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Designing for Sustainable Development: a case study of takeaway culture in Serbia

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Abstract: Since contemporary culture, in its diversity of forms, includes special forms of design, the analysis of connections between design and different patterns of life is imposed as one of the important tasks of theoretical thinking. Due to its involvement in everyday practices, and a certain permeation with life activities and processes, but also due to a specific connection to daily visions of life, designing is not *just* an artistic activity, but also the activity that changes / creates our patterns of life. In its analysis, the author uses the capability approach. Within this approach, development is seen as the expansion of human capability to lead more worthwhile and more free lives (Sen, 1999). This approach makes a clear distinction between what people are free to do to improve their well-being ('capabilities') and what they actually choose to do ('functioning'). Therefore, to understand and improve design (and our lives), we should understand and improve our choices. The author analyses the connections between the choices and designing for sustainable development. Our assumption is that design, in order to be responsible, must offer opportunities that lead to expected and (yet) unexpected choices with a long-term justification, regardless of the short-term utilitarian nature of such choices. The aim of this analysis is to determine the degree of variety of the offered possibilities and the causal connection between the offered possibilities and choices, i.e. the perception of the offered choices and their understanding. This is a preliminary analysis done on a smaller representative sample with a focus on design of the machines and the process of offering drinks to go and takeaway food.

Introduction

Fast paced life, in the most economically developed societies, leads to the development of habits that, among other things, include more intensive use of machines and services that offer food and drinks to go. In the Republic of Serbia, this tendency has been especially intensified during the recent years. Currently, there is almost no higher education institution in which vending machines and devices for various soft drinks are not installed, and the situation is similar in many high schools, as well as in companies of different profiles. In addition, measures introduced to prevent the spread of the covid-19 pandemic over the past two years have intensified the practice of getting hot drinks to go, as well as the use of food delivery services. Until 2000, fast food restaurants were mostly of the traditional type, offering food in simple packaging (mostly paper packaging) and very rarely offering tap drinks in non-reusable packaging. Since the 2000s, there has been a tendency

for Western-style fast food restaurants to grow (regardless of whether they are foreign or domestic franchises), and in the last five years there has been an intensive growth of express restaurants offering cooked meals to take away. The growth of these services significantly intensifies the growth of packaging waste, contributing to negative tendencies that disrupt environmental stability. Despite a certain increase in environmental awareness among Serbian citizens, the degree of choice, or acknowledgement of alternatives when using these services, has been recognized as an important limiting factor in overcoming growing environmental problems. In the following text, the degree of choice is observed in direct relation to the development of responsible design.

Theoretical premises

Global communities are faced with escalating challenges to our eco system, which force us to re-think the choices we make. But our choices are always connected to the possibilities we have. Some of those are possibilities defined by design solutions. It means that we should start rethinking choices in connection to design. For that, we need a new approach to design. Heskett defined design as 'the human capacity to shape and make our environment in ways without precedent in nature, to serve our needs and give meaning to our lives' (Heskett, 2005). According to Thackara, many of the troubling situations in our world are the result of design decisions (Thackara, 2005). This is why designers should be sensitive to context, relationships and consequences (Thackara, 2005). Besides, we should also look at educational dimension of design. Through design we accept new patterns of life, we develop new choices and new forms of behavior. Designers learn to see the world from the point of view of their target-users, and to understand their motivations and aspirations. But they should also be pioneers, able to reimagine world, to force more responsible behavior and to support choices that are socially, ecologically and economically sustainable. Designers have the possibility to induce positive changes, but to do this they have to change their point of view. They have to reimagine their role, to think about solutions not just in order to make processes and services easier and more efficient, but above all, more responsible.

Methodology

In this analysis, we will use the capability approach. Explained by I. Robeyns, the capability approach is a broad normative framework for the evaluation and assessment of individual well-being and social arrangements (Robeyns, 2005). This approach is most prominently used in welfare studies and political philosophy. The core characteristic of this approach is its focus on people's capability. In its present form, the approach has been pioneered by Amartya Sen and further developed by Martha Nussbaum and other scholars. The important presumption of this approach is that people have the freedoms or valuable opportunities (capabilities) to lead the kind of lives they want to lead, and that once they effectively have these opportunities, they can choose the options that they value most (Robeyns, 2005).

Our assumption is that design, in order to be responsible, must offer opportunities that lead to expected and (yet) unespected choices with a long-term justification, regardless of the short-term utilitarian nature of such choices. The aim of this analysis is to determine the degree of variety of the offered possibilities and the causal connection between the offered possibilities and choices, i.e. the perception of the offered choices and their understanding. This is a preliminary analysis done on a smaller representative sample with a focus on design of the machines and the process of offering drinks to go and takeaway food.

For the purposes of the research, a questionnaire containing 55 questions was compiled, including 12 control questions with the primary goal of disqualifying incoherent answers. The survey involved 250 respondents, students (133 respondents – 53.2 %) and employees (117 respondents – 46.8 %) of young and middle age (from 25 to 50 years of age). Gender is not emphasized as important for the needs of the research, but in the structure of the respondents it was taken into account that 50% are female and 50% are male. All respondents, according to the average monthly expenses, belong to the middle and middle-upper financially influential group. The selection of the structure of the respondents was made on the basis of the assumption that the members of this group participate the most in the use of the surveyed services. The survey was conducted in the Republic of Serbia on the territory of the city of Belgrade, during January and February 2022.

Results

A total of 250 respondents participated in the survey, of which 233 questionnaires were considered, based on the analysis of control questions. Control questions are not shown in the table.

Table 1. Survey results

qs	QUESTION	
	ANSWER	**RESULTS** **percentage of users** (number of respondents) *percentage of respondents*
q1	**How many times a week, at least once a day, do you buy takeaway food at fast food restaurants or express restaurants?**	
	0	**6** (14) *6*
	1	**12.87** (30) *12.87*
	2	**15.88** (37) *15.88*
	3	**18.45** (43) *18.45*
	4	**15.45** (36) *15.45*
	5	**12.02** (28) *12.02*
	6	**9.01** (21) *9.01*
	7	**10.3** (24) *10.3*
q1.1	**Do you pick up food in your own container?**	
	always	**0** (0) *0*
	never	**88.58** (194) *83.26*
	rare (up to 10% of cases)	**3.65** (8) *3.43*
	sometimes (11-30% of cases)	**7.76** (17) *7.30*
	moderately commonly (31-60% of cases)	**0** (0) *0*
	often (61-99% of cases)	**0** (0) *0*
q1.2	**What is the reason you do not pick up food (more often) in your own container?**	
	the food dispensing process does not provide that possibility	**72.15** (158) *67.82*
	it is simpler than carrying my own container	**27.85** (61) *26.12*
q1.2.1	**Does the choice of ecological materials for the production of packaging in which the purchased food is packed influence the decision whether to buy it?**	
	yes	**3.65** (8) *3.43*
	no	**69.35** (211) *90.56*
q.1.2.2	**Do you pick up food in returnable containers?**	
	always	**0** (0) *0*
	never	**100** (219) *93.99*

	rare (up to 10% of cases)	**0**	(0)	*0*
	sometimes (11-30% of cases)	**0**	(0)	*0*
	moderately commonly (31-60% of cases)	**0**	(0)	*0*
	often (61-99% of cases)	**0**	(0)	*0*
q1.2.3	**What is the reason you do not pick up food (more often) in returnable containers?**			
	there is no such possibility	**100**	(219)	*93.99*
	such possibility is offered very rarely	**0**	(0)	*0*
	returnable containers from different manufacturers are not standardized, which makes their use difficult	**0**	(0)	*0*
	it is easier to use non-returnable container even though returnable is offered	**0**	(0)	*0*
	it is easier to pay for non-returnable container than to carry returnable one with me	**0**	(0)	*0*
q1.3.1	**If this service allowed it, would you use your own and/or returnable container?**			
	yes	**36.07**	(79)	*33.91*
	yes, but only in exceptional situations	**16.44**	(36)	*15.45*
	I don't know, I haven't thought about it	**38.81**	(85)	*36.48*
	no, I would continue to use non-returnable containers	**8.68**	(19)	*8.15*
q1.3.2	**If you had to use your own or returnable container, how would that affect your decision to use this service?**			
	it would not, I would continue to use this service	**81.74**	(179)	*76.82*
	I would avoid using this service	**15.98**	(35)	*15.02*
	I would not use this service	**2.28**	(5)	*2.15*
q2	**How many times a week, at least once a day, do you get water from a machine installed in a public space?**			
	0	**7.72**	(18)	*7.73*
	1	**0.86**	(2)	*0.86*
	2	**4.72**	(11)	*4.72*
	3	**28.75**	(67)	*28.76*
	4	**39.48**	(92)	*39.48*
	5	**6.0**	(14)	*6.00*
	6	**1.29**	(3)	*1.29*
	7	**11.16**	(26)	*11.16*
q2.1	**Do you use your own container to take water?**			
	always	**13.02**	(28)	*12.02*
	never	**77.67**	(167)	*71.67*
	rarely (up to 10% of cases)	**6.51**	(14)	*6.00*
	sometimes (11-30% of cases)	**2.79**	(6)	*2.57*
	moderately commonly (31-60% of cases)	**0**	(0)	*0*
	often (61-99% of cases)	**0**	(0)	*0*
q2.2	**What is the reason you do not use (more often) your own container for taking water?**			

	the machine does not provide such a possibility	**1.07**	(2)	*0.86*
	it is simpler than carrying my own container	**98.93**	(185)	*79.40*
q2.2.1	**Does the choice of ecological materials for making cups that the machine offers influence the decision whether you use it?**			
	yes	**2.14**	(4)	*1.72*
	no	**97.86**	(183)	*78.54*
q2.2.2	**Do you take water from machines that use reusable cups?**			
	always	**0**	(0)	*0*
	never	100	(187)	*80.26*
	rarely (up to 10% of cases)	**0**	(0)	*0*
	sometimes (11-30% of cases)	**0**	(0)	*0*
	moderately commonly (31-60% of cases)	**0**	(0)	*0*
	often (61-99% of cases)	**0**	(0)	*0*
q2.2.3	**What is the reason you do not take water (more often) from machines that use reusable cups?**			
	there is no such a possibility	**100**	(187)	*80.26*
	such a possibility is offered very rarely	**0**	(0)	*0*
	not hygienic	**0**	(0)	*0*
	it is easier to use non-reusable cups	**0**	(0)	*0*
q2.3.1	**If a serviceallowed it, would you use returnable containers?**			
	yes	**51.34**	(96)	*41.20*
	yes, but only in exceptional situations	**6.95**	(13)	*5.58*
	I don't know, I haven't thought about it	**27.81**	(52)	*22.32*
	no, I would continue to use non-returnable containers	**13.90**	(26)	*11.16*
q2.3.2	**If you had to use your own or returnable container, how would that affect your decision to use a service?**			
	It would not, I would continue to use this service	**79.14**	(148)	*63.52*
	I would avoid using this service	**14.44**	(27)	*11.59*
	I would not use this service	**6.42**	(12)	*5.15*
q3	**How many times a week, at least once a day, do you get hot drinks / coffee, tea, hot chocolate, etc. / from a machine installed a a public space?**			
	0	**0**	(0)	*0*
	1	**1.29**	(3)	*1.29*
	2	**5.15**	(12)	*5.15*
	3	**16.31**	(38)	*16.31*
	4	**71.67**	(167)	*71.68*
	5	**4.72**	(11)	*4.72*
	6	**0.86**	(2)	*0.86*
	7	**0**	(0)	*0*
q3.1	**Do you use your own container for hot drinks?**			

	always	**0**	(0)	*0*
	never	**100**	(233)	*100*
	rarely (up to 10% of cases)	**0**	(0)	*0*
	sometimes (11-30% of cases)	**0**	(0)	*0*
	moderately commonly (31-60% of cases)	**0**	(0)	*0*
	often (61-99% of cases)	**0**	(0)	*0*
q3.2	**What is the reason you do not use (more often) your own container to take hot drinks to go?**			
	the machine does not provide such a possibility	**100**	(233)	*100*
	it is simpler than carrying my own container	**0**	(0)	*0*
q3.2.1	**Does the choice of ecological materials for making cups that the machine offers influence the decision whether to use it?**			
	yes	**10.3**	(24)	*10.30*
	no	**89.7**	(209)	*89.70*
q3.2.2	**Do you get hot drinks from machines that use reusable cups?**			
	always	**0**	(0)	*0*
	never	**100**	(233)	*100*
	rarely (up to 10% of cases)	**0**	(0)	*0*
	sometimes (11-30% of cases)	**0**	(0)	*0*
	moderately commonly (31-60% of cases)	**0**	(0)	*0*
	often (61-99% of cases)	**0**	(0)	*0*
q3.2.3	**What is the reason you do not take hot drinks (more often) from machines that use reusable cups?**			
	there is no such possibility	**93.13**	(217)	*93.13*
	such a possibility is offered very rarely	**0**	(0)	*0*
	not hygienic	**6.87**	(16)	*6.87*
	it is easier to use non-reusable cups	**0**	(0)	*0*
q3.3.1	**If a service allowed it, would you use returnable containers?**			
	yes	**52.79**	**(**123)	*52.79*
	yes, but only in exceptional situations	**3.00**	**(**7)	*3.00*
	I don't know, I haven't thought about it	**30.90**	**(**72)	*30.90*
	no, I would continue to use non-returnable containers	**13.30**	**(**31)	*13.30*
q3.3.2	**If you had to use your own or returnable container, how would that affect your decision to use a service?**			
	it would not, I would continue to use this service	**82.40**	**(**192)	*82.40*
	I would avoid using this service	**8.15**	**(**19)	*8.15*
	I would not use this service	**9.44**	**(**22)	*9.44*
q4	**How many times a week, at least once a day, do you use cutlery to consume takeaway food (purchased at fast food restaurants or express restaurants or those you bring from home)?**			
	0	**19.74**	(46)	*19.74*

	1	**7.72**	(18)	*7.72*
	2	**2.57**	(6)	*2.58*
	3	**28.75**	(67)	*28.76*
	4	**39.48**	(92)	*39.48*
	5	**1.72**	(4)	*1.72*
	6	**0**	(0)	*0*
	7	**0**	(0)	*0*
q4.1	**Do you use reusable cutlery to consume takeaway food?**			
	always	**28.34**	(53)	*22.75*
	never	**65.24**	(122)	*52.36*
	rarely (up to 10% of cases)	**6.42**	(12)	*5.15*
	sometimes (11-30% of cases)	**0**	(0)	*0*
	moderately commonly (31-60% of cases)	**0**	(0)	*0*
	often (61-99% of cases)	**0**	(0)	*0*
q4.2.1	**Does the choice of ecological materials for making cutlery that you get with the food you buy influence the decision whether you will buy that food?**			
	yes	**4.48**	(6)	*2.58*
	no	**95.52**	(128)	*54.94*
q5	**How many times a week, at least once a day, do you drink a juice from a machine that is installed in a public space or in fast food restaurants?**			
	0	**16.31**	(38)	*16.31*
	1	**3.0**	(7)	*3.00*
	2	**12.02**	(28)	*12.02*
	3	**48.07**	(112)	*48.07*
	4	**11.16**	(26)	*11.16*
	5	**5.58**	(13)	*5.58*
	6	**0**	(0)	*0*
	7	**3.86**	(9)	*3.86*
q5.1	**Do you use your own container to get tap juice?**			
	always	**10.77**	(21)	*9.01*
	never	**85.64**	(167)	*71.67*
	rarely (up to 10% of cases)	**1.54**	(3)	*1.29*
	sometimes (11-30% of cases)	**2.05**	(4)	*1.72*
	moderately commonly (31-60% of cases)	**0**	(0)	*0*
	often (61-99% of cases)	**0**	(0)	*0*
q5.2	**What is the reason you do not use your own container (more often) to drink tap juice?**			
	there is no such possibility	**4.02**	(7)	*3.00*
	it is simpler than carrying my own container	**95.98**	(167)	*71.68*
q5.2.1	**Does the choice of ecological materials for making cups that the machine offers influence the decision whether to take a juice?**			
	yes	**13.70**	(24)	*10.30*

	no	**86.21**	(150)	*64.38*
q5.2.2	**Do you get juice from machines that use reusable cups?**			
	always	**0**	(0)	*0*
	never	**100**	(174)	*74.68*
	rarely (up to 10% of cases)	**0**	(0)	*0*
	sometimes (11-30% of cases)	**0**	(0)	*0*
	moderately commonly (31-60% of cases)	**0**	(0)	*0*
	often (61-99% of cases)	**0**	(0)	*0*
q5.2.3	**What is the reason you do not take juice (more often) from machines that use reusable cups?**			
	there is no such possibility	**90.8**	(158)	*67.81*
	such a possibility is offered very rarely	**0**	(0)	*0*
	not hygienic	**9.2**	(16)	*6.87*
	it is easier to use non-reusable cups	**0**	(0)	*0*
q5.3.1	**If a service allowed it, would you use reusable containers?**			
	yes	**18.46**	(36)	*15.45*
	yes, but only in exceptional situations	**12.30**	(24)	*10.30*
	I don't know, I haven't thought about it	**61.03**	(119)	*51.07*
	no, I would continue to use non-returnable containers	**8.20**	(16)	*6.87*
q5.3.2	**If you had to use your own or reusable container, how would that affect your decision to use this service?**			
	it would not, I would continue to use this service	**81.03**	(158)	*67.81*
	I would avoid using this service	**10.77**	(21)	*9.01*
	I would not use this service	**8.20**	(16)	*6.87*
q6	**How many times a week, at least once a day, in one of the cafes do you take hot drinks to go /coffee, tea, hot chocolate/?**			
	0	**0**	(0)	*0*
	1	**29.18**	(68)	*29.18*
	2	**7.72**	(18)	*7.72*
	3	**31.76**	(74)	*31.76*
	4	**22.32**	(52)	*22.32*
	5	**5.58**	(13)	*5.58*
	6	**0.43**	(1)	*0.43*
	7	**3.0**	(7)	*3.00*
q6.1	**Do you use your own container for hot drinks to go?**			
	always	**0**	(0)	*0*
	never	**87.98**	(205)	*87.98*
	rarely (up to 10% of cases)	**12.02**	(28)	*12.02*
	sometimes (11-30% of cases)	**0**	(0)	*0*
	moderately commonly (31-60% of cases)	**0**	(0)	*0*
	often (61-99% of cases)	**0**	(0)	*0*

q6.2	**What is the reason you do not use (more often) your own container to take hot drinks to go?**			
	there is no such possibility	**76.82**	**(179)**	**_76.82_**
	it is simpler than carrying my own container	**23.18**	**(54)**	**_23.18_**
q6.2.1	**Does the choice of ecological materials for making cups that cafe offers influence the decision whether to use their service?**			
	yes	**15.88**	**(37)**	**_15.88_**
	no	**84.12**	**(196)**	**_84.12_**
q6.2.2	**Do you get hot drinks in returnable containers?**			
	always	**0**	**(0)**	**_0_**
	never	**100**	**(233)**	**_100_**
	rarely (up to 10% of cases)	**0**	**(0)**	**_0_**
	sometimes (11-30% of cases)	**0**	**(0)**	**_0_**
	moderately commonly (31-60% of cases)	**0**	**(0)**	**_0_**
	often (61-99% of cases)	**0**	**(0)**	**_0_**
q6.2.3	**What is the reason you do not take hot drinks (more often) in returnable containers?**			
	there is no such possibility	**100**	**(233)**	**_100_**
	such a possibility is offered very rarely	**0**	**(0)**	**_0_**
	the returnable containers of different cafes are not standardized, which makes their use difficult	**0**	**(0)**	**_0_**
	it is easier to use non-returnable container even though returnable is offered	**0**	**(0)**	**_0_**
	it is easier to pay for non-returnable container than to carry a returnable one with me	**0**	**(0)**	**_0_**
q6.3.1	**If a service allowed it, would you use (more often) your own or returnable containers?**			
	yes	**34.76**	**(81)**	**_34.76_**
	yes, but only in exceptional situations	**15.88**	**(37)**	**_15.88_**
	I don't know, I haven't thought about it	**20.60**	**(48)**	**_20.60_**
	no, I would continue to use non-returnable containers	**28.75**	**(67)**	**_28.75_**
q6.3.2	**If you had to use your own or returnable container, how would that affect your decision to use a service?**			
	it would not, I would continue to use this service	**67.81**	**(158)**	**_67.81_**
	I would avoid using this service	**26.60**	**(62)**	**_26.60_**
	I would not use this service	**5.58**	**(13)**	**_5.58_**

Source: own study.

The analysis of the obtained answers indicates that the majority of respondents use food and beverage services at least once a week. Only 6% of respondents answered that they do not use these services, while 7.72% of respondents do not use water from machines, and 16.31% of respondents do not purchase tap juice, which indicates the relative

prevalence of this form of behavior. This observation is supported by a noticeable percentage of those who use services of this type on a daily basis (q1 = 10.3, q2 = 11.16, q5 = 3.86, q6 = 3.0), and a pronounced percentage of those who moderately regularly (2-3 times), or regularly (4-6 times) use such services (q1 = 34.33 / 36.48, q2 = 33.47 / 46.77, q3 = 21.46 / 77.25, q5 = 60.09 / 16.74, q6 = 39.48 / 28.33). The results obtained in this way indicate that the selection of respondents is proper, in other words, that it is a representative group on the basis of whose answers it is possible to better understand the choices that accompany the observed forms of behavior.

The choice to use their own container for taking food and drinks to go (q1/2/3/5/6 .1) is made by a significantly small share. The answer "always" was given by a relatively small number of respondents, and only in the categories of getting water and juice from machines (q2.1 = 13.02 and q5.1 = 10.77). Close values manifest the connection of the type of choice, where those who always use their container for getting water from machines most often use their container for getting tap juice. On the other hand, the number of people choosing to never use their own container is very pronounced, where this value is 100% when getting hot drinks from machines. The value of q3.1 is directly related to the value of q3.2, and in relation to the answers q2.1 and q5.1, suggests that those who use their container to get water and juics from machines would use their container to take hot drinks too, but do not do so because of the very design of the machines, which does not allow it. This is supported by the result that 12.02% of respondents use their container for hot drinks in cafes (the decision to *rarely use this option* is explained by the structure of the answer q6.2, i.e. by the rare possibility of making this choice). However, based on this answer, we conclude that a number of respondents have a developed tendency to use their own container even to get hot drinks. It is important to note that those who choose to use their own container for drinks to go, do not make such a choice when taking takeaway food (q1.1), which suggests that they do not make such a choice due to the inability to use their container in such situations (relation q1.2 and q 4.1).

The results of the choice to use reusable containers shows that none of the respondents make this choice (qX2.2 = 100). The analysis of the answers (qX2.3 in relation to q2.1 and q5.1) suggests that such a choice would probably be made by some respondents if such a possibility were enabled.

The use of environmental materials has relatively little influence on the decision to use the offered services (qX.2.1), with an average value of 8.36%. The relation between q2.1 and q5.1 to q2.2.1 and q5.2.1 in some ways mitigates the registered low percentage of those whose choice is influenced by the use of materials for making cups, since those who always use their containers when getting water and tap juice from a machine avoid the use of non-organic packaging offered by the machine. In the analysis of this type of question, a significant deviation in the choice depending on the type of service is noticeable. The use of non-ecological packaging has the least negative impact on the decision to use the service in cases of taking food to go (q1.2.1 = 3.65 and q4.2.1 = 4.48), as well as in the case of getting water from a machine (q2.2.1 = 2.14), while the influence of this factor is much more pronounced in the choice of using machines for hot drinks (q3.2.1 = 10.3), tap juice (q5.2.1 = 13.70) and hot drinks to go offered in cafes (q6.2.1 = 15.88). A comparison of the relation between q3.2.1 and q6.2.1 with q3.1 and q6.1 in relation to q2.1 and q5.1 indicates that those who would use their own container in a specific situation, but are not able to do so, adjust their choice by the possibility to use ecological materials. Interestingly, this influence is most pronounced in the use of tap juice (relations q5.2.1 and q5.1), which is explained by the influence of additional factors on the choice of juice consumption.

A comparison of the values of qX.1-b with qX.2-a and qX.2-b, as well as qX2.2-b with qX2.3-a indicates that in addition to a large number of respondents who in their choice were primarily guided by comfort in execution of the service (qX.2-b), there is a significant number of those who explain their decision by the lack of possibilities (qX.2-a). Although it cannot be assumed that the introduction of such a possibility would automatically mean its influence on decision-making, it is reasonable to assume that it would influence the reconsideration of choice. Furthermore, a comparison of the values qX.2-a and qX.2.3-a with qX.3.1-a and qX.3.2-a (where X=1,2,3,5,6), with the exception of q2.2-a, q5.2-a and q5.3.1-a, indicates that design that does not offer the possibility of choice that supports environmentally sustainable behavior can be recognized as a factor that psychologically justifies or strengthens irresponsible choices. This is further supported by the comparison of the values qX.2-a and qX.2.3-a with qX.3.1-a and qX.3.1-c (where X=1,2,3,5,6), with the exception of q2.2-a and q5.2-a, which indicates that alternative choices were not taken into account due to already existing technical limitations.

Finally, results of the values qX.3.1-a (where X=1,2,3,5,6) indicate that a change in the design of certain machines and processes would have a positive effect on increasing the percentage of environmentally responsible choices, while results of the values qX.3.2-c (where X=1,2,3,5,6) shows that such a change in the design of certain machines and processes would not significantly influence the abandonment of these services.

Summary, recommendations

The growth of services that offer food and drink to go go in Serbia has negatively affected the ecological stability by increasing the packaging waste. The text presents the results of a preliminary survey, conducted to examine the relationship between the options offered to the users of these services and the choices made by themin relation to their current opinion on increasing packaging waste. The research did not include the measurement of attitudes regarding the preservation of environmental stability, but the focus was on the analysis of choices in the forms of behavior related to the problem. The assumption I started from is that these choices are conditioned by multiple factors, of which the offered possibilities, related to these processes, play an important role. Analysis was focused on a connection between design solutions and forms of behavior. In this sense, the educational function of design is emphasized. Namely, design that does not offer the possibility of choice that supports environmentally sustainable behavior is recognized as a factor that psychologically justifies or strengthens irresponsible choices. The results of the research showed that the environmental commitment is sufficiently strongly developed in a smaller number of respondents, influencing their choices to a limited scope. In most cases, alternative choices were not taken into account, which was explained by technical limitations. This leads us to an assumption that different choices would be considered in the changed circumstances. A group of questions examining potential choices in changed circumstances indicates that a change in the design of certain machines and processes would have a positive effect on increasing the percentage of environmentally responsible choices, and that such a change would not significantly influence the abandonment of these services.

Although design should not be understood as the only factor influencing the type of choice, changes in this domain would provide a prerequisite for the development of environmentally responsible choices without significant potential withdrawal from the

use of services offered. One of the conditions for understanding a design as responsible is to offer responsible choices. In this case, it means the development of those solutions that will encourage the use of their own containers in the use of food and drinks to go. Such a design approach would be in line with the growing campaigns to increase environmental awareness, which in turn would potentially contribute positively to its acceptance.

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Country's green brand: the core drivers

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Abstract: In the view of rushing globalization development dissolving the national and cultural frontiers in favor of global brands, countries face the urgency to design their own unique and positive image on the international stage. A strong country's brand is considered to be one of the triggers for attracting foreign investments and tourists, increasing economic and social prosperity. On the other hand, adverse climate changes raise environmental concerns and require decisive action to mitigate and overcome their consequences. Thus, the global mainstreams are green consciousness, environmental protection, rational energy and natural resources consumption, minimizing the environmental burden from business activity and sustaining the environment for future generations. Therefore, green positioning is a competitive advantage and an essential element of the country's brand that increases its reputation and global engagement. However, the systematization of scientific treatises showed that scholars mainly focus on green brand's investigation at the corporate level, while analysis of green brands at the national level is in the initial stage. This study aims to identify and estimate the main drivers of a country's green brand elements. To achieve the study aim, this research involved data for 28 countries (EU members and Ukraine as a potential candidate for joining the EU) from 2010 to 2020. The data were retrieved from the statistical databases of Eurostat, World Bank Open Data, and OECD.Stat. The empirical study estimates the contribution of the country's green brand factors using the principal component analysis. The estimation procedures employed were the correlation analysis, Kaiser-Meyer-Olkin Test, Bartlett's Test of Sphericity and the orthogonal Varimax rotation. All calculations were conducted using the SPSS software tools. The obtained results showed that the factors most contributing to a country's green brand are the export of goods and services, real GDP per capita, secure Internet servers, renewable energy consumption, forest and organic agricultural land. The findings could improve the strategy for promoting a country's green brand and determining its position in the world.

Keywords: green brand, country reputation, brand model, country's brand, green development, green promotion.

JEL: Q01, O01, O05

Introduction

Amid global competition, the countries of the world are putting more focus on their brand positioning on the international scene. Political and economic relations involve objective, as well as subjective, psychological and information factors. A country's image is considered to be an essential determinant of international policy, which attracts tourists,

investors, business partners, etc. The country should present an original, identifiable, reliable and positive image for inviting investments. Indeed, a strong country image is a competitive advantage. It influences the political and economic opportunities, international status, ability to influence other countries, etc. Noteworthy here, a country brand has a special meaning for emerging countries breaking into the world market, as well as for the developed countries to get an advantage under the vibrant competition.

However, the long-term economic development aimed at profit-maximization and cost minimization provokes a strong degradation of the natural and social environments. It has resulted in aggravating the environmental challenges, global climate change, social and gender inequity, etc. Therefore, the world community has recognized the importance of sustainable development, emphasizing economic growth, social responsibility, and ecological balance. In 2015, all UN member states commited to 17 Sustainable Development Goals (SDGs) under the 2030 Agenda for Sustainable Development. Generally, the achievement of SDGs would allow enhancing the life quality of the living and future generations.

Figure 1. 2021 SDG Index Score

Sources: own work based on The Sustainable Competitiveness Report, 2021.

Figure 1 demonstrates that the high-income European countries have made considerable progress in achieving the SDGs. Thus, the top 10 countries with the highest SDG

Index Score are Finland (85.9), Sweden (85.6), Denmark (84.9), Germany (82.5), Belgium (82.2), Austria (82.1), Norway (82.0), France (81.7), Slovenia (81.6) and Estonia (81.6). Following the European standards of life and values, Ukraine has occupied the 36th position with a 75.5 SDG Index Score.

The 2030 Agenda for Sustainable Development emphasizes the social, economic, and ecological responsibilities at the national level. Sustainable development and a green economy are embodied in the guiding principle of the national development strategy for many countries. Thus, in 2019, the European Commission presented the European Green Deal (EGD) as a roadmap to transform Europe into a climate-neutral continent by 2050 with a sustainable and competitive economy. Thus, the climate and ecological challenges transform into opportunities in all spheres and policies. The green transformation contributes to economic development, as well as gains in health and quality of life. Since green transformation covers a wide range of directions, it influences trade and economic cooperation at the international level.

The above demonstrates that a robust country green brand could provide particular competitive advantages in global engagement. Therefore, this article aims to determine the contribution of a country's green brand drivers.

In order to accomplish this aim, this paper presents the results of the main literature systematization devoted to the country's brand assessment; provides the data and methods applied in the study; provides the empirical results; presents the conclusions and some suggestions for further research.

Theoretical premises

Given growing environmental concerns and climate change, green issues have become a priority worldwide. Even though past studies pay more attention to green brands at the corporate or regional levels, a country's green brand is a practical research field perspective. This study section employed bibliometric analysis techniques to identify the main research directions in the literature addressing country brand and green brand relationship. The search for the relevant articles was conducted applying two sets of key phrases combinations: 1) 'country brand', 'nation brand' and 'national brand' (780 documents); and 2) 'green brand', 'sustainable brand', 'environmental brand' and 'eco-

friendly brand' (242 documents). The boolean operator' 'OR' was used to include one or more terms in the query. Appropriate terms were searched in article titles, keywords and abstracts. The main limitation criteria for the search were:

- time of publications: from 2000 until 2021;
- subject areas: Business, Management and Accounting; Social Sciences; Economics, Econometrics and Finance;
- document type: articles.

The obtained keyword co-occurrence network map consists of 94 items interconnected by 582 links with total link strength of 957. The total number of clusters is seven (Figure 2).

Figure 2. Network map of keyword co-occurrence (2000-2021)

Source: own work based on Scopus (2022) data.

The first (red) cluster demonstrates the scholars' interest in developing the green brand concept covering sustainability issues. Thus, this cluster combines 20 items addressing the issues of green advertising, green brand equity, green brand image, green brand knowledge, green brand loyalty, green brand positioning, green perceived value, greenwashing and green trust, etc. Under this research direction, it is appropriate to mention that most previous studies have paid great attention to the green brand concept

at the industrial level (Kakalejcik et al., 2021; Husetnov, 2021; Chygryn et al., 202; Yang et al., 2021; Chygryn et al., 2018). Thus, Chen (2010) applied the questionnaire survey method to confirm that green trust, green satisfaction and green brand image are the main drivers of green brand equity. Addressing the electronics industry in South Korea, Kang and Hur (2012) found that eco-friendly attributes grab the positive emotional response of consumers and strengthen their loyalty to the green brand. In the study (Ng et al., 2014), the procedure of structural equation modeling was employed to confirm that promotion of green brand image increases the perceived quality and credibility of the green brand that has a significant positive impact on green brand equity.

The second (green) cluster is formed with 19 items related to nation branding. In this line, the studies considered the issues of brand equity, brand image, country image, destination branding, identity, image, stereotypes, supply chain management, tourism, advertising, etc. It is essential to mention the study by Fan (2006) that considered the main difference between nation branding, country brand and product brand. The scholar determined that nation brand attributes are difficult to define while its image is complicated and multiple. Generally, nation branding aims to direct its image and message at political, economic and social benefits to create competitive advantages internationally.

A large stream of literature proposes to assess a country's brand based on the subjective survey data. The Anholt Nation Brands Index is the first analytical index for nation brand assessment grounded on the Nation Brand Hexagon, covering a nation's competence in tourism, exports, people, culture and heritage, investment and immigration as well as governance. Anholt (2006) surveyed 10,000 people from 10 countries to determine their perception of political, human, commercial and cultural assets, tourism appeal and investment potential. The results allowed determining the strengths and weaknesses of a nation's brand based on the global opinion regarding the image, character and personality of the nation's brand.

In turn, Lahrech et al. (2020) applied the data on export, governance, investment and immigration, culture, people, and tourism to measure a nation's brand. The scholars noted that a country brand differs from a nation brand, since it should be considered in the supply and demand of the country brand. Thus, the nation brand focuses more on the country's economic performance, while the country brand emphasizes the country's intangible assets,

country's image and reputation. Therefore, for assessing a country's brand, Lahrech et al. (2020) applied the data on quality of life, value system, heritage and culture, suitability for business and tourism.

On the other hand, Fetscherin (2010) employed the company-based brand equity approach to estimate the country brand index based on objective secondary data. In the study, Fetscherin (2010) remarked that the strengths of a country's brand depend on the development of in-country export, tourism arrivals, foreign direct investments, immigration and the government environment. Rojas-Méndez (2013) developed the nation brand molecule consisting of seven dimensions: tourism, economy, culture and heritage, science and technology, society, government, as well as geography and nature.

The third (blue) cluster covers the stream of literature concerning the relationship between national brands and their origin. The blue cluster identifies the studies covering the issues of innovation, positioning, pricing, private labels, promotion, retailing, distribution channels, category management, assortment, etc. It is appropriate to remark the study by Zhu et al. (2021) applied the exogenous pricing approach to measure the influence of promotional and cooperative advertisement and product quality on the outcomes of the national brands. In the study on private labels, Li (2021) developed a game-theoretic model to determine the influence of private labels' sourcing strategies on the relationship between the national brand manufacturer and retailer in different distribution channels. Ghosh et al. (2021) proved that consumers choose national brands considering their reputation. Moreover, this study emphasized that in the case of young consumers, the focus should be on the brand image and its repositioning rather than price gaps.

The fourth (yellow) cluster shows the scholars' interest in brands in the view of consumer attitudes and behavior, customer loyalty, perception, corporate social responsibility, etc. In this research direction, Hwang et al. (2021) found out that satisfaction, cost, perceived quality and trust are the main factors of customer loyalty. Furthermore, the scholars identified the different influences of customer loyalty on private and national brands.

The fifth (lilac) cluster showed close links between the studies addressing green branding in brand awareness and management, marketing, perceived quality, etc. The sixth (cyan) cluster covers the studies focused on competition, loyalty, price, quality, etc. In

contrast, the seventh (orange) cluster indicates the researchers' interest in investigating nation brands focusing on culture, cultural and public diplomacy, social responsibility and soft power.

Methodology

To determine the factors strengthening a country's green brand, this study employed the panel data for 28 European countries for 2010-2020, derived from the statistical databases of Eurostat, World Bank Open Data, and OECD.Stat. All calculations were conducted using the SPSS software tools.

Based on the analysis of the theoretical background on a country's brand formation and the international indexes on the green growth estimation, this study applied the following variables which could drive a country's green brand:

- GDP – Real GDP per capita (US Dollar, 2015);
- EXP – Exports of goods and services (% of GDP);
- BEDI – Business extent of disclosure index (units);
- REC – Renewable energy consumption (% of total final energy consumption);
- ERT – Development of environment-related technologies (% all technologies);
- NEEP – National expenditure on environmental protection (percentage of GDP);
- FORE – Forest area (% of land area);
- ORG – Organic agricultural land (% of land area);
- SIS – Secure Internet servers (per 1 million people);
- ITA – International tourism (number of arrivals);
- Foreign direct investment, net inflows (% of GDP).

Table 1 visualizes the findings of descriptive statistics of all employed variables as of 2020 for countries involved in this study. The presented dataset is balanced, since the number of observations is 28 for all variables.

Table 1. The findings of descriptive statistics (2020)

Variable	Description	Mean	Min → Max
GDP	Real GDP per capita (US Dollar, 2015)	39814.58	10686.44 → 104591.3
EXP	Exports of goods and services (% of GDP)	65.939	27.874 → 204.691
BEDI	Business extent of disclosure index (units)	6.345	2.000 → 10.000
REC	Renewable energy consumption (% of total final energy consumption)	22.843	6.137 → 55.951
ERT	Development of environment-related technologies (% all technologies)	10.311	1.716 → 25.03
NEEP	National expenditure on environmental protection (percentage of GDP)	1.639	0.314 → 3.000
FORE	Forest area (% of land area)	34.279	1.438 → 73.733
ORG	Organic agricultural land (% of land area)	3.364	0.161 → 8.037
SIS	Secure Internet servers (per 1 million people)	51637.27	8893.62 → 277081.8
ITA	International tourism (number of arrivals)	35736885	1119133 → 214274306
FDI	Foreign direct investment, net inflows (% of GDP)	6.022	34,66 → 0.01

Sources: own calculations.

Following the methodology proposed by Fetscherin (2010), the simplified model of a country's green brand could be designed as follows:

(1) $CGB_{it} = f(GDP_{it}, EXP_{it}, BEDI_{it}, REC_{it}, ERT_{it}, NEEP_{it}, FORE_{it}, ORG_{it}, SIS_{it}, ITA_{it})$

where i –country, t – year.

The model above (1) requires modifications to transform data into relative values to make meaningful calculations, interpretations, and comparisons for different countries. Therefore, following Lachrech et al. (2020), to compare countries while avoiding biased rankings for the less populated countries, the factors of a country's green brand model were divided by its country maximum. Therefore, the modified model is as follows:

(2) $CGB_{it} = f(GDP_{it} maxt GDP_n, EXP_{it} maxt EXP_n, BEDI_{it} maxt BEDI_n, REC_{it} maxt REC_n, ERT_{it} maxt ERT_n, NEEP_{it} maxt NEEP_n, FORE_{it} maxt FORE_n, ORG_{it} maxt ORG_n, SIS_{it} maxt (SIS_n), ITA_{it} maxt (ITA_n), FDI_{it} maxt (FDI_n)$

where n –number of countries.

Although Fetscherin (2010) offered to use equal weights of factors to design the model, this study employed an unequal factor analysis method (Lachrech et al., 2020).

(3) $CGB_{it} = W_1 GDP_{it} maxt GDP_n + W_2 EXP_{it} maxt EXP_n + W_3 BEDI_{it} maxt BEDI_n + W_4 REC_{it} maxt REC_n + W_5 ERT_{it} maxt ERT_n + W_6 NEEP_{it} maxt NEEP_n + W_7 FORE_{it} maxt FORE_n + W_8 ORG_{it} maxt ORG_n + W_9 SIS_{it} maxt (SIS_n) + W_{10} ITA_{it} maxt (ITA_n) + W_{10} FDI_{it} maxt (FDI_n))$

where W – weight coefficients.

