends in several aspects, including academic, medical, banking, and government. Accelerated internet usage and smartphone penetration have allowed e-commerce to emerge as a game-changer in the Indian business. With further advancement in technology, the traditional technique of doing business has been replaced by the digital space by introducing e-commerce. The technology upgradation has vividly led to increase in the internet users. When business operations are carried out via different website as the main platform then its also results in increasing of competitiveness as one of the factors that can ensure competitive advantage and can ensure higher success of e-commerce.

There have been several government initiatives in this direction. For example, programmes and schemes such as Digital India, make in India, Start-up India, Skill India, Innovation Fund have made a significant contribution to the progress of digital advancement and technology in the country. There are plans to roll out 5G and this is also expected to play a prominent role to intensify the e-commerce business in India.

There has been a significant importance of e-commerce especially catering to the needs of the Indian MSME. This is reflected in the recent surveys conducted by the International Trade Centre (ITC). The results found that 82 percent of the MSMEs are solely engaged in the cross-border e-commerce transactions. The pace of growth of e-commerce has made it evident that digital platforms and approaches do have a good potential in matters of helping MSMEs carrying out trade in the post-pandemic situation. There have been improvements, developments and change in the pattern of shopping. Many popular brands have shifted from traditional mode of shopping to online shopping platforms via digital apps and options. Presently consumers are preferring to shop using online digital platforms rather than visiting crowded market places. The ease of accessibility and feedbacks obtained via using online marketing strategies have boosted the confidence of several MSMEs and their existing brands.

Websites have been launched and MSMEs have tried to make them user-friendly as they believe that an easy navigation website can garner higher transaction for e-commerce websites. However, precautions are required to be taken in the form of data privacy and security for continuous growth of sales in the e-commerce platform. Also, a variety of product can be displayed in the e-commerce site and consumer will have a variety of choice in the e-commerce platform. A good digital navigation flow will ensure admittance to accessible data for specific goods as per the needs of the consumer. In this context, a friendly user interface will play a key role in the success of MSMEs and further ensure highest satisfaction among consumers. In addition to this, multiple online payment mode will give more opportunities to consumers to increase their purchase in the e-commerce sites.

Some major MSMEs are considering many advertising tools such as Google Ads to make consumer aware about their products. There is an increase in di9gital transition especially among several industries and further it will facilitate higher use and development of e-commerce platforms to meet the consumer demand.

### *3.1 Use of E-commerce for growth of Indian MSME in the Post-Covid times*

In the recent times since the onset of Covid-19, there has been significant growth of e-commerce in an unprecedented scale. By adopting e-commerce, MSMEs have experienced an increase in revenue, improved market reach, more ties with newer markets, and enhanced customer outreach.

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*Mukherjee, S. pp.198-205*

According to experts, the Indian e-commerce sector is targeted to reach around $80 billion by the end of the year 2021. For MSMEs, e-commerce has the potential for economic stability, growth of MSMEs and can assist the small MSMEs to display their products and reach every corner of the world through the help of e-commerce. Recently, the e-commerce platforms have enabled MSMEs to take advantage of online platforms with minimal investment in various forms such as packaging, logistics, warehousing and other infrastructure.

E-commerce platforms provide links on Facebook and Instagram, to create consciousness about their goods and services. Furthermore, MSMEs can lower their expenditure on advertising and marketing and can reduce the operating cost of physical stores. In recent times, B2B e-commerce players have started generating store and is capable of analyzing customer data including prices of their products, and purchases made for some time period. The datapoints analyze the delivery time, location, methods of payment. The MSMEs are capable of using the data for meeting the demands of the consumers and provide better services to increase the consumer base.

Traditional modes of exports are not valid in this current pandemic situation. To overcome this problem, MSME are using the e-commerce platforms to access global markets. With the help of e-commerce, MSMEs are now able to identify the needs of the customers in various segments. As an example, since the pandemic has hit the economy, a Maharashtra based NMK textiles which is an export company have recently adopted Amazon's e-commerce platform to launch its new "California Design Den" brand. Lastly, e-commerce platforms provide many different forms of technological advantages. For examples, tracking of the order, details of recurring purchases etc. MSMEs can benefit immensely from all these services. From time to time, there have been different online platforms launched by the government of India from time to time.

Samarth was launched by Flipkart in the year 2019. The objective of the program was to promote Indian artisans and help MSMEs can enter into the online commercial bazaar. MSME Accelerate was launched by Amazon in June, 2020 to assist MSMEs. "Shopclues" has introduced an online 'Vocal for Local' market platform. It works with thousands of local dealers and endorses home-grown goods in the market.

*3.2 Key Recent Developments Supporting MSMEs after Covid-19 pandemic*

- Amazon had announced the 'Spotlight North East' programme (US$ 25 million) in April 2021. The aim of the programme provided an online funding to 50,000 artisans, weavers and small industries from the Northeast by 2025. In addition to this, the other goals are to boost exports of important supplies such as tea, spices and honey.
- ICICI Bank introduced the 'Merchant Stack' programme in April, 2021. This is a complete digital banking services that is predominantly aimed at retail traders. In addition, people using this service can take advantage of contactless services (InstaBIZ). Vedanta Limited, a leading producer of metals and oil & gas, launched the '*Vedanta Saathi'* programme. The aim of the programme is to provide financial assistance for MSMEs to set up new manufacturing units near it.
- Walmart's *Vriddhi* programme has been stretched to Uttar Pradesh on February 2021. It is expected to profit 50,000 MSMEs across the nation.
- Mastercard and Razorpay merged in February, 2021 to benefit small Indian businesses to adapt digital payments. Lastly, Bank of Maharashtra cooperated with *Vayana* Network, to bring financial assistance to MSMEs.

## 4. Challenges to Overcome

With the onset of Covid-19, there has been a dampening of the overall economic activity in the country. With respect to Indian MSMEs, there has been a number of challenges in the post-Covid times.

The first and foremost challenge is generating cash for businesses in the long run. Lack of cash will further choke the India's small and medium companies. In addition to this, delayed payments can create problems for small companies as they have to pay the Goods and Services Tax (GST) in a timely manner to the Government of India (GOI). If payments are delayed, the capital cost will add to the inefficiency and threaten their survival.

Secondly, the pandemic has led all the economies especially Indian economy to rethink their strategies regarding MSMEs. MSMEs being the backbone, employment generators, revenue earners and growth drivers are facing several obstacles in the current scenario. Indian MSMEs contribute around 29.7 percent to the GDP and 49.66 percent to Indian exports. Looking into their contribution, the vision and objective of the Government of India

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(GOI) was to increase their contribution to 50%. However, with the spread of COVID-19, there has been a lot of uncertainty regarding the enhancement of the contribution of the MSMEs. COVID-19 has created a challenging environment for Indian MSMEs, paving way for survival of not the fittest

The increasing access to smartphones, increasing internet usage, and rising digital media use are determining the future of MSMEs. India is among the major developing markets growing at a faster pace especially for digital users. In the current times, Indian MSMEs have hindrances in the path and need to clear some barriers to bear on the track of digital transformation. MSMEs have inadequate development capital that makes technology embracing and digital alteration process delayed to a certain extent.

Procurement of the up-to-date smart devices, superlative internet amenities, and retaining expert employees to succeed digital systems is too an exclusive matter for them. There are still a number of small and medium scale enterprises have no knowledge about the influence of digital alteration and are unsuccessful in matters of building customer loyalty and holding of customers. MSMEs are unaffected to enlarge digital knowledges because cutting-edge know-hows evolve faster, and they from time to time may not be able to match competition with the others. Storing, analysing, and handling vital organized and shapeless data to make commercial conclusions is challenging for MSMEs.

Looking into the digitalization process, intensive use of Information and Communication Technology (ICT) and e-commerce platforms are ways for newer and advanced innovation. They are also ways of communication amongst stakeholders to the association (Narayanaswamy et al. 2008) The acceptance of digital technology can meaningfully contribute to the evolution of MSMEs (Helpworth & Ryan, 2000; Tan et. al., 2009). ICT includes the usage of the internet and other digital technologies used in grasping storage and dispensation of information (Duncombe & Heeks, 2002). The use of Internet marketing is developing as a hopeful tool to expand customer-centric marketing and preserve their relationship with clients, partners and other stakeholders (Shin, 2001). Information Communication and Technology allows the firms to process client information and analyse goal client segments (Zhang et al., 2008). The drivers of ICT usage and adoption amongst the MSMEs are categorized as factors which have arose from outward competition, organization capabilities and knowledge and monetary reliability, technology related factors including IT infrastructure (Wymer and Regan, 2005).

However, the process of adoption of ICT channels is marred by a number of factors such as dearth of necessary resources, information asymmetry and financial constraint. Apart from these, there are several notable roadblocks which come in the way of Indian MSMEs in matters of embracing digitalization.

The first notable challenge is the availability of tech-talent. MSMEs are often confronted with challenges such as access to affordable skilled manpower and managing their digital infrastructure. A number of small-scale enterprises are still compelled to use the brick-and-mortar models and they need experts and digital tools to transform themselves in their supply chain accounting and marketing.

The second notable challenges that the MSMES have to overcome to accept newer technology on the pathway of this digital transition is Insufficient growth of Capital. The MSMEs do not have sufficient proprietors and have access to limited capital. Lack of sufficient growth capital makes technology adoption difficult and hence the pace of digital transformation is slow.

The third notable challenge is lack of awareness of Digital Transformation. In some situations, it has been found that the MSMEs are not fully aware about the process of digital transformation. Hence, the choice to hold the changing digital alteration is deferred to a greater extent.

The fourth notable challenge is lack of inherent technology expertise. This makes it difficult for them to create a digital transformation road map. Furthermore, it is often delayed or not taken at all. Sometimes external consultation is adopted by the MSMEs but the process of external consultation is often costly.

The fifth challenge are the dynamic nature of digital technologies. This puts a number of hindrances in matters of purchasing up-to -date smart devices, availing internet connectivity and good service providers and appointment of skilled staffs to accomplish this change.

Lastly, with the adoption of latest digital technologies, firms have a habit of to generate and stockpile serious data. Without requisite training it becomes difficult to manage and handle data and makes MSMEs anxious while implementation of latest digital know-hows.

With growth in the service-led economy, the increase in the usage of digital tools, technology and platforms are helping the MSMEs in improving its competitiveness over the time. This is true especially in the pandemic when

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*Mukherjee, S. pp.198-205*

everything has been in a standstill with consecutive physical lockdowns in several states of the country as well as abroad especially European Markets. With the suspension of international flights and other communication modes connecting the countries across the world, embracing digital modes and technologies can be proved to be advantageous for the Indian MSMEs.