Following the approach proposed by Arbolino et al. (2018), this study applied the principal component analysis (PCA) to identify the contributions of the country's green brand factors derived from the eigenvalues of the covariance matrix. This methodology allows to determine the weights of factors used for further calculation. Noteworthy here, PCA is a dimensionality reduction method. It allows to determine the minimum number of factors that accounts for the maximum variance in the data relying on the correlation matrix. The eigenvectors and the corresponding eigenvalues of the covariance matrix should be found to derive the components. The first principal component represents the largest corresponding eigenvalue that captures most of the data variability. What is more, the first principal component shows the rotation of the original data along an axis describing the largest spread. Then, the rest of the components with the following largest variance ascertain residual variability uncorrelated to the first principal component.

Moreover, before running the PCA, it is essential to estimate the correlation between the components. Thus, this study applied the correlation analysis by Pearson's coefficient (R) (Busu, 2019) to determine the highly correlated variables under equation (4) as specified below:

(4) $R = \dfrac{E(X - EX)(Y - EY)}{\sqrt{var X}\sqrt{var(Y)}}$

where $E(X)$ and $E(Y)$ – the depended and independent variables, respectively; $var(X)$ and $var(Y)$ – the variance of X and Y, respectively.

Then, this study employed the Kaiser-Meyer-Olkin Test (KMO) to determine the adequacy of the data sample for each model variable and complete model. According to Li et al. (2019), the KMO test findings prove that the set of variables is suitable for PCA if the KMO test value exceeds 0.5.

The formula for the KMO test is as follows (5):

(5) $KMO_j = \dfrac{\sum_{i \neq j} r_{ij}^2}{\sum_{i \neq j} r_{ij}^2 + \sum_{i \neq j} u}$

where r_{ij} – the correlation matrix; u_{ij} – the partial covariance matrix.

In the next stage, the study used the Varimax rotation to calculate the loadings for each variable (Arbolino et al., 2018).

Results

At the first stage of the empirical calculation, the study provides the correlation analysis of the involved variable. Table 2 presents the correlation matrix. According to the obtained results, GDP per capita has a moderate correlation with the export of goods and services (EXP) (R = 0.561) and secure Internet servers (R = 0.530). At the same time, there is a low negative correlation with the rest of the variables. Besides, the correlation matrix reveals a moderate correlation between renewable energy consumption (REC) and forest area (FORE) (R = 0.683).

Table 2. Correlation Matrix

	GDP	EXP	BEDI	REC	ERT	NEEP	FORE	ORG	SIS	ITA	FDI
GDP	1.000										
EXP	.561	1.000									
BEDI	-.181	-.355	1.000								
REC	-.070	-.399	.238	1.000							
ERT	-.140	-.022	-.055	.080	1.000						
NEEP	-.040	-.078	-.133	.155	-.027	1.000					
FORE	-.038	-.257	.193	.683	-.068	.189	1.000				
ORG	.085	-.215	-.111	.208	-.076	.415	.299	1.000			
SIS	.530	.330	-.301	-.022	-.083	.156	-.228	.019	1.000		
ITA	-.054	-.409	.072	-.145	.003	.037	-.060	.205	-.195	1.000	
FDI	.099	.308	-.039	-.303	.046	-.176	-.359	-.309	.158	-.169	1.000

Sources: own calculations.

The KMO value of 0.523 in Table 3 indicates the sampling data is adequate. Bartlett's Test of Sphericity is 1000.825 with less than a 0.001 p-value. Therefore, these findings show the intercorrelations of variables while the correlation matrix isn't the identity matrix. Thus, it could be easily extracted for further factor analysis to compute eigenvalues (Yap et al., 2019).

Table 3. KMO and Bartlett's Test

Test		Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.523
Bartlett's Test of Sphericity	Approx. Chi-Square	1000.825
	df	55
	Sig.	<.001

Sources: own calculations.

According to the approach proposed by Nicoletti et al. (2000), to select the significant factors, three conditions must be satisfied: 1) the eigenvalues exceed 1; the factor explains more than 10% of the variance; 3) the set of factors explains more than 60% of the total variance.

Figure 3. The Factors' Scree Plot
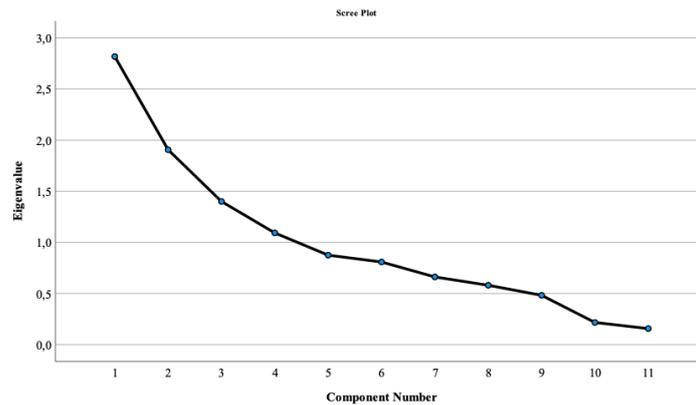
Sources: own work.

Table 4 shows four latent factors that could be selected. These factors explain 65.6% of total variance that exceeds 60% needed for satisfactory construct validity. The first factor accounts for 25.63% of the total variation, the second factor – 17.33%, the third factor – 12.73%, and the fourth factor – 9.93%. It stands to note that despite Factor 3 explaining less than 10% of the variance, its eigenvalue exceeds 1. Figure 3 demonstrates the scree plot of 11 factors.

Table 4. Total Variance Explained

Factors	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
GDP	2.819	25.625	25.625	2.331	21.190	21.190
EXP	1.907	17.333	42.958	1.936	17.600	38.790
BEDI	1.400	12.731	55.689	1.840	16.724	55.514
REC	1.093	9.932	65.621	1.112	10.107	65.621
ERT	.875	7.956	73.577			
NEEP	.808	7.350	80.927			
FORE	.662	6.018	86.945			
ORG	.581	5.278	92.223			
SIS	.482	4.385	96.608			
ITA	.217	1.969	98.577			
FDI	.157	1.423	100.000			

Note: Extraction Method is Principal Component Analysis.

Sources: own calculations.

Table 5 presents the final rotated component matrix developed using the orthogonal rotation method Varimax with Kaiser normalization. Noteworthy here, according to Hair et al. (2010), the practically significant factors should have loading values exceeding 0.50. The values characterizing each factor most are highlighted with bold font. Therefore, Factor 1 consists of GDP, EXP, and SIS; Factor 2 – REC and FORE; Factor 3 – NEEP and ORG. Figure 4 visualizes the factors' plot in rotated space.

Table 5. Varimax Rotation Factor Matrix

Variables	Factors			
	1	**2**	**3**	**4**
GDP	**.755**	-.019	.047	.355
EXP	**.776**	-.217	-.276	-.066
BEDI	-.480	.354	-.342	.346
REC	-.107	**.876**	.170	-.066
ERT	-.137	-.016	-.021	-.823
NEEP	.132	.115	**.698**	-.184
FORE	-.124	**.823**	.244	.102
ORG	.008	.140	**.794**	.118
SIS	**.747**	-.070	.135	.044
ITA	-.494	-.423	.418	.316
FDI	.252	-.320	-.495	-.139

Sources: own calculations.

According to Table 5, a strong correlation exists between Factor 1 and real GDP per capita (GDP), exports of goods and services (EXP), as well as secure Internet servers (SIS). This integrated factor could be interpreted as macroeconomic. Factor 2 is strongly correlated with renewable energy consumption (REC) and the areas covered by forests (FORE). Thus, this factor could be interpreted as renewable energy sources. Factor 3 is highly correlated with national expenditure on environmental protection (NEEP) and organic agricultural land (ORG). This factor could be interpreted as environmental conservation.

Figure 4. The Factors' Plot in Rotated Space
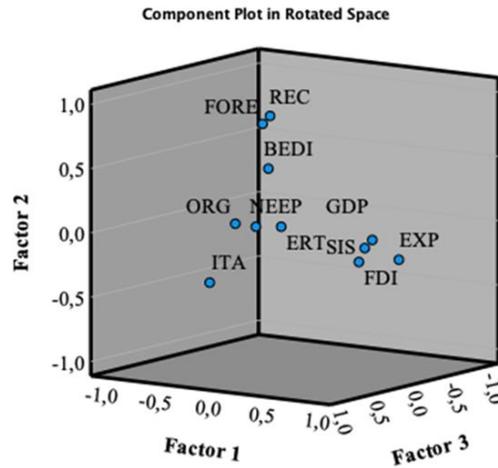
Sources: own work.

Therefore, based on the obtained results, it is possible to conclude that a country's green brand mostly relies on macroeconomic stability, renewable energy sources, and environmental conservation.

Table 6. Results of factors weights

Factors	Squared rotated factor	Weight of respective factor	Resulting weight	Resulting weight scaled to sum to 1
GDP	0.755	0.212	0.160	0.132
EXP	0.776	0.212	0.165	0.136
BEDI	0.354	0.176	0.062	0.051
REC	0.876	0.176	0.154	0.127
ERT	-0.016	0.176	-0.003	-0.002
NEEP	0.698	0.167	0.117	0.096
FORE	0.823	0.176	0.145	0.119
ORG	0.794	0.167	0.133	0.109
SIS	0.747	0.212	0.158	0.130
ITA	0.418	0.167	0.070	0.058
FDI	0.252	0.212	0.053	0.044

Sources: own calculations.

To calculate the weights of factors, the squared rotated factors from Table 5 were multiplied by the percentage of the variance of the appropriate factor. Table 6 demonstrates the weights of factors designing the CGB model. Therefore, the obtained results show that the export of goods and services has the highest weight in the model of CGB (W_{EXP} = 0.136) followed by real GDP per capita (W_{GDP} = 0.132), secure Internet servers per 1 million people

(W_{sis} = 0.130), renewable energy consumption (W_{REC} = 0.127), forest areas (W_{FORE} = 0.119), and the land devoted to organic agriculture (W_{ORG} = 0.109).

Conclusions

The theoretical results of this study showed that scientists pay profound interest in green branding at the corporate level. However, because of the growing concern about adverse climate changes and snowballing globalization processes, the world scientific community considers countries' green brand to be a prospective area for research. Therefore, this study aimed to elaborate on the methodology to assess the factors that mostly contributed to a country's green brand.

The empirical part of this paper involved the principal component analysis methodology to identify the contributions of a country's green brand factors. The obtained results determined four practically significant factors in the proposed model of a country's green brand, such as macroeconomic stability, renewable energy sources, and environmental conservation.

The results of the calculation of the weights of the factors designing a country's green brand model showed that export of goods and services has the highest weight in the model (0.136), followed by real GDP per capita (0.132), secure Internet servers per 1 million people (0.130), renewable energy consumption (0.127), forest areas (0.119) and the land devoted to organic agriculture (0.109).

This study has theoretical and practical value. The findings could be beneficial for academic researchers addressing a country's green brand assessment. The proposed methodology could be used to mostly determine the factors that contribute to a country's green brand. Policymakers might find the study results helpful in making decisions concerning strengthening their country's green branding.

The main limitation of this study is the lack of open data to estimate a country's green brand more comprehensively. Therefore, this work could be a starting point for future investigation of country's green brand, which should involve more dimensions of the proposed country's green brand model.

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Dual Model of Education in the Republic of Serbia

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Abstract: A lot of work has been done on the development of education, digitalization, new technologies and educational methods in the Republic of Serbia in the last few years.
The Republic of Serbia is making significant efforts to adapt its education system to the needs of the economy. In this regard, great efforts are directed towards dual education, which will be presented in this paper. Based on the results of the research, directions of development trends will also be presented.

Key words: dual education, higher education institutions, cooperation between companies and higher education institutions

JEL: H0, I2

Introduction

Educational institutions have great importance and role in the society and economy of a country. The development of the market economy through modern tendencies shows that education and formation of human resources are the main priorities of the national strategy and policy for social, economic and technological progress. Promoting education has an investment character, which must be harmonized with the needs of the economy and society. The development of the economy and society is based on knowledge that is shaped by the educational system (Trifunović, et al., 2019).

In the last few years, the Republic of Serbia has been making significant efforts to adapt the education system to the needs of the economy and provide necessary skilled labor force. Accordingly, it has directed great efforts towards dual education. One of the main advantages of this type of education is the fact that upon completion of such studies, students are able to work in the chosen field, because their knowledge and experience is already adapted to the needs of the economy (Obradović, Dmitrović, 2022, p. 353).

The dual education system provides a more efficient response to the needs of the economy and the labor market, technological changes and the need for new competencies -

knowledge, skills, abilities and attitudes (The Ministry of Education, Science and Technological Development, 2022).

In the first part of the paper, within theoretical foundations, the introduction of dual education in the Republic of Serbia is explained. Clarification of the dual model in secondary and higher education is also included. The second part of the paper refers to the methodological framework of the conducted research. The third part of the paper refers to the graphic presentation of the results of the conducted research and the analysis of the obtained results on the importance of connecting the economy and higher education institutions. Finally, concluding remarks follow.

Theoretical premises

Dual education in the Republic of Serbia

The project of dual education in Serbia was launched 20 years ago by the German Agency for International Cooperation in the Field of Economic Development (GIZ). The project was supported by the Ministry of Education. The pilot project for the application of the dual model through education was within the profile of economics. Afterwards, the joint international team continued to carry out activities in this area. GIZ has focused its support on industrial occupations and profiles, such as mechanic, locksmith, welder or electrician. Serbia is working on making dual education only a supplement to the current model of vocational education, and that is why it differs from the model in other European countries (Grujić, 2021, pp. 140-147).

The Ministry of Education, Science and Technological Development has been committed to reforms in education with the goal of joining the European Union. Education reform is aimed at modernization of general, vocational and higher education, digitalization, entrepreneurship, and pedagogical education. The Ministry of Education, Science and Technological Development is orienting its capacities towards the national priority, the dual education sector and the digitalization sector in education and science (Grujić, 2021, pp.140-147).

Today, the system of dual education is at the level of secondary and higher education in Serbia. The goal of dual education is to improve human capital through faster integration

of secondary school and university students into the world of work. It is regulated by the Law on Dual Education and the Law on the Dual Model of Studies in Higher Education. In addition, the development of dual education is regulated by the Master Plan for the Implementation of the Law on Dual Education (The Ministry of Education, Science and Technological Development, 2022).

The development of the National Model of Dual Education in Serbia was supported by the German Development Cooperation (GIZ) within the project "DECIDE" and "The Reform of Secondary Vocational Education in Serbia", the Swiss Agency for Development and Cooperation (SDC) within the project "Support to Development and Establishment of the National Model of Dual Education" and the Austrian Chamber of Commerce and the Austrian Development Agency (ADA) (The Ministry of Education, Science and Technological Development, 2022).

Dual education in secondary schools

The Law on Dual Education was passed in 2017, and its implementation began in the school year 2019/2020. The law regulates the rights and obligations of stakeholders who participate in the dual model of teaching in secondary vocational education. The Ministry of Education was in charge of creating the Law on Dual Education, and it is envisaged that the entrusted tasks will be carried out by the Serbian Chamber of Commerce. Other partners were other relevant institutions - representatives of various ministries, educational institutions, employers, representatives of local self-government, the National Employment Service and other actors. According to the Law on Dual Education, it is a model of teaching in the system of secondary vocational education and upbringing in which the curriculum is taught in two places, i.e. at school and in a company (with an employer), which means that students acquire competencies, both in the school through theoretical classes and exercises, and in the company, in which learning through work is performed, all in accordance with the standard of qualification and the curriculum (Grujic, 2020).

Three rulebooks were adopted: The Rulebook on the manner of deploying students for learning through work; the Rulebook on closer conditions, manner of work, activities and structure of the Team for career guidance and counseling in secondary school that implements educational profiles in dual education; the Rulebook on training programme,

closer conditions and other issues of importance to take the instructor exam. In addition, on the basis of the Law on Dual Education, the Chamber of Commerce of Serbia has passed the Rulebook on the organization, structure and manner of work of the Commission for determining the fulfillment of conditions for conducting learning through work with the employer (Grujić, 2021, pp.140-147). This Ordinance regulates the process of obtaining accreditation for companies wishing to engage in dual education, from the structure of this commission, through the manner of submitting applications by companies and the process of verifying their eligibility, including going out on the field, to the decision on the requirements, the procedure for determining fulfillment of conditions, etc (Grujic, 2020).

The Serbian Chamber of Commerce has conducted training for instructors, i.e. company employees. The government of the Republic of Serbia has established the Commission for the Development and Implementation of Dual Education for the implementation and improvement of dual education and a three-year evaluation of the achieved results (Grujić, 2021, pp.140-147).

Currently, about 30% of vocational schools in Serbia have at least one dual educational profile (Grujić, 2021, pp.140-147). The system of dual education includes over 10,000 students. The number of dual educational profiles, which are implemented in over 150 secondary vocational schools, has grown to 54. The National Online Database of Dual Profiles has been created, which contains 764 units. Teaching contents were recorded in equipped classrooms-workshops and training centers, as well as in some companies that educate a significant number of students with dual educational profiles. Topics for learning through work were recorded in real work environment with licensed instructors and coordinators. The provided materials enable students who finish primary school to be informed about the manner of realization of dual education, so that they can decide on a future profession. The online database of lectures will also be used in regular classes, so that students who are not able to learn in real work environment can use the simulation to network theoretical knowledge with practice (The Ministry of Education, Science and Technological Development, 2022).

In the school year 2020/2021, a total of 2,447 students enrolled in the first year of secondary school (Grujić, 2021, pp. 140-147).

Table 1. Dual education in secondary schools in Serbia

Dual educational profile	Number of students in dual programmes	Number of schools in the system of dual education	Number of companies in the system of dual education
54	10,000	150	900

Source: Own work based on official data from the Ministry of Education, Science and Technological

Development (Dual Education –The Ministry of Education, Science and Technological Development)

(mpn.gov.rs)

The dual model in higher education

Dual education in secondary schools was followed by the introduction of the dual model in higher education, and it began in 2019 with the Law on the Dual Model of Studies in Higher Education (Grujić, 2021, pp. 140-147). The dual model of studies has been applied in the Republic of Serbia for a short time and this Law regulates basic issues related to this model of education, such as defining the content and implementation of this model, rights and obligations of students, employers and higher education institutions, etc. (Obradović, Dmitrović, 2022, p. 353).

The goal of introducing the dual model in higher education is to provide students with the opportunity to significantly increase their competitiveness in the labor market and have greater chances to be employed by employers with work-based learning, but also by other employers in the same field. According to the dual model, a higher education institution can organize a study programme of academic or vocational studies, in which through active teaching at a higher education institution, as well as practical training and work with an employer, knowledge, skills, abilities and attitudes are acquired in accordance with the study programme and qualification standard (The Ministry of Education, Science and Technological Development, 2022).

In this way, it is possible for students to have the opportunity to learn through work during their studies. "Learning through work" is an integral part of the study programme according to the dual model of studies that carries a number of ECTS credits and is an organized process during which students under the supervision of a mentor working with an employer apply theoretical knowledge in real work environment. They have direct contact with business procedures and technologies used in the business world, they connect with professionals and prepare themselves for the world of work (NAT, Rulebook, 2020).

The ratio in the volume of hours of teaching performed at a higher education institution and learning through work with an employer is determined by the study programme, with teaching (lectures, exercises and other forms) represented with at least 450 hours per year on average at the level of the entire study programme, and learning through work with at least 450 hours per year on average at the level of the entire study programme (The Ministry of Education, Science and Technological Development, 2022).

In order to realize the dual model of studies, the study programme should be accredited in accordance with the accreditation standards established by the law governing higher education and the qualification standard determined in accordance with the law governing the national qualifications framework (The Law on the Dual Model of Studies in Higher Education, 2019).

In February 2020, the Rulebook on Amendments to the Rulebook on standards and procedure for accreditation of study programmes was adopted by the National Accreditation Body. The Rulebook explains the procedure and manner of conducting the accreditation process according to the dual model in higher education (Trifunović, Lalić, Radovanović, 2021, pp. 339-349). The National Accreditation Body in the Republic of Serbia performs accreditation, quality control of higher education institutions and their units, evaluation of study programmes and quality assurance in higher education (Law on Higher Education, 2021).

The dual study model can be accredited as an independent study programme or as one of the modules within the study programme. In addition to the elements prescribed by the law governing higher education and accreditation standards, it contains a description and scope of learning through work expressed in hours and ECTS credits (The Law on Dual Model of Studies in Higher Education, 2019).

Employers also participate in the development of study programmes or modules, in accordance with the law governing higher education (The Law on the Dual Model of Studies in Higher Education, 2019).

Before enrolling in a faculty, students can decide whether they want dual education or classic study programmes. Faculties define in their regulations that a student who opts for dual education can return to the classic way of studying and vice versa - that a student who has decided to study in the classic way can switch to dual education. Through this form

of education, although more demanding and difficult, young people acquire practical skills and abilities that will enable them easier entry into the world of work, as well as competencies for career management, lifelong learning and entrepreneurship. This form of education enables employers to participate in the education of future staff. In the long run this reduces costs of searching for qualified staff (Grujić, 2021, pp. 140-147).

Studies according to the dual model cannot be introduced in the field of social sciences and humanities (NAT, Regulations, 2020).

The dual model of studies in higher education, which began with the implementation of the first study programmes in October 2021, contributes to increasing the relevance of higher education, employability of graduates, modernization of the teaching process through cooperation with the economy and contact with modern technological achievements (The Ministry of Education, Science and Technological Development, 2022).

Table 2. The dual model in higher education in Serbia

Number of faculties that implement study programmes according to the dual model	Number of accredited study programs according to the dual model	Number of academies of professional studies that implement study programmes according to the dual model
3	26	5

Source: Own work based on official data from the Ministry of Education, Science and Technological Development (The Dual Model of Studies – The Ministry of Education, Science and Technological Development) (mpn.gov.rs)

Methodology

The research, a part of which used in this paper, was conducted on the territory of the Republic of Serbia in the period from October to December 2021. A questionnaire was used to collect data. A hundred companies of different sizes and activities were included. It was observed how much importance is given to cooperation and connection of companies and higher education institutions, how much the awareness of dual education is developed. It also included research on students' practical work and how much was invested in employees so as to receive additional education in the last few years. In addition, the cooperation between companies and higher education institutions in the past ten years was analyzed in order to see possible tendencies and directions of development in the future.

The conducted research was followed by data processing, which was presented through graphical representations. For the purposes of this paper, six graphic representations are presented.

Results

The first graphic shows the percentage of cooperation between companies and higher education institutions. There is high percentage of companies that stated that they have some kind of cooperation with higher education institutions, and that is a good indicator. The percentage of companies that gave positive answer was 75%, while 25% gave a negative answer. This type of cooperation brings great benefits for both companies and higher education institutions.

Cooperation between companies and higher education institutions leads not only to their development, but also to increased expertise of human resources, increased innovation and economic development (Trifunović, Lalić, Radovanović, 2021, pp. 339-349).

On the other hand, from the aspect of higher education institutions, this type of cooperation is also extremely important and can be achieved in various ways through the development of new academic programs, joint research projects, seminars, presentations at fairs, etc. (Polovina, et al., 2020).

Cooperation between companies and higher education institutions not only leads to their development, but also increases the level of expertise of the entire population, the diversity of knowledge among companies, and the diffusion of innovations in terms of quantity and speed. In addition, companies in interaction with higher education institutions are becoming more attractive to other companies, leading to new forms of cooperation, connections and partnerships (Ahrweiler, 2011, pp.218-235).

Figure 1. Cooperation between companies and higher education institutions
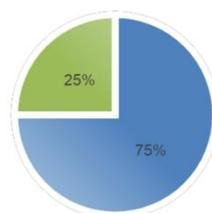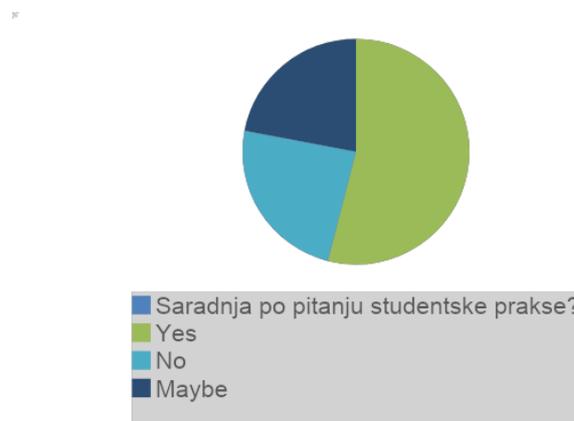

Source: Authors' illustration based on own research

One of the types of cooperation and connection of companies and higher education institutions is sending students for internships at companies. It is also one of the obligatory elements of the dual education system, as well as short study programmes. Graph 2 shows the percentage of companies that cooperate with higher education institutions by accepting students for internships. The percentage of companies that answered in the affirmative was 54%, 24% answered in the negative, while 22% answered that they might work on achieving this type of cooperation.

This type of cooperation is one of the ways in which students learn and understand more easily through practical experience. On the other hand, new scientific and technical knowledge is implemented in companies. The goal of cooperation through this programme is to teach students to apply theory in practice. In that way, students will gain self-confidence and motivation, become proactive, creative and learn how to work in a team (Oosterbeek, 2010, pp. 442–454.).

Figure 2. Cooperation on student internships

Source: Authors' illustration based on own research

Graph 3 shows a company's investment in additional education of employees. This investment can be in employees to take part in undergraduate, master's or doctoral study programmes, or in short study programmes. In addition, it can be through different further educational programmes such as different courses or trainings. This certainly contributes to employees' implementation of new scientific knowledge in their companies. In this regard, 51% of companies answered yes, 25% maybe and 24% no. This is a good indicator because investing in employees, by financing their additional training, leads to an increase in the knowledge fund, new scientific knowledge and practical application of newly

acquired knowledge. Companies that invest in human resources in this way influence the skills, attitudes and behavior of individuals to do their job (Trifunovic & Tankosic, 2013).

Figure. 3. Investments in employees to be further educated
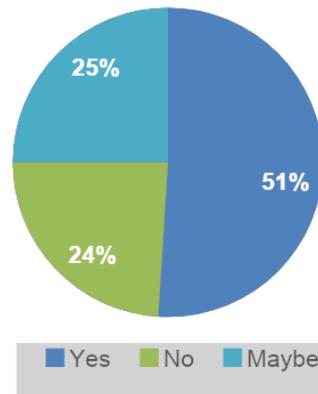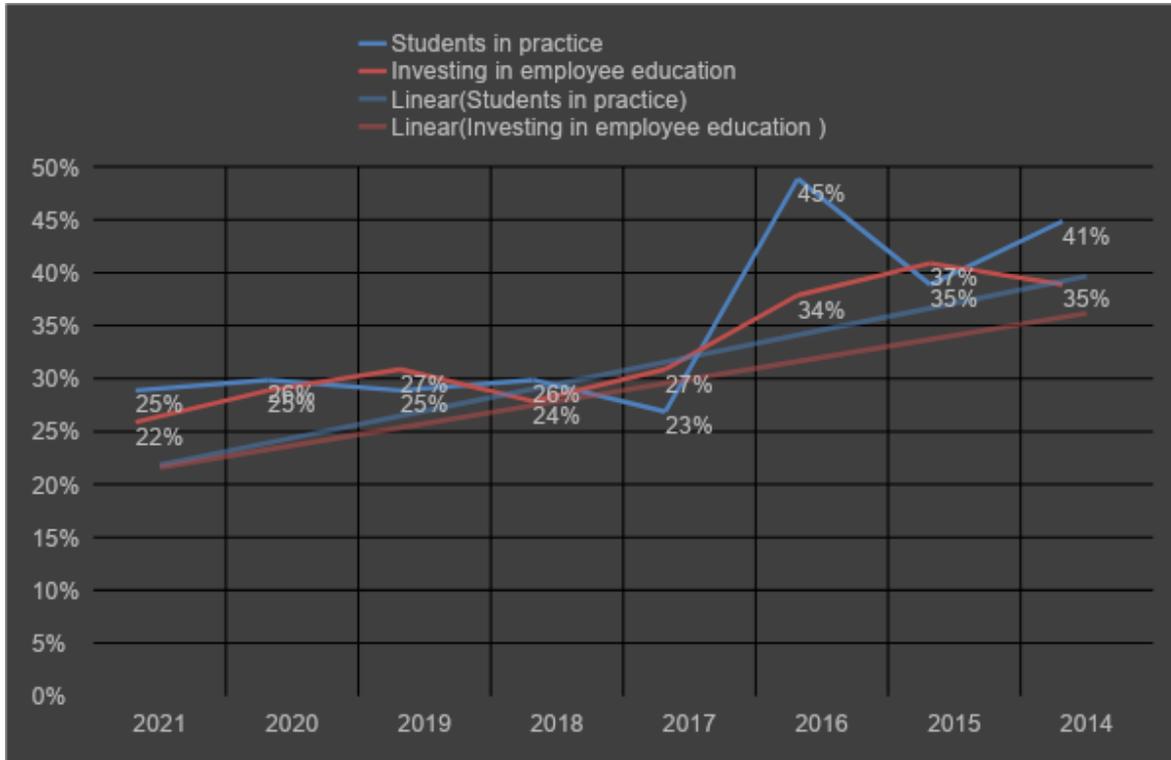

Source: Authors' illustration based on own research

Various environmental factors and working conditions impose the need for the constant introduction of new development programmes based on innovation and new technologies. There is also a positive trend from year to year of linear increase in the introduction of new technologies. Innovations and new technologies are going in a new direction that leads to better life and work experience (Trifunović et al., 2020). New technologies, innovations, digitalization of education have contributed to the fact that employees can acquire the necessary knowledge in a simpler way. Thanks to new technologies, employees are not obliged to be present in classes, but have the opportunity to follow everything on a platform, as well as have access to various types of *online teaching*.

Graphic 4 shows the cooperation between companies and higher education institutions in terms of student internships and investments in employees to receive additional education in the last eight years, from 2014 to 2022.

When we look at students doing practical work at companies, we see that their number is increasing from year to year and that a signinficant increase followed the launch of dual education. The percentage of the ascending line would have been even higher if it were not for the emergency situation and various restrictions due to COVID-19.

When we look at the investment of companies in additional education of employees in the last eight years, we see that it is increasing from year to year.
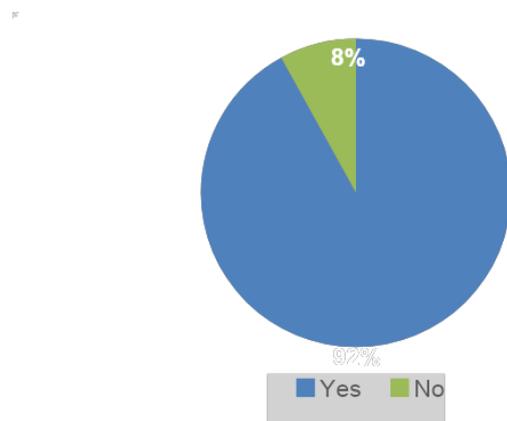
Figure 4. Cooperation between companies and higher education institutions in terms of student internships and investments in employees to receive additional education in the period 2014-2022

Source: Authors' illustration based on own research

Graph 5 shows whether companies in the Republic of Serbia have developed awareness of dual education and whether they support the dual model. The number of companies that answered yes was 92%, while 8% answered no. This is a good indicator.
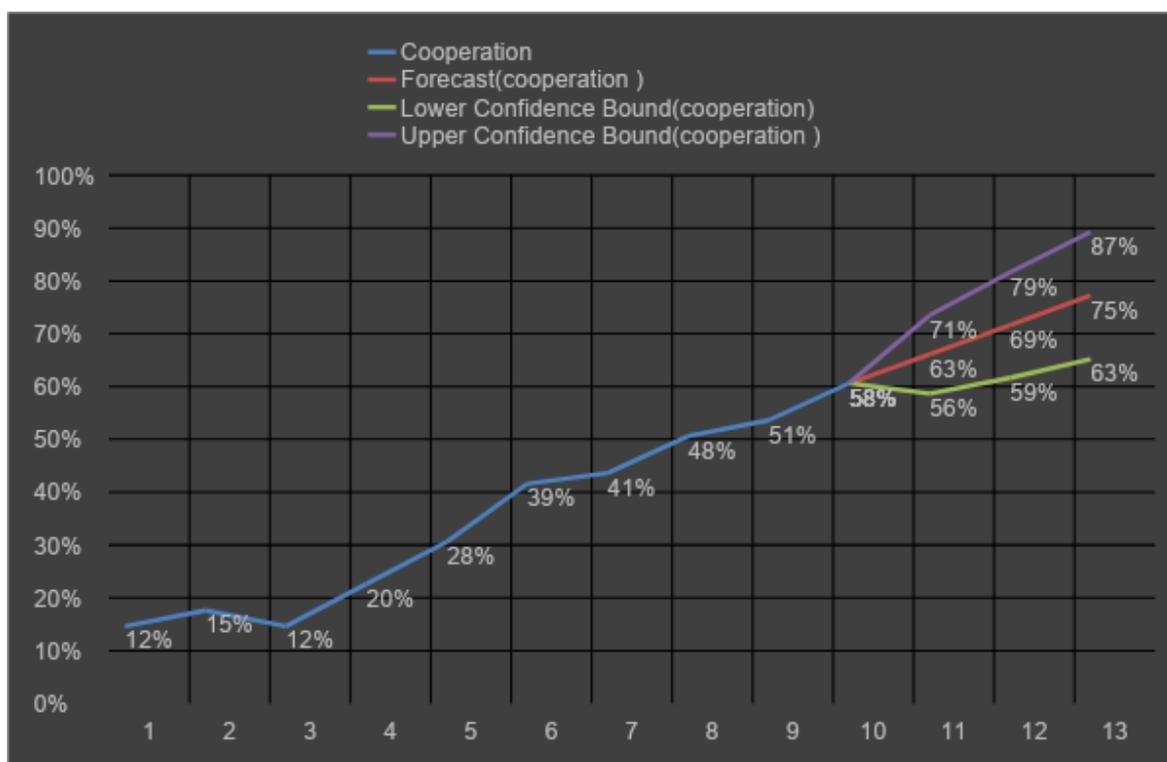
Figure 5. Do companies support dual education?

Source Authors' illustration based on own research

Graph 6 shows the cooperation between companies and higher education institutions in the previous ten years, from 2012 to 2022. From year to year, the cooperation between companies and higher education institutions is growing. The graph also shows a projection of the increase in the cooperation in the next couple of years.

Figure 6. Cooperation of companies and higher education institutions from 2012-2022

Source: Authors' illustration based on own research

Summary, recommendations

Cooperation between companies and higher education institutions can be achieved in several ways. Each of these methods has numerous advantages for both organizations and economic development (Trifunovic, Tankosic, 2013, pp. 227-231). The Republic of Serbia is making great efforts to connect the economy and higher education institutions.

The Republic of Serbia, in response to the needs of society for skilled workforce that will be immediately ready to jump into the process of production of goods and services (Stojanović, et al., 2021, pp. 29-40), by addressing youth unemployment and modernization of educational system, turned to dual education and its implementation in the school year 2019-2020. Dual education is a model of teaching and learning in the system of secondary

vocational education and upbringing. In dual education, students acquire competencies through theoretical classes at school, practical classes at school and learning through work with employers (Renold, Caves, Oswald-Egg, 2021, p. 3). The introduction of the dual model was followed by its introduction in higher education in the academic year 2020/21.

This paper presents the importance of the dual education model and the efforts of the Republic of Serbia to implement it.

The conclusions based on the research presented in this paper are: a high percentage of companies establish a certain type of cooperation with higher education institutions; the number of internships in companies is increasing from year to year, same goes for the investment of companies in employees to receive additional education; there is a high percentage of companies that support dual education; in the last ten years, in the period from 2012 to 2022, cooperation between companies and higher education institutions has been increasing, with a tendency for further development.

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Angel Investing Trends and Characteristics in the EU

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Abstract: The financing of entrepreneurial ventures in the European Union is facing many challenges, but its actors are constantly striving to improve its market conditions in order to provide support to entrepreneurs in the early stages of development. Business angel investments, as the most common source of financing in the early stages of enterprise development in the European Union, have been recognized as a form of investment that transcends national borders. The growth of business angel investments has been slowed down by the global pandemic, but there is no doubt that this form of investment is growing, and business angels have long not been just individuals who invest only in the early stages of enterprise development, so by uniting these individuals, there are created new investment concepts that expand their activities into later stages of company development. In 2020, business angel investments accounted for the largest share of the European investment market, or about 58% of the total investment market in the early stages of enterprise development. In 2020 alone, these investments amounted to as much as 7.67 billion euros, and in 2019 to as much as 8.04 billion euros. Disorders in the economy caused by the pandemic will undoubtedly affect all segments of the European economy, but the survival and development of small businesses are part of the economic recovery after the crisis, so all hope lies in that investments of business angels and other forms of early business financing will continue to grow. It's not odd that such investors are currently looking for companies to finance outside domestic economies, because geographical distance in the conditions of a high degree of globalization is becoming less and less important. However, cross-border investments remain a challenge.

Key words: business angels, financing entrepreneurship, alternative finance, informal finance, early stages of entrepreneurial development

JEL: D53, F65, L26

Introduction

Business angels are most often successful entrepreneurs, people who have been in managerial positions for a long time or owners of successful companies with considerable knowledge and skills in their field, which allows them to use it to invest in other companies that need expertise and capital at the same time. These investments are usually informal and without intermediaries, i.e. done directly through the founders' agreement. These investors are therefore often referred to as informal venture capital.

Business angels invest their own money, individually or with others, in companies with which they have no family ties (Mason et al., 2016). They can also invest within a union in which one angel usually takes the lead. Angel investors often operate as "small investment groups within which they enlarge their capital and coordinate investment decisions, and with the help of their lawyers and accountants they conclude contracts and invest in small companies, most often start-ups." The angel market is very heterogeneous and localized (Prowse, 1998). In the case of these investors, there are no rules on the amount of money and other aspects of the investment agreements, but they are a great choice for initial seed investments. The amounts that angel investors usually provide range from ten thousand euros to millions of euros.

Angel investors usually offer their experience, contacts, knowledge and other forms of intangible contributions in the industry in which the company operates (Tenca, Croce, & Ughetto, 2018), which can help with legal issues, sales and marketing of products, as well as other elements of importance for the development of initial business. Due to this way of investing, it is considered that they provide "a smart and patient capital."

Business angel investments have been on an upward trajectory in the world, primarily in America and Europe. There are no precise data, but it is believed that business angels in the United States represent the informal venture capital market and that they have the largest reserves of free capital for investment. It is estimated that every year more than 100 thousand independent investors finance from 30 to 50 thousand entrepreneurs in the amount of 7 to 10 billion dollars (Njegomir et al., 2017). There are about 28,000-33,000 business angels in the European Union who are members of networks that provide information about them. However, it is estimated that there are over 300,000 angel investors in Europe who provide about 60% of the total investments in the early stages of a company. Despite the disturbances caused by the outbreak of the COVID-19 pandemic, it is believed that this informal investment market will continue to grow in the future.

Characteristics of angel investors in Europe

Business angels or angel investors are successful and wealthy individuals who prefer to invest money in promising projects in exchange for a share in the company ownership,

very often without a managerial role. According to some studies, up to 80% of business angels are wealthy entrepreneurs (Harrison et al., 2010).

In the past, it was believed that business angels who invest capital and knowledge in start-ups are mostly successful former managers or entrepreneurs over the age of 50. Today, business angels are much younger individuals. Start-up entrepreneurs who successfully sold their businesses at a fairly young age have found that investing in business angels is an opportunity to foster and mentor young entrepreneurs.

Business angels are particularly important from the perspective of the regional economic development, as most of their investments are local (Harrison et al., 2010). However, as of late, angel investors have been looking for companies to finance outside domestic economies. Geographical distance in the conditions of a high degree of globalization is becoming less and less important. However, cross-border investment remains a challenge.

The way we do business and organize things, and the way business angels invest their money, change over time, although due to their informality there is not much literature on the subject. Also, the literature thought of angel investors as a homogeneous category and therefore not much research has been done on how much these investors differ in terms of personal characteristics, risk attitudes, investment strategies, portfolio management and post-investment inclusion (Croce, Ughetto, & Cowling, 2020). Furthermore, studies have failed to present a profile of the type of business ventures in which business angels invest and the extent to which investors can improve the performance of these ventures in line with previous experience (Croce, Ughetto, Bonini, & Capizzi, 2021).

The business angel market has changed from an isolated and rather inconspicuous market made up of individuals investing alone or in small temporary groups, to one in which these angels have become visible groups of investors or angel unions, uniting and channeling funds from individual investors to entrepreneurial ventures (Mason et al., 2016).

During the 1980s and 1990s, as the business angel market was slowly developing, business angels invested mostly independently, or within temporary groups of business associates or friends, in ventures that they found through personal social or business networks. During that period, this form of investment did not work efficiently, as it was

relatively difficult for investors and entrepreneurs to find each other. After a period characterized by a low level of professionalism, the first business angel networks appeared, first in the United States, then in Canada, and even in Europe.