*4.1 Theoretical Model using insights -Impact of Digital Transformation on MSMEs*

The Indian Micro, small and medium enterprises have become vulnerable especially after the onset of the Covid-19 pandemic. MSMEs are accelerating the process in matters of the adoption of e-commerce. With the prevailing scenario, adoption of digital solutions can help the Indian MSMEs in managing transactions at a distance, delivering goods in an efficient manner, access to financial services and keep in constant touch with the new as well as existing consumers. E-commerce tools and digital payment services are serving MSMEs lock in dealings and distribute goods and services to consumers stuck in their home due to the lockdown. Several services different operators such as Ebay, Shopee, and Alibaba are facilitating B2B, B2C and C2C transactions to reach MSME sellers significantly.

In India, Amazon, Flipkart, Myntra and others are helping in delivering essential and non-essential products to the consumers since the onset of the lockdown. People are using different digital apps and preference have switched from offline to online shopping since the lockdown. For higher exports and revenue earnings, higher usage of ICT, digital apps and platforms are the mandatory requirement especially after the post- pandemic period.

In a theoretical framework, a higher export propensity defined as $EX_{it}$ (dependent variable) will be dependent on a number of factors. The main factors include higher technological usage by the Indian MSMEs ($Tech_{it}$), recruitment of highly productive workers ($LP_{it}$), usage of advanced knowledge and skills ($SK_{it}$), availability of high-quality human resources $HR_{it}$, use of different services such as advertising, selling, marketing and distribution to differentiate the product in the market and boost sales ($SER_{it}$), availability of sufficient capital and finance, $CAP_{it}$, previous years exports performance ($EX_{it-1}$). With the onset of the Covid Pandemic (2020), now use of e-commerce platforms ($EC_{it}$), digital tools and apps (Dit) and higher usage of ICT ($ICT_{it}$) have become the necessary thing as people and consumers are preferring online shopping and avoiding physical marketing in the current situation. Lastly, in the absence or reduction of physical movement of goods and services due to lockdown, things are not same as compared to the last years. Sellers and producers will definitely be using higher digital modes to run their business. Accordingly, higher exports and revenue earnings will be positively associated with all the above-mentioned factors including higher digitalization and digital adoption of the Indian Economy.

In the equation form they are written as follows-

$$\boldsymbol{EX_{it} = Tech_{it} + LP_{it} + SK_{it} + HR_{it} + SER_{it} + CAP_{it} + EX_{it-1} + EC_{it} + D_{it} + ICT_{it}}$$

Where it represents firm i in year t.

## 5. Conclusion

Firms in developing countries have a weaker digital infrastructure. For example, in the City of London, many of the business services have started operating online during the COVID-19 pandemic. The process of Digital transformation requires some forms of search and experimentation with newer technologies and business models. Some firms will grow while some will fail and exit in the process. Countries with suitable and favourable business environment and having factors such as finance, skills, knowledge assets will be better able to seize the opportunities from digital transformation. Lack of understanding of digital skills that fit into the business will do more harm than good.

E-commerce has a tremendous potential for Indian MSMEs more opportunities to sell across global markets with an unprecedented ease and earn higher dividends and move up the value-chain. It also can become an indispensable tool for Indian MSMEs in matters of lowering the operational costs, increasing revenue, acquiring more customers and benefiting from customer advocacy. In addition, it has the potential to understand the needs of the customers. For example, leather goods firm from Kanpur can showcase its product and sells its products to customers in Kansas City. Similarly, artisans from Rajasthan can find buyers for their beautiful handicraft products from across the length and breadth of our country.

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*Mukherjee, S. pp.198-205*

To make good use of digital transformation, micro-businesses nowadays are captivating help from tech-based start-ups. Building a complete digital network and executing the best backing will endorse Indian MSMEs towards positive digitalization and enable the digital change for MSMEs.

Constructing special tools can help MSMes. These apparatuses can improve the commercial proficiency and productivity for these small and medium firms. For example, Google Advantage, an inventiveness by Google India helps MSMEs to usage the rising online business base. Google My Business precisely have been established to support MSMEs in India to prosper effectively through digital tools. These tools are countless unrestricted resources to make and re-establish the commercial data on Google Maps and Google+ in Hindi and English.

The workers today require things to be fast and without errors. Making digital will demonstrate to be game-changer. For an MSME to be successful in today's world, it must accept making digital and include latest technologies such as Advanced technologies, data science, Blockchain, cloud computing, can change the businesses of Indian MSMEs. Digitally renovating firms will be the possible winners in the long run.

In addition to this, Indian MSMEs need to solve a number of other problems to facilitate digital transformation.

Digital literacy can play a crucial role to catalyse the acceptance of digital skills and address the relevant skill related issues to fill the loopholes.

The total debt requirement is estimated around Rs. 65-70 crore. A large number of funding is needed by Indian MSMEs to remain in working capital. MSMEs find it difficult to access funds from formal channels of lending and are more dependent on the informal channels. The MSMEs can resort to Digital credit. It provides immediate, automatic, and distant credit to users. Lots of users have profited from digital credit to fulfill their consumption needs. For example, since the onset of the Covid-19 pandemic, Kenya and other nations resorted to online payment. Nearly more than one-fourth of the population is using digital credit to fulfil the requirements of working capital. While some initiatives are taken to use digital credit, it is seen as a last resort to meet greater working capital requirements. Digital credit suppliers may grow MSME-specific products to on alternative data sources, modified credit -score approaches and accumulating existing and possible digital footprints. The platform is planning to roll digital lending platform to around 500,000 MSME customers.

There is technological backwardness affecting MSME segment, and the technological innovation remains low. Although government has resorted to several financial stimulus measures for helping MSMEs more needs to be done. The need of the hour is using latest modern technology in addition to marketing schemes to provide assistance to MSMEs. With the onset of globalization, technology is increasingly becoming indispensable as a vital tool for MSMEs to improve their productivity and efficiency. A strong technology enabled sector has the potential to become a global player. The role of technology in the form of social media, e-commerce platforms, cloud computing have the potential to unleash great value and opportunity. Lastly, higher adoption of digital technology is expected especially after the pandemic.

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25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Terziev, V. pp.206-209*

# National map of higher education in Bulgaria

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## Abstract

This publication examines the current deficits in higher education policy, attempting to make a brief analysis of the situation. Justification of the need for the introduction of a Map of Higher Education in Bulgaria is pursued, outlining certain recommendations and proposals.

***Keywords:*** National map, higher education, Bulgaria

***Jel Codes:*** I20, P00

## 1. Introduction

In the existing structure of higher education in Bulgaria, imbalances - different in nature and depth - can be detected. We are talking about discrepancies in the demand and supply of educational services at national and regional level, as well as discrepancies in the realization of graduates on the labour market in professional fields and specialties of regulated professions. This becomes apparent from the National Map of Higher Education in the Republic of Bulgaria draft, which got published today for a 30-day public discussion. An example of a disturbed balance is the comparison between the total capacity determined by the National Agency for Evaluation and Accreditation (NEAA) for all professional fields in all higher education institutions and the actual number of students. On average for the country, students are only 53% of the total capacity determined by NEAA. Less than half of the allocated positions are occupied, given a total of 29 professional fields. The least places are taken up in the professional field of Mathematics - only 19.1%. There is also little interest in Theory of Arts, Materials and Materials Science, and Political Science. At the same time, the number of students is equal to the defined capacity in the professional fields of Medicine, Dentistry and Theatre and Film Arts. Over 90% of defined capacity is occupied in the professional fields Pedagogy, as well as in the specialties of the regulated professions Dental Mechanic and Veterinary Medicine. Over 10% of all government procurement places in 10 priority fields remain vacant. Among them are Metallurgy and Mathematics with only 64-65% occupancy of the approved government procurement, followed by Chemical Sciences with 71%, Military Affairs with 72% and Research, Mining and Processing of Ores and Minerals with 74%.

The most popular professional fields on a national scale are Economics, Pedagogy, Administration and Management, Medicine, Communication and Computer Engineering, IT and Computer Sciences, Pedagogy of Teaching of ... and Law. Nationwide, approximately half of the current students study in these eight fields. There are serious imbalances in the territorial structure of higher education. The most numerous (27) are the universities in the Southwest Planning Region, including Sofia. At the other end is the North-western region where only two universities are based (the Medical University - Pleven and the Higher Air Force School Georgi Benkovski in Dolna Mitropolia), and three others operate through branches.

Regional imbalances are also observed with regard to the realization of graduates. For a period of five years - from 2015 to 2019 inclusive, 263 500 students graduated; 46.6% of these graduated from universities in the Southwest region. The percentage of graduates who remain to work in this area, including the capital city, is similar. Unlike the North central region, which most graduates leave soon after graduation.

The National Map of Higher Education in the Republic of Bulgaria will be updated every year. Thus, the need for specialists in each region will be identified. The available resources of lecturers and prospective students will be taken into account, as well as the opportunities for attracting both foreign students and Bulgarians living abroad.

In combination with the data from the Rating System of higher schools in Bulgaria, the Map of Higher Education will be used in determining the state procurement admission for training as well as in the opening of new higher schools or branches. They will help to promote and control the number of places in certain areas and regions. The aim is to have a balanced development of the universities network that meets the real needs of the regions and the labour market forecasts (Terziev, 2020).

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## 2. Necessity for introduction of a strategic document

The National Map of Higher Education has been prepared in response to a statutory requirement and, above all, in response to the huge disparities created in recent years in higher education and various other areas related to it. The idea of creating a National Map of Higher Education, based on the serious concern about the deteriorating quality of education caused by these disparities, certainly has its rationality. Over the last 20 years, ways have been sought to carry out a set of reforms, certain modernizations, improvements and a number of other endeavours. Therefore, I think that the time has definitely come to come up with working ideas that will change the situation by substantially including higher education in the economic development of the country.

How and to what extent will the National Map help to carry out such an operation? Will it help to give a reply to the much avoided for direct and honest answer present-day question: Are there too many universities in Bulgaria or not? Is there a reason to open new universities? Or there will be a set of boxes in which numbers are fixed, corresponding to the well-known factual state of higher education. A condition that has been known for a long time now as the recently developed Strategy for Higher Education is based on this factual situation - with all the conclusions and analysis that have also been made in this map.