In the late 1990s, the business angel market began to take a different shape, when angels began investing within mutual funds groups. The Band of Angels was founded in Silicon Valley (USA) and is considered the first such group. Angel groups arose for two main reasons: first, business angels are characterized by difficulties in investing in relation to formal venture capital, which is in some ways more protected because it uses different investment instruments, which was especially evident during the dot.com crash; second, after the aforementioned breakdown, venture capital shifted to later stages of investment, which somewhat limited business angels in continuing to fund business ventures, but it was still suggested that angels would continue to provide financial support after the initial stage. Angels recognized the benefits of investing within a group, some of these being: easier investment and less effort of each individual, exchanging experiences and knowledge, learning from experienced investors, providing networking opportunities with like-minded investors, creating investment opportunities in which they would not be able to invest individually, providing a chance to make larger investments by acting together and securing additional investments and exit from investments without the need for subsequent financing with formal risk capital (Mason et al., 2016).

Although business angel financing is usually linked to the early stages of company development, this may not always be the case, as their entry into corporate financing depends on the projected rate of return and the level of risk at that stage. In Anglo-Saxon economies, business angels are considered the only investors in the early stages of a company's business. These investors usually invest capital on an informal basis in projects that are similar to previous projects in which they have invested, or for which they already have enough experience.

Some time ago, business angels invested in companies primarily in the early stages of business. Recently, these investors have also been investing in later stages of a company's development, especially in the continuation of financing their portfolio companies in order to compensate for the lack of suitable VC companies. Most angel investors focus on certain sectors, but of course not all. Most often, companies in the field of information and

communication technologies are the focus of business angels' investments across Europe. Other important sectors in which these investors most often invest are biotechnology, medical technology or consumer products (Business Angels Europe (BAE), 2016).

Potential of business angels in Europe

The European angel market, and the capital market in general, is not as deep as the one in the United States, where beginners have more ways to get their initial funding, but also more ways to raise funds in later stages of development. The big problem of the European capital market lies in the pronounced fragmentation of the market (Mason, Botelho, & Duggett, 2021)

The European venture capital industry is characterized by lower funding, lower average investment per venture, lower funding and lower investment in later stages of financing (Duruflé, Hellman, & Wilson, 2018). The European Union recognized the need for changes in the European market, and in 2014, the Capital Markets Union (CMU) initiative was launched, which aimed to further deepen and integrate the market. Such initiatives are now even more necessary in order to prevent the fragmentation of the European market in the direction of preserving investments, but also in the context of recovery from the crisis caused by the COVID-19 pandemic.

It is well known that angel investors play a key role in promoting economic growth and entrepreneurship by helping to fill the "financing gap" between demand and supply of equity at an early stage (Wiltbank, Read, Dew, & Sarasvathy, 2009). An appropriate offer of financing sources and an easier access to them becomes a necessity, because the provision of capital affects all aspects of business operations and is a significant factor in achieving the development of enterprises (Đekić & Ristanović, 2021). Some of the most important non-banking sources of financing for small businesses in developed and, as of late, in transition countries are crowdfunding, venture capital funds and business angels. These forms of financing are often related to the early stages of company development, but using these sources of financing is becoming increasingly common in the later stages of company development as well (Đekić, Brzaković, & Janošik, 2019). According to the data of EVCA (European Private Equity and Venture Capital Association), the total volume of investments in the early stages of the company's operations in 2013 amounted to 7.5 billion euros,

of which as much as 5.5 billion euros were business angels' investments. This resulted in the financing of 33,430 companies, which contributed to the creation of 184,170 new jobs. The average investment per company was around 166,000 euros, and the average investment of a business angel was around 20,000 euros (European Commission, 2015a).

Business angel investments in Europe amounted to about 6.1 billion euros in 2015, almost 6.7 billion euros in 2016, and in 2017 they increased by about 9% compared to 2016 and reached the amount of almost 7.3 billion euros, and so on.

European business angel investments decreased by 4.5% in 2020 compared to 2019, bringing the (visible and invisible) market to an estimated total investment of 7.67 billion euros in 2020 (compared to as much as 8.04 billion in 2019). The previous decline in business angel investments was recorded in 2008 due to the financial crisis.

Graph 1. The three most common forms of company investment in the early stages of company development in 2019
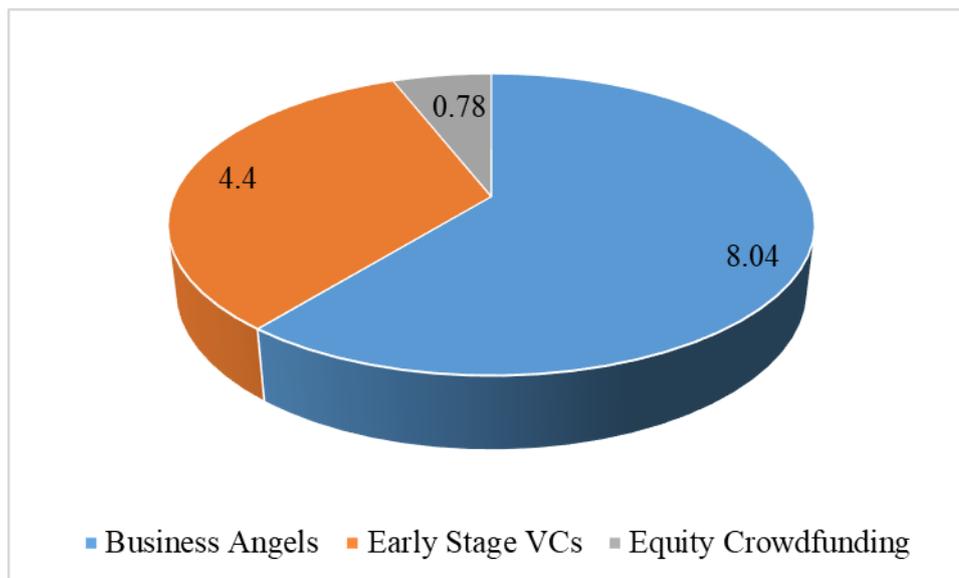
Source: (EBAN, 2019)

There are about 28,000-33,000 business angels in the European Union who are members of networks that provide information about them. Of course, there are others about which networks do not provide data. The average network has about 70-75 registered angels, although not all are active. It is estimated that there are at least seven times more business angels than within the EU networks (European Commission, 2017e). The latest estimates show that in 2019 there were a total of 410 networks, and that there was a total

of about 322 thousand angel investors on the European market, counting those who are and those who are not in networks. Business angel networks provide a communication channel through which entrepreneurs can present their investment proposals to potential investors, and the investors can examine investment opportunities without compromising their privacy.

The following table shows the movement of the number of investors, networks and business angels' investments for the three-year period, starting in 2015.

Table 1. Movement of basic characteristics of business angels' investment activity for the period 2015 - 2020

Year	Investments in millions of euros	Number of networks	Number of investors	Number of ventures
2015	6069	371	303 650	32 940
2016	6672	414	312 500	38 230
2017	7274	401	337 500	39 390
2018	7450	410	345 000	37 200
2019	8040	404	345 000	36 020
2020	7670	408	322 000	35 830

Source: (EBAN, 2016, pp.. 1-2; EBAN, 2017, p. 6; EBAN, 2018, p. 6; EBAN, 2021, pp. 10-11)

Assumptions for future business angel investment trends

Angel investors are one of the main sources of financing for the European companies in the early stages of development, which, in addition to financing, provide development support and mentoring. The economic and social impacts of business angels show that they play a key role in the economy as they contribute to the development of private capital, business experience and skills that support the growth of small businesses. Angels' investments should be considered an important means that should encourage others to support entrepreneurs and innovation.

Business angel networks provide a communication channel through which entrepreneurs can present their investment proposals to potential investors, and investors can explore investment opportunities without compromising their privacy (Mason & Harrison, 1997).

As mentioned, during 2020, there was a decline in investments of angel investors, and this is the only decline since 2008. The market for visible angel investors has actually

been growing steadily since 2011. The European investment activity of angels in 2020 is approximately 80% higher than in 2011, and this growth is expected to continue in 2021.

Despite the uncertainty created by the pandemic, the effects on the investment community at an early stage varied significantly across European countries. Despite some initial difficulties in adjusting to the "new normal", networks and individual investors have used digital technologies to continue to assess and monitor initial investments.

Over the past few years, the market for angel investors has grown in terms of the total amount of invested funds, the number of deals and the number of business angels, which is also expected in the future. Angel investors are playing an increasingly important role in the economy of countries around the world. As a result, they have attracted the attention of policy makers.

Governments typically provide financial support to BANs (Business Angels Networks) to enable them to improve market efficiency by connecting angels with entrepreneurs seeking finance (OECD, 2011). At the beginning of the development of this market, institutional support is of particular importance, as evidenced by the example of Great Britain, where certain networks of business angels were shut down after losing government support. Network development requires sustainability and the existence of a commercially viable model, especially in the early stages, when it is necessary to provide investment preparation and investor training programs. Following the example of the developed countries of the world and Europe, which have supported the development of the business angel market, guided by their importance for the development of entrepreneurial spirit and willingness to take risks, developing countries should also work on performing more focused activities.

The government of each country has a big role in attracting investors, so business angels should be talked about as investors, especially in the region, since their capital is necessary, and they still do not appear in this field, or they do, but insufficiently. Also, the EU regulators should promote and support cross-border angel investments.

The angel investment market has developed significantly in many countries around the world, especially in the last 15-20 years. In some countries, policies to encourage more angel investors seem to have played an important role. This includes supply-side measures, such as tax incentives and the creation of co-investment funds.

An adequate entrepreneurial ecosystem is key to a successful angel investing. Entrepreneurship does not function in a vacuum. It can only flourish in a healthy entrepreneurial ecosystem in which many stakeholders play a role, including entrepreneurs, investors, large companies, universities, governments, service providers, etc. Governments can help by providing appropriate legal and financial conditions and by helping to address market failures. However, the main actors in building the angel market must be the angel investors themselves.

Summary, recommendations

Angel investors are the primary source of funding for new ventures and appear to be largely heterogeneous in terms of personal traits and characteristics. In addition to the benefits of capital infusions, companies in which they invest benefit from the entrepreneurial and investment experience of business angels, knowledge about the industry and a network of business contacts. These competencies are transferred directly to the firm; they form the basis on which the company's capabilities are built and are responsible for superior performance. Therefore, it is considered that the presence of greater availability of capital, together with an additional set of non-monetary contributions, affects the growth prospects of financed ventures.

The investments of European business angels have a growing trend, and their influence on the development of companies is growing. With this, business angels have strengthened their position as the most important source of financing for start-ups and small and medium-sized enterprises in the early stages of development.

Business angel investments accounted for the largest share of the European investment market in 2020, followed by Early Stage VCs and group equity financing. These three forms of investment at an early stage had stable growth between 2015 and 2019, but declined in 2020 due to the Covid-19 pandemic. Business angels invested around 6.1 billion euros in Europe alone in 2015, and in 2019 these investments reached 8.04 billion euros. In 2020, however, business angels invested 7.67 billion euros, which was almost 58% of the total investment in the early stages of European business.

The European capital market is highly fragmented, but what has been recognized is the need to unify the market and move towards a single-type functioning, in order

to provide opportunities for the most diverse activities of investors such as business angels, outside the local framework. Also, states can provide massive support to the development of business angels, and they often provide financial and other incentives, which is especially important in the period after the crisis caused by the pandemic. Despite the fact that the investments of business angels in 2020 decreased compared to before, as well as the fact that investors are considered to have postponed their investments in the previous period due to market instability, it is believed that this market will continue its upward trajectory in the future.

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The Fama-French Five-Factor Model: Evidence of the Emerging Markets Exchange Traded Funds Performance

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Abstract The main purpose of this study is to provide an insight into the investment performance of emerging markets' exchange-traded funds. The Fama-French five-factor model was used to perform the regression of the returns of individual exchange-traded funds that have exposure to emerging markets, against the model's factors. The study uses monthly returns and covers the period from August 2017 until December 2021, due to the exchange-traded funds' inception date the track record was limited. Overall, the findings are in the line with the Fama-French five-factor model initial results. According to these results, expected positive contributors to the investment performance are, in the presented order of importance, market premium and small-capitalization, as well as funds' tilt towards stocks of the companies with strong operating profit and conservative investing policy. However, there is one exception and that is the growth style that outperformed the value style. Therefore, the value-style tilt of some of the emerging markets' exchange-traded funds led to negative performance contributions, because the style was out of favor. At the same time, during the observed period, there were no exchange-traded funds that delivered statistically significant alpha. Moreover, only one of emerging markets' exchange-traded fund produced a positive alpha, the other three underperformed in relation to the adequate benchmark as per the Fama-French five-factor model.

Keywords: Emerging markets, Fama-French model, Exchange-traded funds' performance

JEL: G110

Introduction

This study aims to provide insight into the investment performance of exchange-traded funds (ETFs) that have exposure to emerging markets. The component of the investment performance evaluation process that needs to be applied to accommodate the stated aim is known as investment performance attribution. To conduct investment performance attribution, it is necessary to identify the components of the excess return concerning the appropriate benchmark. Various attribution models are used to fulfill this goal. However, all the models can be categorized into two groups that are used for investment performance attribution.

The first group is known as asset-based models. These types of models use, in addition to historical returns, holdings data for the portfolio and benchmark (Korenak & Stakic, 2021).

The second group is represented by factor models. The model that has been used in this research belongs to this group. The literature review section provides a chronological

overview of the mentioned models group, as well as its application in the research that followed.

Theoretical premises

Arguably the most used factor model, partially due to its simplicity, is Capital Asset Pricing Model (CAPM), introduced many decades ago, even though it failed many empirical tests (Black et al., 1972; Fama & French, 2004). This is a single factor model that explains expected return using the market premium as a factor.

As an extension to the CAPM, Fama-French three-factor model identifies common risk factors in the returns on stocks and bonds (Fama & French, 1993). Regarding the stock-market, three factors were identified: an overall market factor, same as in CAPM, and additional factors related to firm size, small minus big (SMB), and book-to-market equity, high-minus-low book-to-market ratio (HML). According to the model extension, there are stock return premiums for the stocks that have small market capitalization and the ones that can be characterized as value-style stocks based on a high book-to-market ratio.

Another extension to the model is the Carhart (1997) four-factor model, which uses momentum as an additional factor (Carhart, 1997). For example, one of the studies applied the Fama–French and Carhart models to the South African stock market (SASM) (Boamah, 2015). The study examined the ability of the models to capture size, book-to-market, and momentum effects on the SASM. The author offered evidence that size, book-to-market, and momentum effects exist on the SASM. Also, the small- and high-book-to-market stocks portfolios, respectively, appear riskier than the big- and low- book-to-market stocks portfolios

One of the most prominent examples of the multi-factor model is the Fama-French five-factor model (Fama & French, 2015). The five-factor model extends the three-factor Fama-French model by adding two factors: robust-minus-weak profitability (RMW) and conservative-minus-aggressive investment (CMA). According to model extensions, there are additional stock return premiums for the companies that have a higher level of profitability and for the ones who invest conservatively. The authors also concluded that with the addition of profitability and investment factors, the value factor of the previously used

three-factor Fama-French model becomes redundant for describing average returns in the sample that they examined.

In the following paper, the same authors show that positive exposures to RMW and CMA (stock returns that behave like those of profitable firms that invest conservatively) capture the high average returns associated with the low market beta, share repurchases, and low stock return volatility, and vice versa (Fama & French, 2016).

The study that followed covered the international markets application of the Fama-French five-factor model, and concluded that the average stock returns for North America, Europe, and the Asia Pacific increase with the book-to-market ratio (B/M) and profitability are negatively related to investment. That is in the line with the original conclusions from the prior studies. On the other hand, what is also common with the previous research conducted by Fama-French model's main problem is the failure to fully capture the low average returns of small stocks whose returns behave like those of low profitability firms that invest aggressively (Fama & French, 2017).

The paper published by Foye J. studied whether the new Fama-French five-factor model can offer a better description of emerging market equity returns than the three-factor model. The study covered three different geographic regions, across 18 emerging markets. The findings suggest that the five-factor model consistently outperforms the three-factor model in Eastern Europe and Latin America. On the other hand, a profitability or investment premium cannot be distinguished in the Asian markets and the five-factor model fails to provide an improved description of equity returns in the region (Foye, 2018).

Horváth, D. and Wang, Y.-L. (2021) pointed out that the Fama-French five-factor model performed poorly during the Covid-19 outbreak. The comparison was made to the financial crisis of 2008, when the model also drastically lost its explanation power based on the coefficient of determination (Horváth & Wang, 2021).

In one of the most recent published studies that used the Fama-French five-factor model, Mollaahmetoğlu E. (2021) tested model validity for Istanbul and German Stock Exchanges. Findings suggest that there is not enough evidence to support the explanation power of the five-factor model. The author argues that a four-factor model would be a better fit for the stock returns listed on the Istanbul stock exchange. He also concluded

that contraction of the model's factors would be a better fit for the German stocks (Mollaahmetoğlu, 2021).

The study conducted by Dutta, A. (2019) came to a similar conclusion, i.e. that five-factor specification is more powerful than three-factor specification. However, the findings also suggest that if the book-to-market factor is excluded from the five-factor model, the resulting four-factor model documents almost similar power to the five-factor model (Dutta, 2019).

Mosoeu, S. and, Kodongo O. used Fama-French five-factor model on selected developing and developed equity markets. Their findings suggest that profitability is the single most important factor explaining average equity returns in emerging markets. However, the authors also found out that the market factor does not appear to explain emerging markets' equity returns during the observed period (Mosoeu & Kodongo, 2020).

Methodology

Monthly returns of four emerging markets exchange-traded funds were used. The observed period is from August 2017 to December 2021 (the track record is limited due to the inception date). The following ETFs are included: Invesco BLDRS Emerging Markets 50 ADR (ADRE), iShares MSCI BRIC ETF (BKF), iShares MSCI Emerging Mkts ex-China ETF (EMXC), and SPDR S&P Emerging Markets Small-Cap ETF (EWX).

The first version of the Fama-French model was an extension of the industry's prevailing model at the time, mainly to its simplicity. It was a single factor model, known as the CAPM. The only factor it considers is the difference between market and risk-free return.

In addition to market premium, the researchers argued that two more factors possess explanation power. First is the size of the company, observed through market capitalization. The other is a proxy for the value investment style, namely the book-to-market ratio. The rationalization behind the inclusion of the additional factors is that small companies, on average, should outperform their large peers, at the same time companies that have higher book-to-market ratios should outperform the ones with lower ratios.

Acronym SMB stands for the small minus big (market capitalization) and HML stands for the high minus low (book-to-market ratio).

(1) $$R_{it} - R_{ft} = a_i + b_i(R_{Mt} - R_{ft}) + s_i SMB_t + h_i HML_t + e_{it}$$

In the year 2015, the authors revisited their original model and proposed an extension to it. Two additional factors have been added.

(2) $R_{it} - R_{ft} = a_i + b_i(R_{Mt} - R_{ft}) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + e_{it}$

In practice, there are different ways in which the factors can be obtained. We present the 2x3 approach. This approach is based on six size/book-to-market, six size/operating profitability, and six size/investment portfolios. Size factor can be obtained as the average return on the nine small-size portfolios minus the average return on the nine large-size portfolios.

(3)
$$\text{SMB(B/M)} = 1/3 \text{ (Small Value + Small Neutral + Small Growth)} -$$
$$1/3 \text{ (Big Value + Big Neutral + Big Growth)}$$

(4)
$$\text{SMB(OP)} = 1/3 \text{ (Small Robust + Small Neutral + Small Weak)} -$$
$$1/3 \text{ (Big Robust + Big Neutral + Big Weak)}$$

(5)
$$\text{SMB(INV)} = 1/3 \text{ (Small Conservative + Small Neutral + Small Aggressive)} -$$
$$1/3 \text{ (Big Conservative + Big Neutral + Big Aggressive)}$$

So, the SMB factor is a simple average of the previously obtained components.

(6)
$$\text{SMB} = 1/3 \text{ (SMB(B/M) + SMB(OP) + SMB(INV))}$$

The rest of the factors can be obtained in the following way.

(7) $\text{HML} = 1/2 \text{ (Small Value + Big Value)} - 1/2 \text{ (Small Growth + Big Growth)}$

(8) $\text{RMW} = 1/2 \text{ (Small Robust + Big Robust)} - 1/2 \text{ (Small Weak + Big Weak)}$

(9)
$$\text{CMA} = 1/2 \text{ (Small Conservative + Big Conservative)} -$$
$$1/2 \text{ (Small Aggressive + Big Aggressive)}$$

Results

The results of the Fama-French five-factor model are presented at the individual level for all four analyzed emerging markets exchange-traded funds (Tables 1, 2, 3, and 4). The

coefficients of determination range from 91.96% to 96.80%. F-stat shows a high value and corresponding low p-value for all tested ETFs. There is no presence of significant autocorrelation and heteroscedasticity.

When the market premium is high, all observed emerging markets ETFs perform well, as expected. The coefficients are close to one (0.95 to 1.09). At the same time, t-stat is in the range of 19.453 to 30.390, which leads to the conclusion that this factor has very high explanation power concerning the performance.

The periods when small-size stocks outperform large-size stocks lead to a favorable outcome for two out of four observed ETFs. ADRE and BKF ETFs show a clear exposure tilt towards large-cap stocks. On the other hand, EWX shows relatively significant exposure to small-cap stocks. In both cases t-stat is significant. At the same time, EMXC is relatively neutral when it comes to market cap tilt.

The relative performance of value versus growth style based on market-to-book ratio does not pose significant explanation power, for all observed ETFs. This can be concluded based on relatively low coefficient values with the corresponding low t-stat.

Two more factors need to be considered. The operating profit factor shows a relatively low coefficient but with statistical significance in the case of ADRE, meaning when the returns on the high profitable stocks outperform their peers, the impact is negative for the mentioned ETF.

The investing factor indicates that ADRE and BKF have exposure to the stock of the companies that pursue more aggressive investing policies. The opposite is true when it comes to EMXC. At the same time, the t-stat value suggests statistical significance. The same factor does not show significance in the case of EWX.

Table 1. Invesco BLDRS Emerging Markets 50 ADR

(ADRE) Fama-French Five-Factor Model Results

(Aug 2017-Dec 2021)

Factors	Rm-Rf	SMB	HML	RMW	CMA	Annual Alpha	R^2	F-stat
coefficient	1.04	-0.65	-0.05	-0.44	-0.49	-0.34%	91.96%	107.5
t-stat	19.182	-4.099	-0.261	-2.216	-2.239	-0.116		
p-value	0.000	0.000	0.795	0.032	0.030	0.908		

Source: own work

Table 2. iShares MSCI BRIC ETF (BKF) Fama-French Five-Factor Model Results

(Aug 2017-Dec 2021)

Factors	Rm-Rf	SMB	HML	RMW	CMA	Annual Alpha	R^2	F-stat
coefficient	0.95	-0.48	0.07	-0.15	-0.67	-0.67%	92.28%	112.4
t-stat	19.453	-3.375	0.445	-0.867	-3.426	-0.258		
p-value	0.000	0.001	0.658	0.390	0.001	0.798		

Source: own work

Table 3. iShares MSCI Emerging Mkts ex-China ETF

(EMXC) Fama-French Five-Factor Model Results
(Aug 2017-Dec 2021)

Factors	Rm-Rf	SMB	HML	RMW	CMA	Annual Alpha	R^2	F-stat
coefficient	1.09	0.09	-0.02	0.13	0.64	-1.06%	96.15%	235.0
t-stat	30.390	0.830	-0.191	1.005	4.497	-0.553		
p-value	0.000	0.411	0.850	0.320	0.000	0.583		

Source: own work

Table 4. SPDR S&P Emerging Markets Small-Cap ETF (EWX) Fama-French Five-Factor Model
Results
(Aug 2017-Dec 2021)

Factors	Rm-Rf	SMB	HML	RMW	CMA	Annual Alpha	R^2	F-stat
coefficient	0.99	0.72	0.08	-0.06	0.03	0.86%	94.80%	171.5
t-stat	24.966	6.258	0.609	-0.430	0.179	0.404		
p-value	0.000	0.000	0.545	0.669	0.859	0.688		

Source: own work

Annualized alphas are negative for three out of three ETFs. They also show no statistical significance. For the model comprising purpose, using the three-factor Fama-French model, EWX was once again the only ETF that delivered the positive alpha. Also, the five-factor model provided higher explanatory power than the three-factor model. Only when the coefficient of determination was adjusted to penalize the additional factors, it resulted in slightly less value in the case of the five-factor model for EWX (Table 5).

Table 5. Multifactor models comparison

Name	Fama-French Three-Factor model			Fama-French Five-Factor model		
	Monthly Alpha	R^2	R^2 Adjusted	Monthly Alpha	R^2	R^2 Adjusted
ADRE	-0.09%	90.4%	89.8%	-0.35%	92.0%	91.1%
BKF	-0.05%	90.3%	89.7%	-0.06%	92.3%	91.4%
EMXC	-0.10%	94.5%	94.2%	-0.09%	96.2%	95.7%
EWX	0.06%	94.8%	94.5%	0.07%	94.8%	94.3%

Source: own work

Investment performance appraisal measures for the observed ETFs confirmed that SPDR S&P Emerging Markets Small-Cap ETF (EWX) outperformed the peer group on a risk-adjusted basis. That can be seen by higher values of Sharpe, Sortino, Calmar, and Information ratios. At the same time, it exhibits the lowest expected losses according to VaR., with exception of analytical VaR for the benchmark that is slightly lower. This time a single-benchmark iShares MSCI Emerging Markets ETF (EEM) that captures 24 emerging markets countries was used (Table 6).

Table 6. Descriptive Statistics and Investment Performance Appraisal for Emerging Markets ETFs (Aug 2017-Dec 2021)

Measure	ADRE	BKF	EMXC	EWX	Benchmark
Arithmetic Mean (monthly)	0.51%	0.50%	0.69%	0.78%	0.52%
Arithmetic Mean (annualized)	6.25%	6.11%	8.59%	9.80%	6.45%
Geometric Mean (monthly)	0.34%	0.36%	0.54%	0.64%	0.40%
Geometric Mean (annualized)	4.19%	4.37%	6.64%	8.00%	4.86%
Standard Deviation (monthly)	5.77%	5.29%	5.48%	5.22%	5.04%
Standard Deviation (annualized)	19.99%	18.31%	18.98%	18.09%	17.45%
Downside Deviation (monthly)	3.82%	3.55%	3.75%	3.57%	3.44%
Maximum Drawdown	-27.76%	-25.91%	-34.43%	-35.85%	-29.69%
Beta	1.08	1.01	1.02	0.95	1.00
Alpha (annualized)	-0.71%	-0.37%	1.89%	3.42%	NA
R Squared	89.27%	91.95%	87.49%	84.09%	100.00%
Sharpe Ratio	0.25	0.26	0.38	0.45	0.29
Sortino Ratio	0.37	0.39	0.54	0.66	0.43
Treynor Ratio (%)	4.58	4.80	7.03	8.70	5.15
Calmar Ratio	0.42	0.38	0.40	0.58	0.42
Active Return	-0.67%	-0.49%	1.78%	3.14%	NA
Tracking Error	6.71%	5.19%	6.72%	7.26%	NA
Information Ratio	-0.10	-0.09	0.27	0.43	NA
Skewness	-0.09	-0.27	-0.80	-1.01	-0.48
Excess Kurtosis	0.57	0.84	3.75	4.23	0.93
Historical Value-at-Risk (5%)	-8.14%	-7.24%	-6.47%	-5.22%	-6.79%
Analytical Value-at-Risk (5%)	-8.99%	-8.20%	-8.32%	-7.81%	-7.76%

Source: own work

However, to get a better insight into the investment performance of the emerging markets' ETFs it is necessary to decompose the tracking record. To do that the performance attribution results are presented (Table 7).

Starting with the market premium, the outperformance of the stock market about the risk-free proxy created a quite favorable environment for all observed emerging markets ETFs. The outperformance of the small to large stocks created an additional layer of positive return to the ETFs that had a bias toward the small-cap stocks. At the same time, ADRE and BKF experienced negative return contributions due to their tilt towards large-cap stocks. The results are in the line with expectations of the Fama-French model studies and the outperformance of the small- vs large-cap stocks.The value style delivered lower returns than the growth style, judging by the book-to-market ratio. Due to exposure to stocks with a relatively high book-to-market ratio, in the case of ADRE and EMXC the value was lost. The other two ETFs had the benefit of the growth style outperformance. Exposure to stocks of the companies that have strong operating profits together with the outperformance of these stocks to their peers resulted in the added value only in the case of EMXC. The stocks of the companies with conservative investing have underperformed. However, due to the negative exposure to this factor, the value was added in the case of EMXC and EWX.

Table 7. Emerging Markets ETFs Performance Attribution (Aug 2017-Dec 2021)

Name	Rm-Rf	SMB	HML	RMW	CMA	Total	Annual Alpha	R^2
Invesco BLDRS Emerging Markets 50 ADR (ADRE)	59.44	-3.48	-1.38	-6.30	-3.87	41.58	-0.34%	91.96%
iShares MSCI BRIC ETF (BKF)	54.07	-2.57	2.11	-2.21	-5.31	40.46	-0.67%	92.28%
iShares MSCI Emerging Mkts ex-China ETF (EMXC)	61.91	0.46	-0.66	1.88	5.11	59.85	-1.06%	96.15%
SPDR S&P Emerging Markets Small-Cap ETF (EWX)	56.40	3.88	2.35	-0.89	0.23	69.13	0.86%	94.80%
Factor Premiums (BPS)	56.91	5.38	30.08	14.36	7.94			

Source: own work

Conclusion

The main purpose of this study is to provide an insight into the investment performance of emerging markets' exchange-traded funds, and it was achieved by deploying the Fama-French five-factor model for the observed emerging markets ETFs.

Fama-French five-factor model showed a higher explanation power in relation to the three-factor model and single-benchmark model. It is worth mentioning that there is a high level of consistency among models and appraisal measures regarding ETFs' excess return and risk ranking.

Classifying an ETF as an emerging market investment might not be insightful enough for an investor. Utilizing this model from the perspective of an investor provides an insight into the factor exposures of the particular ETFs that are part of the current portfolio or being considered to be included in the portfolio. Only once being able to understand the associate risk exposures of emerging markets ETFs, as a relatively new investment instrument, should be included in the portfolio. Moreover, an ETF risk/return profile needs to be always considered in the overall portfolio context.

The findings lead to a twofold set of conclusions. The first pertains to the Fama-French five-factor model application itself and corresponding factor exposures. The other set of findings pertains to the performance attribution of the analyzed emerging markets ETFs and their components.

Within the span of the observed relative short-time period, the market premium is still the main factor to explain the investment performance of the emerging markets ETFs. That means that emerging market stock premium over risk-free rate is the key determinant of the emerging markets ETFs, as expected. The size factor is in the line with initial findings from the Fama-French model, and subsequent studies. The small-cap stock outperformed on average the ones with large-cap.

However, the value style has been out of favor in comparison to the value style for the past decade and is shown in this study as well. The emerging markets stocks of the companies that have higher operating profit outperformed their peers. This is also in line with expectations from the model. Finally, the stocks of the companies that had conservative investing policies outperformed in relation to their peers. Once again this is in the line with the model expectations.

Overall, the findings are in the line with the Fama-French five-factor model initial results. According to these results expected positive contributors to the investment performance are, in the presented order of importance, market premium and small-capitalization, as well as funds' tilt towards stocks of the companies with strong operating profit, and conservative investing policy. However, there is one exception and that is the growth style that outperformed the value style. Therefore value-style tilt of some of the emerging markets ETFs led to negative performance contributions because the style was out of favor.

Understanding the source of the realized ETFs results is possible by using multifactor models for the investment performance attribution. Doing so makes it relatively straightforward to determine which factors were in favor and due to exchange-traded funds' exposures over time the given performance was delivered. Exposures to the given factors defined the direction and levels of sensitivity. Together with the market premium and other factors effects the performance of each emerging market ETFs were presented.

Lastly, during the observed period, there was no emerging markets ETF that was able to deliver statistically significant alpha. Moreover, only one emerging markets ETF produced a positive alpha, the other three underperformed in relation to the adequate benchmark as per the Fama-French Five-Factor model. The excess return results show a high level of consistency using the Fama-French three-factor model, as well as the single-benchmark model.Possible further studies that may complement this one might be in the field of asset-based attribution. The same one would include in addition to return track-record dynamic holdings data for emerging markets ETFs and benchmarks. The application of both types of mentioned investment performance attribution models provides an explanation of all aspects of return and risk sources of the observed ETFs. Additionally, it quantifies the sources of investment success and offers in-depth feedback regarding the impact of investment choices on risks and realized returns. This kind of information is highly valuable to the current and potential investors in emerging markets ETFs.

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Labor market characteristics of the youth in Serbia and trends of labor migration in EU

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Abstract: Youth unemployment has been an important economic and social issue over the last decades. The transition from education to work has become more difficult for young people all over Europe. As for Serbia, according to the analysis of the youth labour market, unfavourable circumstances of the post-socialist transformation in Serbia and unfavourable economic trends, as the consequence of the global economic crisis and the current pandemic crisis, have additionally aggravated the problem. Given the unfavourable position on the youth labour market, majority of young people, not only from Serbia, are seriously taking into account migration, which has played an important role in the new globalized world where the borders and restrictions on free movement of people, goods and capital have been removed. What is worrying is the fact that in Serbia, in recent decades, there has been a very high rate of migration of the population with tertiary education, which is considered to be most strongly influenced by economic and other various factors in the labour market. This situation, except for losing human resources, directly contributes to and affects the loss of the intellectual potential of the state. Therefore, the paper presents, first of all, the situation on the labour market and the position of young people in Serbia, followed by the most common motives and causes of migration of young people from Serbia into the countries of the European Union (EU).

Key words: labor market, youth unemployment, migration of young people

JEL: J21, J60, E24, F66

Introduction

The problem of unemployment is considered to be one of the key economic factors that directly affect the economic stability of a country, particulary the problem of youth unemployment, which has not been handled since the recession caused by the global financial crisis up to now, further aggrevated by the consequences caused by the current pandemic crisis.

Analysing this situation in terms of the youth population in Serbia, we can outline that in the previous period, there were some improvements according to the official analysis, but despite those improvements, young people still have great difficulties in accessing and participating in the labour market, finding a stable job, as well as staying employed.

Fairly high unemployment rate of young people worldwide, the most mobile part of the population, is a major problem that almost every young person faces after graduation, and given that knowledge tends to be the most important economic resource, labour

migration is becoming the dominant form of migration flows. Since in Serbia, over the last decades, there has been a very high rate of migration of the population with tertiary education, which is considered to be most strongly influenced by economic and other various factors in the labour market, we need to be aware that in addition to great loss of human resources, this is the loss of the intellectual potential of the state as well.

Therefore, the paper presents, first of all, the situation on the labour market and the position of young people in Serbia, followed by the most common motives and causes of the migration of young people from Serbia into the countries of the European Union (EU).

Theoretical premises

The importance of human capital is being recognized in both developed and developing countries, considering that we live in the era of globalization, fierce competition, continuous technology development and innovation (Matovac Andrejević et., 2010). High rate of unemployment demonstrates a low level of economic activity in the country, insufficient utilization of human resources and a lower average quality of life in the country.

Employment and unemployment are fundamental issues of every modern economy, and a rise in employment and a fall in unemployment are considered one of the criteria for societies' development (Kheiravar and Qazvini, 2012). A large unemployment rate causes concerns because of all socio-economic factors that directly cause this phenomenon (Tošović-Stevanović, Bogdanović, 2018).

Before the pandemic crisis, according to a report by the International Labor Organization (ILO, 2019), the mismatch between labor supply and demand exceeded 188 million unemployed people worldwide in 2019. An additional 165 million people were employed, but wanted to work more paid hours. This low trend continued after the pandemic crises with more difficulties and damage. According to the last report from 2021, the latest global estimates and country-level data confirm the unequal employment impact of the Covid-19 crisis in 2020, and the fragile, and often diverging, recovery trends over the first half of 2021, as well as the fact that a number of people employed and participating in the labor force has not fully recovered, and "labor market slack" remains significant in many countries (ILO, 2021).

The situation before Covid-19 was worrisome and unfavorable, but young people, impacted by the crisis, continue to face greater employment deficits, especially in middle-income countries. During the pandemic, employment rates of young workers have been 2.5 times greater than adult workers. The second problem young people were facing was disrupted education and training, which has negatively affected the transition of many individuals from school, vocational training, or university to the labor market. All these negative effects will be new problems for young people, because of the necessary skills development substantial for the workforce (ILO, 2021).

Many young people experience a difficult transition from school or university to a first job, which can take many months or even years (Oruc, Bartlett, 2017).

Due to all the above-mentioned data, the transition of young people to the world of work is a current issue in modern researches and scientific analyses, and one of the most common reasons for this is the fact that young people are more likely to get jobs in low-productivity and poorly paid positions, they are insufficiently protected and become unemployed easily, while at the same time they find new employment more slowly (Savković, Gajić, 2016; Tomanović et al., 2012; Mojić, Petrović, 2013; Tomanović, Stanojević, 2015), which is why young people are often considered to be a vulnerable social group.

According to Stanojević and Pavlović (2021), regardless of their position, research into NEET youth in Serbia is relatively rare, generally focusing on their position within the context of overall youth employment. Moreover, it has mainly dealt with the economic position of the youth (Stanojević, Petrović, 2018), their transition into the labour market (Tomanović, Stanojević, 2015) or problems facing those at risk of social exclusion (Aleksic et al., 2021).

Accordind to Bell and Blanchflower (2011), the "scarring" effects of long-term youth joblessness leaves a legacy that reduces lifetime earnings, increases the risk of future periods of unemployment, augments the likelihood of precarious employment, and results in poorer health, well-being, and reduced job satisfaction more than 20 years later. So current levels of youth unemployment need to be understood in the context of increased labor market flexibility, an expansion of higher education, youth migration, and family legacies of long-term unemployment (O'Reilly et al., 2015).

Regardless of their position, many young people, not only from Serbia, think about migration, which has played an important role in the new globalized world, where borders and restrictions to free movement of people, goods and capital are being removed. The analysis of labor market characteristics of young people in Serbia with the analysis of general economic, political and social situation in the country can contribute to the decision of young people whether to migrate or not. This primarily refers to the category of young people migrating mostly from Eastern to Western European countries. The volume of migration varies from region to region, so greater mobility potential is noticed in economically less developed parts of the country (ETF, 2010). This primarily refers to the category of young people migrating mostly from Eastern to Western European countries, but migration activities to non-EU countries are also noticeable, which follows the principle that young people from economically developed countries move to even more developed and richer countries during economic recessions (O'Reilly et al., 2015).

Human capital is considered to be an important factor of economic growth and development, as well as one of the sources of competitive advantages. In order to attain highly skilled human capital, countries should improve their labor market competitiveness and increase investments in education, science and technology (Andrejević Matovac, 2010). Human capital, especially intellectual capital, is one of the basic factors in the competitiveness of enterprises and the economy (Jovanaci & Tošović-Stevanović, 2013).

Labor market characteristics of the youth in Serbia

Youth unemployment in Serbia had been considered an important economic and social issue in recent decades, but it has become even more important after the global economic crisis and the current pandemic crisis. Youth unemployment is also a problem in the rest of Europe, but the circumstances of post-socialist transformation, economic instability and the transition period, further deepened by the global economic and pandemic crisis, also resulted in an unfavourable climate in Serbia. In Figure 1, we can see the the youth unemployment rate from 1999 to 2019 and the direct impact of the mentioned circumstances.