Analytical ranking of the data on the universities and students of each country is absolutely necessary, same is true about registers and rating systems. They determine the demographic and territorial distributions and are part not only of the national statistics but also of the national security system of each country. Especially at a time when the slogan, or the message, knowledge economy is turning from a formality into a working mechanism. Especially at a time when we want to link this economic development with the opportunities of higher education. Emphasizing just some of the prerequisites is enough to justify the need to draft such map. And these are:

- the strong discrepancy between the type of specialists who are trained in the higher education system and the specialists who are needed by the economy /business environment/;
- the discrepancy between higher education quality of specialists and the quality of the specialists that the business is looking for;
- the engineering of "surpluses" and "deficits" in various professional fields - a sharp increase in the number of specialists in economic, legal and other professional fields at the expense of technics and technology professional fields;
- the strong decrease in the quality of training, the fast and ill-planned growth of the number of universities;
- legislative changes that have led to a deterioration in the management of higher education and a difficult-to-control process of expanding the second level in higher education - the master's degree, with a huge range of specialties for which market demand is negligible;
- the over-qualification /by number of received diplomas, but not in knowledge, skills and competencies/ of specialists for the jobs offered on the labour market.

It is a matter of time, analysis and evaluation if the accumulated expectations from a National Map of Higher Education draft, spread among a large part of the academic community as well, will provide an opportunity to solve the problems in it and will justify the project itself.

Determining the profile and territorial structure of higher education in the Republic of Bulgaria by professional fields according to the needs of the labour market is quite complex and definitely not only a quantitative characteristic. Even more seriously, this applies to identifying the needs for the development of higher education - what economic development and what education is required for this? Current trends in higher education, expressed in the creation of consortia, technology centres, hubs, university networks, etc., are an important part of what is happening in regional development. In this regard, the support of a balanced development of higher education institutions network, according to the needs of the respective regions and according to the real possibilities, is an essential element of the national policy regarding higher education. But it is by no means determined only by quantitative indicators, the latter, in most cases, being well known for quite some time.

It would be an exaggeration to give a positive answer to the National Map of Higher Education draft. Much of the data described in the National Map appears on the website of the Ministry of Education and Science and anyone with basic skills in using the possibilities of the Internet platforms can get acquainted with them. What is new in the current situation is the identification of the four groups of regions with their important and significant role to define different, albeit very similar, procedures for opening new universities. However, the purpose of the National

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Map of Higher Education is not only to denote the restrictions of opening new universities. Although the main thesis "There are too many Bulgarian universities" is well known, we should have understood long ago that it is not quantity that is the most important criterion, but quality: quality of any education - from primary to higher or be it the acquisition of a doctoral degree. Yet, the National Map is not dealing with the matter of quality. The different cross points between the number of students, the number of lecturers, the number of unemployed persons, the number of accomplished by their vocation / which does not always coincide with the professional field of study / are important, necessary but infinitely insufficient to say that this National Map will be more useful than the information available at present. Thus structured, the National Map will provide opportunities for opening new universities in certain groups of regions. Probably in line with specialties that are absent in them, which is currently also possible outside the moratorium. In fact, the National Map reflects the goals set for its creation - education for itself (Terziev, Lyubcheva and Mihailova, 2021a; 2021b).

What else could be included in the National Map for Higher Education?

We all know that in order to achieve economic growth, it is especially important that education operates together with business. It is also well known that universities, in addition to educational goals, also aim at scientific development and surely without the symbiosis between them there is no way to achieve economic growth - neither intelligent, nor integrative, nor sustainable. Therefore, the question is not whether business or education should play a leading role in this unity. So, at this point, it is important to define both at national and regional level this interaction - how and in what areas it should be carried out. It is no coincidence that for each planned economic region economic priorities for development in a certain future period have been set and universities should have a serious participation in this development. In fact, one of the goals of the ongoing reform of higher education, which many have already forgotten, was precisely this - the transformation of higher institutes into universities so that they can develop both educational and research activities in more professional fields and thus to participate in the development of the regions. How and to what extent do universities participate in this development through their graduates and teachers? This can be determined both analytically and mathematically (Terziev, Lyubcheva and Georgiev, 2021c; 2021d).

Indeed, if such participation exists, and if university professionals (graduates, professors and scientists) ensure sustainable economic development in the regional priority areas, even if there is a surplus of students in some specialties, this would not be a serious problem.

Yet it is written in the National Map: "The approved number of places for training of students of state procurement in the state higher education institutions are not being filled in a number of priority professional directions". And this is undoubtedly a fact. If criteria for joint work between business and universities are introduced, the problem will be overcome relatively quickly as consequently there will be jobs provided. However, for the implementation of this process, something else is also required and it is the availability of good motivators. For third- and fourth-year students, these could be: offering of business scholarships, qualified modern practical training, jobs guaranteed upon graduation, a good career standard, including satisfactory payment. Which of these elements is actually implemented in our country? This type of education-business interaction exists only in the discussion field and this has been going on for more than fifteen years. Neither can dual education solve this general problem. We find the most direct way to solve the problem by creating a set of constraints.

Yet, the National Map reads, "The capacity of the higher education institutions in Bulgaria accredited by the National Agency for Evaluation and Accreditation is almost twice as large as the number of active students and is not always in line with the demand for educational services under Professional Direction and Regulated Professions Specialty"; which means poor planning or lack thereof in the process. Probably it also means insufficiently accurate or ineffectively met criteria in the process of accreditation of universities since in our country the tendency is for all high school graduates to enter universities. This has long upset the balances of labor market requirements and can be easily demarcated and defined. Overqualification for many of the positions is an indisputable fact. Why and who needs this? Let us also consider if education is a service or something else. Shouldn't we seriously think about a better presence of different types of college education?

"The number of higher education institutions defined by professional fields does not always correspond to the number of students" says another paragraph of the National Map. The issue is also related to the territorial distribution of universities. It is no coincidence that the Southwest region is glutted - there is the capital Sofia with a huge concentration of higher (and not only) education. The topic of regionalization must solve this problem as well as the issue of over-concentration of business in several major cities in the country. The National Map of Higher Education will make no sense if these questions do not find adequate answers and precise solutions (Terziev, 2021e; 2021f).

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*Terziev, V. pp.206-209*

## 3. Conclusion

What else should the National Map include?

Number of students per capita in the region; professional realization of the specialists in the region by fields of training; professional realization of students from the region in the fields of their education at national level; professional realization of students from the respective region abroad; student's profile by regions; coefficient of conformity of the university/ and its specialties /with the economic profile of the region; working University networks /projects, joint specialties, joint trainings/; working education-business consortia; business evaluation of education, etc.

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25-26 August 2021, Kadir Has University, Istanbul, Turkey

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*Micu, N. pp.210-221*

# Universal postal service : An integral part of a competitive postal sector[1]

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## Abstract

The doctrine and practice of recent years has signaled the emergence of new challenges for public postal administrations everywhere in areas such as security, technology and infrastructure, which require quick and practical solutions. Citizens of different countries around the world are increasingly interested in protecting their right to a good and uninterrupted delivery of universal postal service, through effective public policies and institutional devices connected to the current reality of the digital age. Also, changes in the way consumers use postal services, as well as the accelerated decline in correspondence volumes lead to the need for an analysis of the definition of universal postal service (accessibility, access points, frequency of distribution, transit time, obligations quality of service), including an analysis of its sustainability. Any possible redefinition must take into account the financial impact and efficiency of service delivery. In order to cope with the decline in the core business area, postal service providers are required to diversify their activities by engaging in financial, digital or expanding services to cover and cover the entire value chain of postal services (eg logistics, supply chain management etc). The basis for a consistent transformation of the postal services must be found in the fundamental change of the operational mechanisms. Thus, innovation through the use of information and communication technology is a decisive factor in the development of postal service providers, by improving processes and quality, in line with customer needs so as to address recent market developments marked by declining correspondence traffic and increasing volumes. of parcels. In a broader context, the issue of providing universal postal service in the postal field has been considered less attractive at least for young researchers, who want to focus more on academic careers and less on the innovative methods that can underpin the provision. a universal postal service, with a profound social component, globally. The major changes produced in the economy, globally, the liberalization of the postal services market and the emergence of competitive companies, the provision of the universal service impose a new strategy on the postal services. As the promotion and protection of the interests of end-users must be a priority of the strategy for the development of the field of postal services and especially of the universal service, I appreciate that in-depth research is useful. The aim is that the results of the research can be used by the factors that can lead to the updating of primary legislation on postal services in order to review universal service in line with new legislation adopted at European level, taking into account the needs and characteristics of the national market, legislative framework that meets the needs of the national market in a global context.

***Keywords:*** Universal postal service, strengthening the capacity of postal administrations, strengthen the capacity of states to implement universal postal service, international administrative cooperation.

***Jel Codes:*** M2,F5,O21

## 1. Introduction

The postal sector is currently undergoing an intense transformation process aimed at creating a more competitive framework in the European Union (EU). In view of the general interest of postal services taken into account in the relevant European directives, they define and delimit a universal postal service (SPU) and impose universal service obligations (OSU) on operators. The costs of such obligations shall be offset by the temporary allocation of a reserved area or compensation fund to the universal postal service provider. This study examines the scope of the SPU and the alternatives for funding it. Significant regulatory action has been taken in the European Union, first in terms of funding and then in terms of regulating network access.

By the end of the last decade of the twentieth century and in the countries of the European Union (EU), universal postal service providers - generally in the form of a state monopoly - had only begun to adapt their offer, structures

[1] "This paper was financially supported by the Human Capital Operational Program 2014-2020, co-financed by the European Social Fund, under the project POCU/380/6/13/124708 no. 37141/23.05.2019, with the title "Researcher-Entrepreneur on Labour Market in the Fields of Intelligent Specialization (CERT-ANTREP)", coordinated by the National University of Political Studies and Public Administration."

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and operational processes to the requirements of a new technological reality, the world of communications. This does not mean that technology is the determining factor in political decisions, but rather a factor that conditions political agendas and their frameworks for action. From this perspective, external interests and values are those that use technology to drive technical progress. The paths of technical change in a highly complex sector such as the postal service is directly related not only to structures of interest, but also influence political institutions and dominant approaches.

It must be admitted that the merger of public powers with other relevant institutions of society generate sufficient capacity to decisively promote technological innovation. For these reasons, the European postal sector is an appropriate area to highlight a good number of meeting points between politics and technology, as, having been one of the most representative areas of the natural monopoly, the states themselves have become actively new markets for postal products, without abandoning the identification of priorities in the public sphere. This has meant that, since the date indicated above, the European postal sector has undergone major changes, in which different actors participate and interact in a competitive and increasingly global environment.

Some of these changes were driven by exogenous factors - determined, above all, by the replacement of demand for services - which forced a change in the direction of the postal business and a deepening of continuous quality improvement. Others have asked the public policy on several levels to remove the old organizational structure of national - often closely related to public administration and budget - to make them more operational and to adapt them to a process that has a time horizon specifically to be achieved, the total openness of the postal sector to the criteria of market competition.