Figure 1. Youth unemployment rate from 1999 to 2019.
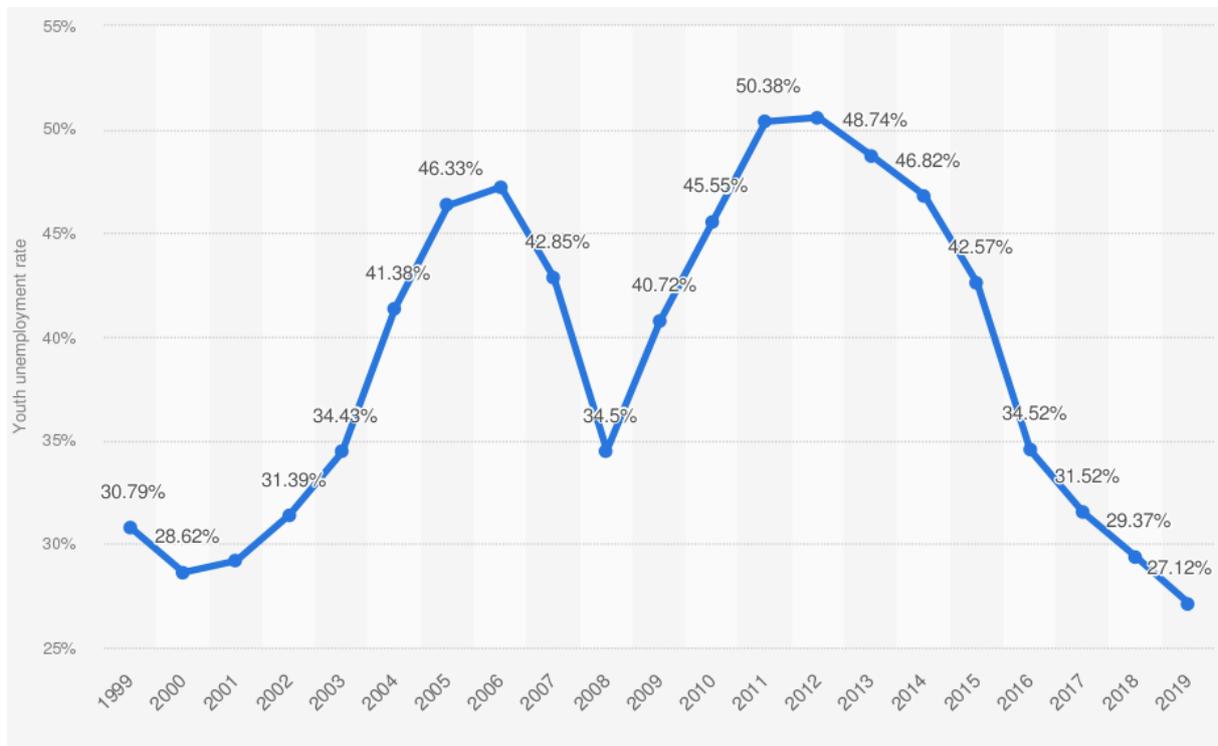
Source: Statistica - World Bank, 2022.

The situation of the labour market in regards to the situation of the youth in Serbia improved in the 2015–2019 period was better. Activity and employment increased, the employment rate of young people (15–24 years) increased by almost 5 percentage points and was close to the average for the Western Balkans (20% in 2018), but still far from the average for EU Member States (35% in 2018).

When entering the labour market, young people face difficulties, and those who are not in education, employment or training (NEET) are of particular concern. The NEET rate is a relatively recent indicator and it was designed to include a particularly vulnerable group of young people who had not been sufficiently supported by active employment policy measures and posed a particular challenge to economic policy makers (Eurofound, 2012).

This category of young people is characterized by low motivation and low self-confidence, as well as insufficient interest in social events and inadequate skills for finding employment. According to statistical data of Statistical office of the Republic of Serbia (2020) and Eurostat (2020), the NEET rate of the Republic of Serbia (RS) is 20.7%, almost 5 p.p. higher compared to the EU's average.

Table 1. NEET statistics, 2020, Serbia.

	Youth 15 to 24				
	2016	2017	2018	2019	2020
NEET rate	**17.7**	**17.2**	**16.5**	**15.3**	**15.9**
Unemployed persons	9.3	8.7	8.1	7.5	6.7
Persons outside the labor force (former name: inactive persons)	8.4	8.5	8.4	7.8	9.2
Persons who would like to work (seeking employment or not)	14.4	13.6	12.5	11.2	11.5
Persons who do not want to work	3.3	3.6	4.0	4.1	4.4
	Youth 15 to 29				
	2016	2017	2018	2019	2020
NEET rate	**22.3**	**21.7**	**20.1**	**19.0**	**20.0**
Unemployed persons	12.3	11.2	10.6	9.2	8.4
Persons outside the labor force (former name: inactive persons)	10.0	10.5	9.5	9.7	11.6
Persons who would like to work (seeking employment or not)	19.7	18.1	16.4	14.5	14.7
Persons who do not want to work	3.8	4.3	4.5	4.8	5.3

Source: ETF, 2021; Eurostat, 2020.

As per European Training Foundation's (ETF) study results (2021), alarmingly, although the NEET rate in Serbia has also been declining gradually over the past 5 years, the number of young people who are not in education, employment or training (NEET) is still inordinately high. Although significantly higher than the EU average, where NEET rate for youths aged 15 to 24 was 11.1% and 13.7% for youths aged 15 to 29, the share of NEETs in the total youth population in Serbia is generally somewhat lower than in the economies of the region, with the exception of Croatia (12.2% for youths aged 15 to 24; 14,6% for youths aged 15 to 29). In Europe (Table 2), Turkey has the highest NEET rate (32% youths aged 15 to 29), while the Netherlands has the lowest (5.7% for youths aged 15 to 29). According to some study results, the average school-to-work transition in Serbia lasts more than two years, being the highest among women and youths living in rural areas. The youth with the lowest level of education spend 19.4 months more to find their first job as compared to those with high-level education. As per focus group results, the main determinants of such a long school-to-work transition refer to outdated education system including entrepreneurship education curricula, coupled with low quality of the career management and counselling activities.

According to *Study on Youth Employment in the Western-Balkans* (2021), in the last part of the decade, up until the onset of the Covid-19 pandemic, all economies experienced fairly strong economic growth. This was reflected in improving employment rates, both overall and for the youth in the Western Balkans and in the EU. However, the improvement

in youth employment was slow in Serbia. Young people in the Western Balkans face many challenges in finding good quality jobs that match their skills and aptitudes. The economy reports have identified specific challenges facing young people on the labour market in each economy, as detailed in Table 2.

Table 2. Challenges of the youth labour market identified in economy reports

Factors related to the education system
Weaknesses in education systems
Inadequate work experience during school or university
High level of skill mismatch
Factors related to the job search process
Inadequate support for the education-to-work transition
Inadequate career advice and counselling services
Scarcity of information on job vacancies
Perceptions of unfair / informal recruitment practices
Youth preference for secure public sector jobs
Internship's revolving door
Factors related to the labour market
Inadequate number of jobs, especially in the private sector
High level of informality on the labour market
Prevalence of precarious employment
Long-term unemployment and the associated deuteriation of skills
Policy related factors
Insufficiently targeted youth employment policies
Absence of support and barriers to youth entrepreneurship
Inadequate consultation with young people

Source: Study on Youth Employment in the Western-Balkans, 2021.

There is a large gender gap in labour force participation, partly reflecting a shortage of child-care facilities for young mothers who wish to join the labour market. The gender gap is also reflected in female youth employment rates, which are everywhere below the male youth employment rates. The youth unemployment rate is significantly higher in rural areas, which creates a special social problem since a third of the population in this category simply moves in search of work first to a nearby town, then to a larger city, then across the border.

With a good "labour market scan" identifying misregulation and difficulties, all the afore-mentioned international organizations (public and private) aim to identify companies' recruitment needs, the situation of the youth, and the mismatch between the skills they possess and the skills they need to find a job. That is why everyone is focusing on additional education and new skills in order to find a job more easily.

Labor migration of the Serbian youth in the EU

Population migration is a very important social phenomenon, and with the process of globalization, these movements are becoming more frequent and noticeable. Although these mass migrations have been significantly influenced by the consequences of the world economic crisis, as well as the current pandemic crisis, we cannot link only these periods to labour migration from Serbia, because such a trend existed before. According to Stanković (2014), population migrations were in particular caused by the crisis and the war in the 1990s, as well as the unfinished process of transitional reforms in the 2000s; the prolonged period of the economic crisis did not result only from the international economic flows, there was also the accession of the neighbouring countries to the EU and intensified immigration activities of the ethnic minorities in Serbia who had the citizenship of these countries. In 2009, Serbia was included in Schengen White List, which is a factor that could have influenced the intensity of migration. The extent of migration also varies from region to region, so greater mobility potential is seen in economically less developed parts of the country (ETF, 2010).

The migration of the population since the 1960s in the previous century had the effect of reducing the number of permanent residents, both directly and indirectly. The Republic of Serbia directly lost its population by migration, and indirectly also their children, who moved with them, or were born abroad (Strategies on Economic Migrations of the Republic of Serbia for the Period 2021-2027). Nowadays, on the other hand, we have the situation where as many as 90% of young people, especially students, are thinking of leaving the country and have the full support of their parents.

The same can be said for internal migrations, i.e. the transfer of the population from rural to urban settlements due to intensive processes of urbanization, industrialization and deagrarization, which led to the devastation of rural areas and their emptying (Rašević, 2017).

For the purpose of this paper, we have analysed the *Student Migration Survey* (2018), which involves a total of 11,013 students from public and private colleges and universities, showing that a third of the respondents plan to go abroad after graduation, and as the main cause for leaving the country as many as 94.3% respondents state the reason of economic nature (impossibility of finding a job in their profession, impossibility of finding any job,

poorly paid job in their profession, impossibility of professional advancement, low standard of living, poor economic situation), while the remaining 5.7% state non-economic reasons (corruption, obeying the law, etc.). According to the share of students who plan to look for better living and working conditions in other countries, the students of information and communication technologies account for the biggest segment (36.5%), followed by the students in the field of medical sciences (36.2%).

According to the analysis of the *Student Migration Survey* (2018), one third of the students of natural sciences and mathematics, as well as the students of technical sciences plan to go abroad (33.8% and 33.9%, respectively); while the smallest share of those who plan to leave Serbia is among the students of social sciences and humanities (28.5%). The main reason for going abroad, according to the largest number of students (27.3%), is the impossibility of finding a job in their profession in the Republic of Serbia, followed by reasons related to low-paid jobs in the profession (21.3%), and low standard of living (20.1%) (Demographic Review, 2018).

Serbia is the leading country in the region in terms of migration of young people, and almost every fifth person (19%) has a vocational or university degree. The countries to which the largest number of the population with tertiary education migrated are Germany, the United States, Austria, Switzerland and Canada. The full availability of the information on the destination countries significantly accelerates emigration and migration. The negative migration balance is increasingly leading to a deteriorated demographic picture of Serbia. Better business offers and safer living conditions, as well as a shorter adaptive period, enable the migration of entire families, which leads to longer stays abroad of the entire family and moving away from the country of birth.

Conclusion

One of the key goals of every country is the adequate social integration of young people, because young people are expected to be the driving force and the foundation of the whole society in the future. Although considered a significant social resource, young people continue to face prolonged institutional education, inadequate and difficult employment conditions, difficulties in gaining independence and delayed family formation.

All of the above-mentioned data and researches conducted in Serbia on the current state and employment of young people and the migration of young people from Serbia into the EU countries aim to realistically analyse the situation and encourage the Government to adopt and implement concrete actions and mechanisms so as to create a favourable environment for the young people to stay in Serbia, i.e. to return to the country after completing their study programs abroad and thus contribute to the improvement and faster economic development.

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Development of the Nature-Reserved Fund of Ukraine on the Basis of the Best Polish Experience

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Abstract: Nature loss presents risks to future human prosperity and well-being of all nations. That is why every nation, sector and person play a key role in protecting the nature. Taking into account the fact that nature protection is a global problem, adaptation of national standards with European directives will make it possible to unify the financial support for the development of natural-protection fund (NPF) in Ukraine. Today the priority direction of Ukraine's foreign policy is the ratification of the agreement with the EU, the harmonization of national legislation on the nature protection preservation with European directives. COVID-19 and other high-threat destabilizing factors combine to constitute to the negative impact on economic condition of the EU states. The main objectives of this work are to integrate different knowledge and research from diverse sectoral, geographical, historical, political, managerial and institutional perspectives and to develop an efficient system of preserving ecosystems, in particular to implement of international experience and to improve the socio-cultural development level of Ukraine in the context of sustainable development. The object of study is nature-protected fund as the country's national wealth, while the subject of study is the process of development of Ukraine's nature-protected fund on the example of Poland's financing and positive experience under the conditions of climate change. The factor analysis of indicators on financing of NPF in Ukraine and Poland has been carried out. The main factors of NPF financing efficiency in the Republic of Poland and Ukraine have been compared. The main problems of state financing of nature-protected fund in Ukraine have been revealed. The measures to improve state financing of nature-protected fund in Ukraine on the best Polish experience base have been proposed. The correlation-regression modeling of environmental expenditures conducted in the work allowed to identify certain reserves for improving the economic and financial indicators of nature conservation in Ukraine in the long run to offset the negative impact of the COVID-19 pandemic. Furtheremore, on the basis of correlation-regression analysis between current environmental costs and innovation costs, conclusions were made on the effectiveness of environmental costs in Ukraine.

Keywords: Nature-Reserved Fund, Economy, Covid-2019, Development, Correlation-Regression Analysis

JEL: E 240, H 550

Introduction

Nature loss presents risks to future human prosperity and well-being of all nations. Today there must be comprehensive, worldwide efforts for protecting and restoring nature. The nature-reserved fund (NPF) ensures human life, maintains the ecological balance of territories and creates a safe ecological environment. Only losses of all pollinators (including moths, bees, butterflies and other insects) would lead to a drop in annual agricultural output of about US$ 217 billion []. To prevent losses from the destruction of the nature reserve fund by 2030, the world's total annual cost of maintaining ecosystems should be about $ 800 billion. This means that the deficit of funding for the conservation of the nature reserve fund in the coming years will be about $ 700 billion a year. Today, not all countries are ready to spend such funds on nature conservation. That is why, every nation, sector and person play a key role in protecting the nature.

The main objectives of this work are to integrate different knowledge and research from diverse sectoral, geographical, historical, political, managerial and institutional perspectives, and to develop an efficient system of preserving ecosystems, in particular to implement international experience and to improve the socio-cultural development level of Ukraine in the context of sustainable development. The *object* of study is nature-protected fund as the country's national wealth, while the *subject* of study is the process of development of Ukraine's nature-protected fund on the example of Poland's financing and positive experience under conditions of climate change. The main *purpose* of this article is to compare the economic impact of current expenditures on environmental protection in Ukraine and Poland with the main economic indicators of innovation spending in the country and assess their impact on the economy as a whole and nature protection in particular.

Theoretical premises

The state of the environment has always worried the great minds of the planet. After all, the future of each person depends on the state of nature. The famous scientist of ancient times, Cicero, emphasized the «great power of nature» (Cicero, 2022). And Charles-Louis Montesquieu said: "Nature always acts slowly and economically in its own way" (Montesquieu, 2022). Prominent people appreciated the power of the forces of nature.

Many famous quotes and sayings of great people about the need to preserve nature have become textbooks. For example, J. Goethe said: «Nature is always right. Mistakes happen because of people's actions» (Goethe, 2022). Indeed, everyone feels how harmonious the laws of nature are. It is the responsibility or vocation of modern man to preserve nature as pristine. Most importantly, it is necessary for the existence of humanity itself.

Methodology

The methodological basis of the study are the publications of domestic and foreign scientists in the field of nature reserves and environmental protection. In particular, a significant contribution to the development of nature reserves was made by such well-known scientists as A. Jaszczak, N. Małkowska, K. Kristianova, S. Bernat, E. Pochodyła (2021); W. Zgłobicki, S. Kukiełka, B. Baran-Zgłobicka (2020); I. Shkola, T. Orehovska, V. Kozmenko (2003); O. Korkuna, I. Korkuna, O. Kulyk, (2020). The issues of financing the conservation of the nature reserve fund were dealt with by such specialists as S. Bernat (2019); A. Yakymchuk, N. Popadynets, A. Valyukh, T. Skrypko K. Levkov (2021); P. Pasierbiak (2016). However, the trajectory of financing the territories and objects of the nature-protected fund of Ukraine is still undefined. The research is based on such methods as systems theory, organization theory, dialectical and analytical methods as well as the modeling method. An interdependence between current costs for environmental protection and innovation expenditures in Ukraine (2000-2020) have been found on the basis of correlation-regression model. The selective linear regression function in this case will look like:

(1)
$$\hat{y} = b_0 + b_1 x$$

where $\hat{y}$ – estimation of mathematical expectation of the dependent variable model (number of tourists); x – independent model variable (GDP per capita); b_0, b_1 – selective regression parameters. The statistical significance of the model was tested on the basis of Fisher's and Student's criteria. The following F-statistics (Fisher's F-criteria) have been used for verification:

(2)
$$F = \frac{R^2}{1 - R^2} \cdot \frac{n - k}{m}$$

which has a Fisher distribution with degrees of freedom $v_1=m$ i $v_2=n-k$.

To determine the significance of which parameters of the model provide its overall statistical significance, the statistical significance of the model parameters was checked by *t*-statistics were used (Student's criterion):

(3)
$$t_{b_j} = \frac{b_j}{\sigma_{b_j}}, \; j = \overline{0, m}$$

whereas b_j – estimation of the parameter $β_j$ of the theoretical regression, σ_{b_j} – standard error of the *j*-th parameter of the model.

The relationship between the current financing for environmental protection and innovation expenditures in Ukraine is close to linear, so in this case, as a relationship between variables, it is advisable to choose a linear function.

Literature Review

"Nature has granted the use of life like a loan, without fixing any day for repayment" – this statement of the famous philosopher and scientist Cicero has a deep meaning in our time, namely that nature gives us the basis for life – natural resources, environment and health, which are real treasures. Therefore, the preservation of nature for future generations is at the same time an indisputable condition for the existence of mankind in general.

Currently, ecotourism in Poland and Ukraine very well imbibes into sustainable tourism as a means of maintaining the social, cultural and natural environment of the community. It is worth noting that ecotourism sustainability also aims to increase the awareness and understanding of local cultures and environments through the participation of local people. J. Glenn Eugster (Nature writers and natural area, 2011) notes the importance of the line of work of professional ecologists. As the protection of our natural heritage is becoming increasingly difficult and more and more people are concerned about the loss of natural areas and species of plants and animals, it is necessary to find ways to actively involve ecologists in protecting other natural areas. By encouraging people to make personal connections with nature, environmentalists can really help change the way people feel about reserved natural areas and ultimately influence the future of these important natural systems and all their inhabitants.

The authors A. Deutz, G. M. Heal, R. Niu, E. Swanson, T. Townshend, L. Zhu, A. Delmar in their scientific work (Financing Nature, 2020) emphasize that the natural resources of the nature-reserved fund are still nonvalued financially , as a result of which the economy loses its income every year. Famous scientists E. Plambeck, G. Daily and D. Hoyt argue that any human activity reduces the quality and quantity of water flowing downstream to consumers, but maintaining natural ecosystems in good condition and managing their conservation can help ensure a clean and reliable water supply for downstream water users. By spending money on the restoration and preservation of natural ecosystems, water users can maintain a quality water supply (Water Funds, 2022).

R. Chami, T. Cosimano, C. Fullenkamp, and S. Oztosun (Nature's Solution to Climate Change, 2022) study the effect of carbon dioxide on the state of wildlife. Scientists believe that there is no time to lose in identifying and implementing new methods to prevent or reverse harm to the global ecosystem. That is why clear economic conservation measures must now be put in place, without waiting for decades, because society and our own survival can't afford to wait this long.

Results

Global financial crisis had consequences for almost every country, and resulted in serious economical losses. Unreasoned fiscal and financial politics causes collapses at the macro economical level, which lead to huge financial problems for all the economical subjects – of state and private sector. Influence of military-political instability on financial state safety has special consequences and cannot be ignored by any conditions, that is why the methodology of financial safety calculations should be adapted to modern conditions.

The environmental management instruments comprise several dozen positions. This is a diversified spectrum of detailed management instruments. There are several classifications of these instruments. The most frequently used one is divided into the following instruments: economic, administrative, legal, voluntary and instruments of social influence. Management subject is the widely perceived natural environment, i.e. the following levels of life: ecosystem, bio-geographical, species and genetic, as well as environment elements – space and land surface, wastes, atmospheric air, noise and vibrations, water, as well as pollution, radiation and ionizing radiation. The main

management instruments could be: economic entities and various organizational units, individuals, groups and communities.

Global community faces numerous threats, problems and local, regional and worldwide challenges:

- Covid-19 Pandemic,

- Debt crisis,

- The threat of global financial collapse,

- Uncontrolled demographic development,

- Poverty and social inequality as well as drug abuse and present-day civilization diseases.

The peculiarity of the system of environmental protection financing in the Republic of Poland is that each voivodship has a separate account for environmental protection expenditures, from which nature protection measures are financed. Polish National Fund for Environmental Protection and Water Management Fund has a rich financial offer tailored to the expectations of a wide range of beneficiaries: local governments, public entities, social organizations, individuals and enterprises. This National Fund conducts independent financial management, acting on the basis of the Environmental Protection Act and in accordance with the EU principle that «the polluter pays». The system of financing nature conservation involves banking institutions, public authorities and local governments, various environmental funds at various levels and foreign corporations and partners. Grant project financing is especially well developed here, which is an extremely valuable experience for the current conditions of Ukraine.

Figure 1. Characteristics of the environmental financing system in the Republic of Poland
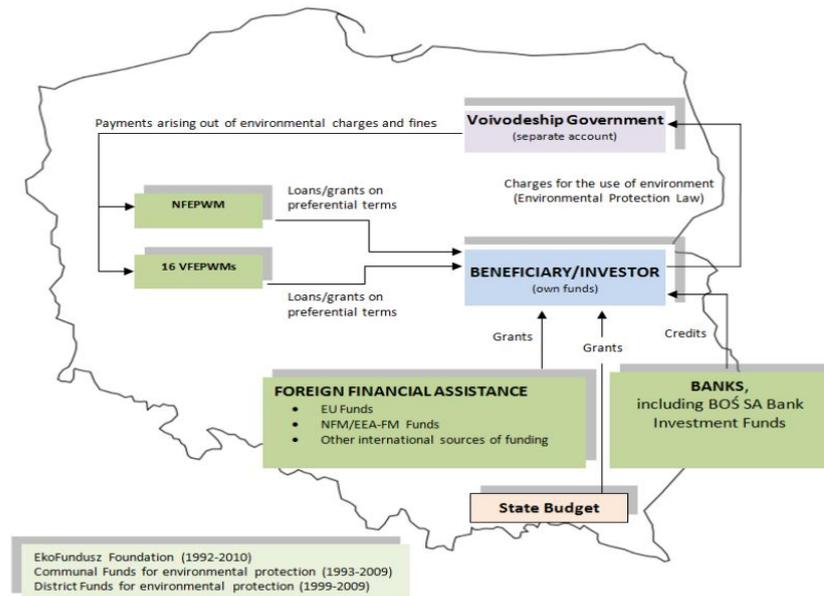
Source: adapted from data (Poland, 2019; Official Site of the European Statistics Service, 2022).

Common instruments for financing nature protection in Poland are loans, credits, grants, taxes, incentives – assistance or restrictions on the market, promotion of environmentally friendly products, preferences, trust funds. The authors compare the number of main categories of nature reserves in Poland and Ukraine, which showed that Poland has a much larger area of nature reserves and the number of nature reserves (Table 1). The number of national parks and area of forests in Poland are twice as large as in Ukraine. The number of nature monuments there are more than four times more in Poland – 36,293 objects and only 8,245 objects in Ukraine.

Table 1. Comparison of the number of objects of the nature reserve fund

Category of nature-protected fund	Poland	Ukraine
National Parks	23	49
Landscape Parks	121	81
Nature monuments	36,293	8,245
Forests constitute of the state area	30 %	15 %

Source: own work based on data from (Poland, 2019; Official Site of the European Statistics Service, 2022).

Compared to other <u>middle-income countries</u>, Poland became a high-income nation in a short time. According to the data of the World Bank, between the years 2009-2019, Poland's annual growth rate has averaged a consistent 3.6%. This is due to steadily increasing productivity, investment in human capital, strengthened institutions and

successful macroeconomic management. In 2019, Poland's GDP (<u>gross domestic product</u>) grew by 4.1%, spurred by higher wages and increased domestic consumption. In 2020, however, growth was dramatically reduced to 0.4%. The worldwide outbreak of COVID-19 has had far-reaching impact on Poland's economy , when businesses closed down amid a temporary border lockdown. The World Bank is provided a gradual return to growth for Poland, with growth estimated at 2.2% in 2021 and expected to be at 2% in 2022. That is why effective economic growth and positive examples of nature conservation in Poland are extremely useful and promising for Ukraine. Ukraine needs to use innovative nature conservation tools that have been effective in Poland in recent years. From these positions, a scientific and practical interest is the analysis of environmental costs in Ukraine and, accordingly, the costs of implementing innovative development, including industrial enterprises (water treatment, decontamination of air emissions and discharges into water bodies, the introduction of the use of closed environmental cycles of natural resources, etc.). Ukraine has places with unique ecosystems: Ukrainian Carpathians; Gorgany, a mountain range of the Outer Eastern Carpathians in Western Ukraine, Roztochya Biosphere Reserve, one of the hidden natural reserves in Ukraine; Medobory Natural Reserve, created for preservation and popularization of unique natural beauty; Podilski Tovtry Natural Park in Chemerivstsi; Rivne State University. Some of them offer activities, attractions, facilities and excursions in their parks and reserves, so that visitors can enjoy and learn. Sometimes the private sector can manage them more efficiently, effectively or flexibly, as foreign experience shows. It is important that the public and private sectors work together to manage professional operations in a coordinated manner and to provide these quality and innovative services to the public. Only significant investments in the nature reserve fund of Ukraine will help protect these valuable places for future generations. However, today, in order to preserve all these ecosystems, it is necessary to develop financial instruments that work well in developed countries.

In this work an interdependence between current costs for environmental protection and innovation expenditures in Ukraine in the years 2000-2020 has been described (Table 2).

Table 2. Interdependence between current costs for environmental protection and
innovation expenditures in Ukraine in the years 2000-2020

Years	Current costs for environmental protection, thousand UAH (X)	Innovation expenditure, million UAH (Y)
2000	2,618,375	1,760.1
2001	2,903,747.3	1,979.4
2002	3,080,131.5	3,018.3
2003	3,361,979.5	3,059.8
2004	4,152,245.6	4,534.6
2005	5,313,588	5,751.6
2006	5,172,413.1	6,160.0
2007	66,10318	10,821.0
2008	8,444,589.9	11,994.2
2009	8,032,734.5	7,949.9
2010	10,366,565.5	8,045.5
2011	12,039,439.5	14,333.9
2012	13,924,654.3	11,480.6
2013	14,339,060.4	9,562.6
2014	13,965,726	7,695.9
2015	16,915,535.2	13,813.7
2016	19,098,224.8	23,229.5
2017	20,466,423.3	9,117.5
2018	24,317,991	12,180.1
2019	27,480,190.3	14,220.9
2020	28,092,551.9	14,406.9

Source: own work based on data from (State Statistics Service of Ukraine, 2021).

It was found that increasing the cost of nature protection increases the cost of innovation, i.e. preventive measures, instead of just eliminating the negative consequences. The results of the verification of the model of dependence current costs for environmental protection and innovation expenditures in Ukraine (2000-2020) are presented in Table. 3.

Table 3. Regression statistics and model values

Regression statistics of the model					
Multiple R		0.735389037			
R-square		0.540797035			
Normalized R-square		0.516628458			
Standard error		3.654967366			
Observations		21			
Indicator	df	SS	MS	F	Significance F
Regression	1	298,916,733	298,916,733	22.37603948	0.000145611
The rest	19	253,816,942.5	13,358,786.45	Fcr	4.380749692
Total	20	552,733,675.5		tcr	2.093024054
Standard error	t- statistics		P- Meaning	Lower 95%	Upper 95%
1,431.437285	b_o=2.56284135		0.019033056	672.5139939	6,664.579333
9.95689E-05	b_1=4,.730331858		0.000145611	0.000262594	0.000679394

Source: calculated by the authors.

Since Fisher's criterion is F=22.376, which is more than its critical value of F_{cr} =4.38, the model is adequate and statistically significant. Since the values of b_o=2.56284135 and b_1=4.730331858 are greater than its critical value, t_{cr}=2.09, this also confirms the adequacy and significance of this regression model. To find estimates of the parameters of the model b_o, b_1 used the value of the current costs for environmental protection and innovation expenditures in Ukraine for the years 2000-2020 (Table 2). As a result of calculations, the values of the model parameters were obtained b_o=2.56284135; b_1 = 4.730331858.

The economic interpretation of the model is that with the increase of current expenditures on environmental protection in the country as a whole, the expenditures on ecological innovations in Ukraine also increase, which is an extremely positive phenomenon. As a result, it increases the chances for the effectiveness of nature conservation, the formation of adequate preventive measures in nature protection. Accordingly, the correlation model obtained in this study of the dependence of current expenditures on environmental protection and innovation expenditures in Ukraine has the form:

$$Y= 4.7303x +2.5628$$

The correctness of the choice of the model structure of the dependence of current costs on environmental protection and innovation costs in Ukraine was assessed on the basis of statistical testing of the model for significance, adequacy and quality. Determination and

correlation coefficients have been used to assess the quality of the constructed model. The statistical significance of the model was tested on the basis of Fisher's and Student's criteria.

To assess the adequacy of the model with statistical data, the value of the coefficient of determination R^2 has been calculated. The value of the coefficient of determination is $R^2=0.54$, that means that the impact of current costs for environmental protection on innovation expenditures in Ukraine (2000-2020) is quite significant. The degree of closeness of the linear relationship between the model variables was estimated using the correlation coefficient. Based on the value of $r = 0.73$, it was concluded that there is a close linear relationship between the indicators of the model.

According to the statistical tables of Fisher's F-distribution (Pryshchepa, 2020) at a given level of significance $\alpha = 0.05$, the critical value of Fisher's criterion $F_{cr} = 4.3808$ has been found. Because the actual value of Fisher's criterion ($F_f = 22.376$) is more than critical, this indicates the statistical significance of the constructed model as a whole and its adequacy. According to the selected level of significance $\alpha = 0.05$ and degrees of freedom according to the statistical tables of Student's t-distribution, the critical value of Student's criterion $t_{cr} = 2.09302$ was found. Since $t_{b0}= 2.5628$ and $t_{b1} = 4.73$ are greater than t_{cr}, we concluded the statistical significance of the parameters b_0 and b_1. The results of the verification of the model of dependence of the current costs financing for environmental protection and innovation expenditures in Ukraine indicate the adequacy of the model to statistics and the existence of a close linear relationship between its variables, as well as the significance of the model as a whole and its parameters.

In this paper, the authors summarize the state of the nature-preserved fund of Ukraine in order to implement the best Polish experiences. The results of the analysis are represented in Table 4. The target value of the nature reserve in Ukraine was 10.8% of the state area by 2021, but this value was not reached and today it is only 6.8%. The forestry target in Ukraine, set for 2021, is 17%, but now it is lower and amounts to 15.9%. According to experts, timber reserves in forests amount to 2.1 billions of cubic meters. The area of agricultural lands of extensive use (hayfields, pastures) in 2000 was 2.36 million hectares, but this is three times less than the established target – 8.4 million hectares. In Ukraine the share of research and development expenditures in GDP is only 0.4%, which is three times

less than the target of 1.5% and five times less than in the Republic of Poland. In recent years, a positive trend is that the area of nature reserves of national importance has increased slightly, which in 2020 amounted to 4.27% of the total territory of the country, as compared to 3.72% in 2015.

Table 4. The analysis state of the nature-reserved fund of Ukraine

Indicator	Years					
	2015	2016	2017	2018	2019	2020
The area of territories and objects of the nature reserve fund, thousand hectares	3,803.13	3,985.60	3,985.02	3,991.64	4,082.2	4,105.5
The share of the area of territories and objects of the nature reserve fund in the total territory of the country, %	6.3	6.6	6.6	6.61	6.76	6.80
The share of the area of the national ecological network in the total territory of the country, %	38.16	38.16	38.16	38.16	38.16	38.17
The forest cover of the country, %	15.9	15.9	15.9	15.9	15.9	15.9
The area of agricultural lands of extensive use (hayfields, pastures), thousand hectares	7,840.5	7,833.8	7,820.8	7,577.0	7,534.2	2,362.7
The share of research and development expenditures in GDP, %	0.55	0.48	0.45	0.47	0.43	0.41
The number of cultural and natural heritage sites included in the UNESCO World Heritage List, units, including by type of heritage:	7	7	7	7	7	7
-cultural	6	6	6	6	6	6
-natural	1	1	1	1	1	1
The area of nature reserve fund of national importance, % of the country's territory	3.72	4.10	4.10	4.10	4.24	4.27

Source: own work based on data from (State Statistics Service of Ukraine, 2021; Ministry of Culture of Ukraine, 2022).

Tourism in Ukraine has been a direction of peaceful encounters between people and cultures, it has been an important element of peace building. Now ecotourism in Poland and Ukraine very well imbibes into sustainable tourism as a means of maintaining the social, cultural and natural environment of the country. The concept of sustainability generally is one in which a new development does not damage natural, social, economic or cultural diversity. The view of sustainable tourism development has been one that uses resources

sustainably, that reduces overconsumption and waste, that maintains cultural, social and natural diversity, and that integrates tourism development into national development policy (Tkachenko T., 2006; Yakymchuk, 2017). It is worth noting that ecotourism sustainability also aims to increase the awareness and understanding of local cultures and local environments through the participation of local people. Tourism focuses on natural and mixed World Heritage Areas and tracks the extent of tourism planning. Tourism can contribute positively to nature conservation. Tourism in both terrestrial and marine protected areas depends on a healthy environment, and good planning ensures the sustainable use of these natural resources. This indicator raises awareness of the important role of tourism in nature conservation and may catalyse other types of protected areas to engage more proactively in visitor management, biodiversity protection and conservation (Tourism industry of Ukraine, 2021).

Summary, recommendations

The destruction of nature-reserved fund today is a loss not only of plants and animals. It creates enormous risks to the prosperity and well-being of the population. Science is only now beginning to correctly interpret and assess the scale of this impact, not only quantitatively, but also economically. Global loss of pollinators, including bees, butterflies and other insects that is caused by excessive use of pesticides and herbicides in the fields leads to a drop in annual agricultural production by about 217 billion dollars. First of all, this negative phenomenon is associated with such social risks as increased hunger in poor countries, which is potentially more serious, but more difficult to assess economically. Poland's growth was 2.2% in 2021 and is expected to be at 2% in 2022. That is why effective economic growth and positive examples of nature conservation in Poland are extremely useful and promising for Ukraine. Ukraine needs to use innovative nature conservation tools that have been effective in Poland in recent years.

Authors summarize the state of the nature-preserved fund of Ukraine in order to implement the best Polish experiences. The results of the analysis are show that the target value of the nature reserve in Ukraine was 10.8% of the state area by 2021, but this value was not reached and today it is only 6.8%; the forestry target in Ukraine, set for 2021, was 17%, but now it is lower and amounts to 15.9%; the area of agricultural lands of

extensive use is three times less than the established target; the share of research and development expenditures in GDP is three times less than the target and five times less than in the Republic of Poland. A positive trend is that the area of nature-reserved fund of national importance has increased to 4.27% in 2020, from 3.72% in 2015.

The correlation-regression modeling of environmental expenditures conducted in the work allowed to identify certain reserves for improving the economic and financial indicators of nature conservation in Ukraine in the long run, in order to offset the negative impact of the covid-19 pandemic. With the increase of current expenditures on environmental protection in the country as a whole, the expenditures on ecological innovations in Ukraine also increase, which is an extremely positive phenomenon. As a result, it increases the chances for the effectiveness of nature conservation and the formation of adequate preventive measures in nature protection. To assess the adequacy of the model with statistical data, the value of the coefficient of determination R^2 has been calculated. The obtained value of the coefficient of determination (R=0.54) indicates that the impact of current environmental protection costs on innovation costs in Ukraine (2000-2020) is quite significant. The degree of closeness of the linear relationship between the model variables was estimated using the correlation coefficient (R=0.73), and it was concluded that there is a close linear relationship between the indicators of the model. Furthermore, on the basis of correlation-regression analysis between current environmental costs and innovation costs, conclusions were made on the effectiveness of environmental costs in Ukraine.

Tourism is maintaining a stable development in the Republic of Poland. Even the maintenance of nature reserves increased by 32%, and these are essential for the recreation of Polish tourists, as well as the development of environmental education. Tourism has been a major economic activity in the European Union with wide-ranging impact on economic growth, employment and social development. The costs of tourism development in recent years are constantly increasing. Addressing the major challenges faced by the tourism industry of today, tourism's full economic potential requires an integrated and multi-faceted approach to tourism policy development across many government levels and departments.

Tourism has been now recognized as one of the key sectors of development in both countries and a major source of income, jobs and wealth creation. It can be a powerful tool in fighting the economic decline and unemployment. It also plays a wider role in promoting

the image and international perception of Poland and Ukraine, as well as influencing complementary domestic policies. This range of influence and importance creates challenges in measuring competitiveness in tourism. EU countries see considerable benefit in co-operating to address economic, sustainability and employment issues, and promote tourism policy performance and evaluation, innovation and liberalization of tourism. In the coming years, cooperation between Poland and Ukraine will be important in the development of tourism, which will improve the economic situation of both countries.

Conservation finance is an important task for the governments of Poland and Ukraine of today, and over the years many mechanisms have been developed and tested. To that end, rigorous approaches have been developed to determine, validate and monitor the conservation impact on nature-reserved fund. Yet, for most of the last 30 years, the discussion has been geared toward the conservation objective and focused on how to meet the financing demand for conservation programs and strategies, i.e. finding investments to activate particular conservation mechanisms and scaling them up to broader programs and eventually whole markets. Using financial incentives, payments for ecosystem services are a form of conservation finance that rewards people for maintaining these ecosystem services. In order to facilitate these transactions, the service provider must clearly define the service and secure an ecosystem which needs those particular resources. In addition, service purchasers carefully monitor the providers to ensure that conversation has been efficiently carried out. Only significant investments in the nature-reserved fund of Ukraine will help protect these valuable places for future generations. However, today, in order to preserve all these ecosystems, it is necessary to develop financial instruments that work well in developed countries.

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From the paradigm of responsibility for sustainability to the EU law on corporate social responsibility

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Abstract: Sustainability has roots going back thousands of years and its evolution goes from the ethical dimension and collective responsibility to international and even national law dimensions and individual responsibility. The EU and EU law have consistently endorsed sustainability and recently they have moved to the issuance of a set of new provisions deserving a developed analysis and critical exploration facilitating their deeper understanding. The need for such an exploration is magnified by recent crises, such as the Covid-19 pandemic and the war in Ukraine, which have multispectral consequences. Since the evolution of sustainability projected into the individual responsibility of business CSR is pretty organic, the appreciation of the new stage of CSR and the teleological interpretation of its framework demands (i) a presentation of theoretical premises represented by the summary of the evolution of the conceptual understanding of responsibility for sustainability along with (ii) the identification of data and method. Based on that, there is presented (iii) a practical overview of EU milestones in the CSR evolution with an implied shift from the collective accountability over individual liability to corporate responsibility. This allows (iv) for selecting the three most relevant instruments of EU policy and law about the sustainability and individual responsibility for it and juxtaposing their teleological interpretation with comparative evolutionary notes and content analysis employing both quantitative aspects (key word counts and frequency or concentration) and qualitative aspects (Delphi assessment and LIWC). Such an exploration, interconnected via Meta-Analysis offers the potential for (v) pioneering conclusions about the modern paradigm of social responsibility, including the revelation of EU law preferences regarding CSR.

Key words: EU; law; policy; responsibility; CSR; sustainable development.

JEL: K32; K33; M14; O38; O44; Q01; Q56.

Introduction

Current Western society is deeply rooted in ancient philosophy, Christianity and Roman law [MacGregor Pelikánová, 2017], which have consistently endorsed individual responsibility and private ownership in the context of the morality of individuals and ethics of the society. Consequently, our normative individual beliefs (morality) and the community standards distinguishing good and bad (ethics) are determinants and causes of sustainability, digitalization and other post-industrial features and commands of modern European inegratition, EU law and the EU social market economy [Balcerzak & MacGregor Pelikánová, 2020; Lafferty, 2019]. EU law and national laws of all EU member states, regardless of whether from the continental law family or common law family, include explicit provisions about the responsibility of all Private law subjects, both natural persons and legal entities,

for their own action or omission and their direct or indirect impacts and consequences: contractual and extra-contractual legal liability.

Regarding this liability in the case of the absence of a contract, i.e. extra-contractual liability, a rather progressive evolution has occured during recent decades in European jurisdictions. Namely, regarding a Private law subject, it has expanded from his duty to „not to do bad" to a much broader duty to „prevent harm" to another super broad duty to „do good" to others and even the entire society. Consequently, businesses in the 21st century are expected by the society, and even partially demanded by the law, to engage in behaviour which conventionally belonged into the sphere of the international law and its subjects (states and international organizations) or, utmost, National Public law and its subjects (state, regional and local authorities). The EU and EU law are examples of that.

Indeed, the EU is persuaded about the sustainability called for by the UN and deeply convinced that a smart, sustainable and inclusive growth, along with the development of EU fundamental principles and intellectual property commitment [MacGregor Pelikánová, 2019], will lead to the EU world leadership [Turečková & Nevima, 2018]. After a set of initiatives and projects, which often ended in disappointment, the EU has learned that this requires the active support from all stakeholders, including businesses. The sustainability concern exhibited since classical Antiquity needs to turn into a modern concept of sustainability linked to shared values and enjyoing the support and commitment by all stakeholders, including businesses. Indeed, there is no doubt that European businesses have a responsibility going beyond a mere profit generation for their investors, i.e. they are accountabe for their operations vis-a-vis the entire society. Consequently, the modern concept of sustainability resting on the economic, environmental and social pillar is recognized and (should be) embraced by European businesses engaging in their corporate social responsibility („CSR"). To put it differently, modern businesses should accept a set of social responsibilities: economic, legal, ethical, etc. [Sroka & Lörinczy, 2015; Sroka & Szántó, 2018].