This makes it necessary to pay attention to the way in which the public and private needs of postal services are limited in today's EU countries. These are the cases in which public intervention is defended from certain social and productive spheres, in order to be implemented from the different channels in which it can act, and, on the other hand, which are the cases in which the same intervention is discouraged and therefore a removal from state controls.

From a historical perspective, the conditions for the provision of the European postal service have shown marked differences between states and insufficient quality to meet citizens' expectations. Also, the lack of financial capacity of service providers - and perhaps adequate economic incentives - to adapt to changing demand and to adapt to the contexts created by the new telecommunications has considerably delayed the modernization of their work processes. and its adaptation to the new reality. the supply of traditional products has barely met the new potential demand and, only in recent years, the various postal operators have completed and adapted their networks, making the IT support necessary for access to a wide range of products and services available to the public, postal and para-postal services more in line with the current needs of users.

The path to free competition in the sector, whose full market opening (atm) in the European Union, was reflected in three main regulatory instruments: Directive 97/67 EC, December 1997, Directive 2002/39 EC of 10 June 2002 and Directive 2008 /6 EC of 20 February 2008. However, there have been notable difficulties in implementing these instruments in creating a framework of free competition in the postal sector due to a number of features inherited from the previous model, which have forced the design of a slow and staggered process.

It is therefore important to know the potential of liberalization policies to promote competition in the European postal sector. In relation to this question, it is relevant to ask whether the influence of these policies is uniform or, on the contrary, unequal, because, in my opinion, some of the decisions taken in the EU are clearly framed within the public policy group they promote, intensity of long-term competition, while others may favor short-term competition, but have limitations in the first. (Armstrong, m. y david e.m. Sappington, 2006:89-92)

Another relevant issue for the study arises from the fact that the relative merits and successes of monopoly and liberalization depend to a large extent on institutional factors.

## 2. Universal postal service in the reform process

The large savings that took place in the postal systems were a main argument for defending the status quo of the public monopoly in this sector. However, the combination of technology with political change and pressure from stakeholders has led to significant changes in the ways in which the aforementioned economies are achieved, which has ceased to justify maintaining the natural monopoly as the main organizational model of the postal sector. In that regard, Directive 97/67 CE does not even attribute the nature of postal services to public services, although it

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*Micu, N. pp.210-221*

assumes in the second recital that they are an essential tool for the Community and trade, and in the fourth it acknowledges that some postal services are of Community interest.In some European Union countries, the implementing rules of the directives give, although limited, the nature of a public service to a part of the postal services, but it is convenient to distinguish between services incorporating universal service obligations (OSU) and, within those that are part of the so-called reserved area or monopoly, provided exclusively by the incumbent.

The Universal Postal Service (SPU) consists of a valuable set of quality postal services that are provided on a permanent basis throughout the country and at an affordable price for all users. The intrinsic characteristics of the mentioned service are the following: a) quality, whose predetermined parameters will refer to: time commitments, network extension, access facilities, distribution and delivery standards, customer service, regularity and reliability of services, among others; b) permanence, which requires the provision of the service without interruptions and without unjustified suspensions; c) ubiquity, which guarantees citizens the availability of essential postal services in any part of their national territory and throughout the EU; d) price, which must be affordable for all users.

The notion of universal service contains different nuances depending on each country, each industry and even each period ( Cremer, H.A. et al., 2001: 5-43 ).

In postal services, as in other network industries, universal service is evolving and will evolve according to the economic and social development of a country and the evolution of technology in the communications sector to the extent that modern telecommunications - fixed and mobile telephony, internet and others - replace postal communication, the SPU will have to be redefined as often as necessary. The applicability of full compliance with the characteristics of the SPU may expose its provider to significant losses requiring the adoption of a compensation mechanism. The justification of the SPU and the financing of its cost is the central element of the debate on postal policies and strategies arguments for the implementation of the SPU can be obtained from a public policy perspective ( Crew and Kleindorfer, 2006: 3-22 ).

First, universal service obligations are one of the foundations of postal policy for several fundamental reasons, such as: transparency, reduction of transaction costs and consumer protection through a uniform price for the basic element of postal communication - the letter ( Crew and Kleindorfer, 2006:5 ).

Secondly, the SPU can also be used as an economic policy instrument of notable importance due to its special ability to achieve objectives in the following contexts ( Cremer H.A.et al.,2001:24 )

1. Correction of market failures caused by the presence of network outsourcing.

2. Design redistributive policy instruments. When a government has a limited capacity to redistribute revenue directly, regulated prices for certain essential services can be a means of promoting universal service.

3. To have a means of providing a public good. A communications or transportation network has a characteristic of a public good in the sense that it unites the entire nation, and society perceives and defends that it is unacceptable for someone to be excluded from communications services ( Cremer H.A.et al., 2001:18 ).

4. Activation of a territorial policy instrument. Rural areas with a scattered population can coexist in a country, with poorly developed communications and transport infrastructure and areas with a population concentrated in large populations that enjoy advanced communication systems. the maintenance of post offices (which provide postal and other services) in rural areas can help to stop the economic decline and abandonment of these areas. Directive 6/2008 CE justifies the maintenance and consolidation of rural and dispersed postal networks in line with employment and social cohesion objectives, while maintaining that post offices in these areas can provide an important network infrastructure for access to new electronic communications services.

5. Arbitrate decisions between interest groups that exert political pressure to achieve results. In this case, the affordable price would be the result of pressure from territorial interest groups that prefer price interventions instead of receiving compensatory direct transfers.

Table 1 shows the set of services that make up the SPU in the EU (The reports nera,1998:16 and wik Consult, 2006:21). However, my study confirms that it cannot be considered homogeneous, as there are significant differences between EU Member States.

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**Table. 1** Universal postal service (SPU) in the European Union

**Products included:**

Postal items up to 2 g (letters, direct mail, catalogs, books, newspapers).

Postal packages of up to 10 g.

Added values of certificate and insurance.

**Frequency:**

A daily collection at all access points and a daily delivery at all addresses, at least five days a week (except for justified exceptions).

**Network access and expansion:** Extensive network of mailboxes and offices.

**Price:** accessible to all users.

**Quality:** on time in the EU end to end.

D + 3, 85% of transports;

D + 5, 97%.

**Customer rights:** For information about access, prices, quality, complaints.

**Source:** own elaboration with data from the European Commission.

Regarding the required quality requirements, number of collections and deliveries, quality on time, home delivery, accessibility, price control systems and others. In addition, there are differences in the size of the SPU, which depends not only on the set of products or services included in it, but also on the conditions for the provision of that service.

Regarding the financing of the SPU, given the full opening of the market in the literature there is a debate focused on two fundamental aspects: 1) delimitation and calculation of the net cost of its implementation and 2) methods and sources used in its financing ( wik Consult, 2006:116 ).

There is no consensus in the postal sector on which is the most appropriate method of calculating the cost of universal service. Until now, this activity was almost useless, as services were provided under a public monopoly, but the liberalization process made it essential to assess and standardize this cost. If we consider the works of Cremer, the cost of USO would be determined by the difference between the benefits that the provider would obtain in the absence of universal service obligations and that which would actually be obtained under USO conditions ( Cremer, H., A. Grimaud y J.J. laffont, 2000:47-68 ).

Other studies that use arguments similar to the previous ones are those of Panzar, J., 2000: 211-220, based on the loss of potential benefits, and that of Chone, P.l., l. Flochel y A. Perrot 2002:1247-1276, formulated on the principle of competitive neutrality.

On the other hand, the NERA report (1998) proposes two main methods for calculating OSU costs: 1) the net avoided cost method (NAC, for its acronym in English), which consists in estimating the avoided cost if it is not provided to the service obligations universal and 2) the method of fully distributed costs, which, in short, consists in deducting the costs of each of them from the income of the various postal activities ( Bradley and Colvin, 2001:224-245 ).

However, the transfer of SPU calculation results from one country to another should be taken with some caution, as 1) the content and requirements of SPU differ from one to another; 2) cost structures vary between countries due to different factors, such as relative labor costs, technological development and the degree of concentration or dispersion of the population and 3) the concept of SPU changes over time.

The NAC method is based on accounting arguments and its importance lies in the fact that it is provided by the Postal Directive. His calculation is similar to that of the loss of benefits when abandoning universal service does not change prices or market structure ( Cremer, H.A. et al., 2001:79-93 ).

There will be significant customers who will bear the costs of switching suppliers in deficient areas if their current operator limits its activity to profitable (urban) areas. The latter would have been forced to reduce prices in those

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areas in order to maintain the customer, so that their revenues - and profits - would be reduced, which means that the cost of SPU would not correspond to that proposed by the NAC method.

The two calculation procedures are extremely complex, as most costs are common, and their allocation to different services is possible only on the basis of a general allocation factor. The solution given by Directive 97/67 is pragmatic, as it solves the fact that the net cost of the SPS is calculated by the difference between the net cost for a designated universal service provider operating with OSU and that corresponding to the same postal service provider when operating without OSU (Directive 97/67, 14.3.iii).

## 3. Actions internally derived from critical analysis of the regulatory framework for postal services in Romania

Traditionally, postal service providers have been public monopolies. Although some important steps have been taken, today many of the suppliers still retain one or both of the following characteristics: monopoly and state ownership. In the last quarter of that century, most countries converted their postal operators into state-owned companies or government agencies with their own assets and an increasing degree of managerial autonomy and commercial flexibility. Some countries have even set up joint stock companies which are governed by the same rules as joint stock companies. On the other hand, other European countries have taken a step further, reaching the total or partial privatization of this type of company.

The process towards total or partial privatization of operators is not the only way in which the service can be efficient. The core problem is not facing private and public, but public property contrasting with the existence of independent regulatory body. When the state is the sole owner of the PSU, attention should be focused on the fact that it is not effective for the regulator to depend on ownership, as the state cannot be a judge and a party. Although total or majority public ownership can be justified by the characteristics of permanence, quality, ubiquity and affordability for all users, typical of SPU, some literature argues that a policy of privatization of state-owned suppliers can give positive results for several reasons: 1) it directs the company's efforts to reduce costs and provide superior services; and 2) it reduces the supplier's incentive to set prices below cost as a policy of expanding or maintaining market share, preventing more efficient competitors from entering. In this regard, and as Sappington and Sidak point out, a state-owned company - more concerned with maintaining or expanding its market share - is more likely to keep prices below cost for long periods of time compared to another companywhose goal is to maximize profit (Sappington, david e.m. y J. Gregory Sidak, 2003:183-206 ).

However, an independent regulatory body, with sufficient material, technical and legal means, can limit and even eliminate the two previous arguments in favor of privatizing the operator.

Directive 6/2008 CE provides that the supply of SPU may be carried out by systems other than that supplied by market forces (Directive 6/2008 CE, Article 4.2.). When institutional and organizational reforms in the service of public management include quasi-competitive and market mechanisms (technical pillar), incorporation of private sector management techniques and styles (cultural pillar) and normative reforms (political pillar), the praise of privatization is based on ideology. The privatization is one of several possible answers, but not the only one ( Osborne d. y t. Glaeber, 1992:87-112 ).

The postal operator who owns the postal network completes the value chain of the service, from the collection of deliveries to the access points to the network to their physical delivery, both to large and small customers, without discrimination. We could make a comparison of psu with a company that offers its services in the wholesale and retail markets, while competing with other companies in the retail market, companies that access the postal network at some point in the downstream access and pay a price by the network operator's infrastructure from the access point to the final distribution.

Through CN Poșta Română SA ( CNPR ), the Romanian State, which is defined in the Romanian Constitution as a state governed by the rule of law, with a social state character, fulfills its constitutional functions in the public domain of communication, under the law and through the postal services, both internally and and internationally, collaborating with similar organizations abroad in performing these functions, in order to satisfy the public and social interest. CN Posta Romana SA is the national operator designated to provide basic postal services according to the law and licenses granted by the relevant ministry, which is organized and operates as a specialized body of the central public administration, with legal personality, subordinated to the Government, having the role to implement the Government's policy in the field of electronic communications, postal services, information technology and the information society.

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Thus, the Government of Romania established CN Poșta Română S.A. through which it carries out its constitutional social policies and functions in the following fields:

- in the field of universal postal service, the public service provided by the state, throughout the national territory and in international relations,

- in the field of social assistance rights, according to the state budget law, the expenses for the transmission and payment of social assistance rights financed from the state budget or from transfers from the state budget to local budgets and paid at the beneficiaries' domicile through CN Posta Română SA,

- in the field of defense and national security system, under contracts or conventions or legal provisions, Compania Națională "Posta Romana" - SA, provides the necessary postal services to the national defense system and national security system, at the request of the competent public authorities.

CNPR performs all these public services respecting the regulatory framework and respecting the financial, fiscal and commercial discipline, as well as respecting the legal provisions on competition.

Government Emergency Ordinance no. 13/2013 on postal services is the primary legislation transposing the provisions of the European Directive on Postal Services 2008/6 / CE (full liberalization of the Romanian market on January 1, 2013). The legislative framework on postal services applies to correspondence and parcels (if they are express services).

The most regulated part is the Universal Service Obligation in Romania which is provided by CNPR as a mandatory universal postal service provider.

The National Authority for Administration and Regulation in Communications ANCOM designated CNPR as a universal service provider (to which USO was entrusted) until December 31, 2012. Subsequently, by Decision no. 975/2012, this term was extended until December 31, 2013. The rights and obligations of the universal service provider were established by Decision no. 1158/2013 regarding the designation of the CN Posta Română SA CNPR has been designated universal service provider in the field of postal services for the period January 1, 2014 - December 31, 2018. Taking into account the need to ensure universal service in the field of postal services, the Ministry of Communications and Information Society at that time requested ANCOM to extend the period of appointment of CNPR until December 31, 2019 according to the legislation in force.

Following the completion of the procedure for designating the universal service provider carried out between October and December 2019, ANCOM communicated to CNPR the decision on its designation as universal service provider in the field of postal services for the period January 1, 2020 - December 31, 2024. The decision was published on the ANCOM website. As a provider of universal service CNPR benefits, among others, the right to act in international relations and to conclude operational arrangements to use the specific international forms and the right to apply special fares for all users and integrators in transparent and non-discriminatory conditions, both with regard to the tariffs themselves and with regard to the conditions associated with them. CNPR has the obligation to provide services included in the scope of universal service throughout Romania, including in geographically inaccessible or low population density areas, where the low number of postal items collected or distributed does not justify the presence of a postal service provider on commercial principles. At the same time, CNPR will ensure the access of persons with disabilities to the services in the sphere of universal service that it has the obligation to provide in conditions equivalent to those enjoyed by other users.

I have made an analysis on some aspects regarding the effects of the application of the regulatory framework of postal services in Romania, based on a comparative analysis regarding the aspects notified in the law enforcement process and I refer to the problems that arise especially when the legal provisions are amended repeated and at short intervals, when they are not harmonized (incoherent), when they are contradictory or incomplete, and when their content is unclear.

This analysis is based on the following two principles:

1. The principle of hierarchy of norms, the following norms were subjected to the analysis process: hierarchy of norms in Romanian law, hierarchy of norms in relation to European Union law, hierarchy of norms in relation to international law, the purpose being to ensure compliance with regulatory powers complement and are not contradictory to the observance of the principle of economic efficiency.

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*Micu, N. pp.210-221*

2. The principle of economic efficiency of the rules of law, when the rules of law govern economic activities and they directly influence economic efficiency and economic outcome.

The main Institutions in Romania with regulatory attributions in the postal field are the Ministry of Transports, Infrastructure and Communications / Government and the National Authority for Administration and Regulation in Communications (ANCOM).

The National Authority for Administration and Regulation in Communications (ANCOM) is the institution that protects the interests of communication users in Romania, by promoting competition on the communications market, managing limited resources, encouraging efficient investments in infrastructure and innovation.

ANCOM was formed by bringing together two institutions with experience and expertise in the field of administration and regulation of this sector: the General Inspectorate for Communications and Information Technology (IGCTI) and the National Regulatory Authority for Communications and Information Technology (ANRCTI).

The Ministry of Transport, Infrastructure and Communications, as part of the Romanian Government, establishes the guidelines of the postal policy, while ANCOM is the postal regulatory authority responsible for the implementation of national policies in the postal services sector.

In accordance with the European Directive on postal services, ANCOM in Romania is defined as an independent regulatory body, a public autonomous body subject to parliamentary control. The benefits of ownership unbundling can be enhanced if there is a regulatory body with sufficient resources, experience and authority to capture relevant data that can prevent the practice of strategic behaviors to the detriment of participants.

ANCOM's main responsibility is to implement the national policy in the postal services sector (as established by the Ministry of Transport, Infrastructure and Communications / Government of Romania), including the issuance of technical and market regulations in this regard.

From the analysis of the application of the postal legislation in Romania it can be observed that the competences of ANCOM are not always well defined in the primary legislation.

In the context of the implementation of the European postal acquis (postal services directives and ancillary regulatory rules), a clear separation between the roles of the Ministry of Transport, Infrastructure and Communications / Government of Romania and the Romanian regulation (ANCOM).

The unclear attributions and tasks lead to unwanted discretionary powers and legal unpredictability on the part of ANCOM, in this sense, I consider that the main role of the Ministry / Government is to establish the policy on postal services through the primary Legislation on postal services.

Postal policy under the European Directive can be centered around two major objectives:

1. The objective of conservation and sustainability of the Universal Compulsory-Postal Service;
2. The objective of facilitating market entry, combined with consumer protection.

A regulatory authority such as ANCOM under the European Directive should ideally focus its tasks on compliance with and implementation of postal services policy.

In the primary legislation of Romania, the concept of Universal Postal Service is transposed from Article 3 of the European Directive on postal services and is broadly defined as the services of verification, sorting, transport and delivery of:

■ Postal, domestic or cross-border items up to 2 kilograms;

■ Services for checking, sorting, transporting and delivering postal parcels, domestic or cross-border up to 10 kilograms;

■ Distribution of postal parcels up to 20 kilograms, sent from abroad to an address located in Romania;

■ Recommended and insured postal items for the postal items presented above;

■ Domestic and international "Cecograms";

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■ Any other postal services established by law, if they address the social or economic needs of the user; which can be reasonably satisfied in the competitive market.

The primary law in Romania establishes only general provisions, based on the European Directive on postal services.

However, ANCOM retains its decision-making power regarding the classification of a product as Compulsory Universal Service or non-Compulsory Universal Service.

This decision-making power must belong to the Ministry of Transport, Infrastructure and Communications / Government of Romania, which makes the policies in the postal field and transposes them into the Primary Legislation according to the directives of the European Union, and a regulatory authority such as ANCOM under the European Directive should assume its powers and responsibilities only with regard to the application of postal policies, ideally to be given the tasks regarding the observance and implementation of the postal services policy.

A regulatory authority such as ANCOM according to the European Directive has tasks only regarding the application of the primary legislation and not for legislating or interpreting the primary legislation.

The Romanian primary legislation on postal services must establish a clear separation between the roles of the Ministry of Transport, Infrastructure and Communications / Government of Romania and the regulatory authority (ANCOM), thus avoiding the too broad powers of ANCOM which decided since 2007, for example, that direct mail marketing should be outside the scope of the Universal Compulsory Service as well as postal items with the following additional characteristics: change of destination, special deliveries, acknowledgment of receipt, express.

These very important concepts with macroeconomic impact must be defined in the primary legislation of Romania by the Ministry of Transport, Infrastructure and Communications / Government of Romania given that the Government is responsible for ensuring policies and macroeconomic balance.

I mention that even in this field ANCOM cannot have competencies that overlap with those of the Ministry of Transport, Infrastructure and Communications / Government of Romania and no responsibilities can be delegated for this field because it does not have mechanisms and levers to make political decisions.

In this sense, I appreciate that it is necessary to complete and amend the Primary Legislation. Thus, these concepts will be defined by law and not only by ANCOM as it happens at present, which leads to an alignment of Romanian legislation with European Union practice, on the transposition and application of the European Directive on postal services, which has based on the principles of economic and social efficiency.

The primary legislation must define very clearly the competences and tasks of ANCOM regarding the observance and implementation of the postal services policy. In this sense, the arguments of an economic nature regarding the classification of postal services are also very important, in support of this fact are the following legal and economic arguments:

1. The classification of a product outside the universal service removes regulatory control and has the negative economic consequence that the services provided by other postal service providers in this classified segment do not make any economic contribution to the compensation fund (if applicable) as it happens in Romania.
2. This way of regulation as in Romania has a negative influence from the economic point of view and by the fact that certain economic costs cannot be allocated to the Compulsory Universal Service (with a possible resulting consequence regarding the increase of the minimum price).

I would like to point out that in no country of the European Union does this way of regulating apply because it lacks the principle of economic efficiency, taking into account that all European public policies are oriented towards economic and social efficiency.

Moreover, a Universal Postal Service provider as established by ANCOM may be designated only for a part of the universal services and / or a part of the territory. Also in this field, ANCOM has broad powers to determine the decision path for selecting the Universal Postal Service provider, by ANCOM decision no. 541/2013, ANCOM has defined the selection procedure and allows the designation of the Universal Postal Service provider at the request of the interested operator or ex officio.

The fact that in theory more than one Universal Postal Service provider can be designated to provide these services and that each can be designated for a part of the universal services and / or a part of the territory was considered

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hypothetical, because currently all EU Member States apply the coverage of the entire territory of the country as a criterion.