Since crises mangnify differences, the COVID-19 pandemic even further accelerates pre-existing trends and induces a move to a new stage of CSR [Dahlke et al, 2021; MacGregor Pelikánová & MacGregor, 2020]. Heuristics and qualitative trend-base analysis suggests that this pandemic is unique and that, along with the EU's policy response, it affects

macroeconomic performance in a particular manner [Zinecker et al, 2021a], as well as other dimensions of the Europan integration [MacGregor Pelikánová & MacGregor, 2020], including the impact of changing conditions on business decision-making [Zinecker et al, 2021b]. This leads to a fundamental research question – how exactly does this new stage of CSR look like, namely what kind of businesses responsibility is semi-imposed by the EU and EU law in the current turbulent times [MacGregor Pelikánová et al, 2021c].

The need for such an exploration is magnified by recent crises, such as the Covid-19 pandemic [MacGregor Pelikánová et al, 2021c] and the war in Ukraine, which have multispectral consequences [Dahlke et al, 2021; MacGregor Pelikánová & MacGregor, 2021]. Since the evolution of CSR is pretty organic, the appreciation of the new stage of CSR and the teleological interpretation of its framework demands (i) a presentation of theoretical premises represented by the summary of the evolution of the conceptual understanding of responsibility for sustainability along with (ii) the identification of data and method. Based on that, there is presented (iii) a practical overview of EU milestones in the CSR evolution, with an implied shift from the collective accountability over individual liability to corporate responsibility. This allows (iv) for selecting the three most relevant instruments of EU policy and law about the sustainability and individual responsibility for it and juxtaposing their teleological interpretation with comparative evolutionary notes and content analysis employing both quantitative aspects (key word counts and frequency or concentration) and qualitative aspects (Delphi assessment and LIWC). Such an exploration, interconnected via Meta-Analysis, offers the potential for (v) pioneering conclusions about modern paradigm of social responsibility, including revelation of EU law preferences regarding CSR.

Theoretical premises – Evolution of the conceptual understanding of responsibility for sustainability

In classical Antiquity, morality as a system of principles concerning the distinction between right and wrong or good and bad behavior was strongly determined by the tribal setting. Such a semi-collectivist morality could easily be transformed in a systematic constellation of concepts about right and wrong behavior, i.e. ethics. Christianity brought a focus on the individual as a free being able to make choices between good and bad and be accuntable for that. Over time, state and other authorities have transformed certain

of these personal moral values as systematized by ethics into a structured enforceable system of law. Hence, ethics are both a source of law and interpretation plus application guidelines for law. Therefore, over thousands of years, the sustainability concerns have progressively made their way from religious and philosophical teachings to the applicable positive law, and since the 19th century has shaped a special branch of busienss accountability – CSR. Hence, the description and analysis of CSR and its evolution demands an appreciation and understanding of the prior sustainability concerns evolution, as well as the current parallel evolution of the modern concept of sustainability. Plainly, the understanding of the evolution of CSR and an appreciation of its latest stage demands a deep engagment with foundations and concepts linked to sustainabiltiy concerns, both from the spheres of ethics and law [Sroka & Lörinczy, 2015; Sroka & Szántó, 2018].

Since Classical Antiquity, numerous kinds of ethics interact [Hooker, 1996; Law, 1999], while three have played a predominant role with a direct impact on the EU current setting – (i) Bentham utilitarian or consequentialist ethics (good results), (ii) Kantian deontological ethics (good intentions), (iii) Aristotelian ethics (good sense of human life) [MacGregor Pelikánová, 2021]. The rather broad perception of Aristoelian ethics reflected the dual perception of justice – the geometrical model of distributive justice reflected by the public law and the arithmetical model of corrective justice reflected by the private law. The advent of Christianity with the Bible brought a new stage for the perception of justice and the implied responsibility. Namely, the synalagmatic and pragmatic attitude became an integral part ofdurable social interaction. To put it differently, the biblical desire for a just and ongoing growing prosperity vested in the concept of sustainability became not only an issue and command from God and the elites, but instead everybody became individually responsible for their behaviour towards other individuals [MacGregor Pelikánová, 2021].

The expansion of commerce by the Hanseatic League and North Italian Rennaissance, and later on by collonialism, induced the re-organization of business models by moving from the sole proprietorship over to a guild system to company and corporate settings, which was critical for launching the industrial revolution in the 18th century. Exactly during these times, companies and corporations have been recognized as capable to become legal entities, aka artificial persons with a legal, aka juridical, personality, and thus subject of the law able to be responsible and even legally liable. In parallel to this evolution towards the responsibility

of businesses taking the form of companies and corporations, sustainability has become materialized. The ephemeral biblical idea was made manifest especially in the German setting. Then, the early European Enlightment brought a concern to pro-actively support sustainability. In the 17th century, John Evelyn in England and Jean Baptist Colbert in France became concerned about the diminishing forests and began to push the idea of sustainability and the need to maintain resources, especially in the context of industries such as wood, timber and mining. It needs to be pointed out that Jean Baptiste Colbert was a truly famous French minister of finance, because he avoided the bankruptcy of the French economy by supporting manufacturing, equal taxing, inventors´ protections, and at least indirectly, showing sustainability concerns [MacGregor Pelikánová et al., 2021 Sustainability].

In 1713, Hans Carl von Carlowitz, the head of the Royal Mining Office in the kingdom of Saxony, published his influential book, Sylvicultura Oeconomica, about *Nachhaltigkeit*, while condemning short-term thinking and mere immediate money-making concerns, offering recommendations and even ecological concerns. Those who were involved in mining became considered responsible vis-a-vis the entire society. The foundation for the CSR of businesses was laid down, in particular the indiviudal responsibility of businesses active in the forest and wood industry. Further, in 1832 in Prague, Emil André published his leading book, *Einfachste den höchsten Ertrag und die Nachhal-tigkeit ganz sicher stellende Forstwirthschafts-Methode*, in which he emphasized the importance of long-term responsibility in dealing with resources [MacGregor Pelikánová et al., 2021a].

The 20th century made the *Nachhaltigkeit* to go from long-term to eternal, aka *perpetuitas,* dimension and started the pathway from the ethical setting to the law setting [Schüz, 2012]. In 1948, the United Nations ("UN"), as an international organization and subject of international law, made the Universal Declaration of Human Rights ("UDHR"), bringing a common standard of achievements for all peoples and all nations, as well as setting, for the first time, fundamental human rights to be universally protected. Despite its international law nature, individual rights and duties are included in the UDHR, see provisions such as that everyone has the right to a standard of living (Art. 25) and the duty to the community (Art.29). At the same time, it must be admitted that UDHR does not deal with sustainability and CSR *per se.*

In the 1960s, in a large part of the Western world, there emerged a reinforced interest in social progressive values, along with political awareness under the auspices of "communitarianism" and in the 1970s this was transformed into an individualist focus marked by a set of world crises and a general move from Keynesian economic theory to neoliberal theory [Balcerzak & MacGregor Pelikánová, 2020]. In 1972, acadmia voiced its concerns about the ongoing development and presented the conviction that sustainability is based on environmental, social and economic pillars, and that the challenges of the reconciliation of available resources in the context of an increasing world population must be addressed [Meadows et al., 1972]. This value judgement about the reconciliation of the needs of the current generation and the ability of future generations to meet their needs became a hot topic and the interaction and overlap of the economic (profit), environmental (planet) and social (people) became its visualization [Marinova & Raven, 2006].

This trend reached the international law level in 1987, when the Gro Harlem Brundtland Commission prepared, and the UN published, the UN Annex to document A/42/427, called the Report of the World Commission on Environment and Development Report: Our Common Future ("Brundtland Report 1987"). Importantly, the 300 page-long Brundtland Report 1987 defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". It is often overlooked, but the Brundtland Report 1987 radically demands a major shift in the way governments and individuals approach the issues of environment, development and international cooperation. A number of influential UN documents followed and ultimately led to the UN Resolution A/RES/71/1, made during a historic UN Summit in September 2015 and entitled Transforming our world: the 2030 Agenda for Sustainable development ("UN Agenda 2030"), which brought with it its 17 Sustainable Development Goals (SDGs) and 169 associated targets, and has progressively moved into national settings. The UN Agenda 2030 is founded upon the five Ps and is an aspirational plan of action for people, planet, prosperity, peace and partnership. The UN Agenda 2030 has contributed to the employment of the multi-stakeholder model [Van Tulder, 2017] and cross-sector partnership [Van Tulder et al., 2016] for sustainability resources [Balcerzak & MacGregor Pelikánová, 2020]. The UN Agenda 2030 is an international law instrument not binding private law

subjects, and so definitely not imposing legal liabilities and duties to business, but it has the potential to be an impulse for national laws to do so. Indeed, sustainability is not merely a topic for international law subjects, instead it should be a priority and perhaps even a responsibility for all stakeholders, including businesses. Indeed, businesses should be responsible towards the entire society, i.e. socially responsible, for the sustainable development, which represents a general direction to create a better world by balancing social, economic and environmental factors [Polcyn, 2021; Zikic, 2018]. The next step is to move such a responsibility from the sphere of ethics into the sphere of the law, namely national law, as CSR ... and the following step could be the expansion towards the shared value command and further development of the multi-stakeholder model, while paying particular attention to consumers and investors, especially the young ones [MacGregor Pelikánová & Hála, 2021].

In the 21st century, sustainability is not only a concern of states and their governments [Griffiths, 2018], but also of businesses, see the multi-stakeholder sustainability model [MacGregor Pelikánová et al., 2021b] and shared values as its pillars [Washburn et al., 2018]. This is iconically depicted by the famous Carroll´s pyramid, with the required economic and legal layers along with the expected ethical and desired philanthropic layer [Carroll, 2016]. Indeed, shared value policies and principles linked to the eternal search for "good", and sustainability should benefit by a multi-spectral support across the society [MacGregor Pelikánová et al., 2021b] while facilitating the move of the political and economic setting to "a more sophisticated form of capitalism" [Porter & Kramer, 2019, pp. 323–346]. Businesses, regardless whether large or small, regardless from what industry [Polcyn, 2021], have to team up with governments, NGOs and even competitiors to capture the economic benefits of social progress [Kramer & Pfizer, 2016]. They need to be open-minded and listen in order to find a strong symbiosis with customers and investors [MacGregor Pelikánová & Hála, 2021; Polcyn, 2021]. The EU, in particular the European Commissions, has recognized and endorsed this trend and e.g. the current Commission of Ursula van der Leyen has been proclaiming from its begining [European Commission, 2020] its commitment to sustainable development [European Commission, 2021a], SDGs [European Commission, 2021b], a holistic approach along with multi-

stakeholder features [European Commission, 2021c] and to real (not illusory) and measurable outcomes [European Commission, 2021d].

Since crises magnify differences and bring about both challenges and opportunities, perhaps they are the vehicle par excellence to bring progress as stated by Einstein [D´Adamo & Lupi, 2021], the current EU and its law should be heralding the responsibility for sustainaiblity by each and every stakeholder and businesses via their CSR in particular. It should induce business to put sustainability and CSR in their business models [Schaltegger et al. 2018; Razminiene 2019; Petera et al., 2021], and, in particular, in internal moral constitutions of businesses — codes of ethics [Van Tulder & Kolk, 2001]. Well, before checking the newest policy and law documents, it is instructive to see the EU law milestone paving the way from the concept of sustainable development to the mandate of CSR disclosure.

Methodology

The explored data and employed methods are determined by the aim of this paper, namely to identify a modern paradigm of social responsibility, including the revelation of EU law preferences regarding CSR. This can be achieved by two steps – firstly, to research and identify critical EU policy and law instruments about sustainability and individual responsibility for it, aka CSR, and secondly, to select the three most relevant and current instruments of EU policy and law about sustainability and individual responsibility and explore them. Naturally, a pre-requirement for both these consecutive steps is a robust overview of theoretical premises about the evolution of a conceptual understanding of responsibility for sustainability, as implied by the academic literature about the sustainability and CSR.

To perform the first step, research in the EU law e-platform EurLex database and e-justice [MacGregor Pelikánová, 2018] needs to be done while targeting primary law and secondary law, and in the Commission e-platform ec.europe.eu, in particular https://ec.europa.eu/growth/industry/sustainability/corporate-social-responsibility-responsible-business-conduct_en, while targeting policy instruments. The primary law information is to be obtained from treaties and in particular their provisions addressing the sustainability and sustainable development. The secondary law information is to be obtained

from pertinent Regulations and Directives. A rather mechanical and literate interpretative approach is to be employed.

To perform the second step, proper methods for explorations and analyses, such as methods of legal modeling and methods of systemic interpretation, including a teleogical approach focusing on the "spirit of the law", are to be employed and lead to the identification of key documents. Their selection is done based on their validity, applicability, relevancy and currency. Regarding their exploration, a thematic analysis (involving both induction and deduction) of the conceptual background points to categories and key words for the legislative data assessment [Vourvachis & Woodward, 2015]. They are to be used for the content analysis of key documents [Krippendorff, 2013], which entails both quantitative aspects presented by automatic word counts (frequency and concentration of pre-set key words) and qualitative aspects [Kuckartz, 2014] presented by manual category, meaning identification (manual outcome of a simplified Delphi with Likert-style scoring automatically verified via artificial intelligence instruments such as LIWC) [Boyd, 2017; Tausczik & Pennebaker, 2010]. This predominantly qualitative content analysis [Silverman, 2013] uses as informal constants categories and key words identified by the thematic analysis of the conceptual background data and, along with the relevancy-validity criterion, helps in the selection process.

Ultimately, the following three key documents are selected, i.e. identified: Directive 2013/34 from 2013/2014; SWD(2019)143 Commission Staff Working document - Corporate Social Responsibility, Responsible Business Conduct, and Business and Human Rights: Overview of Progress (SWD CSR RBC 2019) from March 2021; and Regulation 2019/2088 from November 2019. Their multi-disciplinary contextual and evolutionary exploration and interpretation is done while focusing on a teleological and purposive interpretation approach and paying particular attention to the comparative juxtaposition of the evolving (pre)legislative wording, while further taking advantage of the above-mentioned content analysis. The formal dogmatic approach is to be applied. Regarding terminology, logic and the employed logic processes and procedures, such as analysis, synthesis, abstraction, generalization, comparison, separation and classification will be explored in an open-minded manner. The semi-proposition must be compared while strictly maintaining standards and requirements of the methodology of comparative law [Eberle, 2011].

Due to the conviction that more information is available than conventionally admitted and realized [Schmidt & Hunter, 2014], especially considering the scientific model of both direct and indirect causality [Heckman, 2005], a holistic and heuristic Meta-Analysis is used and offers pioneering conclusions about a modern paradigm of social responsibility, including the revelation of EU law preferences regarding CSR.

EU law milestones – From sustainable development to CSR disclosure

In 1957, the Treaty establishing the European Economic Community (EEC) and the Treaty establishing the European Atomic Energy Community were signed. They declared as their objective "*a harmonious development of economic activities, a continuous and balanced expansion*", see Art. 2 TEEC. The lack of a reference to the environment and/or sustainable development became an issue two decades later and various environmental groups began to voice their critical opinion in this context in the 1970's [Bär & Kraemer, 1998].

In 1992, the Treaty of Maastricht creating the EU (TEU) was signed in 1992 and entered into force in 1993. All twelve member states of the European Communities agreed via the Maastricht Treaty about a new stage in the process of European integration towards a shared European citizenship, a single currency and common foreign and security policies. However, the ambitious tenor was rather declaratory, the EU did not have a legal personality and the expectation of the advent of an EU constitution failed in the following years, ultimately forcing the EU to go for plan B – the reform Treaty of Lisbon. Regarding objectives, a merely indirect step towards sustainability and CSR was made. Namely, one of the objectives was stipulated as "*to promote economic and social progress which is balanced and sustainable, in particular through the creation of an area without internal frontiers, through the strengthening of economic and social coherison and through the establishment of economic and monetary union, ultimately including a single currency …*" (Art. B).

Due to the planned enlargement and need to increase democratic aspects, the amendment of TEU was prepared and materialized in 1997 by the signature of the Treaty of Amsterdam [Bär & Kraemer, 1998]. It brought for the first time a direct and explicit command for sustainable development by stating "*Article 2. The Community shall have as its task, by establishing a common market and an economic and monetary union … to promote*

throughout the Community a harmonious, balanced and sustainable development of economic activities, a high level of employment and of social protection, equality between men and women, sustainable and non-inflationary growth, a high degree of competitiveness and convergence of economic performance, a high level of protection and improvement of the quality of the environment, the raising of the standard of living and quality of life, and economic and social cohesion and solidarity among Member States." Only a few years later, in 2000, the Lisbon European Council set for the EU a new strategic goal for 2010 – "to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion." Even more importantly, as a part of the strategies to be mobilized to this effect, the European Council made "*a special appeal to companies' corporate sense of social responsibility regarding best practices on lifelong learning, work organisation, equal opportunities, social inclusion and sustainable development.*" In sum, sustainability and, even more, the CSR made their entry into the positive EU law and policy framework in the context of the EU fear regarding global competition and the role played by others, such as the USA [De Schutter, 2008].

Additional amending and reforming treaties, including the 2007/2009 Treaty of Lisbon, have followed and led to the current consolidated version the TEU, which states in Art.3 para 3 "*The Union shall establish an internal market. It shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment. It shall promote scientific and technological advance.*" Indeed, the entire EU constitutional trio of primary sources, i.e. TEU, TFEU and Charters, have acquired social and environmental dimensions [Polcyn et al., 2019]. These followed a number of ideas and initiatives about, among others, social and environmental reporting, but the modernized accounting directives were a true challenge to be agreed upon and the work on them extended from 2001 to 2013 and several times it was described as a "failure" [De Schutter, 2008].

In 2014, a new reporting duty was imposed upon certain European businesses, increasing their social responsibility and boosting their CSR. Namely, the long awaited Directive 2013/34 on the annual financial statements, consolidated financial statements and

related reports of certain types of undertakings ("Directive 2013/34") was amended by Directive 2014/95/EU as regards the disclosure of non-financial and diversity information by certain large undertakings and groups [MacGregor Pelikánová & MacGregor, 2020]. Pursuant to this amendment, i.e. the updated version of Directive 2013/34, public-interest entities with over 500 employees must disclose information about how they address five challenging categories: (i) environmental protection, (ii) social responsibility and treatment of employees, (iii) respect for human rights, (iv) anti-corruption and bribery and (v) diversity on company boards (age, sex, background)

In 2019 came Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial sector ("Regulation 2019/2088"), which lays down harmonized rules for financial market participants and financial advisers on transparency in regard to sustainability disclosure, in particular so-called sustainable investment. No transposition is needed and this regime applies from the 10th of March, 2021 (Art. 20) on the territory of the entire EU.

On the 21st of April, 2021, the Commission published COM/2021/189 final proposal for a Directive amending Directive 2013/34, Directive 2004/109/EC, Directive 2006/43/EC and Regulation (EU) No 537/2014, as regards corporate sustainability reporting. The goal is mainly to change the wording of Directive 2013/34 to support the European Green Deal, a set of policy measures intended to combat the climate crisis by transforming the EU into a modern, resource-efficient and competitive economy, with no net emissions of greenhouse gases by 2050. Furthermore, the directive is part of the bigger Sustainable Finance package, which enables the Green Deal by helping to channel private investments behind the transition to a climate-neutral economy.

This primary and secondary law evolution was naturally organically intra-related with strategic policy instruments prepared by the Commission and in order to avoid inherent complexity [MacGregor Pelikánová & MacGregor, 2020], it is illustrative to present an overview of them, see Table 1.

Table 1. EU strategic policy instruments for the sustainability and CSR

Date	Number	Title
2001-05	COM(2001)264	A sustainable Europe for a better world: A European strategy for Sustainable Development (EU Sustainable Development Strategy)
2001-07	COM(2001)366	GREEN PAPER. Promoting a European framework for Corporate Social Responsibility
2010-03	COM(2010)2020	Europe 2020: A strategy for smart, sustainable and inclusive growth (Europe 2020 Strategy)
2011-10	COM(2011)681	A renewed EU strategy 2011-14 for CSR
2019-01	-	Reflection paper: Towards A Sustainable Europe by 2030
2019-03	SWD(2019)143	Commission Staff Working document - Corporate Social Responsibility, Responsible Business Conduct, and Business and Human Rights: Overview of Progress (SWD CSR RBC 2019)
2019-2024		The six policy priorities of the Von der Leyen Commission (6 Commission priorities for 2019-24) – A European Green Deal, A Europe fit for the digital age, An economy that works for people, A stronger Europe in the world, Promoting our European way of life, A new push for European democracy.
2021-04	COM/2021/219	Better regulation: Joining forces to make better laws

Source: Own work by the Author based on EurLex.

Documents relevant for the EU sustainability and CSR setting but not directly generated by the EU include the UN global compact, UN guiding principles on business and human Rights, UN 2030 agenda for sustainable development, ISO 26000 guidance standard on social responsibility, OECD guidelines for multinational enterprises, OECD due diligence guidance for responsible business conduct and Social policy principles for multinational enterprises by the International Labour Organization, see https://ec.europa.eu/growth/industry/sustainability/corporate-social-responsibility-responsible-business-conduct_en . Since so far no case law by the Court of Justice has developed, this supplementary source with a strong input not only for the interpretation cannot be used.

The analysis of the three most relevant instruments of EU policy and law about the sustainability and individual responsibility for it – Directive 2013/34, SWD CSR RBC 2019 and Regulation 2019/2088

The overview of primary and secondary EU law and related EU policies provided above reveals that currently there are basically only two EU law instruments specifically and exclusively dealing with sustainability – Directive 2013/34 and Regulation 2019/2088. However, there are a number of related policies, with the most recent and CSR focused being SWD CSR RBC 209. Therefore, the following teleological interpretation and content analysis, both manual simplified Delphi with Likert-style scoring and automatic LIWC, can be completed and juxtaposed in order to facilitate a critical thematic analysis involving both induction and deduction and ultimately, via Meta-Analysis, generate propositions about a modern paradigm of social responsibility, including the revelation of EU law preferences regarding CSR.

Chronologically, the first of this trio of documents is Directive 2013/34, naturally as updated especially in 2014. Its exploration was done while selecting the most relevant category – formal writing - the LIWC processing led to results presented in Table 2, to which Delphi-Likert style scoring and comments were added.

Table 2. Content analysis of Directive 2013/34

Traditional LIWC Dimension	Directive 2013/34	Average for formal language	Scoring	Citation (Art.19a) and Comments
I-words (I, me, my)	0.84	0.67	- - -	*"shall include a non-financial statement information to the extent necessary for an understanding … including"* – formalistic, declaratory, general, vague
Positive Tone	0.24	2.33	- -	
Negative Tone	0.36	1.38	-	
Social Words	2.90	6.54	+	
Cognitive Processes	11.22	7.95	+	
Allure	0.60	3.58	-	
Moralization	0.00	0.30	-	
Summary Variables				
Analytic	99.09	87.63	+	Good v. Weak authenticity.
Authentic	33.70	28.90	--	

Source: Own work by the Author based on EurLex, LIWC and Delphi.

Directive 2013/34 has a strong Categorical-Dynamic Index ("CDI") and represents superior analytical thinking that focuses on reasoning and arguments, but not on intuition, friendliness or a personal approach. Interestingly, this rather cold, professional and rigid inclination does not hurt the authenticity. At the same time, Directive 2013/34 attempts to

be neutral and not moralizing, and this ultimately leads to a tone which is neither positive nor negative. As a matter of fact, the tone is rather negative and not alluring. Manual Delphi suggests a formalistic, declaratory, general and vague tenor, along with a weak authenticity, i.e. the authenticity assessment is different and depends upon the selected methodology.

Chronologically, the second of this trio of documents is Directive SWD CSR RBC 2019. Its exploration was done while selecting the most relevant category – formal writing - the LIWC processing led to results presented in Table 3, to which a Delphi-Likert style scoring and comments were added.

Table 3. Content analysis of SWD CSR RBC 2019

Traditional LIWC Dimension	SWD CSR RBC 2019	Average for formal language	Scoring	Citation and Comments
I-words (I, me, my)	0.14	0.67	-	*"The EU has made progress ….. revealed a high rate of approval for the Commission´s action ……"* – self-laudatory.
Positive Tone	2.47	2.33	+	
Negative Tone	0.69	1.38	-	
Social Words	3.70	6.54	+	
Cognitive Processes	10.97	7.95	++	
Allure	1.78	3.58	-	
Moralization	4.25	0.30	++	
Summary Variables				
Analytic	93.90	87.63	-	Absence of self-reflection, Reliance on the out of EU drive
Authentic	16.52	28.90	--	

Source: Own work by the Author based on EurLex, LIWC and Delphi.

The policy instrument SWD CSR RBC 2019 has a strong CDI and represents superior analytical thinking that focuses on reasoning and arguments, but not on intuition, friendliness or a personal approach. This rather cold, professional and rigid inclination hurts the authenticity. At the same time, SWD CSR RBC 2019 attempts to be neutral, but still slips into strong moralizing. The tone is not alluring. Manual Delphi suggests a self-laudatory tenor, a lack of self-reflection and a strong reliance on external sources, such as policies of the UN or ISO.

Chronologically, the last of this trio of documents is Regulation 2019/2088. Its exploration was done while selecting the most relevant category – formal writing - the

LIWC processing led to results presented in Table 4, to which Delphi-Likert style scoring and comments were added.

Table 4. Content analysis of Regulation 2019/2088

Traditional LIWC Dimension	Regulation 2019/2088	Average for formal language	Scoring	Citation (Art.1) and Comments
I-words (I, me, my)	0.39	0.67	---	*"lays down harmonized rules for financial market participants … and the consideration of adverse"* – terminological inconsistency
Positive Tone	0.39	2.33	--	
Negative Tone	0.91	1.38	-	
Social Words	1.96	6.54	+	
Cognitive Processes	10.82	7.95	++	
Allure	0.91	3.58	-	
Moralization	0.00	0.30	-	
Summary Variables				
Analytic	99.16	87.63		Fragmented, not coherent.
Authentic	22.46	28.90		

Source: Own processing by the Author based on EurLex, LIWC and Delphi.

Regulation 2019/2088 has a strong CDI and represents superior analytical thinking that focuses on reasoning and arguments, but not on intuition, friendliness or a personal approach. This rather cold, professional and rigid inclination only moderately hurts the authenticity. At the same time, Regulation 2019/2088 attempts to be neutral and not moralizing. Again, the tone is not alluring. Manual Delphi suggests a fragmented approach with a problematic terminology. In particular, the "harmonization" is conventionally understood as an instrument reducing differences and taking the form of Directives, while standardization means direct cancellation and replacement, and so taking the form of a Regulation. Indeed, each Regulation is directly applicable and does not require any transposition … but Regulation 2019/2088 appears rather vague and fragmented.

Conclusions

The concept of sustainability and responsibility, in particular individual responsibility, has millennial roots and has undergone a rather linear, smooth and slowly progressing evolution, strongly marked by ancient philosophy, Roman law, Christianity, the Hanseatic

model and *Nachhaltigkeit*, as well as UN endeavors in the 20th century. In 1997, the EU crossed the Rubicon and decided to join by launching an EU journey towards sustainability, both on the state and individual business levels. Undoubtedly, the drive and momentum towards the responsibility for sustainability and ultimately to CSR was matched by initial enthusiasm. However, it almost immediately became clear that such an approach is much too ambitious and the focus shifted toward merely informing. Nevertheless, even this appeared to be a challenge, taking over ten years. Ultimately, Directive 2013/34 came with its superior analytical and cold thinking that focuses on reasoning and arguments with a problematic authenticity. Over one decade ago, there came the policy instrument SWD CSR RBC 2019, taking a similar analytic attitude and adding to it a strong moralizing aspect and reliance on external sources and output, and achieving an extremely low authenticity. This grim authenticity outcome is indicated by both automatic LIWC and manual Delphi, and is cemented by self-explanatory quotations and citations. Regulation 2019/2088 attempts to continue the analytic thinking while improving authenticity and trying to stay away from moralizing. Again, the tone is not alluring and confusion is added by conceptual and terminological issues. However, these propositions and suggestions are not conclusive due to the inherent and inevitable limitations of the performed research, methodology, study and analysis. Indeed, a further ongoing observation and exploration of law and policy instruments are necessary, as well as particular attention needs to be paid to the case law of the Court of Justice of the EU, which could have perhaps the last word.

Nevertheless, it can be now safely argued that the modern paradigm of social responsibility is definitely more fragmented on the EU level than on the global level, where the UN manages to move continuously and systematically forward, see Agenda 2030 with 17 SDGs. The linear evolution can be observed in general, but not in particular with respect to the modern European integration process under the auspices of European communities and the EU. Indeed, the so-called CSR European style is undergoing a rather cyclical evolution dominated by over-ambitious optimistic enthusiasm confronted with realism and suspicious of stakeholders. The Commission, with its policies, is probably getting the message, the Council of ministers and Parliament with their Regulations and Directives are definitely getting the message while correctly heading towards a framework inducing CSR and leaving a good part of the enforcement to the public-at-large, in particular

consumers and investors. After all, ostracism is a democratic procedure and has basically only two pre-requirements – free critically thinking individuals and proper relevant information. Hence, the EU, especially the Commission, should be less patronizing, moralizing and dictatorial, and more facilitating and inducing regarding CSR, so Europeans could organically transition into sustainable development based on shared values and "promoting our European way of life", as repeatedly advanced by the current President of the Commission, Ursula von der Leyen.

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Current state of the foreign trade of the Republic of Moldova with agri-food products

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Abstract The paper aims to discuss the latest developments in the foreign trade with agri-food products of the Republic of Moldova, as it represents an important pillar for the general trade in goods. Agri-food exports have a constant high share in the total trade of over 40%, thus confirming the high importance of the sector for the national economy. The trade values of the commodity groups 1-24 have been analyzed, also pointing to the most competitive groups of products on the international market by using the Revealed Comparative Advantage indicator. A quantitative and qualitative analysis has been performed while observing the trade data at the level of imports and exports for the period 2010 – 2021. As a result, a series of recommendations have been provided in order to increase the competitiveness of Moldovan agri-food products, like enhancing investments in added value sub-sectors, improvement of the quality of products, investments in post-harvest and processing infrastructure, etc.

Key words: agri-food trade, Revealed Comparative Advantage, Republic of Moldova, export, import

JEL: Q17, F13

Introduction

Foreign trade is historically the oldest and still important part of the external economic relationships (Jenicek, Krepl, 2009). The general notion of international trade refers to as the transfer of goods and services which include capital goods from one country to another (Hassan et al, 2014). OECD defines the trade in goods and services as the transactions in goods and services between residents and non-residents. It is measured in million USD at 2015 constant prices and PPPs, as percentage of GDP for net trade, and also in annual growth for exports and imports (OECD, 2022). Economics Concepts (2012) indicates that, the difference between international trade and domestic trade is that, the foreign trade is costlier than the domestic one, as it is based on some additional costs, like logistics, transportation, tariffs, fees, etc. On the other hand, factors of production such as capital and labor typically move more freely within a country than across countries (Hassan et al, 2014).

Tracing back the evolution of what today is recognized as the standard theory of international trade, one goes back to the years between 1776 and 1826, which respectively mark the publications of Adam Smith's Wealth of Nations and David Ricardo's Principles of Economics. Free trade, as opposed to the Mercantilist policies of protection, was championed by both Smith and Ricardo as a route to achieve production efficiency at a global level (Sen, 2010). David Ricardo's theory of comparative advantage, developed at the beginning of the 19th century, has played a major role in modern thinking about trade (Helpman, 1999). It is worth mentioning that in the recent period, the role and importance of foreign trade has been constantly increasing, from the economic point of view, as well as social and political.

Currently, foreign trade is one of the most important components of international economic relations and is an important part of a country's economy, and what is more, globalization has intensified the actions of international trade in goods and services (Cucu, Panait, 2020). Trade with agri-food products is of main importance for countries with a developed agricultural sector or those who put a specific emphasis on agriculture.

The agricultural sector of the Republic of Moldova represents an important pillar for the national economy, playing a vital role in ensuring food security, employment, especially in rural areas, and the population's general wellbeing (Lucasenco, 2021). Therefore, the trade with agri-food products, especially exports, is becoming increasingly important for the national economy. Severe climatic conditions that occasionally affect the agricultural sector of Moldova are not contributing only to the diminishing of agriculture's share in GDP, but also to a negative impact on the GDP growth, creating severe consequences on exports.

Therefore, the aim of the paper is to analyze the latest developments in foreign trade with agri-food products of the Republic of Moldova, with an emphasis on the most competitive products on the external markets.

Theoretical premises and literature review

Overall, there are many theories of international trade provided by different scholars. The Smith's theory called absolute advantage, is focused on the ability of a country to produce a good more efficiently than another nation. The Recardian model is based on the theory of comparative advantage, according to which, countries involved in trade,

specialize in producing the products in which they have comparative advantage (Kruman et al, 2012). On the other hand, the Heckscher-Ohlin model is focused on endowments factors of production as the basis for international trade (Hassan et al, 2014). According to it, countries will be specialized in and export those products which make use of the domestically abundant factors of production more intensively than those factors which are not quite available in the home country (Blaug 2006). According to the model, economic sizes and distance between nations are the primary factors that determine the pattern of international trade (Hassan et al, 2014).

Therefore, one can note that international trade can play an important role in promoting economic growth through the specialization of each country in producing the products in which it has a comparative advantage and by transferring the resources among the different countries (Belloumi, Alshehry, 2020).

Foreign trade affects the level of a gross domestic product of the country as well as the performance of industries and enterprises. The foreign trade balance is used as a starting point in clarifying the competitive advantages especially at the level of industries and sectors within the economic structure of the country. Competitiveness on the world market is the basis for the theory of international trade and economic growth, while in comparison with classical and neoclassical economic theory of international trade, it highlights innovative, realistic sources of trade, and economic development (Bobáková, Hecková, 2007). The Moldovan international trade is rather comprising distinct elements from different theories, as is based both, on comparatives advantage, as well as on sectors with more production factors.

The Moldovan international trade with agri-food has been analyzed by various scholars and from different points of view. Thus, foreign trade with agri-food products as a consequence of the DCFTA implementation was performed by (MIEPO, 2015; Savva, 2015). The perspective of competitiveness was approached by (Stratan, 2017, Lucasenco, Ceban, 2020), while the comparative advantages have been analyzed by (Cimpoies, Gherman, 2016).

Competitiveness of the external trade of the Republic of Moldova was analyzed by various researchers through a series of different methods, including Revealed Comparative Advantage (RCA), Revealed Symmetric Comparative Advantage (RSCA), Trade

Specialization Index (TSI) or Grubel-Lloyd index (GLi) (Lucasenco, 2021). Moreover, the Revealed Comparative Advantage of Moldovan agri-food products was approached the most recent in 2020 by (Cimpoies, Sarbu, 2020), but only with respect to EU countries.

The given paper, presents, first of all, the most recent, one decade, analysis of the agri-food trade of the Republic of Moldova, with the latest year of available data (2021) and also, gives an insight in the competitiveness of some commodity groups of agrti-food products at the current stage of development of the Moldovan external trade.

Methodology

In order to achieve the main aim of the paper, the following scientific methods have been approached by the authors: generalization of empirical and applied material, induction and deduction methods for making the paper conclusions, comparison method and analytical one.

During the development of the analysis, data on Moldovan general trade and, more specific, data on values of exports and imports of agri-food products have been analyzed. The covered period concerns the years 2010 – 2021. A quantitative and qualitative analysis was performed in order to identify the most competitive agri-food products on the external market by using the RCA indicator.

The Revealed Comparative Advantage (RCA) is the most common indicator used for the assessment of the level of specialisation in trade, but still has lots of inconsistencies, so it is performed in different forms (Drozdz, 2018). The most commonly used RCA formula to assess the competitiveness of certain products or categories of products is the following:

$$RCA = \frac{\dfrac{X_{ij}}{X_{it}}}{\dfrac{X_{nj}}{X_{nt}}} = \frac{\dfrac{X_{ij}}{X_{nj}}}{\dfrac{X_{it}}{X_{nt}}}$$

where X represents exports, i – a country, j – a commodity or an industry, t – a set of commodities or industries, and n – a set of countries (Balassa, 1965). If RCA> 1, it denotes a comparative advantage, for example: the sector in which the country is relatively specialized in the terms of exports (Moroz et al, 2011).

The informational background and analytical support for the given paper is represented by data on international trade retrieved from the World Integrated Trade

Solutions database, based on UN Comtrade database, the data of the National Bureau of Statistics of the Republic of Moldova and other relevant data.

The character of the structural changes in international trade, and the possibility that these might impact countries differently depending on their pattern of specialisation, has been a matter of great concern for many observers from the 1950s onwards (Fagerberg, Srholec, 2004). Therefore, in order to perform an analysis of the agri-food trade, the current paper has been using the HS-07 classification (as the period subject to analysis starts with 2010), HS codes 1 to 24. Although FAO recommends the inclusion of some additional commodities to the main group, their share in the total agri-food trade of the Republic of Moldova is less than 0,1%, therefore, were not taken into account, the authors focusing on the HS codes 1 – 24.

Results

Moldova is one of the countries with significant potential in agriculture, one of the largest areas and farmland as a share of total land, but is among the last places in Europe in terms of view of efficiency of agricultural production (Timofti et al, 2016). Agriculture is a key sector for the economic development in Moldova, however, the fiscal resources for its support are limited. There are positive trends in the agri-food sector development in Moldova in recent years. However, this sector's vulnerability to natural, economic and trade hazards, remains very high (Stratan et al, 2018).

The Gross Domestic Product of the Republic of Moldova between 2014 and 2021 marked an increase of almost 2 times, reaching 241,870.5 million MDL in 2021. At the same time, the gross added value of the agricultural sector increased from 18,568.6 million MDL in 2014 to 25,118.9 million MDL in 2021, thus contributing to a share in GDP varying from 14.1% in 2014 to 10.4% in 2021. The minimum value was reached in 2020, accounting for 9.4%.

On the other hand, the national economy is largely relying on the agricultural sector in terms of provision of employment for population, especially the one from rural areas. In the period 2014 – 2021, the number of the employed population in total per country decreased from 869.7 thousand people to 843.4 thousand people. At the same time, a downward trend is also observed for the agricultural sector, where the population

employed in agriculture decreased from 206.5 thousand people in 2014 to 181.2 thousand people in 2021. The share of the population employed in agriculture in the total employed population varies between 23.7% in 2014 and 21, 5% in 2021, with a slight increase in the last 3 years (from 21.0% in 2019 to 21.5% in 2021).

From an organizational perspective, the National Bureau of Statistics distinguishes three major categories of agricultural producers: agricultural enterprises, peasant farms, and rural households (FAO, 2020). While all agricultural enterprises are legally registered entities, the category of peasant farms consists of legally registered family farms as well as non-registered individual farms. Most recent statistics indicate that the number of peasant farms declined to less than 193 thousand and the number of non-registered rural households increased to 220.5 thousand in 2019 (National Bureau of Statistics of the Republic of Moldova, 2022). In comparison with 2010, the number of peasant farms declined by 36% and the number of households increased by 32%. Large scale agricultural companies produce mostly low value-added crops (such as cereals, oilseeds, sugar beet). About two thirds of agricultural land is cultivated by agricultural farms that cultivate more than 50 ha of land. These companies form the export potential of the agri-food sector (Shik et al, 2016).

During 2010 – 2021, Moldovan trade in products experienced a constant increase in trade value, as the value of exported goods increased about 2 times (reaching 3144.48 mil. USD in 2021) and the value of imports –by about 86% (7176.84 mil. USD in 2021). Decreases in the growing trend of the total exports from 2012, 2015 and 2020 were due to various factors, like drought, which affected the agricultural sector capacities, devaluation of the national currency and the Covid-19 pandemic. The general trade balance of the Republic of Moldova has been negative all over the analyzed period, with a sharp declining value in 2021, when the maximum amount in the last years (-4032.36 mil. USD) was reached.

The trade with agri-food products is an intense one. The export values from 2010 almost doubled in 2021, while the import values – increased by about 71%. Decreases in the value of agri-food exports in 2012 and 2020 are due to the droughts that affected the sector, while in 2021 the maximum value of agri-food exports (1436 mil. USD) was due to the high agricultural yield registered in the country.

At the international level, as a result of the analysis of the agri-food products exported by the Republic of Moldova, one can note that the share of Moldovan agri-food

exports in the total world-wide exported agri-food products accounts for a value of 0.07% in 2021. With respect to agri-food imports, the share of Moldovan agri-food imports in the totalworld imported agri-food products account for a value of 0.05% in 2021.