In practice, the countries of the European Union consider that a division of the Universal Postal Service is not likely to occur, given the economic and social inefficiencies it would bring.

In European Union member states, the Regulatory Authority is most concerned about the consumer and will continue to impose Universal Postal Service in regions where there is no competition.

Critical considerations in this area take into account the complexity of the regulation that requires a strategic decision for Romania which has the obligation to provide universal service, so we are dealing with a state policy decision.

The primary law on postal services in Romania is vague regarding the critical aspects, such as the selection and process terms, the bidding criteria, the duration of the designation period, etc. and delegated many competencies to ANCOM. The coverage criterion (nationwide, two or more Universal Service Providers ("USP") is decided by ANCOM.

ANCOM also decided that the following criteria must be evaluated in the file for choosing the postal operator:

(a) coverage, including the density of access points and postal contact networks,

(b) technical and financial capacity,

(c) the ability to ensure a uniform level of universal service charges throughout the country,

(d) the net cost of the universal service offer, ANCOM also decided that USP Universal Postal Service providers are appointed for a sufficient period to ensure the economic viability of the services provided, but not more than 10 years.

Given that the power of decision and selection is not determined by the primary law, CNPR depends entirely on the approach of ANCOM, an approach that becomes unpredictable by unilateral change by ANCOM of the rules without legal control.

In the field of financing the cost of the Universal Compulsory Service, Directive 97/67 EC establishes as a principle of price fixing their cost orientation. However, the existence of a quality SPU at an affordable price is, in some areas, incompatible with this principle. The SPU provider serves rural areas at lower prices, extending the debate on different financing alternatives for universal service obligations. Complementary state funding, either through income tax or postal service taxes, must respect the principles of fiscal neutrality and financial sufficiency for the competitive process to adjust prices to costs. Intense long-term competition in the postal sector is strengthened when psu adjusts prices to marginal costs. This adjustment helps to capitalize on the forces of competition so that both the current supplier and other interested companies can offer their services more efficiently.

The European directives on postal matters do not impose a uniform price throughout the territory of each Member State, as they provided that prices are set taking into account costs, although they also took into account the fact that, whenever necessary for reasons of public interest, Member States may decide to apply a single rate throughout their national territory (Directive 6/2008 CE, Article 12 ). Omnipresence and a uniform price are the two attributes of the traditional postal service, as the sender of a letter pays the same price regardless of whether he is in his own city or on the outskirts of the country, regardless of whether the destination is a large city or a remote rural town ( Crew, m. y Paul r. Kleindorfer, 1998:103-125 ).

On the other hand, the price is the same if the sender is a person who communicates sporadically with a friend or if the sender is an electricity company or a bank that makes massive deposits of letters every day.

In countries such as Romania, where the rural population is relatively important and where, consequently, there are many deficient pathways, the uniform - and affordable - price contributes to the goal of SPU. At the same time, the defense of the uniform price justifies the need for the provider of financing through other mechanisms, such as the reserved area, a compensation fund provided by participants or consumers and even through public funds.

The constitutive elements of the SPS definition can generate the economic imbalance of CN Poșta Română SA. Of all the elements, the uniform price and frequency of collections and deliveries, due to their specificity and accuracy, are the most used in the literature as a source of financial imbalance.

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*Micu, N. pp.210-221*

In this area too, ANCOM takes decisions as it deems appropriate, with a summary check of legality, without taking into account that according to the European Directive, Member States implement laws and regulations necessary to regulate and harmonize the postal sector, and they must be compatible with the Treaty and its principles, and I am referring here to the principle of economic efficiency. The law confers the competence of ANCOM to establish the financial instrument on the basis of a compensation fund or price increases from CNPR.

In addition, while CNPR calculates the net cost of universal service, ANCOM has the exclusive decision-making power to assess the value and to define the "intangible benefits" and the unfair burden. The criteria that ANCOM must comply with are not mentioned in the primary law, nor in the relevant ANCOM decisions.

The clearing fund, the share of the contribution from competitors to the net cost compensation fund from market revenues is probably very small, as part of the postal services such as direct mail marketing is taken out by ANCOM outside the scope of application of universal service. The same is true of "substitutable" services, which, although they may also be included in the revenue from the universal service segment.

Cost accounting and cost allocation in accordance with the European Postal Services Directive, the basic principles of separation of accounts and cost allocation are incorporated in the primary legislation. However, the cost allocation methodology is determined by ANCOM (Decision no. 1159/2013). CNPR is also required to submit separate financial statements for audit by an independent auditor as appropriate. ANCOM sets out the requirements to be met by the auditor regarding the separate financial statements and the alternative scenario, in all these years ANCOM has not provided the necessary methodology and guidance for the alternative scenario, and CNPR was put in the situation to take legal action to compensate the net cost and oblige ANCOM to provide the methodological norms for the alternative scenario so that CNPR can comply with the legal requirements. We note that ANCOM has full decision-making power, without legal control over the issued documents necessary to regulate and harmonize the postal sector, and they must be compatible with the treaty and its principles and I refer here again to the principle of economic efficiency. ANCOM cannot replace the Government in this field either. ANCOM's main responsibility is to implement the national policy in the postal services sector (as established by the relevant ministry / Government), including the issuance of technical and market regulations in this regard.

Although the Postal Services Directive allows for a stricter licensing regime for operators providing universal service, with some regulatory oversight in terms of performance, quality and reliability, the primary law regulates new entries through a procedure of general authorization.

In this field, too, ANCOM has wide regulatory powers regarding the conditions related to the authorization. In accordance with ANCOM Decision no. 2858/2007, a person may provide postal services without first obtaining an explicit decision from ANCOM, but only by notifying the intention to provide postal services, based on this notification, ANCOM will prepare, update and publish the Public Register of Postal Service Providers and will issue a template certificate on the right to provide postal services.

The absence of a licensing system implies that the supervision and control of new economic operators of postal services entering the market are almost non-existent.

Given the specific territorial and economic situation in Romania, it would have been advisable to apply a strict licensing approach, in order to diminish the vulnerability of the Compulsory Universal Service which faces selective choices and unequal regulatory competition conditions, with an negative impact on the sustainability and financing of the Universal Mandatory Service.

According to Directive 2008/6 / CE amending Directive 97/6 / CE on the full accomplishment of the internal market of Community postal services are provided two ways of authorization:

1. General authorization means an authorization, whether governed by a block or common law license and whether such regulation requires registration or declaration procedures, which do not require the supplier concerned to obtain an explicit decision from the national licensing authority, regulation before exercising the rights resulting from the authorization;
2. An individual license which means an authorization which is granted by a national regulatory authority and which confers specific rights on a postal service provider or which makes the activities of the postal service provider subject to specific obligations in addition to the general authorization, as appropriate, if the postal service provider is not entitled to exercise those rights until it has received the decision from the national regulatory authority.

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*Micu, N. pp.210-221*

In view of this situation, it is necessary to amend and supplement the Primary Law on Postal Services, so that there are no restrictions on the application of the European regulatory rule (Directive 2008/6 / CE amending Directive 97/6 /CE), in order to be able to applied the best decisions for the organization of the market in accordance with European policies based on the principle of economic efficiency to be respected by all Member States and in the manner of authorization.

Given the specific territorial and economic situation in Romania, it is advisable to consider a stricter approach to licensing, in order to reduce the vulnerability of the Universal Postal Service, which is a public, social service that the Romanian State is obliged to insure it throughout the national territory.

## 4. Conclusion

The postal service itself is undergoing a strong shift in favor of other communication systems due to rapid technological changes and the adaptation of consumer preferences.

European regulation in the postal sector faces as many different scenarios as the Member States of the Union. Consequently, Member States have transposed the European Postal Directives into their national law taking into account the specific situation. Since the late 1990s, the European Commission has tried intensively to extend its prerogatives in the postal sector, using two main lines of action: on the one hand, promoting the implementation of specific industrial policies to structure national sectors in a European network and on the other hand, the release and regulation of markets to promote and facilitate the orderly integration of the sector into the global market.

The Commission has established itself as a key player in the postal sector, although it does not have a specific constitutional mandate and this has made it necessary for it to develop important methods and tactics to promote its sectoral policy approach through recommendations, directives, reports and other persuasion tools. On many occasions, he has made creative use of legislation to create rules and influence the postal sector. The most prominent intervention tools in these lines of action are long-term planning, technological homogenization, the introduction of new approaches channeled practically through green papers, the development of partial regulations and sectoral directives, the implementation of interventions and the implementation of sectoral control mechanisms based on authority by the Commission in competition policy. The above revealed a process of relocation and redefining the postal functions and competencies of nation states, in a context in which the European Commission unequivocally exercises leadership tasks and promotes voluntary cooperation in implementing the necessary specific public policies.

Under these influences, in most EU countries, responses to technological change and economic globalization in the postal sector have consisted of implementing public policies based on complex regulatory models, segmenting markets and postal products experiencing competitive duopoly or operator regulation.

In this sense, if the central aim of liberalization was to replace regulatory oversight with the discipline imposed by market forces across the EU, greater coordination of National Regulators would contribute to greater integration of the postal liberalization process in Europe and could serve as an example in non-EU countries.

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*Atanasova, P. & Nedkova, S. & Kasarov, R. & Totzeva, R. & Totzev, A. pp.222-228*

# Radiological monitoring of sand and soil from Vromos Bay[1]

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## Abstract

The radiological monitoring of the living environment is extremely important because it assesses the radiation status and the dose of ionizing radiation for its detection, humans have no developed senses. The creation of a logistic model for monitoring of any territory for which there is a risk of radiation contamination will stop the spread of incorrect information flow and will contribute to the sustainable management of natural resources. The researched radiological monitored area is located around the beach of Vromos Bay and was contaminated by ex-mining activities of copper, with flotation waste with increased content of natural radionuclides, as a result of which there are conditions the radiation status of the area to exceed the normal background values and to create risk.

The results of the study show that the highest content of $^{226}$Ra (495 ± 3Bq/kg), $^{210}$Pb (222 ± 3Bq/kg) and $^{238}$U (150 ± 12Bq/kg) was determined in the sample from the wetted part of Vromos Bay. This result is confirmed when determining the gamma background at the sampling points. The values of the specific activities indicate the presence of radiation risk, which goes beyond the acceptable values.