Figure 1. External trade of the Republic of Moldova, 2010 – 2021, mil. USD
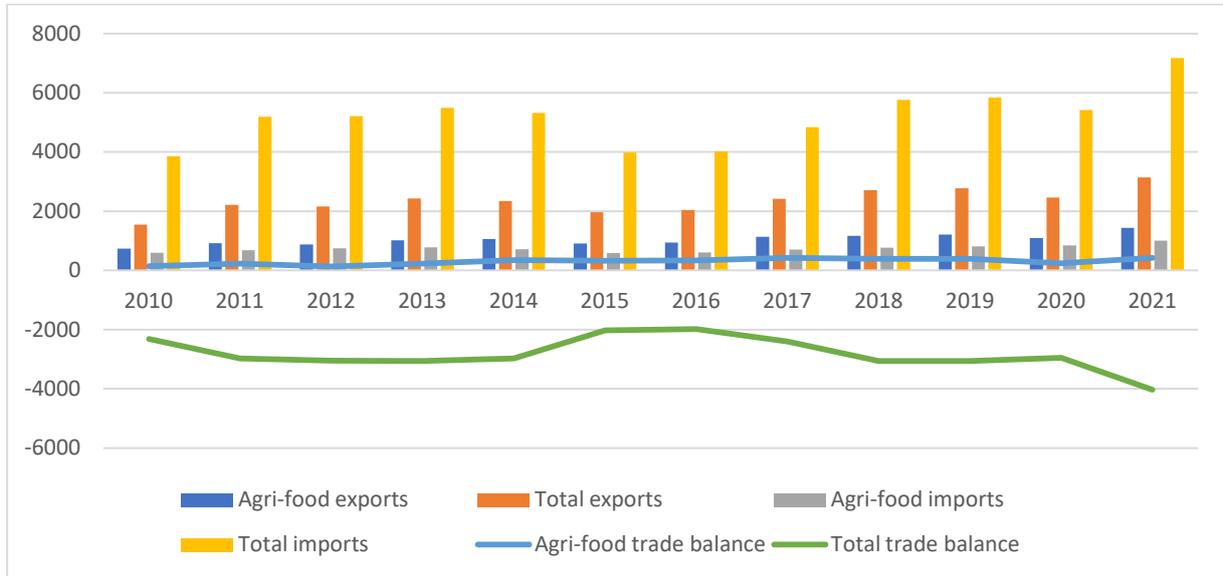
Source: World Integrated Trade Solutions database, 2022

The agri-food trade plays an important role in the total trade of the Republic of Moldova. Agri-food products hold an impressive share in the total exported products (Ceban, 2022), which during the years 2010 - 2021 varied around 40% - 47%. In 2021, the share of agri-food exports in total exports of goods of the country accounted for 45.7%. On the other hand, being self-sufficient in most of the needs with respect to agri-food products, the share of agri-food imports in the total imports of the country accounts for values between 13.2% - 15.6% during 2010 – 2021. In 2021, the share of agri-food imports in total imports of goods amounted to 14.1%.

Figure 2. Shares of agri-food imports and exports in total trade of the Republic of Moldova, 2010 – 2021, %
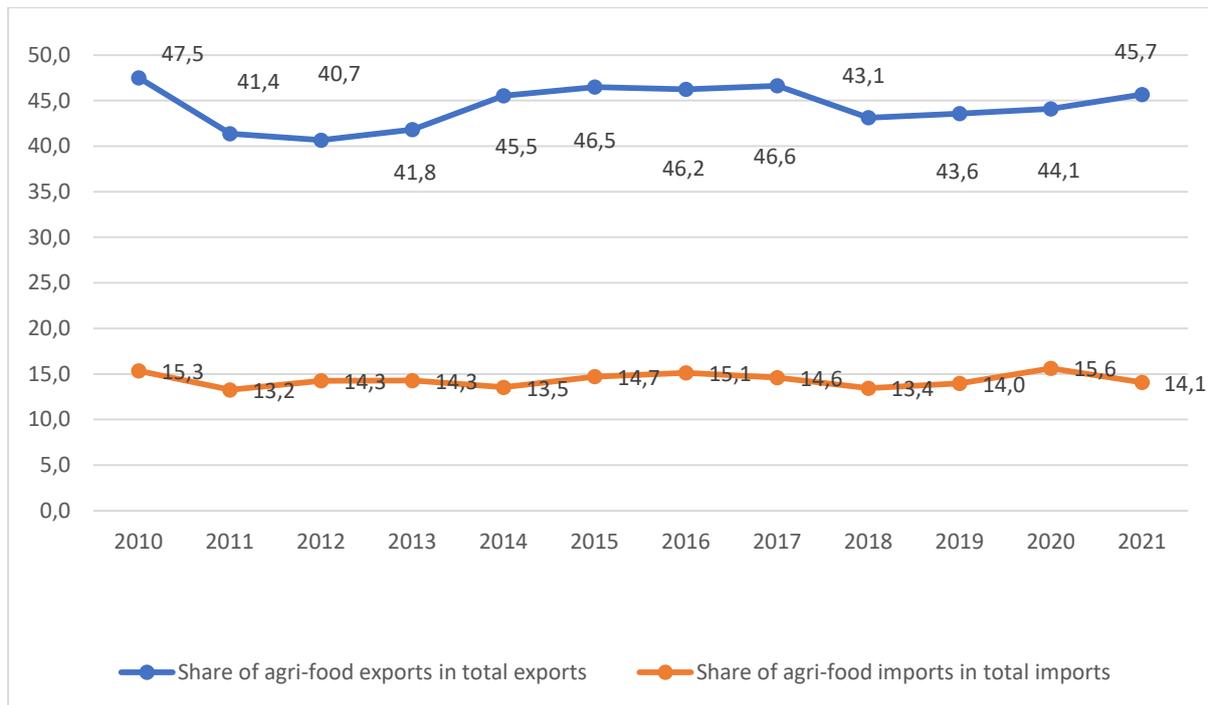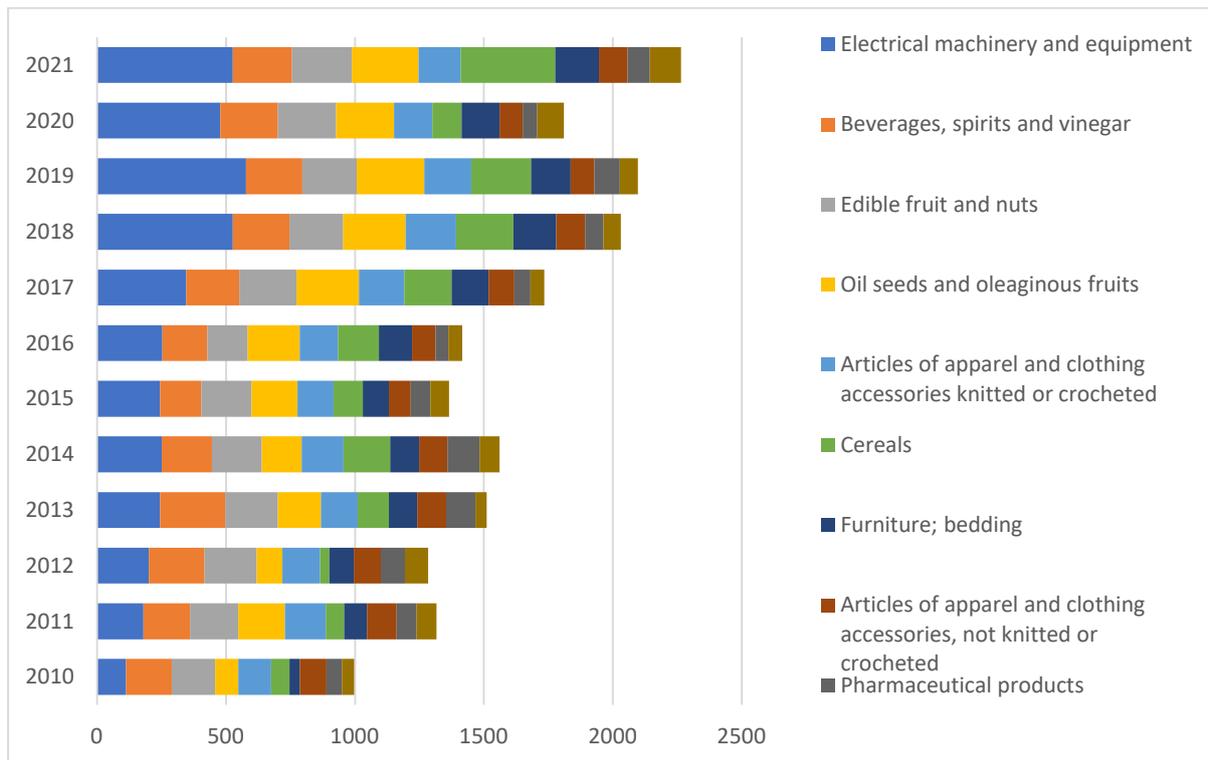

Source: World Integrated Trade Solutions database, 2022

Analysis of Moldovan agri-food exports.

During the years 2010 – 2021, the most exported Moldovan products were represented by the following commodities groups: electrical machinery and equipment (with as total value of 3942.7 mil. USD and an average of 14% of total exported goods); beverages, spirits and vinegar (2451.5 mil. USD and 8.7%); edible fruit and nuts (2404.7 mil. USD and 8.5%); oil seeds and oleaginous fruits (2301.8 mil. USD and 8.2%); articles of apparel and clothing accessories, knitted or crocheted (1887.7 mil. USD and 6.7%); cereals (1871.9 mil. USD and 6.6%); furniture (1454.4 mil. USD and 5.2%); articles of apparel and clothing accessories, not knitted or crocheted (1224.5 mil. USD and 4.3%); pharmaceutical products (970.1 mil. USD and 3.4%) and animal or vegetable fats and oils (877.8 mil. USD and 3.1%). During 2010 – 2021, the top 10 exported products accounted for 68.7% of the value of all exported goods. It is worth noting that out of the top 10 exported commodity groups, 5 of them are represented by groups affiliated to the agri-food sector.

Figure 3. Top 10 exported Moldovan products, 2010 – 2021, mil. USD

Source: World Integrated Trade Solutions database, 2022

During the years 2010 – 2021, out of the commodity groups 1 – 24 affiliated to agri-food products, the top 10 exported goods were related to: beverages, spirits and vinegar (with a total value of 2451.5 mil. USD and an average of 19.6% share of the agri-food exports); edible fruits and nuts (2404.7 mil. USD and 19.2%); oil seeds and oleaginous fruits (2301.8 mil. USD and 18.4%); cereals (1871.9 mil. USD and 15%); animal or vegetable fats and oils (877.8 mil. USD and 7%); preparations of vegetables, fruit (751.3 mil. USD and 6%); sugars and sugar confectionery (333.2 mil. USD and 2.7%); tobacco and manufactured tobacco (243.7 mil. USD and 1.9%); residues and food waste (242.6 mil. USD and 1.9%) and dairy produce; birds' eggs; honey (198.3 mil. USD and 1.6%). The top 6 exported agri-food products account for an average share of 85% of the exported agri-food products.

Figure 4. Top 10 exported Moldovan agri-food products, 2010 – 2021, mil. USD
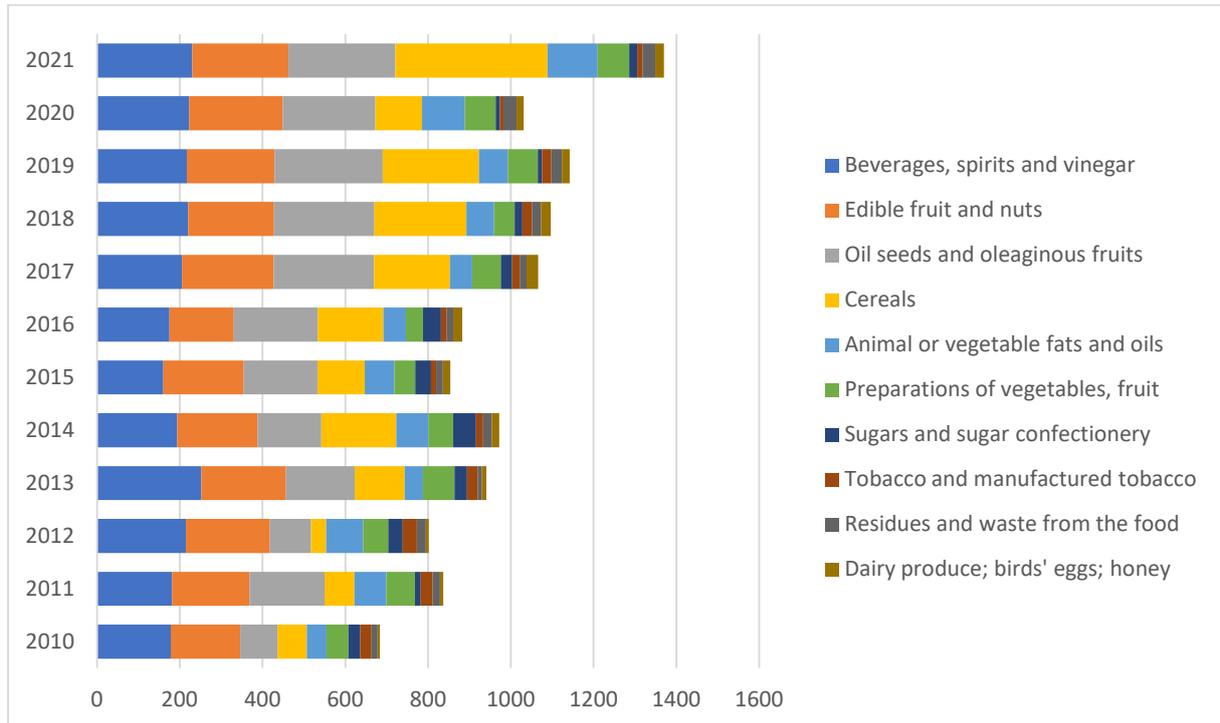
Source: World Integrated Trade Solutions database, 2022

As for the trade patterns, during the years 2010 – 2021, some modifications have occurred in the exported volumes to certain countries. Thus, if in 2010 the Russian Federation represented the main destination of Moldovan agri-food products with a share of 33.1% of the agri-food exports, then in 2021 the leadership was taken by Romania, which experienced an increase in volumes and values, having the highest share of 16% of the total agri-food exports. Meanwhile, Moldovan exports experienced a diversification of partners. Embargos imposed by the Russian Federation on a series of Moldovan products (wine in 2006 and 2013; fruits like apples, peaches, cherries, etc. and canned fruits and vegetables in 2014), DCFTA agreement with the EU, as well as diversification of external markets have represented the main causes in trade patterns changes (Stratan et al, 2019). Other important export partners of the Republic of Moldova are Italy, Belarus, Turkey, United Kingdom, Poland, Ukraine, France and Switzerland. In 2021, about 64% of the exported agri-food products were directed towards these countries.

Figure 5. Top 10 agri-food export trade partners, 2010 – 2021, mil. USD
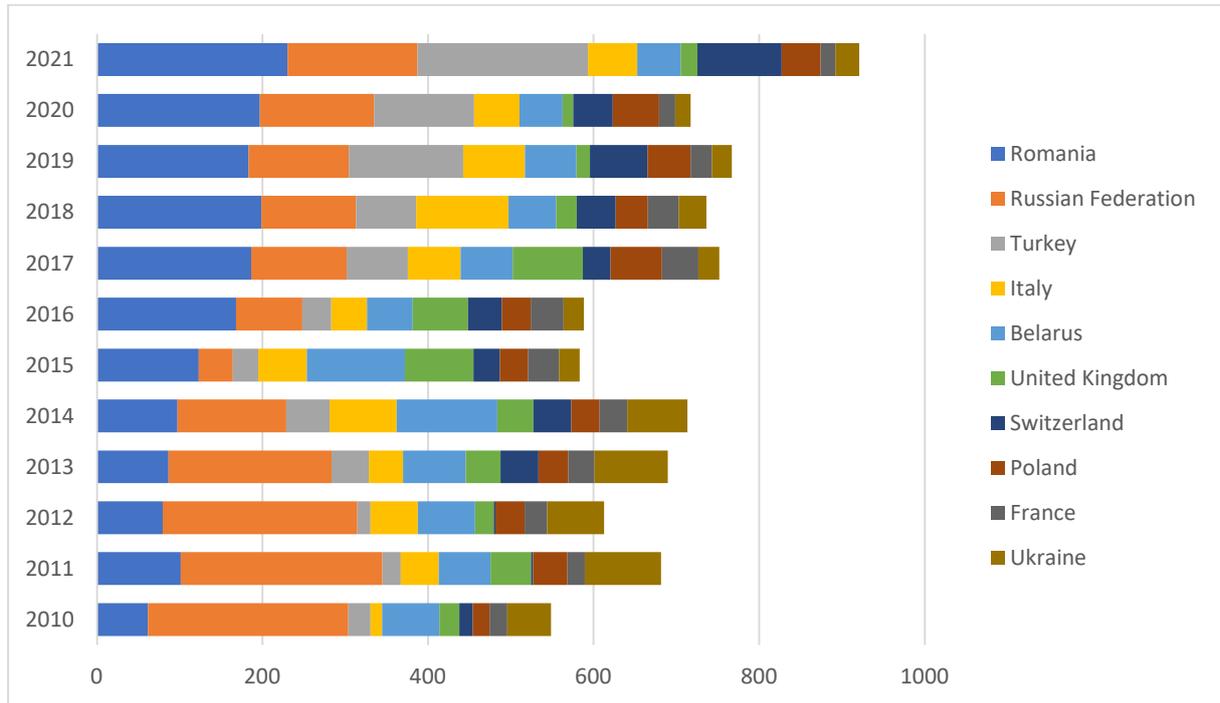
Source: World Integrated Trade Solutions database, 2022

External trade of Moldovan agri-food products is continuously increasing, both in terms of exports, as well as imports. Therefore, it is becoming necessary to analyze which commodities have a considerable competitive potential on foreign markets, and which ones are lacking in it or whose position may be significantly improved (Lucasenco, 2021).

Therefore, the RCA indicator has been used in order to assess the competitiveness of Moldovan exported products. Thus, during 2010 – 2021, the average RCA values have been divided into four specific groups, namely: high competitive degree (Oil seeds and oleaginous fruits; Edible fruits and nuts; Beverages, spirits and vinegar; Cereals; Preparations of vegetables and fruits), high to moderate competitive degree (Animal or vegetable fats and oils; Sugars and sugar confectionery; Vegetable plaiting materials; Tobacco and manufactured tobacco; Live animals; Animal products; Residues and food waste), moderate to low competitive degree (Preparations of cereals, flour; Dairy produce; Birds' eggs; honey; Edible vegetables and certain roots; Cocoa and cocoa preparations; Miscellaneous edible preparations; Meat and edible meat offal; Live trees and other plants; Products of the milling industry) and low competitive degree (Fish and crustaceans; Lac; Gums, resins; Preparations of meat, fish; Products of animal origin, not else specified; Coffee, tea, matt and spices).

Table 1. Competitiveness of the agri-food commodity groups based on the RCA indicator,

average values for 2010 - 2021

| High competitiveness degree	High to moderate competitiveness degree
(12) Oil seeds and oleaginous fruits – 14.9	(15) Animal or vegetable fats and oils – 5.6
(08) Edible fruits and nuts – 14.7	(17) Sugars and sugar confectionery – 4.8
(22) Beverages, spirits and vinegar – 13.8	(14) Vegetable plaiting materials – 4.2
(10) Cereals – 9.8	(24) Tobacco and manufactured tobacco – 3.9
(20) Preparations of vegetables and fruits – 8.0	(01) Live animals; animal products – 3.2
	(23) Residues and food waste - 2
Moderate to low competitiveness degree	**Low competitiveness degree**
(19) Preparations of cereals, flour – 1.7	(03) Fish and crustaceans – 0.0
(04) Dairy produce; birds' eggs; honey – 1.4	(13) Lac; gums, resins – 0.0
(07) Edible vegetables and certain roots – 1.3	(16) Preparations of meat, fish – 0.0
(18) Cocoa and cocoa preparations – 1.0	(05) Products of animal origin, not else specified – 0.2
(21) Miscellaneous edible preparations – 0.9	(09) Coffee, tea, matt and spices – 0.2
(02) Meat and edible meat offal – 0.9	
(06) Live trees and other plants – 0.7	
(11) Products of the milling industry – 0.7	

Source: own work

Analysis of Moldovan agri-food imports.

During the years 2010 – 2021, the most imported products in the Republic of Moldova were represented by the following commodities groups: mineral fuels, mineral oils (with a total value of 7775.4 mil. USD and an average of 12.5% share of the total imports); electrical machinery and equipment (5421.0 mil. USD and 8.7%); boilers, machinery (4936.6 mil. USD and 8%); vehicles other than railway or tram (3674.6 mil. USD and 5.9%); commodities not specified (3478.4 mil. USD and 5.6%); plastics and articles thereof (2932.2 mil. USD and 4.7%); pharmaceutical products (2835.4 mil. USD and 4.6%); articles of iron or steel (1426.4 mil. USD and 2.3%); wood and articles of wood (1239.1 mil. USD and 2%) and paper and paperboard (1225 mil. USD and 2%). During 2010 – 2021, the top 10 imported products accounted for 56.3% of the value of all imported goods. Thus, one can note that among the first top 10 imported commodity groups, agri-food products are absent.

Figure 6. Top 10 imported commodity groups in the Republic of Moldovan, 2010 – 2021, mil. USD
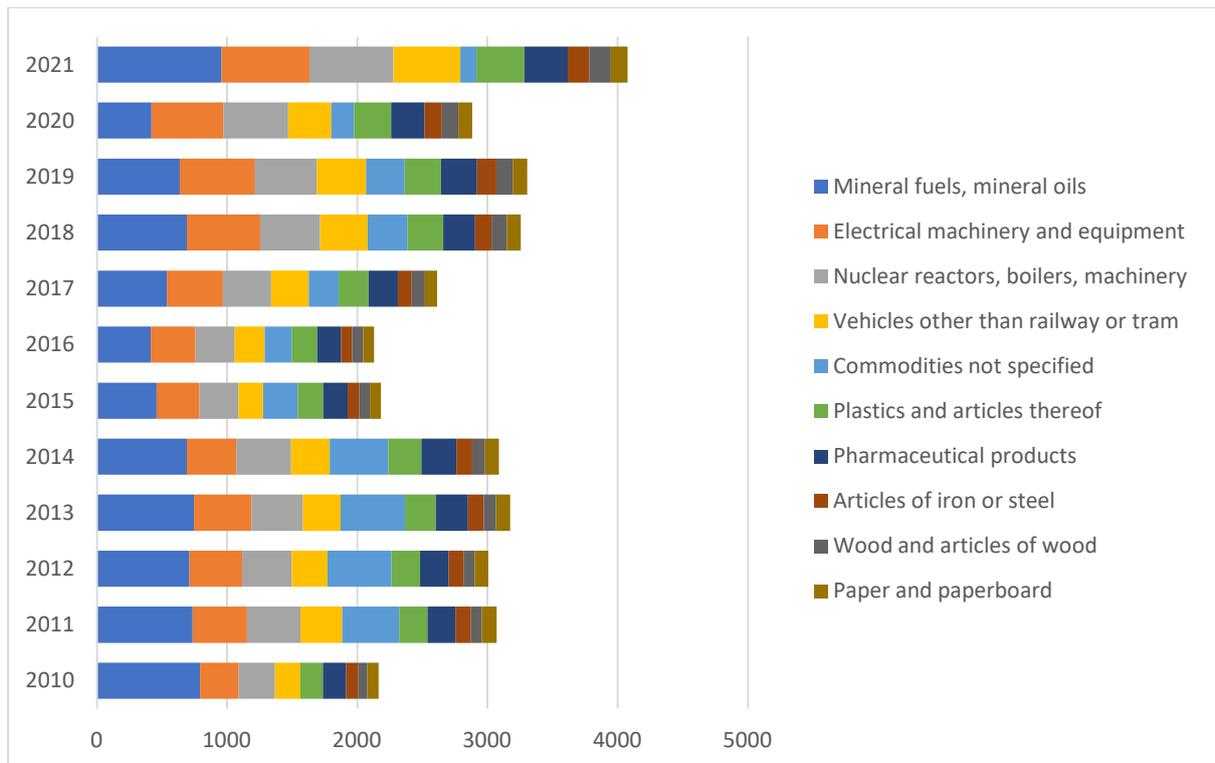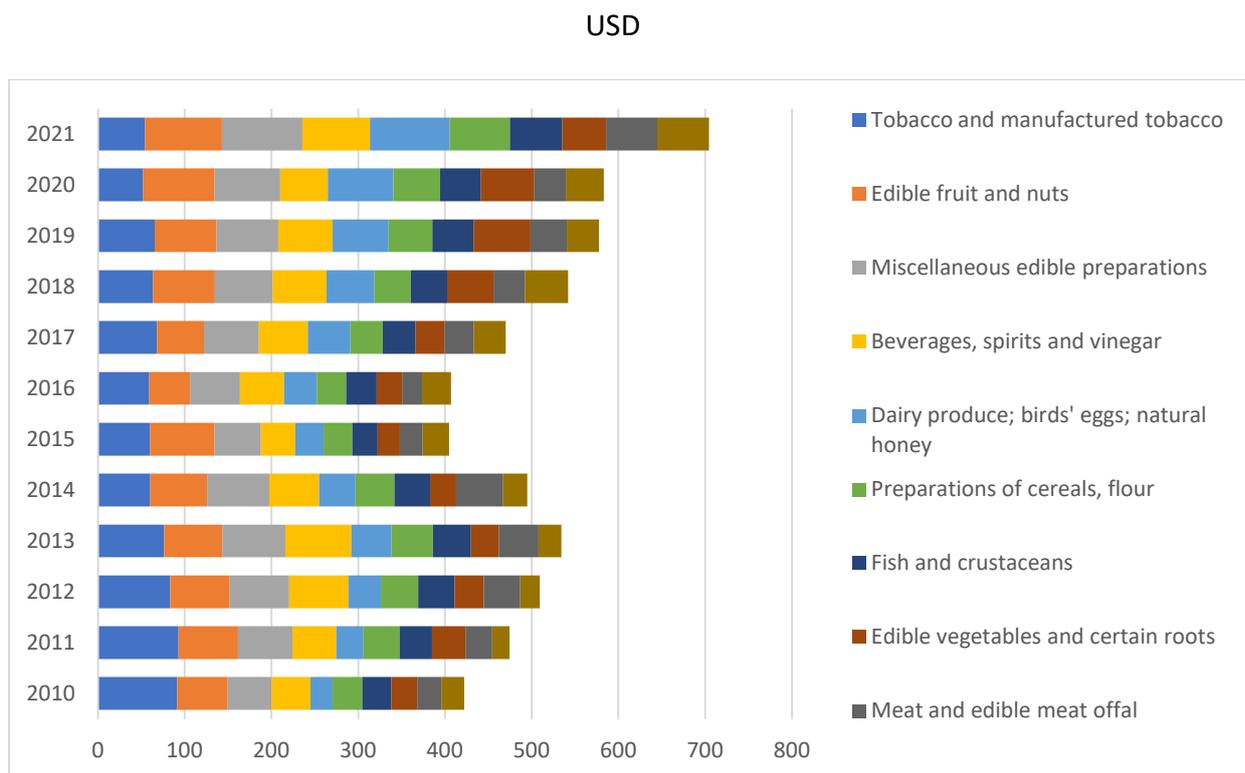

Source: World Integrated Trade Solutions database, 2022

During the years 2010 – 2021, out of the commodity groups 1 – 24 affiliated to agri-food products, the top 10 imported goods were related to: tobacco and manufactured tobacco (with a total value of 825.2 mil. USD and an average of 9.3% share of the agri-food imports); edible fruits and nuts (817.6 mil. USD and 9.2%); miscellaneous edible preparations (806.4 mil. USD and 9.1%); beverages, spirits and vinegar (702.4 mil. USD and 7.9%); dairy produce; birds' eggs; natural honey (589.4 mil. USD and 6.6%); preparations of cereals, flour (531.7 mil. USD and 6%); fish and crustaceans (496.2 mil. USD and 5.6%); edible vegetables and certain roots (484.6 mil. USD and 5.5%); meat and edible meat offal (456.5 mil. USD and 5.1%) and oil seeds and oleaginous fruits (414.3 mil. USD and 4.7%). The top 10 imported agri-food products account for an average share of 69% of the imported agri-food products.

Figure 7. Top 10 imported agri-food products in the Republic of Moldova, 2010 – 2021, mil.
USD

Source: World Integrated Trade Solutions database, 2022

As for agri-food import partners, the most important ones continue to be Ukraine, Romania, the Russian Federation, Turkey, Germany, Italy, etc. In 2021, the top 10 import partners accounted for 90% of the total imported agri-food products.

Figure 8. Top 10 agri-food import trade partners, 2010 – 2021, mil. USD
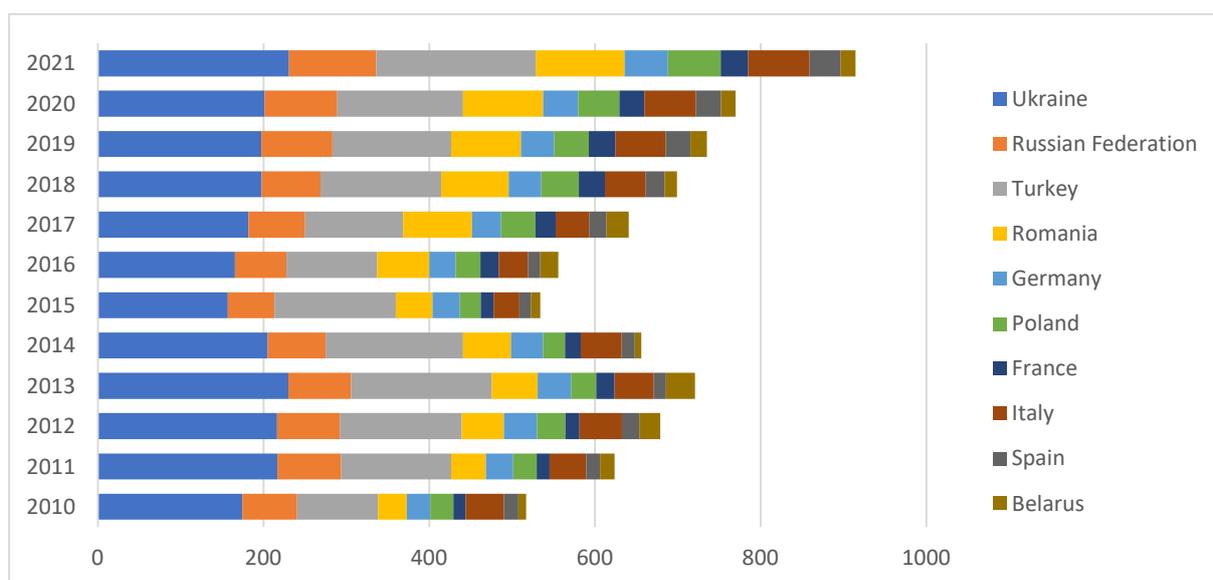
Source: World Integrated Trade Solutions database, 2022

Summary, conclusions, recommendations

The Republic of Moldova is a country that is highly reliant on its agricultural sector, both in terms of its contribution to GDP and employment of population, as well as its generous contribution to foreign trade, especially exports. The foreign trade with agri-food products is constantly increasing, having a net positive trade balance during the period of 2010 – 2021. The Moldovan foreign trade with agri-food products is rather comprising distinct elements from different trade theories, being based on comparatives advantage, as well as on sectors with more production factors.

In 2021, the total value of agri-food exports amounted to 1436 mil. USD, which represents record value for the Moldovan economy. At the same time, the agri-food import values have for the first time overpassed the threshold of 1000 mil. USD, amounting to 1010.3 mil. USD. Nevertheless, being a small country, with a rather low productivity, the share of Moldovan agri-food exports in the total world-wide exported agri-food products accounted for a value of 0.07% in 2021, while with respect to agri-food imports, the share of Moldovan agri-food imports in the total world imported agri-food products accounted for a value of 0.05%.

Republic of Moldova has a focused export of agri-food products on several countries, as in 2021, about 64% of the exported agri-food products were directed towards only 10 countries, the main export partners being Romania, Russian Federation, Turkey, Italy, Belarus, United Kingdom, Poland, Ukraine, France and Switzerland. The recent evolutions on the world market, both, from the economic and geopolitical point of view, place Moldova in a rather dependent situation, with a low diversification of export partners, which contributes negatively to the further development of agricultural sector.

At the same time, the situation with agri-food import partners is even more static and undiversified, as the most important partners such as Ukraine, Romania, Russian Federation, Turkey, Germany, Italy, Poland, France, Spain and Belarus, in 2021, accounted for 90% of the total imported agri-food products.

With respect to the RCA, Moldovan companies are competitive on the foreign market namely with oil seeds and oleaginous fruits, edible fruits and nuts, beverages, spirits and vinegar; cereals, as well as preparations of vegetables and fruits. Among the above mentioned commodity groups there are present both, high value-added products and low

value-added. Therefore, the future focus of the foreign trade should be placed on increasing of exports of high value-added products, fact that will allow the enhancement of development of small and large value chains in the agricultural sector of the Republic of Moldova.

At the same time, special attention should be put to enhancing investments in value added sub-sectors, improvement of the quality of products, investments in post-harvest and processing infrastructure, information activities that will contribute to diversification of export partners, development of strong partnerships between private sector and academia, etc. These measures will mainly contribute to accessing new markets and satisfying the existing demands.

Acknowledgements

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Geographical Indications as a Local Development and Differentiation Strategy Tool: The Case of Poland

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Abstract After the industrial revolution, and especially in the last hundred years, the increase in the number of factories helped to make standardized mass productions in many areas and to experience production abundance. Presently, this situation, which allows individuals to obtain many products, especially food materials, quickly and cheaply, is considered as a positive situation in terms of economy and society. Today, it is expressed by some circles that standardized mass productions have some disadvantages, but also great advantages. Some of these can be listed as the concentration of production at certain points of the country, the danger of chemicals used in production to health and the environment, ignoring the ancient techniques adopted in the production process for centuries and leading to a deterioration in justice of income distribution. An important concept that stands out at the point of eliminating all these counted and uncounted negative externalities is geographical indications. These signs, which establish a link between the characteristic features of the products and their geographical area, have recently increased their popularity in many countries, especially under the leadership of countries such as France and Italy. From this point of view, this study aimed to examine the geographical indication products of Poland, which is a member of the European Union and whose historical ties are quite old, in the context of the importance and its effect on local development. The data to be used in the study is obtained from national institutions and the European Union commission. The findings show that Poland, which has a long history of culture and many traditional products, underutilizes its potential in the area of geographical indicators.

Key words: Economic Development, Sustainable Development, Regional Economic Activity: Growth, Development, Environmental Issues, and Changes

JEL: O1, Q01, R11

Introduction

With the help of the technological changes that have emerged in the last century, the circulation of people, money, ideas and goods in today's globalizing world has accelerated more than ever before in history. Although all this mobility is considered to be an opportunity in some respects; in some ways, it can have negative consequences.

One of these negative results is the possibility of decreasing the product quality by increasing the competition of the goods produced in different parts of the world in a cheaper and mass manner. This possibility primarily risks the disappearance of the goods produced with ancient traditions, the income of the people who earn their living with the production of the related products, and the health of the people who consume these products with the perception that they are of the same quality. At the same time, this risk is not only about economy or health; it can lead to consequences that may indirectly cause damage to products historical and cultural ties.

At this point, the necessity of legal protection of local products, the producers producing these products and the consumers consuming them emerges. One of the most important initiatives in this field is the application known as "Geographical indications". Geographical indications (GI) are defined in the Article 22.1 of the TRIPS Agreement as:

"Indications which identify a good as originating in the territory of a Member, or a regional locality in that territory, where a given quality, reputation or other characteristic of the good is essentially attributable to its geographical origin".

Advantages of Geographical Indications to the Parties

Today, competition is experienced not only between products or businesses, but also between countries and regions. From this point of view, regions that want to gain competitive advantage should determine the features that will enable them to become a brand and take advantage of them (Özdemir ve Karaca, 2009:114). At this point, one of the concepts that will provide a significant advantage to parties is geographical indications.

In Article 22.2 of the TRIPS Agreement, the statements regarding the legal instruments that Geographical Indications will provide to the relevant parties are as follows:

"a) the use of any means in the designation or presentation of a good that indicates or suggests that the good in question originates in a geographical area other than the true place of origin in a manner which misleads the public as to the geographical origin of the good;

(b) any use which constitutes an act of unfair competition within the meaning of Article 10bis of the Paris Convention (1967)."

A wide market offers forces buyers to make conscious choices, taking into account not only the price of goods, but also their origin, including geographic origin. The geographical indications of origin inform about the geographical origin of the goods (Lipińska, 2008). They are an important carrier of information for consumers about a specific place, region or country where the goods were manufactured. They not only indicate the type of goods purchased, but sometimes also determine their quality or taste. For this reason, goods distinguished by a specific geographical origin enjoy great recognition among buyers (Widawski, 2011) (examples are wines, cheeses, mineral waters, etc., the origin of which from a specific geographical location is important for consumers).

If the geographic origin of the goods is of great importance to consumers, then for obvious reasons it also has a significant value for producers. Typically, origin labeled goods are easier to sell and have higher prices than goods of the same type that do not come from a given geographic area (Agnowski, 2008). For example, Antigua Coffee Bean grown in Guatemala rose from 0.5$ to 1.5$, Italian Parma Ham from 39 lire to 42 lire, and Jamao Coffee produced in the Dominican Republic from 67$ to 107$. The price of the agave plant, the raw material of tequila, has increased by 5,000% in seven years (Passeri, 2006, as cited in Doǧan, 2015). Indication of origin increases the market position of goods whose economic value is constantly growing. As a consequence, producers are more and more willing to use designations in the course of trade, which make it possible to distinguish the geographical origin of their goods.

The economic importance of geographical indications of origin cannot be overestimated. Therefore, it became necessary to provide them with a specific legal framework (Skubisz, 2017). It started with appropriate solutions contained in multilateral international agreements, then supplemented by bilateral agreements. Undoubtedly, the protection initiated by the provisions of the Paris Convention and specific agreements issued on the basis of it, as well as the provisions of national legislation that began to provide adequate protection, initially with the regulations on combating unfair competition, and then with the provisions on industrial property law, were of fundamental importance. Furthermore, both international and national legal acts continued this process. It has not yet been completed, as evidenced by the constant practice of signing agreements

by the European Union with third countries on the protection of geographical indications and wine designations of origin (O'Connor, 2004).

Geographical indications of origin (geographical indications) are indications (symbols) that identify a specific place on Earth (town, region, country, etc.) (Bowen, S., 2010). Used to mark goods, they indicate the origin of the goods in a specific geographic location. Geographical indications are intangible goods. Their immaterial nature arises at the moment of creating a conceptual relationship with the commodity in the recipient's consciousness (Skubisz, Gała & Całka, 2017). The relationship between the sign and the product includes the image of the product as a whole because of its origin in a specific geographical area (Skubisz, 2018).

The recipient, when linking the mark with the product, assigns it a specific geographical origin (judgement from TSUE 6.7.2017r., C-139/16). It should be noted that, according to the jurisprudence of the Court of Justice, a sign which is the name of luxury city districts in Spain (Marbella and Madrid) and is also used as a trademark for wines, does not constitute a geographical indication of origin and does not refer to geographical origin, but to a feature of a luxury good or a service consisting in the possibility of finding such good or service in large quantities in one place. According to the Court, the contested sign could fulfil the function of a geographical indication if, for example, it was accompanied by a name describing a specific geographical area, so that it was possible to identify a given physical place associated with a high concentration of a product or service of high value and quality. An image of an individualized commodity appears in the mind of the recipient, which makes it possible to distinguish this commodity from other commodities of the same type produced elsewhere (e.g. the geographical indication "Feta" indicates a Greek sheep cheese made in brine, which due to its geographical origin differs from other cheeses of the same type produced outside Greece).

Geographical indications of origin become a specific phenomenon in human consciousness when they are preserved in material form and become the object of perception of even only one person (Skubisz, 2018). This is the case when designations are applied to goods, used in commercial documents, advertising, etc. It is therefore necessary to distinguish between geographical indications, which are a phenomenon in human consciousness, and their material carriers. Material carriers of geographical

indications are specific copies of goods and indications (Walczak, 2011) (e.g. geographical names, photos, drawings, ornaments referring to geographical places, etc.) placed on these goods or their packaging, in advertising leaflets, commercial documents, etc. The dual nature of geographical indications of origin lies in the fact that, on the one hand, they are a kind of phenomenon registered in the recipient's consciousness, and on the other hand, that they are sensually perceived markings (e.g. words, drawings, etc.) that actually exist in the outside world, which are found on goods, their packaging, in advertising, commercial documents, etc. Geographical indications are thus sensually perceived symbols with a geographical content that distinguish goods (Skubisz, Gała & Całka, 2017).

The goods and their labels are separate elements. Geographical indications of origin link these elements together by assigning, in the minds of recipients, specific indications to given goods (Bramley, Biénabe & Kirsten, 2009). The purpose of such classification is to individualize the goods on the market according to their geographical origin (Skubisz, 2018). The recipients' perceptions of the goods (their characteristics, quality, etc.) are related to the origin of the indicated geographical area. Geographical indications carry these ideas (Sacha, 2017). It follows from the above that the information and ideas conveyed by geographical indications are of two types. First, through their material carriers, the signs create an image of personalized goods (they distinguish goods from other goods of the same type). Second, they reflect opinions about the goods. These opinions, shaped by recipients' associations (usually positive), are of significant economic importance. They can stimulate the growth of sales of goods with geographical indications, increase the price of these goods, introduce them to prestigious distribution networks, etc. (Skubisz, 2012).

In trade, geographical indications of origin perform functions (Barjolle, 2017) such as: information, distinction, advertising (Calboli, 2015) and warranty(quality) (Le Goffic & Zappalaglio, 2017). The informative and distinctive functions together constitute the origin marking function (Skubisz, Gała & Całka, 2017), of which they relate in particular to:

- information function - related to the transmission of information on the geographical area in which the goods were produced. This information is especially important for recipients who are looking for goods with an identifiable geographical origin;

- distinguishing function - this function is performed by distinguishing goods produced in a specific geographic location from other goods of the same type originating from other geographic areas. The criterion for distinguishing is the geographical origin of the goods. It is secondary to the information function. Geographical indications, informing about the origin of goods, at the same time distinguish them from other goods characterized by a different geographical origin - a distinctive function;

- advertising function - plays a secondary role in relation to the origin marking function and consists in encouraging recipients to purchase goods marked with geographical origin. The implementation of this function evokes positive opinions about goods from the indicated geographical area in the minds of recipients (Shimp, Samiee & Madden, 1993). The advertising function, unlike that of origin marking, does not follow from the very nature of geographical indications, but is realized only once positive ideas about the goods are formed;

- warranty function - unlike the other functions, it only applies to Qualified Geographical Indications. These markings inform recipients about the characteristics, quality or reputation of the goods (Rangnekar, 2004). They perform the guarantee function by ensuring (guaranteeing) that goods bearing a geographical indication have specific quality features or a reputation resulting from the specificity of the geographical environment of the production area.

According to the basic division of geographical indications, a distinction is made between ordinary (simple) and qualified indications (Dangjee, 2012). Ordinary indications convey only simple, non-qualitative information about the origin of the goods in a given geographical area. Qualified indications are additionally a carrier of information about the quality features of goods resulting from their geographical origin (Schwagele, 2005). These are qualitative features that are due to the geographical environment, which include natural factors (e.g. climate, topography, soil, water, etc.) and human factors (e.g. work organization, knowledge and experience of local producers in the field of handicrafts, folk art, etc.).

Due to the way in which geographical indications indicate the place of origin of goods, they can be divided into direct and indirect indications (Rangnekar, 2002). Geographical names, e.g. names of places, regions, countries, etc., are direct signs. These names straightforwardly inform about the place of origin of the goods. Indirect geographical indications do not explicitly indicate a specific geographical origin. However, they consist of elements that allow the average recipient - on the basis of many years of use and tradition - to connect certain goods to a specific geographic place.

There is also a division of geographical indications into word, word-graphic and graphic indications. For a better illustration, it was considered justified to present the below in a graphic form.

Figure 1: Division of Geographical Indications
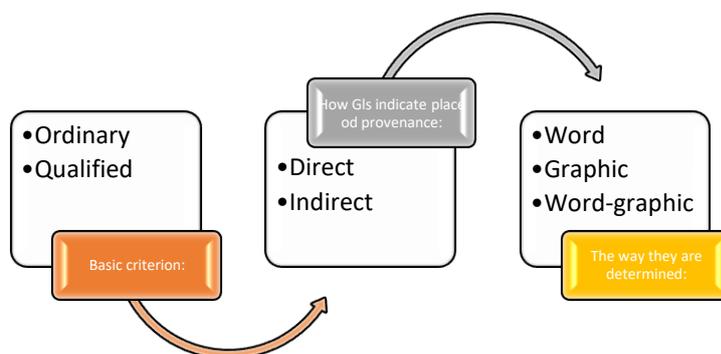
The current system of protection of names and geographical indications significantly influences the diversification of the development of areas both in Poland, as well as in Europe and around the world, which certainly translates into a common policy in this area between countries (Goldberg, 2001). Therefore, it influences the increase of income, which is especially valuable. Thus, the increased funds obtained from the sale of regional products affect not only the stabilization of family farms, but also prevent the migration of young people from rural to urban areas and prevent depopulation of rural areas.

Often, producers of regional products transform typical farms into agritourism farms, expand them and create new jobs related to guest service. They also cooperate with neighbouring farmers, buying fresh vegetables, fruit, dairy products, poultry, eggs, honey and many other traditional rural products. In this way, a local market is created on the spot, in a specific village and commune, new jobs are created and employment increases.

Geographical Indications in Poland from Past to Present

In Poland, the procedure of assigning geographical indications is governed by the Act of 30 June 2000 - Industrial Property Law (Journal of Laws 2001 No. 49 item 508). The Act covers the registration procedure for geographical indications used to mark industrial products. The competent authority for registration of geographical indications for industrial products is the Patent Office of the Republic of Poland. However, the authority competent at the national level for the registration of geographical indications for agri-food products is the Minister of Agriculture and Rural Development.

Geographical indications are divided into ordinary and qualified indications. Qualified indications are marks which identify the origin of a product and indicate the specific features of the product resulting from the place of its origin or manufacture. Qualified designations are those protected under the Industrial Property Law and Council Regulation No. 510/2006 on the protection of geographical indications and designations of origin for agricultural products and foodstuffs. Ordinary designations are identifiers that mainly indicate the place of origin of goods, without exposing the quality of the goods (https://eur-lex.europa.eu/legal, accessed 25.03.2022)

The Industrial Property Law Act identifies the following types of geographical indications:

Verbal designations - it is therefore impossible to register spatial and graphic designations (e.g. Koziołki poznańskie) or sound designations (e.g. hejnał mariacki).

Designations referring directly or indirectly to a specific area. Directly, i.e. these are just adequate geographical names (e.g. Porcelana from Ćmielów, lace from Koniaków) or indirectly, i.e. the area described by this word can be identified in an obvious way (e.g. kierpce, oscypek).

Signs, which are able to identify a product as coming from a particular area, where area is understood very broadly as a distinguishable area, be it legal (e.g. a commune's area), historical (e.g. Sandomierz land), geographical (e.g. Beskid Żywiecki), purely factual or even conventional, as long as a sign allows to identify a particular area.

The features of the goods, such as quality or good reputation, are attributed to the geographical origin of the goods. Such goods have some special characteristic (feature) that distinguishes them from other, similar goods. This feature is associated in the public's mind with a specific geographical location and it is the dominant feature. The Act further indicates that we are also dealing with a geographical indication when:

A. indication is intended to designate goods if they are prepared under special conditions and there is a system for controlling compliance with those conditions, and the raw materials or semi raw materials from which the goods are produced come from a designated area larger than the area of production or processing of the foods,

B. the indication is intended to designate goods prepared under special conditions and there is a system of control of those conditions, and the goods in question are manufactured or processed in an area larger than that which would result from the geographical indication used to designate their origin or where the goods are not manufactured or processed in the indicated area but are traditionally associated with it through the indication (https://eur-lex.europa.eu/legal, accessed 25.03.2022).

The provisions of the Act include a division of geographical indications into regional names and designations of origin. Both groups are used to indicate the place of production or processing of goods. However, regional designations give the goods unique and specific properties, mainly related to the impact of the geographical environment. The geographical environment is understood here as a cohesive effect of the human factor and natural environmental factors. In contrast, designations of origin merely indicate the special qualities of products attributed to them because of their place of origin, without taking into account the influence of the human factor.

Unlike the other aspects of industrial property in question, geographical indications of industrial products are characterized by the fact that:

a) their protection is unlimited in time and runs from the date of entry in the register;

b) the designation highlights the region in which the product was created, not the name of the producer;

c) they are reserved for a single good;

d) protection is provided irrespective of the risk of confusion;

e) transfer of the right from the register to another organization or body by "agreement";

f) geographical indications cannot be licensed;

g) geographical indications can only be verbal.

Agricultural products entered by the European Commission in the Register of Protected Designations of Origin, Protected Geographical Indications and the Register of Traditional Specialties Guaranteed are protected against:

- the direct or indirect commercial use of a reserved and registered name for products not covered by the registration in cases where the non-registered products are comparable to the products registered under that name or where the use of the name damages the reputation of the protected name;

- false or misleading indications relating to the provenance, nature or essential qualities of the product on the inner or outer packaging, advertising material or documents relating to the product which give a false impression as to its origin;

- unlawful appropriation, imitation or allusion, if even the true origin of the product is indicated on the packaging and the protected name is translated and accompanied by the expression "in the style", "of the kind", "using the method", "as produced in", "imitation" or "similar" (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R0787, accessed 25.03.2022):

Regulation (EU) No 1151/2012 of the European Parliament and of the Council distinguishes three categories of protected names:

1. Protected Geographical Indications

2. Protected Designation of Origin

3. Traditional Speciality Guaranteed.

Figure 2. Graphic symbols of Protected Geographical Indication (PGI), Protected Designation

of Origin (PDO) and Traditional Specialty Guaranteed (TSG)

Source: European Commission (2022).

These categories differ in the degree of association with a specific geographic area. Protected Geographical Indications (PGI) specify the name of a region, specific place or country that is used to designate an agricultural product or foodstuff that:

a) comes from a specific place, region or country,

b) has at least one stage of production take place in the geographical area indicated,

c) has quality, reputation or other characteristic that is associated with the region from which the product comes.

The emblem in the middle of Figure 2 shows "Protected designation of origin (PDO)". A Name of Origin is a name that identifies a product:

a) a) originating in a particular place, region or, in exceptional cases, country,

b) b) the quality or characteristics of which are essentially attributable to particular conditions in the geographical environment, consisting of factors of the natural environment and human activity,

c) c) produced exclusively in the designated geographical area specified in the application for registration.

The emblem on the right in Figure 2 shows "Traditional Specialty Guaranteed (TSG)". Traditional Specialty Guaranteed is a designation granted to products that have a "specific character", i.e. a set of features that clearly distinguish it from other, from the indigenous group of products. It must be characterized by a traditional way of production, be made

with traditional raw materials or have a traditional composition. It is not necessary to indicate the connection of a specific product for which the mark of Traditional Specialty Guaranteed is granted with a specific geographical area.

The European Union has created a clothed register of products manufactured with the guarantee of traditional specialty. This is a separate, self-contained inventory of a group of goods produced according to long-standing traditions. This register (as well as the register of EU products with geographical indications and designations of origin) is available on the website at:

https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/geographical-indications-register/tsg.

The number of products registered by Polish producers in the international register of products with certified geographical indications is 37, including 35 food products and 2 spirit products. The Polish register, kept by the Ministry of Agriculture and Rural Development, includes not only products with geographical indications and designations of origin, but also products made in accordance with a guaranteed traditional specialty. The register indicates 44 commodity items, of which:

a) 35 products are food products with geographical indications or designation of origin,

b) 10 products are with traditional speciality guaranteed, namely: traditional rydzowy oil, traditional Polish krakowska dry sausage, traditional Polish kabanosy, traditional Polish hunting sausage, traditional Polish jalowcowa sausage, pierekaczewnik, traditional Polish półtorak, traditional Polish dwójniak, traditional Polish trójniak, traditional Polish czwórniak (www.gov.pl/web/rolnictwo/produkty-zarejestrowane-jako-chronione-nazwy-pochodzenia-chronione-oznaczenia-geograficzne-oraz-gwarantowane-tradycyjne-specjalnosci accessed 13.03.2022)

In order to illustrate the spatial distribution of products with geographical indications, provinces were used. The region of Poland which has the largest number of products with geographical indications is Małopolskie Voivodship. This region boasts 12 products that have been entered into the national register of products registered as protected designations of origin and protected geographical indications, kept by the Ministry of Agriculture and Rural Development. Among 12 products from Małopolska, 4

products have a protected designation of origin: oscypek, carp Zaorski, beautiful Jas beans from the Dunajec Valley, and honeydew honey from the Beskid Wyspowy. There are 8 products with a certified Geographical Indication: suska sechlońska, lisiecka sausage, obwarzanek, prądnicki bread, Podhale lamb, piszczańska sausage, galician garlic, and Łącko apples.

Silesian Voivodeship is the second most abundant region in terms of registered certified products. There are 5 products with geographical indication from this region: oscypek, bryndza podhalańska, redykołka, jagnięcina podhalańska, krupnioki śląskie. In third place is Wielkopolskie Voivodship, which has 4 registered products. These are: rogale świętomarcińskie, smażony ser wielkopolski, andruty kaliskie, kiełbasa biała parzona wielkopolska. The voivodships in which three types of products bearing the designation of origin or geographical indication are produced are:

1. Mazowieckie Voivodship, from which come:

   a) jabłka góreckie (góreckie apples), miód kurpiowski (kurpiowski honey) - have a geographical indication mark,

   b) wiśnia nadwiślańska - have the designation of origin,

2. Świętokrzyskie Voivodship, in which the following are grown:

   a) wiśnia nadwiślańska,

   b) fasola korczyńska and śliwka szydłowska - which bear the GI mark,

3. Podlaskie voivodship can strengthen its competitive advantage by promoting three products originating from this region, i.e:

   a) miód kurpiowski, ser koryciński swojski - with a geographical indication,

   b) miód z Sejneńszczyzny, which stands out from other products in the group by its designation of origin.

The remaining regions of our country have even smaller quantities of products with geographical indications. Podkarpackie Voivodeship has two such products: fasola wrzawska and podkarpacki miód spadziowy, both of which have a certified designation of origin; Opolskie Voivodeship: kołacz and kurpioki śląskie (geographical indication); Lubelskie Voivodeship produces lubelski cebularz and grows wiśnia nadwiślańska. Cebularz has a geographical indication and, similarly to Mazowieckie Voivodeship, wiśnia nadwiślańska has a designation of origin. Zachodniopomorskie Voivodeship has Drahim honey on its list

of certified products protected by a designation of origin or geographical indication, Łódzkie Voivodeship has góreckie jabłka, Pomorskie Voivodeship has Kaszubskie truskawki and Dolnośląskie Voivodeship has heather honey from Bory Dolnośląskie. Kujawsko-Pomorskie Voivodeship can be proud of kujawski podpiwek.

Apart from food products, a separate group of products that are granted a certified geographical indication or designation of origin are spirits and wines. Registration of spirit beverages on the list of products with geographical indications in the Polish legislation is regulated by the Act of 18 October 2006. Journal of Laws from 2006 No. 208, item 1539, on production of spirit beverages and registration and protection of geographical designations of spirit beverages (Dz. U. 2006 No 208, item 1539). Detailed requirements to be met by products bearing the abovementioned names are defined in technical specifications available at the website of the Ministry of Agriculture and Rural Development (https://www.gov.pl/web/rolnictwo/specyfikacje-techniczne-oznaczen-geograficznych-napojow-spirytusowych). Protection at the national and EU level covers two Polish spirit products, i.e.: "Polska Wódka " and Wódka Ziołowa z Niziny Północnopodlaskiej aromatyzowana ekstraktem z trawy żubrowej.

The list of products that have the protected geographical indication of origin, protected designation of origin and guarantee of manufacturing tradition is enriched with much more numerous group of regional products. The List of Traditional Products serves the purpose of gathering and disseminating information on the production of traditional products. (https://www.gov.pl/web/rolnictwo/lista-produktow-tradycyjnych, accessed 25.03.2022). The registration of a product on the list does not entail any protection of the name and does not require any control of the production compliance with the declared method of manufacturing. The producers who have the products entered in the List of Traditional Products can apply for the derogation from sanitary requirements if such a necessity arises from the traditional recipe.

The list of Traditional Products is maintained by the Minister of Agriculture and Rural Development. The relevant application is submitted to the locally competent Marshal of the Voivodship. The list of traditional products can include products whose quality, tradition, unique features and properties result from the application of traditional production methods, i.e. methods used for at least 25 years that are an element of the cultural heritage

of the region where they are manufactured and are an element of local community identity. There are 1969 products registered in the List of Traditional Products.

Table 1. List of Traditional Products in Poland

Voivodship	Dairy Products	Meat Products	Fishery Products	Fruits and vegetables	Bakery and Confectionery Products	Oils and Fats	Honeys	Prepared Meals and Dishes	Drinks	Total Products
Dolnośląskie	2	9	3	4	9	1	6	8	6	48
Kujawsko-pomorskie	6	8	1	9	19	2	1	18	14	78
Lubelskie	12	36	6	21	54	7	10	54	38	238
Łódzkie	8	40	2	20	31	3	5	25	19	153
Lubuskie	6	19	4	8	13	2	6	9	14	81
Małopolskie	13	70	8	15	44	1	8	50	18	227
Mazowieckie	8	39	5	14	16	5	10	37	25	159
Opolskie	3	10	3	10	16	3	3	19	4	71
Podkarpackie	15	81	3	13	61	4	6	49	16	248
Podlaskie	11	12	3	7	16	3	3	7	7	69
Pomorskie	4	27	19	16	30	5	3	52	7	163
Śląskie	12	12	5	12	33	2	5	56	7	144
Świętokrzyskie	4	25	6	17	17	4	7	8	4	92
Warmińsko-mazurskie	3	15	1	2	8	0	5	10	3	47
Wielkopolskie	6	33	1	8	6	6	2	24	10	96
Zachodniopomorskie	1	4	6	7	10	1	12	5	9	55
Total	114	440	76	183	383	49	92	431	201	1969

Source: *https://www.gov.pl/web/rolnictwo/lista-produktow-tradycyjnych*

The list is divided into 9 groups, i.e. dairy products, meat products, fishery products, vegetables and fruits, bakery and confectionery products, oils and fats, honey, ready-made meals and dishes, beverages. The largest number of products entered in the List of Traditional Products can be found in Podkarpackie Voivodship (248), Lubelskie Voivodship (238), Małopolskie Voivodship (227), Pomorskie Voivodship (163), Łódzkie Voivodship (153), Śląskie Voivodship (144). Other voivodships have less than 100 traditional products on their territory. The analysis of individual assortment groups shows that the most numerous group are meat products, with 440 items listed nationwide. The highest number of meat products is in Podkarpackie Voivodship (81), Małopolskie Voivodship (70) and in Łódzkie Voivodship (40). In second place are ready-made products and dishes, 431 products.The third group includes bakery and confectionery products. In this group, 383 bakery products were registered on the list of traditional products in the whole country.

At the Union level, the provision governing the notification of a geographical indication of a spirit drink to the Union list is Regulation (EU) 2019/787 of the European Parliament and of the Council of 17 April 2019 on the definition, description, presentation, labelling of spirit drinks, the use of names of spirit drinks in the presentation and labelling of foodstuffs, the protection of geographical indications of spirit drinks, the use of ethyl alcohol and distillates of agricultural origin, and repealing Council Regulation (EC) No 110/2008 (Official Journal of the EU L 130 of 17.05.2019, p. 1).

Granting of certified geographical indications for wines in Poland is regulated by the Act on geographical indications of wines and aromatized wine products of 12 May 2011 (https://www.prawo.pl/akty/dz-u-2020-1891-t-j,17712020.html, accessed 20.03.2022).

The competent authority for receiving and assessing applications for geographical indications is the minister competent for the agricultural market, i.e. the Minister of Agriculture and Rural Development. At present, the Polish producers of wines and aromatized wine beverages have not filed any applications for the registration of their products with an intent to assign a geographical indication or a designation of origin.

In comparison with European countries, which promote their regions on both national and international markets with the use of goods, agricultural products, wines and spirits having original place of origin or original traditional manufacturing recipe, Poland takes the 17th place, which means that it does not belong to the leaders in this field.

The table below presents a quantitative summary of the registered products of the EU member states on the EU and international list of trademarks and industrial designs. The registered products are divided into three groups: food products, wines, and spirits.

Table 2. Geographical Indications with Numbers in the Member States of the European Union

	Country	Summary	Agricultural products	Wine	Spirit drinks
1.	Italy	884	320	529	35
2.	France	763	268	442	53
3.	Spain	383	217	147	19
4.	Grecee	283	121	147	15
5.	Portugal	213	153	44	16
6.	Germany	180	98	46	36
7.	Hungary	89	31	43	15
8.	Romania	71	12	53	9
9.	Croatia	71	47	16	6

10.	Bulgaria	71	5	57	12
11.	Austria	56	16	30	10
12.	Slovenia	43	23	17	3
13.	Czechia	43	30	13	0
14.	Belgium	40	20	10	10
15.	Netherland	37	11	21	5
16.	Poland	37	35	0	2
17.	Sweden	29	26	0	3
18.	Slovakia	26	16	9	1
19.	Cyprus	24	11	11	2
20.	Lithuania	15	8	0	7
21.	Denmark	13	8	5	0
22.	Finland	10	8	0	2
23.	Latvia	4	4	0	0
24.	Luxembourg	3	2	1	0
25.	Malta	3	0	3	0

Source: Own study based on European Union Intellectual Property Network (2022).

The ranking reveals the unquestionable leader among the European Union member states - Italy. In second place is France. In total, Italy can compete on the European and world markets with 884 registered products, while France has 763 of them. Spain, Greece, Portugal and Germany are the next group of countries, which belong to the European top right after the leaders. These countries have registered the following number of products: Spain - 383, Greece - 283, Portugal - 213 and Germany - 180. Among the Central and Eastern European countries, Hungary is the leader. They have 89 registered products. In the next place with the same number of products, i.e. 71 units, are Romania, Croatia and Bulgaria. In Romania and Bulgaria, most of the certified products are wines. Romania has 53 certified products, while Bulgaria has 57 certified products: 31 food products and 43 wines.

Conclusion

Strategies of branding and differentiation own products from other products are increasing in importance day by day. Branding is no longer a concept that only big companies can achieve, and it has turned into a strategy that even local manufacturers can employ. At this point, one of the methods that come to the fore is geographical indications. Today, it is known that there is a direct relationship between geographical indications and prices. The effect of geographical indications makes a significant contribution to the income of the producers. Thus, the increased funds obtained from the sale of regional products affect not

only the stabilization of family farms, but also prevent the migration of young people from rural to urban areas and prevent depopulation of rural areas.

Often, producers of regional products transform typical farms into agritourism farms, expand them and create new jobs related to guest service. They also cooperate with neighboring farmers, buying fresh vegetables, fruit, dairy products, poultry, eggs, honey and many other traditional rural products. In this way, a local market is created on the spot, in a specific village and commune, new jobs are created and employment increases.

The analysis of products with geographical indications and designations of origin shows that Polish producers still have a lot to do in this product group. The list of products with geographical indications is only 35 items, while producers from Italy have 884 such products, France - 763, Spain - 383. The list of regional products is much longer. There are 1969 products on the regional list of products. This may mean that the EU procedures are more complicated and time-consuming, while registration on the regional list is much less complicated. It can also be concluded that domestic producers do not care about the awareness of their products among foreign customers, or they focus their attention on their promotion at the moment of direct contact, and when promoting their activities, they direct their actions towards tourists from Poland.

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Changing the Canvas of Business Value Proposals in the Context of Achieving Sustainable Development Goals

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Abstract: The article highlights the issue of changing the canvas of business value proposals to ensure sustainable development under the influence of the armed conflict in the East, the Covid-19 pandemic and the war by the aggressor. The research methodology is based on a review of the literature, a survey and a qualitative case study. The obtained results allow to identify the vector of changes in business value proposals under the influence of conflicts and pandemics, as well as to propose an approach for adapting business to changes caused by crises, pandemics and armed conflicts.

Keywords: business value**,** sustainable development, management, change, armed conflict, war, pandemic Covid-19

JEL: M1, G22, Q01

Introduction

Approaches to doing business are transformed in the context of growing social imbalances and socio-psychological tensions caused by pandemics and crises in society, political and economic instability and military conflicts. Therefore, the development of new technologies is an important tool for successful operation and business development.

The study and use of new forms of business for the internal market has become an important aspect of effective business management in the context of sustainable development goals. The current activity of Ukrainian enterprises does not meet the needs of the modern market, which is reflected in lower profitability of institutions due to high costs associated with the operation and management.

In general, Ukraine lags behind European countries in meeting the goals and objectives of sustainable development (in particular, compared to Poland and Germany).

Statistics on HIV patients are alarming, showing low effectiveness in combating this type of disease, which is a sign of the poor state of the medical system and lack of public awareness. At the same time, the carbon capacity of GDP states that Ukraine is also lagging behind in terms of environmental policy, as there is a heavy air pollution (Redko et al., 2022).

Therefore, the priorities for achieving the Sustainable Development Goals (SDGs) are 1. Creating sustainable infrastructure (Cincalova, 2017; Trunina & Khovrak, 2019; Cincialova, 2020); 2. Promoting industry sustainability and innovation (Khovrak, 2013; Polinkevych, 2016; Khovrak & Chernenko, 2021); 3. Ensuring the inclusiveness and broad involvement of private business and society in the SDGs implementation (Khovrak et al., 2021), partnership at the international level (Grzebyk & Stec, 2015); 4. Ensuring effective management of the development of enterprises and territories (Danylkuv et al., 2020); increasing the institutional capacity of public authorities and business, as well as public awareness of these issues (Baranovsky et al., 2020; Tkachenko, 2020). 5. Ensuring the transition to rational models of consumption and production (Calinescu et al., 2020). These goals can be achieved through an understanding of the value proposition of business in the context of achieving SDGs.

Methodology

The research methodology is based on a literature review, a survey and a qualitative case study. The authors analyzed scientific publications from the scientometric database Web of Science, Scopus, Index Copernicus for the period 2003-2021 to determine aspects of the outline of business value proposals, as well as the relationship between business and sustainable development. This allowed identifying specific features of changing the outline of value proposals and to systematize the main factors of positive and negative impact on the processes of creating and implementing sustainable development goals.

As a result of the literature review, the authors constructed a questionnaire for the survey, which has 10 questions. The sample consists of 112 representatives from 35 enterprises operating in the industry.

For in-depth analysis, the authors used a case study, which revealed changes in the outline of business value proposals in 2014, 2019 and 2022. The years chosen for the study are not accidental. In 2014, the armed conflict in the East and the annexation of Crimea

began, in 2019 the COVID-19 pandemic and in 2022 the war in Ukraine, caused by Russian aggression.

Results

The results of the literature review

In 2014, Ukraine is in a condition unlike ever before. On the one hand, it is in a deep economic crisis and in need to reform key state institutions. On the other hand, the war in the east of the country and the annexation of Crimea require resources and mobilization of the whole society. The significance of the contribution of Donetsk, Luhansk regions and Crimea to the Ukrainian economy can be assessed through the following statistics – these territories occupy 13.5% of Ukraine, and produce 18% of Ukraine's GDP, 25% of industrial production, 25% of domestic exports (Ivanov, 2015).

The uniqueness of the crisis caused by the spread of coronavirus SARS-CoV-2 is that its manifestation is not so much a halt in the trajectory of development, but a significant change in the nature of development at both macro and micro levels against the background of radical changes in society. The changes affected all spheres of life (communication / work / study, etc.). At the same time, the forced introduction of permanent quarantine restrictions in the vast majority of countries and in Ukraine, which differed during the year in scale and timing, led to an unprecedented transformation of economic behavior at both consumption and production levels, when the dominant principle of motivation was caution against the background of permanent uncertainty.

In 2022, the coronavirus crisis was exacerbated by the war. This period is characterized by total destruction of infrastructure and forced relocation of enterprises from the East. Under the business relocation program, 300 enterprises have already been relocated from the war zone to the western regions of Ukraine (Ukrinform, 2002a). The physical damage to Ukraine's buildings and infrastructure as a result of the Russian invasion has reached around $ 60 billion and will increase as hostilities continue. According to Ukrainian estimates, Ukraine has already lost around $ 550 billion as a result of the full-scale Russian invasion, and needs almost $ 7 billion monthly support. In the long run, rebuilding Ukraine will cost at least $ 600 billion (Ukrinform, 2002b).

Table 1 shows the change in the main macroeconomic indicators of Ukraine for 2013-2021.

**Table 1.** Main macroeconomic indicators of Ukraine's development in 2013–2021

Indicator	2013	2014	2015	2018	2019	2020	2021	2021/ 2013, %
Nominal GDP, UAH billion	1466.2	1586.9	1988.5	3560.6	3978.4	4194.1	5459.6	272.36
Real GDP, %	0.0	-6.6	-9.8	3.4	3.2	-4.0	3.4	100
Inflation index, up to the previous year, %	99.7	112.1	148.7	110.9	107.9	102.7	109.4	9.73
Average monthly salary of employees, UAH	3282	3480	4195	8865	10497	11591	14014	327.0
Average exchange rate, UAH / USD USA	7.88	11.90	21.84	27.20	25.85	26.96	27.2	245.18
Average monthly salary of employees, USD	416.50	292.44	192.08	325.92	406.07	429.93	515.22	23.70

Source: http://www.ukrstat.gov.ua/

From the data in Table 1 we can conclude that nominal GDP increased in 2021 compared to 2013 by 272%, the inflation index by 9.73%, average monthly wages by $ 23, and the exchange rate by 245%. With the onset of the military conflict in the East, real GDP declined by 48.5%, the inflation index rose by 33.6% and the average exchange rate by 83.5%, and wages fell to $ 192 (34.3%). A similar trend was observed in the second period, after the Covid-19 pandemic. Real GDP growth fell significantly to -4% (225%), the average exchange rate by 4.3%, wages rose by 5.9%, although the inflation index decreased by 4.8%. Nominal GDP tended to slow down. Thus, in 2020 against 2019, it increased by only 5.4%, and in 2015 against 2014 by 25.3%.

Figure 1 shows the basic scheme of technologies for adapting the business to change.

Figure 1. Technologies for adapting the business to changes caused by crises, pandemics and armed conflicts
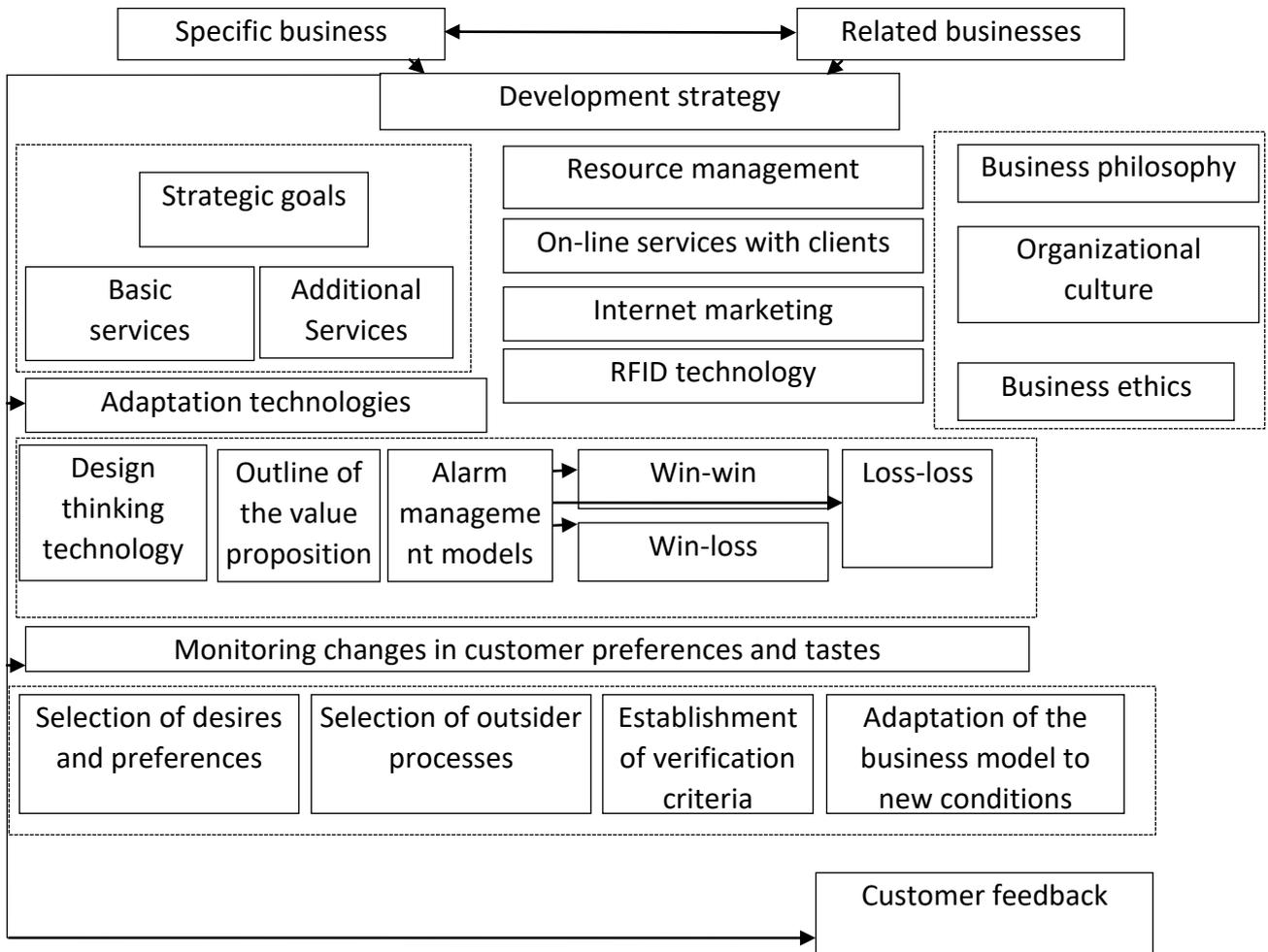
Source: Own work.

The main element in the technology of adaptation to change is the outline of the value proposition, which is changing (Polinkevych et al., 2021). The canvas of value proposals is a technology that promotes a service or product in the plane of value and takes into account the needs of the client. This technology is based on the analysis of the relationship between services, entities and the real needs of the market. It can be used to improve an existing proposal, as well as to study a new one. Thanks to Canvi's value proposition, a product or service can be studied through the prism of the preferences and expectations of a demanding customer. It will answer the question of how a product or service can help a customer solve their personal problems or meet their own expectations.

We present the main stages of implementation of technologies "Thinking Design" (Fig. 2) and the Canvas of value proposition (Fig. 3, Fig. 4).

Figure 2. Stages of the Thinking Design Technology Model (Rossokha V.V., & Cherednikova E.A., 2020)
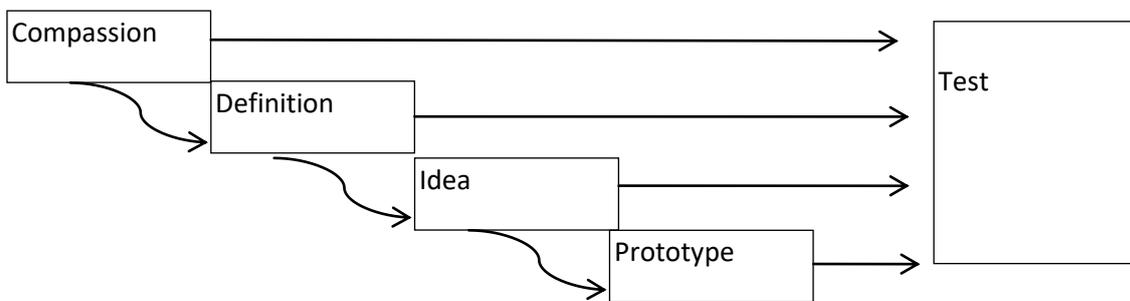

Figure 3. Model of Canvas value proposition technology (Rossokha & Cherednikova, 2020)
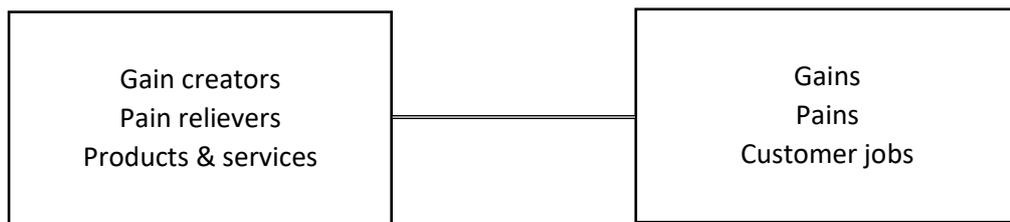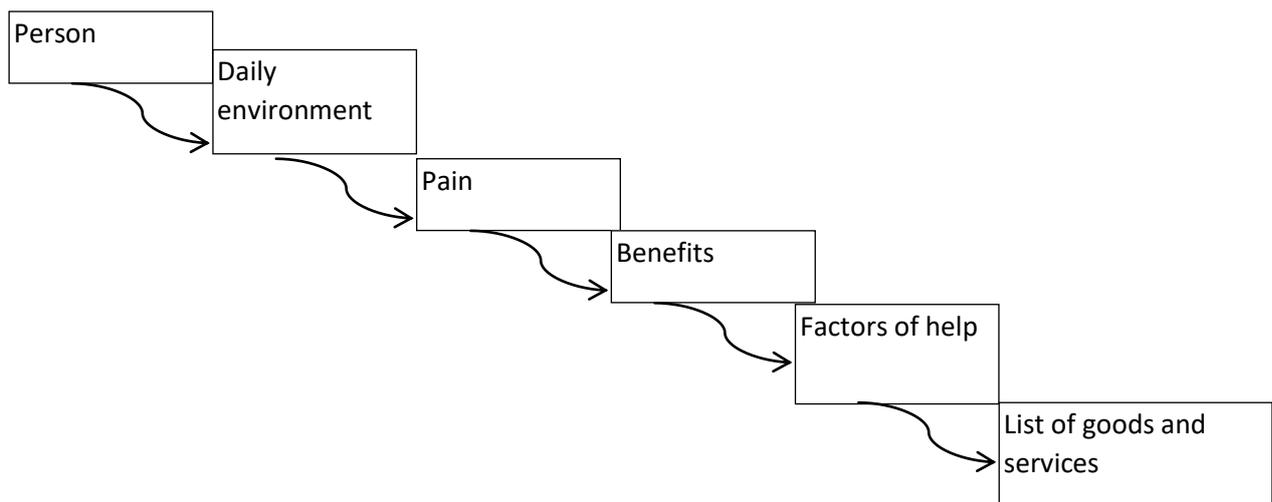

Figure 4. Stages of the Canvas value model supply model (Rossokha & Cherednikova, 2020)

Thus, we see that the value proposition outline directly describes the business response to military conflicts, crises and pandemics, as well as wars, as:

1. takes into account the changes in the external environment;

identifies customer demands and preferences that change under the influence of adverse environmental influences;
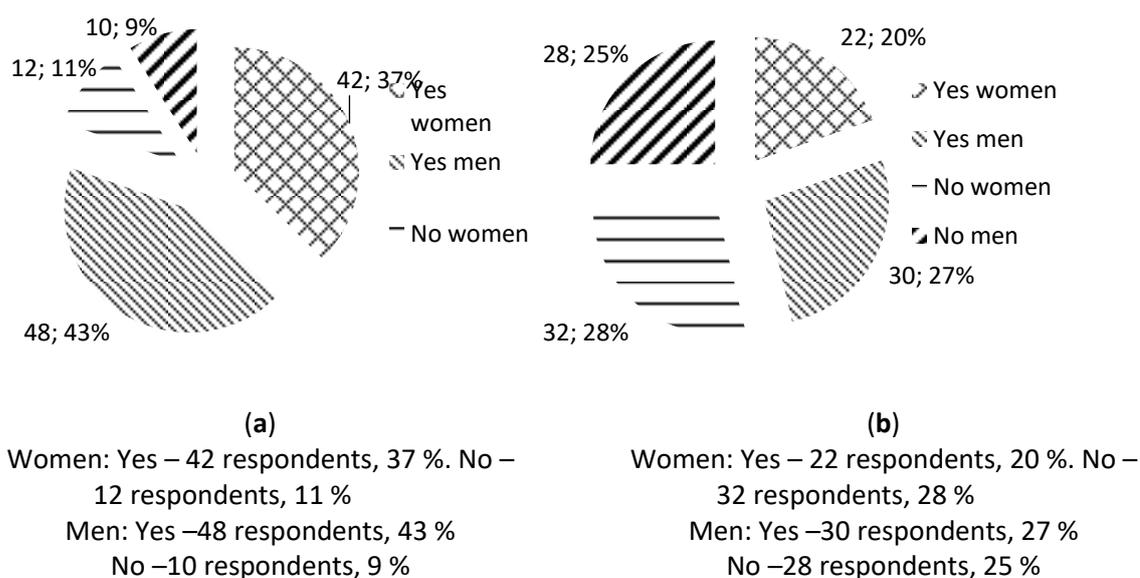
develops factors of mutual assistance that can change the situation;

offers a new list of goods and services that are relevant in the market, taking into account military conflicts, crises and pandemics, as well as wars.