***Keywords:*** Radiological monitoring, sand, Vromos Bay.

***Jel Codes****:* Q00, Q01

## 1. Introduction

Rosen mine region is a place for extraction and processing of copper-containing sulfide ore from antiquity. Rosen Mine is located 25 km southeast of the city of Burgas. The mine consisted of two sections – „Rosen“ and „Korucheshme“ (Stakhanov.). The „Rosen“ section was exploited in the period 1945-1995 and for that time the amount of the obtained ore is about 7563 thousand tones, with a copper content of 1.02% or 77912 tons of metallic copper. The Rosen mine was closed in 1995 due to mining inefficiencies, complex mining-geological and mining-technical conditions, and unsustainable ore veins with small thickness and low copper content, depletion of reserves to a depth of 800 m, complicated transport, ventilation and drainage, increased rock pressure (Ivanov V., 2006). At the area is the bay "Vromos", which covers an area of 203,944 m$^2$. At this location, for decades (1954-1977), flotation waste with increased content of natural radionuclides was deposited by the Rosen Flotation Factory (Executive Environment Agency, 2020). Vromos Bay is a subject to continuous radiological monitoring by government and scientific institutions, which prove the presence of higher values of radionuclides compared to other beaches in the country, despite the activities of recovery of the seabed in the area Totzev A., et al 2015).

## 2. Experiment

Samples were taken from seven points in the area of Vromos Bay and the tailings pond of the Rosen mine. Three of the points (points 1,2,3) are located on the territory of the Rosen mine tailings pond and are located on

[1] **Acknowledgement:** This work was supported by University „Asen Zlatarov”, Burgas, under University Scientific research grant programme, Project 448/2020

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*Atanasova, P. & Nedkova, S. & Kasarov, R. & Totzeva, R. & Totzev, A. pp.222-228*

uncultivated soils (homogenized and averaged, they form Sample 1). Two of the points (points 4,5) are located at the end of the sedimentary channel, which ends in the sandy coastline and is covered with sediment (homogenized and averaged, they form Sample 2) and two of the points (points 6,7) are located on the wettable part on the shore (homogenized and averaged, they form Sample 3). The samples were taken manually with a shovel, according to the following scheme: Soil samples from uncultivated soil - for each point single samples were taken from depth (0-10) cm from a circle area with a radius of 1 m, on a grid basis (approx. every 1 m), which are then homogenized and averaged (Fig.1)

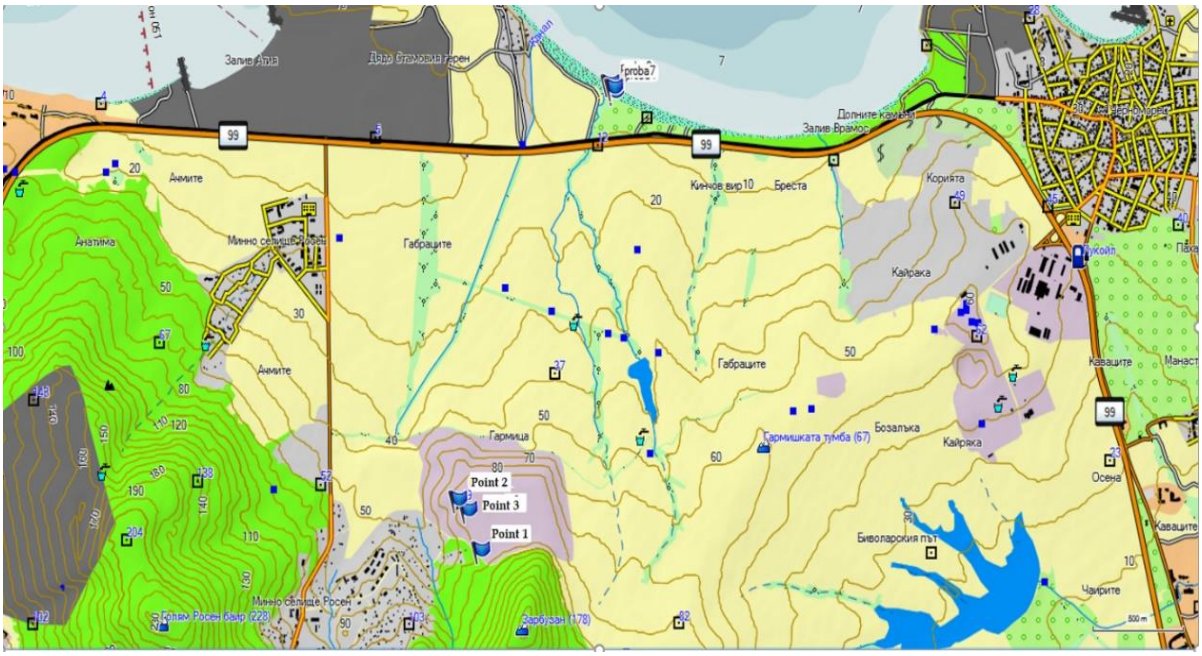


**Figure 1.** Points 1, 2 and 3 for soil samples at the area of the tailings pond of the Rosen mine

**Source:** Authors

The sand samples – from the sedimentary channel for drainage into the sea, were taken as single samples on a grid basis, manually with a shovel in an area with approximate. radius of 1 m, from points 4 and 5, after which they were well homogenized and averaged (Fig. 2). They form sample 2

**Figure 2.** Points (4,5) for sample 2

**Source:** Authors

**Figure 3**. Points (6, 7) for sample 3

**Source:** Authors

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*Atanasova, P. & Nedkova, S. & Kasarov, R. & Totzeva, R. & Totzev, A. pp.222-228*

The samples, taken from the wetted part of the shore were also taken as single samples on a grid basis, manually with a spatula within a radius of 1 m, from points 6 and 7, after which they were well homogenized and averaged (Fig. 2, Fig. 3 and Fig. 4), they form sample 3.

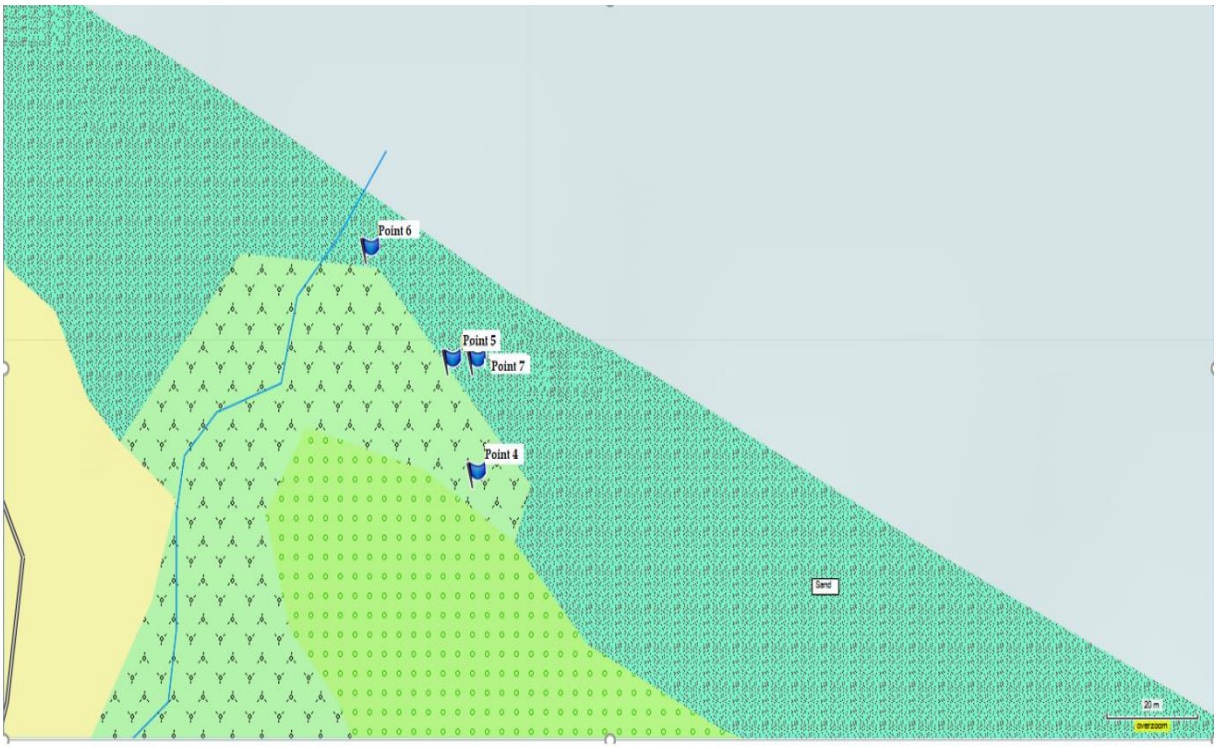


**Figure 4**. Points for sample taking from wetted area of the shore in Vromos Bay and the sedimentary channel, ending at the coastline

**Source:** Authors

The coordinates of the points marking the sample are center of the researched areas are listed in Table 1

**Table 1.** Coordinates of the sample points and the data of dosimeters Seifert Fag, Bella and Graetz for determination of gamma radiation dose rate.

| Point<br><br>№ | Coordinates | Dozimeters | | | Note |
|---|---|---|---|---|---|
| | | SEIFERT FAG<br>[µSvh] | Bella<br>[µSv/h] | Graetz<br>[nSv/h] | |
| 1. | 42 °22 ' 34,9 " N<br>27 °24 ' 39 "E | 0,17 | 0,06 | 56 | Tailings pond |
| 2. | 42 °25 ' 42" N 27 °35 ' 41,3 "E | 0,21 | 0,13 | 70 | Tailings pond -high |
| 3. | 42 °25 ' 40,3 " N 27 °35 ' 43,7 "E | 0,20 | 0,13 | 62 | Tailings pond-high |
| | 42 °26 ' 44,1 " N 27 °36 ' 19 "E | | | | Reed, sediment |

| | | | | | |
|---|---|---|---|---|---|
| 4. | | 0,46 | 0,35 | 341 | |
| 5. | 42 °26 ' 44,7 " N 27 °26 ' 19 "E | 0,28 | 0,18 | 122 | Reed, sediment |
| 6. | 42 °26 ' 45,3 " N 27 °36 ' 18 "E | 0,33 | 0,14 | 145 | Sand, coastline, end of the sedimentary channel |
| 7. | 42 °26 ' 44,7 " N 27 °36 ' 18,8 "E | 0,50 | 0,21 | 374 | Sand, wetted shore on the coastline |

The specific activity of certain radionuclides in the averaged soil and sand samples was determined by gamma spectrometric analysis, according to the international standard IEC 61452 (1995-09). For this purpose was used, a computer multi-channel analyzer ORTEC with HPGe-detector type GEM-45190-P. The detector of the device has a relative efficiency of 45% and a resolution of 1.75 keV (at an energy of 1.33 keV) and is located in a combined protection of 100 mm lead + 10 mm copper. The measurements are performed in a Marinelli type geometry with a volume of 1 L. The combined uncertainty of the obtained values of the absolute efficiency is estimated at 3%. The research was developed at the National Center for Radiobiology and Radiation Protection, Laboratory of Population's Irradiation Monitoring.

In the sampling points' areas, was determined the dose rate of gamma radiation by detecting 5 readings of the radiation exposure (at every 3 minutes) at a height of 10 mm from the surface, for each of the points, which coordinates are listed in Table 1. points, after which the values are averaged. Three different dosimetry devices were used SEIFERT - FAG, Bella and Graetz.

## 3. Results and discussion

The specific activity of radionuclides -$^{40}$K, $^{137}$Cs, $^{210}$Pb, $^{232}$Th, $^{235}$U, $^{238}$U and natural uranium in soils (Sample 1), tailings sands (Sample 2) and wetland sands (Sample 3) are presented in Tables 2, 3 and 4 in units of measurement (Bq/kg) and (mgU/kg) for natural uranium

**Table 2.** Specific activity of radionuclides for Sample 1 - Soil

| *Characteristic assessment of Sample 1* | *Radionuclides* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *$^{40}$K Bq/kg* | *$^{137}$Cs Bq/kg* | *$^{210}$Pb Bq/kg* | *$^{226}$Ra Bq/kg* | *$^{232}$Th Bq/kg* | *nat.U mgU/kg* | *$^{235}$U Bq/kg* | *$^{238}$U Bq/kg* |
| Specific activity | 975 | 4,27 | 119 | 105 | 56,9 | 3,48 | 2,15 | 42,7 |
| Combined standard uncertainty (2σ) | 9 | 0,23 | 6 | 5 | 3,9 | 0,40 | 0,92 | 5 |

**Table 3**. Specific activity of radionuclides for Sample 2 - Sand

| *Characteristic assessment of Sample 2* | *Radionuclides* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *$^{40}$K Bq/kg* | *$^{137}$Cs Bq/kg* | *$^{210}$Pb Bq/kg* | *$^{226}$Ra Bq/kg* | *$^{232}$Th Bq/kg* | *nat.U mgU/kg* | *$^{235}$U Bq/kg* | *$^{238}$U Bq/kg* |
| Specific activity | 1147 | 6,2 | 169 | 368 | 17,3 | 10,3 | 3,59 | 131,6 |
| Combined standard uncertainty (2σ) | 14 | 0,36 | 8 | 10 | 1,4 | 1,4 | 1,57 | 10,3 |

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*Atanasova, P. & Nedkova, S. & Kasarov, R. & Totzeva, R. & Totzev, A. pp.222-228*

**Table 4**. Specific activity of radionuclides for Sample 3 -sand from the wetted part of the shore in Vromos Bay

| *Characteristic assessment of Sample 3* | *Radionuclides* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *$^{40}K$ Bq/kg* | *$^{137}Cs$ Bq/kg* | *$^{210}Pb$ Bq/kg* | *$^{226}Ra$ Bq/kg* | *$^{232}Th$ Bq/kg* | *nat.U mgU/kg* | *$^{235}U$ Bq/kg* | *$^{238}U$ Bq/kg* |
| Specific activity | 1078 | 7,31 | 222 | 495 | 18,3 | 8,30 | 3,31 | 150,3 |
| Combined standard uncertainty (2σ) | 4 | 0,11 | 3 | 3 | 1,2 | 3,16 | 0,43 | 11,7 |

The detailed analyses on the specific activity of radionuclides, presented as values in the tables above and graphically in Figure 5, shows that for most radionuclides, it is in the highest values in Sample 3, which was taken from points 6 and 7 from the wetted part of the shore in Vromos bay. Exception is the natural radionuclide Thorium - $^{232}$Th, whose highest specific activity was found in soil Sample 1 - 56.9 Bq/kg and the natural radionuclide Potassium $^{40}$K, whose highest specific activity is registered in Sample 2 -1147 Bq/kg

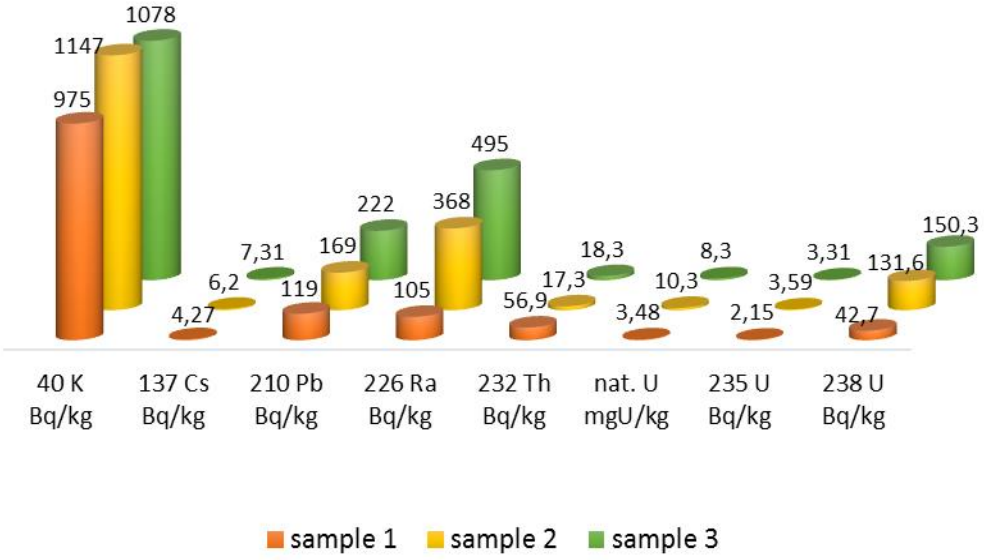


**Figure 5**. Specifical activities of radionuclides -$^{40}$K, $^{137}$Cs, $^{210}$Pb, $^{232}$Th, $^{235}$U, $^{238}$U and natural Uranium in Samples 1÷ 3, in (Bq/kg) and (mgU/kg) for natural Uranium

The results obtained from the analyzed soil and sands are comparable to those obtained for the third quarter of 2019 by the Executive Agency for Environment, within its duty activities on determination of the radiation status of uncultivated soils, sediments from open water bodies and waste products from potential pollutants (Executive Environment Agency, 2019). Their research, stated, that the sample „sand" on the beach has specific activities of the analyzed radionuclides: uranium-238 (358 Bq/kg), radium-226 (396 Bq/kg) and lead-210 (280 Bq/kg). The gamma background at the test points is in the range: 0.30-0.31 μSv / h. The contents of the sample „fresh" sediment from the shore are respectively: uranium-238 (211 Bq / kg), radium-226 (218 Bq / kg) and lead-210 (197 Bq/kg). The gamma background is in the range: 0.17 - 0.18 μSv/h. The measured values of the radionuclides' specific activity in the samples from those two points do not differ significantly, from the previous measurements of the samples, taken from the beach of the bay. Its pollution, during the period 1954-1977 with the deposited flotation waste, with increased content of natural radionuclides, from the flotation plant "Rosen" results in sustainable

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*Atanasova, P. & Nedkova, S. & Kasarov, R. & Totzeva, R. & Totzev, A. pp.222-228*

exceeding of the background values in the bay, comparing with the „clean" beaches in the area (Totzeva Rositza, et al., 2011).

The established values of the specific activity of natural radionuclides are related to the characteristic contamination with flotation waste from the operation of the Rosen mine, which is most clearly seen in the samples from the wetted part of the shore, at the point of the drainage from the channel to the sea shore of the bay. The specific activity of the deposited technogenic cesium-137 ($^{137}$Cs) in the studied samples varies from 4.27 Bq / kg to 7.31 Bq / kg and confirms the presence of the characteristic spotted contamination due to the accident at the Chernobyl NPP, (Executive Environment Agency, 2014) and are lower than some values measured by the Executive Environment Agency for the period July-September 2004, for example: Peshtera town - 230 Bq/kg, White Church town- 355 Bq/kg.

At the seven sampling points, the dose rate of gamma radiation on the surface was determined, with three different dosimetry devices SEIFERT - FAG, Bella and Graetz, which for objectivity are marked with the Latin letter D and code from 1 to 3. The set goal has been achieved to perform a qualitative study to confirm the gamma background of a surface, equivalent to those obtained by a much more accurate but significantly more expensive method of gamma spectrometric analysis with the determination of the specific activity of the radionuclides in the samples. As can be seen from the values reported by the dosimetry devices shown in Table 1, measured in μSv/h for the FAG (D1), Bella (D2) and nSv/h, for Graetz (D3) and Figure 6, the results obtained from the gamma radiation detection, confirm the increase in gamma radiation values at the area of the last sampling points 6 and 7.

Despite the upward growth of the gamma radiation background values, they fall within the limits of the natural gamma background for our country of 0.06-0.40 μSv/h, with two exceptions established by the FAG dosemeter, for points 4 and 7. These values, however, are higher than the typical background for the Southern Black Sea coast, compared to the data on the state of the gamma radiation background at points of the National Automated System for Continuous Control of the Gamma Radiation Background, which is in the range of 0.11-0, 13 μSv/h (for example for the town of Ahtopol - 0.121 μSv/h. (Executive Environment Agency, daily bulletin on the state of the radiation situation in the country, 19.11.2020).

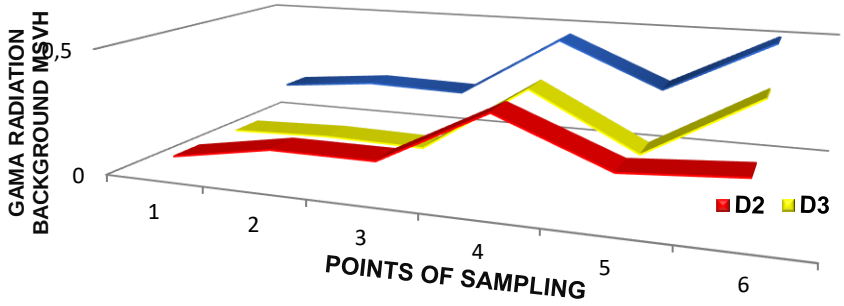


**Figure 6.** Graphical presentation of the gamma radiation background values

## 4. Conclusion

Increased values of the specific activity of natural and technological radionuclides were proved by gamma spectrometric analysis in a study in the area of Vromos Bay, near the Rosen copper mine. The data were also confirmed when determining the gamma background of the surface at the sampling points.

The highest contents of $^{226}$Ra (495 ± 3 Bq/kg), $^{210}$Pb (222 ± 3 Bq/kg) and $^{238}$U (150 ± 12 Bq/kg) were found in the sample from the wetted part of Vromos Bay.

The values of the specific activities show the presence of radiation risk, which goes beyond the acceptable values and creates a danger with a small but continuous dose of radioactive impact.

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