The results of a survey among representatives of business

The authors conducted a survey of 112 respondents in September-October 2020, of which 58 were men and 54 women (52% of senior management and 48% of lower managers). The questionnaire asked the following questions: Has the business model changed under the influence of COVID-19? Has the business model of companies changed under the influence of the armed conflict in the East? Is the company able to transform the model to overcome the negative effects of COVID-19? Does the business model take into account the balance of economic, environmental and social pillars of sustainable development? (Figs. 5, 6).
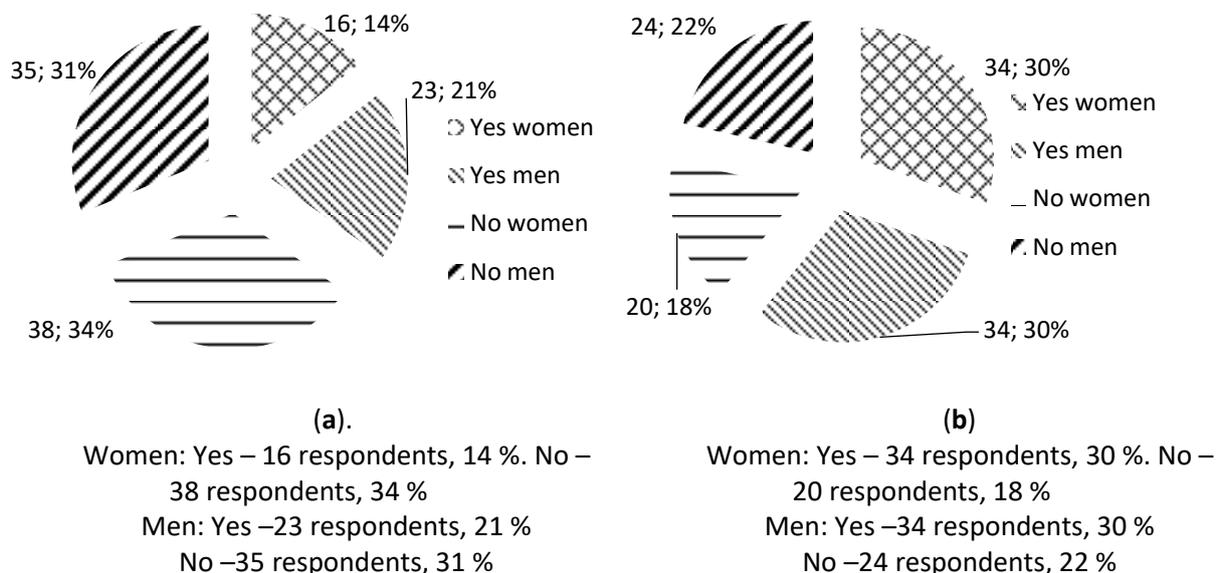
Figure 5. Impact on the COVID-19 Business Model and the Armed Confrontation in the East: a) Have there been changes in the COVID-19 business model? (b) Have there been changes in the business model of enterprises under the influence of armed conflict in the East?

(a)
Women: Yes – 42 respondents, 37 %. No – 12 respondents, 11 %
Men: Yes –48 respondents, 43 %
No –10 respondents, 9 %

(b)
Women: Yes – 22 respondents, 20 %. No – 32 respondents, 28 %
Men: Yes –30 respondents, 27 %
No –28 respondents, 25 %

Source: Own work.

The majority of respondents noted that business in Ukraine has transformed its own model under the influence of COVID-19. In particular, this conclusion was reached by 37% of female respondents and 43% of male respondents. Only 11% of women and 9% of men disagreed that under the influence of COVID-19 they were forced to transform the business model. Also, 20% of women respondents and 27% of men believe that armed conflict has had a positive impact on business. At the same time, 28% of women managers and 25% of men managers believe it to have a negative impact. It should be noted that this is almost half of the respondents. If in the first case, it can be assumed that the majority of respondents are inclined to believe that their business has changed under the influence of COVID-19, then under the influence of the armed conflict in the East, opinions differed. Men are more committed to the transformation of business under the influence of COVID-19 and the armed conflict in the East.

Figure 6. The ability of enterprises to transform the business model under the influence of COVID-19 and the armed conflict in the East: (a) Is the enterprise able to transform the model so as to overcome the negative effects of COVID-19 and the armed conflict in the East? (b) Does the business model take into account the balance of economic, environmental and social pillars of sustainable development?


(a).
Women: Yes – 16 respondents, 14 %. No –
38 respondents, 34 %
Men: Yes –23 respondents, 21 %
No –35 respondents, 31 %

(b)
Women: Yes – 34 respondents, 30 %. No –
20 respondents, 18 %
Men: Yes –34 respondents, 30 %
No –24 respondents, 22 %

Source: Own work.

A minority of respondents said that in Ukrainian companies are able to transform their businesses under the influence of COVID-19 and the armed conflict in the East.

In particular, 14% of women and 21% of men came to this conclusion. Only 34% of women and 31% of men disagree that they are capable of transforming businesses under the influence of COVID-19 and the armed conflict in the East. Also, 30% of female respondents and 22% of male respondents believe that the balance of economic, environmental and social pillars of sustainable development in their business model is maintained. At the same time, 18% of women managers and 22% of men managers say the opposite. It should be noted that this is slightly less than half of the respondents. If in the first case it can be assumed that the majority of respondents are not able to transform their business under the influence of COVID-19 and the armed conflict in the East, and the views differed on maintaining a balance of economic, environmental and social pillars of sustainable development. Women are more likely to lose their ability to transform themselves under the influence of COVID-19 and the armed conflict in the East and to maintain a balance of pillars of sustainable development.

In March 2022, a survey was conducted among business representatives in Western Ukraine on the impact of the war on business. The results of the polls clearly showed the fact that the war is destroying the business and economy of the country (Fig. 7.)

Figure 7. Impact of the war on the business model: Is the war in Ukraine negatively affecting business?
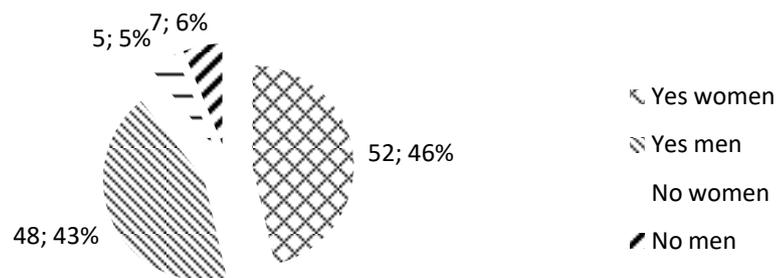
Women: Yes – 52 respondents, 46 %. No – 5 respondents, 5 %

Men: Yes – 48 respondents, 43 % No – 7 respondents, 6 %

Source: own work.

Case study results

Figures 8 – 13 allow to compare CANVAS business model for the industrial sector with the change of external factors of influence.

Figure 8. CANVAS business model for the industrial sector before COVID-19.

Key partners *Agro-industrial complex Construction Transport Foreign producers*	Key activities *Maintaining competitive prices, expanding the trade network to different cities*	Value proposition *Own sales networks Blogging platform*	Customer relationships *Support service, self-service*	Customer segments *Entrepreneurs, small business*
	Key resources *Human, financial*		Channels *Social Networks, Website*	
Cost structure *Introduction of innovative technologies, renewal of fixed assets*			Revenue streams *Trade revenue through trade establishments*	

Source: own work.

Figure 9. CANVAS business model for the industrial sector under the influence of COVID-19.

Key partners *Domestic producers*	Key activities *Development of platforms and blogs*	Value proposition *Internet establishments, YouTube channel, Tik-tok channel, virtual establishments for sale and Internet tasting, online 24/7 ordering of products, access to the range, analysis of the presentation of goods and services, online consultations*	Customer relationships *Support service, self-service*	Customer segments *Large retail chains*
	Key resources *Human, informational*		Channels *Social Networks, Website*	
Cost structure *Development of new platforms for product sales and services, marketing and sales*			Revenue streams *Trade revenue through online sales*	

Source: own work.

Figure 10. CANVAS business model for the industrial sector before the armed conflict

in eastern Ukraine.

Key partners *Foreign and domestic producers*	Key activities *Development of interaction platforms*	Value proposition *Discount system, cash and non-cash payment*	Customer relationships *Support service, self-service*	Customer segments *Big, small and medium business*
	Key resources *Human, financial*		Channels *Social Networks, Website*	
Cost structure *Introduction of innovative technologies, renewal of fixed assets*			Revenue streams *Trade revenue through trade establishments*	

Source: own work.

Figure 11. CANVAS business model for the industrial sector under the influence of the armed conflict in eastern Ukraine.

Key partners *Domestic producers of products Transport*	Key activities *Development of platforms and blogs*	Value proposition *Internet establishments, cashless payment*	Customer relationships *Support service, self-service*	Customer segments *Large business*
	Key resources *Human, informational*		Channels *Social Networks, Website*	
Cost structure *Development of new platforms for product sales and services Marketing and sales*			Revenue streams *Trade revenue through online sales*	

Source: own work.

Figure 12. CANVAS business model for the industrial sector before the war.

Key partners *Foreign and domestic producers*	Key activities *Development of interaction platforms*	Value proposition *Discount system, cash and non-cash payment*	Customer relationships *Support service, self-service*	Customer segments *Large, medium and small business*
	Key resources *Human, financial*		Channels *Social Networks, Website*	
Cost structure *Introduction of innovative technologies, renewal of fixed assets*			Revenue streams *Trade revenue through trade establishments*	

Source: own work.

Figure 13. CANVAS business model for the industrial sector under the influence of war.

Key partners *Foreign producers Transport*	Key activities *Development of platforms and blogs*	Value proposition *Internet establishments, cashless payment*	Customer relationships *Support service, self-service*	Customer segments *Large business*
	Key resources *Human, informational*		Channels *Social Networks, Website*	
Cost structure *Development of new platforms for product sales and services Marketing and sales*			Revenue streams *Trade revenue through online sales*	

Source: own work.

From the proposed CANVAS business models for the industrial sector, it can be concluded that the value proposition has changed under the influence of the armed conflict in the East, the Covid-19 pandemic and the war. Thus, under the influence of the armed

conflict in the East, the value proposition has changed from a system of discounts, cash, and non-cash payments to online establishments and non-cash payments. Under the influence of Covid-19, the value proposition of creating one's own platforms for blogs and sales networks moved to the formation of Internet establishments, YouTube channels, Tik-Tok channels, virtual sales outlets and Internet tastings, online 24/7 product ordering, analysis of the representation of goods and services, as well as online consultations. Under the influence of the war, value offers changed the vector from a system of discounts, cash, and non-cash payments to Internet institutions and non-cash payments. Thus, the value proposition after the Covid-19 pandemic and during the war is similar, due to the pandemic's impact on business.

Conclusions and recommendations

The analysis of literature sources shows the change in the value proposition of business in terms of sustainable development, due to the relocation of enterprises from the East during the war. Moreover, each of the stages left its own imprint on the formation of business value proposals. The change in the business model began in 2014 with the armed conflict in the East. However, this was only the first step of change that hindered business development and negatively affected Ukraine's economy. The Covid-19 pandemic has intensified negative trends in business development and transferred it to another format, i.e. remote. Accordingly, customer service models changed, and channels of presentation of goods and services expanded. During the pandemic, more attention was paid to sustainable development and environmental security. During this period of retardation of development eached the logistics network, which facilitated the delivery of goods and services to end-users without their prior physical inspection. The war contributed to the curtailment of small and microbusinesses, their relaxation in the West.

The results of a survey of 112 respondents at 35 companies show that the majority of respondents are unable to transform their business under the influence of COVID-19 and the armed conflict in the East. Opinions on maintaining the balance of economic, environmental and social pillars of sustainable development differed. Women are more likely to lose their ability to transform themselves under the influence of COVID-19 and the armed conflict in the East, and to maintain a balance of pillars of sustainable development.

Practically all respondents believe that the war in Ukraine has a negative impact on doing business. The survey was conducted among business representatives in Western Ukraine. The results of the polls clearly explained the fact that the war is destroying the country's business and economy. That is, it can be stated that today the philosophy of society regarding the understanding of the consequences of armed conflicts and the annexation of Crimea on the country's economy has changed.

The results of the case method confirm that in the industry the business has changed the value proposals from the system of discounts, cash and non-cash payments to online establishments and non-cash payments. Social networks and SMM marketing also continue to develop. In particular, there are such changes as the creation of sustainable infrastructure, active implementation of innovations in all spheres of activity, focusing on the inclusiveness of the process, and ensuring effective management of enterprise and territorial development. Most companies are moving to rational models of consumption and production.

The outline of value changes is the basis for the development of technology to adapt businesses to change from crises, pandemics and armed conflicts. It contains three interrelated blocks: development strategy, adaptation technology and change monitoring. The outline of the business value proposition is placed in the technology of adaptation, which is an important element of successful business development in compliance with the goals of sustainable development.

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What is the link between renewable&non-renewable energy, foreign direct investment, economic growth, and ICT on Ecological Footprint? Evidence of Environmental Kuznets Curve from European Union Countries and Turkey

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Abstract The purpose of this paper is to investigate the role of FDI, ICT, fossil, and renewable energy consumption on EFP in 25 EU countries and Turkey. In this context, we set up panel threshold models by using data over the 1990-2014 period to test environmental Kuznets curve (EKC) and Pollution Haven Hypothesis (PHH) in these countries. Contrary to previous EKC studies in the literature, the current study employs the more comprehensive indicator of environmental quality than emissions (namely, ecological Footprint, EFP) and examines the role of FDI and ICT on EFP for the first time in the EU countries and Turkey. Moreover, we analyzed the threshold effects of ICT and FDI on other variables. Our results found evidence supporting the EKC and PHH hypothesis when the ICT has been used as a threshold variable. Moreover, our study reveals that while FDI inflow and fossil energy worsen the environmental deterioration, ICT and renewable energy positively affect the environmental quality in EU and Turkey. Policy implications have been presented in the conclusion part.

Key words: Environmental Kuznets Curve, Foreign direct investment, Ecological Footprint, Turkey, European Union.

JEL: Q01, Q43, Q56

Introduction

The interaction between the environment and economic growth has been examined since the report "The Limits to Growth" in early 1970s. The concerns about global warming and climate change have been debated for a long time as well. Since greenhouse emissions (GHGs) are emitted primarily from increasing fossil fuels and/or energy consumption, development of environmentally friendly energy sources (solar, wind, geothermal, bioenergy, etc.) has become key to ensure sustainable economic development. Following the pioneering study of Grossman and Krueger (1991, 1995), the nexus between environment, economic development, and energy has been studies in the framework of environmental Kuznets Curve hypothesis (hereafter EKC). The EKC hypothesis argue that there is an inverted U-shaped relationship between environmental deterioration and economic growth. This hypothesis claims that at the early stage, economic growth makes

environmental degradation worse, but after a certain level of per capita income (called "the turning point"), economic growth enhances the environmental quality.

As argued by Panayotou (2003), the inverted U-shape of EKC emerges due to the mixture of scale, composition, and technique effect. At the initial stage of economic development, pollution accelerates due to industrialization and resource exploitation (scale effect). However, as income increases, output mix changes from agrarian to industrial and finally to service economy that pollutes less (composition effect). Moreover, "cleaner" technologies are replacing "dirtier" technologies in the output creation process (technique effect). In other words, in the first stage, output increase requires higher level of means of production, such as natural resources, but after the turning point, environmental quality is expected to improve due to increased environmental awareness and eco-friendly technologies (Destek, 2021).

Testing EKC hypothesis gained importance in last three decades since it solves the environmental degradation problem as a concept. If EKC is valid, then environmental deterioration will not pose a problem as long as countries achieve certain level of income (Harvieux and Darne, 2003; Caglar et.al., 2021). Inverted U-shaped relationship between economic growth and environmental pollution has been empirically tested by different methodologies for different countries and country groups by many studies, but the obtained results are mixed. While some studies validated the EKC hypothesis (see Ang, 2017; Kasman and Duman, 2015; Saqib and Benhmad, 2021; among others), some others could not find evidence supporting EKC hypothesis (see Lindmark, 2002; Arango-Miranda et.al., 2018). In most of EKC studies, environmental deterioration has been represented by CO_2 emissions. However, this is an important shortcoming in EKC studies since environmental degradation cannot be captured by GHG emissions only. Environmental degradation, however, also appears in other sources such as soil, water, oil, forest, etc. (Destek et.al., 2018). As stated by Stern (2004) and Arrow et.al. (1996), CO_2 emissions tend to decrease due to the technological progress and environmental measures taken by governments, but this may not be the case for all types of environmental degradation and/or pollution. In other words, while EKC hypothesis is valid for CO_2 emissions, it may not be valid for other environmental resources. Hence, when CO_2 emissions is used to represent the environmental quality,

obtained results would be misleading for efficient policy design towards sustainable development (Destek et.al.,2018 Caglar et.al., 2021; Altintas and Kassouri, 2020).

The motivation of this paper is to examine the EKC hypothesis for the EU countries using more comprehensive indicator than GHGs - namely EFP. There are few studies that investigates the link between economic growth and EFP, however, previous studies did not consider the role of foreign direct investment (hereafter FDI) and information and communication technologies (hereafter ICT) for the EU countries and Turkey. As stated by Acharya (2009), FDI can also affect the environmental quality since FDI inflows lead scale, composition, and technique effects in hosting country. The interaction between FDI and the environment is argued under two competing hypotheses. If FDI-led growth creates additional pollution, pollution haven hypothesis (hereafter PHH) will be valid, however, if FDI inward improves the environmental quality, then pollution Haloes hypothesis will be valid (Cole and Fredrikson, 2009). Like FDI, information and communication technologies (hereafter ICT) can help remedy the environmental degradation by eliminating unnecessary transportation cost, creating efficient production practices and awareness of environment, and stimulating environmentally friendly technologies (Caglar et.al, 2021; Mert and Boluk; 2019). To the best of our knowledge, current study is the first attempt that analyzes the nexus between economic growth, renewable and non-renewable energy, FDI, ICT, and EFP in the EKC framework for the EU countries and Turkey. We focus on the EU countries and Turkey since they still face increasing amounts of emissions and waste, poor water quality and forest degradation, etc. (EEA, 2022). Since Turkey is a candidate country for the EU membership, results of the study will contribute to efficient policy design for energy and environmental area towards EU membership process. Finally, we employ the panel threshold regression model for several different reviews. The first is to examine the validity of the EKC hypothesis. Another one is to test whether PHH and/or Pollution Haloes hypothesis are valid. Also, the model in the study is to determine the different effects of energy consumption types (renewable and fossil) on environmental quality. These investigations are based on the results of two panel threshold regression models created over two different threshold variables (namely FDI and ICT).

The rest of the paper is organized as following. The second section reviews the literature and summarizes the results of previous empirical studies. The third section

presents the data and econometric modelling process. The fourth section provides obtained results. The final section concludes and discusses some policy recommendations.

Theoretical premises

The EKC hypothesis between economic growth and CO_2 has been tested for the EU countries and Turkey using different explanatory variables (like energy use, renewable energy, trade openness, urbanization, financial development, etc.) and econometric approaches. However, while some of them found evidence in favor of EKC (see Coondoo and Dinda, 2008; Lopez-Menendez et.al., 2014; Kasman and Duman; 2015, Al-Mulali et.al., 2016; Dogan and Seker, 2016; Ahmed et.al., 2016; Pablo-Romero and Sanchez-Broza, 2017; Halicioglu, 2009; Seker et.al., 2015; Ozatac et.al., 2017), some others did not validate the EKC for these countries (see Akbostancı et.al., 2009; Acaravci and Ozturk, 2010; Bölük and Mert, 2014; Abid, 2017). Moreover, PHH and pollution Haloes hypotheses were investigated by many studies in the EKC framework (see Acharya, 2009; Muhammet et.al., 2011; Hitam and Borhan, 2012; Tamazian et.al., 2009; among others). Like EKC hypothesis, the relationship between FDI inflow and environmental quality is also ambiguous. Hence, it can be said that there is no consensus on the validation of EKC hypothesis and effects of socio-economic drivers between economic growth and CO_2 emissions.

Contrary to previous EKC studies on emissions, there are limited numbers of research papers that focus on the nexus between economic growth and ecological footprint for the EU countries and Turkey. For example, Destek et.al. (2018) investigated the role of economic growth, renewable and non-renewable energy consumption, and trade openness on EFP using annual data from 1980 to 2013. The authors found no evidence in favor of EKC hypothesis in 15 EU countries. Moreover, their results show a contributing effect of renewable energy and trade openness in mitigating the environmental degradation. Using the panel smooth transition regression (PSTR) model and data set over the 1990-2013 period for 26 EU countries, Aydin et.al. (2019) analyzed the link between economic growth and EFP. Authors found mixed results based on the different kinds of ecological sub-parts of EFP. Altıntaş and Kassouri (2020) tested the EKC hypothesis in 14 EU countries by using heterogeneous panel model over the 1990-2014 period and two different indicators of environmental quality, CO_2 emissions and EFP. Their results validated the existence

of EKC when EFP is used for environmental degradation. However, EKC is not confirmed when environmental pollution was represented by CO_2 emissions. Alola et.al. (2019) analyzed the interaction between EFP, real GDP, trade openness, fertility rate, as well as renewable and non-renewable energy consumption in 16 EU member states for the 1997-2014 period. Their results confirmed deteriorating effect of non-renewable energy and GDP on environmental sustainability. However, they found that RE consumption improves EFP in these countries. Using FMOLS and DOLS, Adedoyin et.al. (2020) investigated the role of R&D spendings on EFP in 16 EU countries over the 1997-2014 period. Moreover, authors reveal that there is feedback relationship between EFP, R&D expenditure, renewable and non-renewable energy, and RE decreases the EFP.

Table 1. Summary review of literature focusing on economic growth and EFP in EU and Turkey

Study	Data period	Country	Explanatory variables	Econometric technique	Results
Destek et.al. (2018)	1980-2013	EU-15	GDP, trade openness, renewable and non-renewable energy consumption	MG-FMOLS MG-DOLS DCCE-MG	No EKC
Aydin et.al. (2019)	1990-2013	EU-26	GDP	PSTR	Mixed results
Alola et.al. (2019)	1997-2014	EU-16	GDP, trade openness, fertility rate, renewable and non-renewable energy consumption	PMG-ARDL	No EKC testing Fossil energy and GDP deteriorates EFP, renewable energy improves EFP.
Altıntaş and Kassouri (2020)	1990-2014	EU-14	GDP, renewable energy, non-renewable energy	IFE, D-CCE	Yes, EKC for EFP. No EKC for CO_2.
Adedoyin et.al. (2020)	1997-2014	EU-16	R&D spending, renewable and non-renewable energy	FMOLS DOLS	No EKC testing. R&D and renewable energy improves EFP.
Destek (2021)	1970-2017	Turkey	GDP, urbanization, industrialization, human capital	NARDL	No EKC testing. Industrialization increases CO_2 but has no impact on EFP. Urbanization deteriorates environment. Human capital improves environmental quality.

Study	Data period	Country	Explanatory variables	Econometric technique	Results
Godil et.al. (2020)	1986-2018	Turkey	GDP, tourism, financial development, globalization	Quantile ARDL	EKC yes. All variables deteriorate the EFP.
Köksal et.al. (2020)	1961-2014	Turkey	GDP, shadow economic activities, trade openness, urbanization, financial development, energy consumption.	Cointegration	EKC mixed. Shadow economy, trade openness, financial development deteriorates EFP.
Kirikkaleli et.al. (2020)	1985-2017	Turkey	GDP, energy consumption, globalization, trade openness	DOLS FMOLS	No EKC testing. All variables contribute to environmental degradation.

Some of the empirical studies analyzed the link between economic growth and EFP in Turkey as well. For example, Destek (2021) investigated the impact of structural changes in industrialization on environmental quality. For this purpose, author analyzed the link between GDP, industrialization, urbanization, human capital, and two environmental quality indicators (CO_2 and EFP). Main finding of this study is that while deindustrialization reduces the CO_2 emissions, it has no significant impact on EFP. Using quantile ARDL, Godil et.al. (2020) investigated the role of tourism, financial development, and globalization on EFP in Turkey. The authors found that all explanatory variables deteriorate the environmental quality. Köksal et.al. (2020) examined the role of shadow economy on EFP in Turkey. Using two different EKC modelling, authors discussed the role of shadow economy, financial development, trade volume, urbanization, exchange rate, and trade openness on environmental quality in the 1961-2014 period. Authors found that a 1% increase in shadow economy increases EFP by around 1,008%. Similarly, Kirikkaleli et.al. (2020) analyzed the role of globalization on EFP in Turkey. Using DOLS and FMOLS, the authors found evidence supporting the deteriorating effect of globalization, trade openness, energy consumption and economic growth on EFP in 1985-2017 period for Turkey.

As seen in Table 1, only some of the studies focusing on the EFP test the EKC hypothesis and none of them analyze the impact of FDI and ICT in the EU countries and Turkey. Moreover, there is a lack of consensus in the literature about the validity of EKC hypothesis or the effects of other socio-economic factors on the environment. Hence, our study on the nexus of FDI-led EKC using EFP in these countries is the first of its kind.

Methodology

In this paper, a panel model has been employed to understand how economic growth, FDI, ICT, renewable and fossil fuel consumption affect the EFP in the EU countries and Turkey. The time span has been determined by the data availability. The dependent variable is selected as per capita EFP to represent environmental quality. EFP data is compiled from Global Footprint Network (GFN, 2021) and measured as global hectare (gha) per person. The data of other explanatory variables such as FDI (measured as net inflows USD), per capita GDP (measured as real GDP in terms of PPP based on 2017 USD), ICT (mobile cellular subscriptions, per 100 people), per capita renewable (REN) and fossil (FOS) energy consumption (measured as in kilotons of oil equivalent) are obtained from the open data platform of the World Bank (WB, 2022). All variables are expressed with natural logarithms to both reduce the risk of heteroscedasticity and to reach elasticity values. Data covers the years 1995-2014 from 25 countries. The reason why the end of the data period is 2014 is that the analysis technique used in this study requires a balanced panel data set. Renewable and fossil energy consumption data from Bulgaria, Croatia, Latvia, and Lithuania were available until 2014. For this reason, the end of the data period for balanced panel structure was determined as 2014. Summary statistics for data are presented in Table 2.

Table 2. Summary Statistics

	$lnefp_{it}$	$lngdp_{it}$	$lnfdi_{it}$	$lnict_{it}$	$lnren_{it}$	$lnfos_{it}$
Obs.	500	500	500	500	500	500
Mean	1.601	10.288	13.492	3.864	5.895	7.864
Std. Dev.	0.282	0.445	0.098	1.423	0.840	0.408
Min.	0.829	9.170	13.471	-3.232	4.039	6.709
Max.	2.199	10.994	14.738	5.148	7.863	8.628

The data set is balanced panel data, and the total number of observations is 500. The average value of the *lnefp* is 1.601, with the minimum value of 0.829 (Turkey) and the maximum value of 2.199 (Estonia). The mean value of *lngdp* of the overall panel is approximately 10.288. The minimum ln*gdp* value is approximately 9.170 (Latvia), while the maximum value is approximately 10.994 (Ireland). The average of *lnfdi* is approximately 13.5. In addition, the minimum value of *lnfdi* is 13.471 (Denmark) and the maximum value is 14.738 (Netherlands). It can be seen that the mean value of *lnict* is 3.864, the minimum value is3.232 (Romania) and the maximum value is 5.148 (Finland). Finally, when

the amounts of energy consumption are examined, renewable energy consumption (*lnren*) averages 5.895, while fossil energy consumption (*lnfos*) averages 7.864. In addition, the minimum values of *lnren* and *lnfos* are 4.039 and 6.709, respectively. The maximum values (*lnren* and *lnfos*) are 7.863 and 8.628, respectively. These statistics show that renewable energy consumption is still well behind fossil energy consumption and renewable energy generation needs to be improved.

Given the importance of FDI and ICT on environmental quality, we enlarge EKC hypothesis by incorporating FDI inflows, ICT, and EFP in the nexus of energy-economic growth-environment for the EU countries and Turkey. Accordingly, the model used in the study is defined as follows:

(1) $$lnefp = f(lngdp, lngdp^2, lnren, lnfos, lnfdi, lnict)$$

In the model (1), the assumptions of unit effects and homogeneous slope coefficient are constructed. In addition, *lngdp^2* has been added to the model because of based on the EKC hypothesis. The EKC hypothesis is said to apply if the statistically significant coefficients of *lngdp* and *lngdp^2* are positive and negative marked, respectively. In general, the model provides the opportunity to test the EKC hypothesis through EFP, as well as to measure the impact on environmental quality in terms of energy consumption types (renewable and fossil). Therefore, *lnren* is expected to have a negative effect on EFP, while *lnfos* is expected to have a positive effect. In addition, the model also provides the effect of FDI and ICT on environmental quality. Especially if the effect of FDI on EFP is positive, pollution haven hypothesis is determined to be valid, but if the effect is negative, pollution haloes hypothesis is valid. A similar setup can be made for ICT. The development of ICT is determined to influence improving or worsening environmental quality.

Panel threshold regression model is preferred for the estimation of the model (1). One of the reasons for the use of this technique is that it allows a nonlinear structure in relationships between variables. Another motivation to use panel threshold regression model is to investigate validity of the EKC hypothesis and the effects of energy consumption type differ on environmental quality depending on FDI and ICT threshold values.

For this purpose, following Hansen (1999), fixed-effect panel threshold regression models (single-threshold) are employed as follows:

(2) $lnefp_{it} = \alpha_1 + \beta_{1,k}X_{it}I(g_{it} < \delta) + \beta_{2,k}X_{it}I(g_{it} \geq \delta) + \phi_1 lnfdi_{it} + \mu_{1i} + \varepsilon_{it}$

(3) $lnefp_{it} = \alpha_2 + \theta_{1,k}X_{it}I(h_{it} < \lambda) + \theta_{2,k}X_{it}I(h_{it} \geq \lambda) + \phi_2 lnict_{it} + \mu_{2i} + e_{it}$

where α_1 and α_2 represent constant term, X is independent variables, $\beta_{m,k}$ and $\theta_{m,k}$ (m=1,2; k=1, 2, 3, 4, 5) denote the slope coefficients. μ is the individual effect, while ε and e are the error terms. g and h in model (2) and model (3) denote threshold variables as *lnfdi* and *lnict*, respectively, δ and λ represent threshold parameter for both models, while I is the indicator function. As a result, models in their simple form (only slope coefficients) can be shown as follows (Wang, 2015):

$$lnefp_{it} = \begin{cases} \beta_{1,1}lngdp_{it} + \beta_{1,2}lngdp_{it}^2 + \beta_{1,3}lnren_{it} + \beta_{1,4}lnfos_{it} + \beta_{1,5}lnict_{it}, & lnfdi_{it} < \delta \\ \beta_{2,1}lngdp_{it} + \beta_{2,2}lngdp_{it}^2 + \beta_{2,3}lnren_{it} + \beta_{2,4}lnfos_{it} + \beta_{2,5}lnict_{it}, & lnfdi_{it} \geq \delta \end{cases}$$

$$lnefp_{it} = \begin{cases} \theta_{1,1}lngdp_{it} + \theta_{1,2}lngdp_{it}^2 + \theta_{1,3}lnren_{it} + \theta_{1,4}lnfos_{it} + \theta_{1,5}lnfdi_{it}, & lnict_{it} < \lambda \\ \theta_{2,1}lngdp_{it} + \theta_{2,2}lngdp_{it}^2 + \theta_{2,3}lnren_{it} + \theta_{2,4}lnfos_{it} + \theta_{2,5}lnfdi_{it}, & lnict_{it} \geq \lambda \end{cases}$$

Through this approach, it can be determined how FDI and ICT, which are frequently researched in the literature, affect environmental quality through EFP. It is also an important feature of an approach to address this interaction in a non-linear structure. However, to estimate the mentioned panel threshold regression models, the threshold effect should be tested. If it is concluded that there is no threshold effect, it is not correct to use panel threshold regression model. In the F test designed for this purpose, the null hypothesis represents no threshold effect (linear relationship) and the alternative hypothesis of threshold effect is valid (that is the nonlinear relationship) (Huang et.al., 2018; Wang and Wang, 2021). The F test statistic is calculated as follows:

(4) $$F = \frac{S_0 - S_1(\hat{\delta})}{\hat{\sigma}^2}$$

S_0 and S_1 are the sum of squares errors from linear and nonlinear models, respectively. $\hat{\delta}$ estimated threshold value and $\hat{\sigma}^2$ is a convergent estimate of σ^2 (Candelon, 2013).

Results

Unit root tests will be used to determine the stationary levels of the series. However, the unit root test to be preferred varies depending on whether there is a cross-sectional dependence. For this purpose, cross-sectional dependence tests (LM and CD tests) are carried out. According to the results seen in Table 3, the presence of cross-sectional dependence is determined for all variables.

Table 3. Cross-Sectional Dependence Tests

Variables	Breusch-Pagan LM Test	Pesaran CD Test
lnefp	1393.94***	23.732***
lngdp	4597.16***	66.598***
lngdp²	4586.18***	66.497***
lnren	4047.58***	55.899***
lnfos	2297.46***	31.342***
lnict	5812.12***	76.232***
lnfdi	1380.95***	30.508***

Note: (*), (**) and (***) show the significance level at 10%, 5% and 1% respectively.

Due to the cross-sectional dependence, it is preferred to use Pesaran's (2007) CIPS and Reese and Westerlund's (2016) PANICCA panel unit root tests. The panel unit root tests results presented in Table 4 show that all series are stationary at the level, given the results of both tests. Based on this result, panel regression model can be estimated; there is no need to investigate the cointegration relationship between variables.

Table 4. Panel Unit Root Tests

Variables	CIPS Test		PANICCA Test			Decision
	C	C & T	P_a	P_b	PMSB	
lnefp	-1.696	-2.729**	-23.397***	-8.346***	-2.781***	I(0)
lngdp	-3.061***	-2.815**	-11.129***	-5.084***	-2.226**	I(0)
lngdp²	-2.971***	-2.881**	-11.181***	-5.079***	-2.226**	I(0)
lnren	-2.622***	-3.291***	-15.859***	-6.185***	-2.356**	I(0)
lnfos	-1.842	-2.676*	-19.595***	-7.738***	-2.968***	I(0)
lnict	-3.203***	-3.843***	-10.157***	-4.523***	-1.935**	I(0)
lnfdi	-2.706***	-3.446***	-12.644***	-4.308***	-1.346*	I(0)

Note: (*), (**) and (***) show the significance level at 10%, 5% and 1% respectively.

In the estimation of panel regression model, it should be determined whether the slope coefficients are homogeneous or heterogeneous. For this purpose, the Delta tests

($\widetilde{\Delta}$ and $\widetilde{\Delta}_{adj}$) of Pesaran and Yamagata (2008) are employed. According to the results in Table 5, the null hypothesis of slope homogeneity cannot be rejected ($\widetilde{\Delta}_{adj}$p-value approximately 10%).

Table 5. Slope Homogeneity Test

Delta Tests	Statistics	P-Value
$\widetilde{\Delta}$	1.034	0.301
$\widetilde{\Delta}_{adj}$	1.668	0.095

Based on the finding that slope coefficients are homogeneous, some tests presented in Table 6 have been carried out to decide which of the panel regression model types should be used. The first is the F test, which examines the presence of individual effects, and the other is the Hausman test, which examines which estimator should be preferred for panel regression model estimation in the presence of individual effects. When the results in Table 6 are examined, it is seen that there are individual effects, and the fixed effects model should be preferred for panel regression model estimation.

Table 6. Individual Effects Tests

Tests	Statistics	P-Value
F-Test (Individual Effect)	64.79	0.000
Hausman Test (Fixed Effect & Random Effect)	30.41	0.000

In this study, a different approach was preferred to the effects of *lnfdi* and *lnict* on environmental quality. The validity of the EKC hypothesis and the effects of energy usage (renewable or fossil) differences on environmental quality differ during periods when *lnfdi* and *lnict* are above and below the specified threshold values. From this motivation, it is preferred to use the panel threshold model, which is a nonlinear approach that includes the fixed effects. First, does the estimated threshold values for *lnfdi* and *lnict* have a statistically significant threshold effect? It is possible to see the answer to this question in Table 7. The threshold values for the *lnfdi* and *lnict* are statistically significant at 5% and 10%, respectively. Accordingly, the important threshold values are 13.475 for *lnfdi* and 4.690 for *lnict*.

Table 7. Threshold Effect Test

Threshold Variable	Threshold Value	RSS	MSE	F-Stat	P-Value	Critical Values[*]		
						10%	5%	1%
lnfdi	13.475	2.296	0.005	46.980	0.036	36.996	43.642	54.993
lnict	4.690	2.263	0.005	54.850	0.079	52.069	60.309	79.259

[*] *Bootstrap critical values were calculated from 1000 replicates.*

Considering the threshold values specified in Table 7, the models in equations (2) and (3) are estimated. According to the panel threshold regression model estimation results in Table 8, the EKC hypothesis is not valid in Model-1. However, in Model-2, where *lnict* is the threshold variable, the EKC hypothesis is valid at all levels of *lnict*. Furthermore, in Model-1, it is seen that fossil energy consumption increased and had a higher effect on *lnefp* during periods when *lnfdi* exceeded the threshold. Conversely, the effect of renewable energy consumption on *lnefp* decreases during periods when *lnfdi* exceeds the threshold. In Model-2, unlike Model-1, the increasing effect of fossil energy consumption on *lnefp* decreases during periods when *lnict* exceeds the threshold, and the reducing effect of renewable energy consumption increases.

Table 8. Estimation Results of Panel Threshold Model

Dependent Variable: *lnefp*				
Variable	Model-1		Model-2	
	lnfdi<13.475	*lnfdi>13.475*	*lnict<4.690*	*lnict>4.690*
lngdp	0.723	0.632	3.647**	3.763**
	(1.347)	(1.335)	(1.410)	(1.431)
lngdp²	-0.0143	-0.0153	-0.159**	-0.155**
	(0.0673)	(0.0661)	(0.0720)	(0.0717)
lnren	-0.0805**	-0.0759***	-0.0663***	-0.0776**
	(0.0327)	(0.0322)	(0.0227)	(0.0371)
lnfos	0.370***	0.505***	0.430***	0.396***
	(0.0905)	(0.0808)	(0.107)	(0.119)
lnict	-0.00517	-0.00906	-0.00826	
	(0.00827)	(0.00777)	(0.00814)	
lnfdi	0.149***		0.197***	0.0981***
	(0.0335)		(0.0354)	(0.0273)
Constant	-8.768		-24.64***	
	(6.892)		(7.344)	
F-Statistics	230.02***		357.26***	
Obs.	500		500	
Groups	25		25	

*Robust standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1*

Infdi and *Inict* coefficients show that while FDI positively affects EFP in both models, ICT has no statistically significant effect on EFP. These results show that while the high levels of FDI are an important factor that reduces environmental quality (and vice versa), ICT has a significant indirect (due to threshold effect) but positive effect on environmental quality.

Summary, recommendations

This paper envisaged and estimated a panel threshold model for 25 EU countries and Turkey for the period of 1995-2014, which linked EFP per capita with GDP per capita, renewable energy per capita, fossil energy per capita, FDI inflow, and ICT. Data availability may be assumed as a limitation of current study, however, our data period is still long enough to obtain important linkages between the variables. The main contribution of the current study was threefold: contrary to previous EKC studies, to analyze the EKC hypothesis by using more a comprehensive indicator of environmental quality than emissions, and to investigate the PHH hypothesis for the EU countries and Turkey. Thirdly, the role of FDI and ICT has been tested for these countries by using threshold modelling for the first time.

The obtained findings of our study can be summarized as follows. Since EKC is validated when the ICT is used for the threshold value, EFP increases with economic growth, then reaches a certain level (called the turning point) and tends to decline with greater level of economic development. According to the findings, however, ICT does not affect EFP. Despite this finding, it has been determined that other variables differ significantly in favor of environmental quality when ICT has a threshold variable.

The other important finding is that our results found evidence supporting the PHH hypothesis for 25 EU countries and Turkey. In any case, FDI and fossil energy increase environmental pressure in the analyzed countries. Therefore, FDI does not help reduce environmental pressures. Conversely, FDI inflow stimulates fossil energy utilization. Moreover, environmental regulations seem do not seem to play a promoting role on environmental quality. It's surprising to see this conclusion, since the EU has ambitious targets related to the environment and renewable energy in their energy mix.

Hence, the EU countries should tighten the environmental regulations on FDI inflow. Furthermore, since renewable energy consumption has positive impact on EFP, countries in the EU and Turkey should intensify the effective renewable energy incentives such as FITs,

taxes, R&D, grants loans, etc., to increase the renewable energy deployment in energy mix. Therefore, we conclude that the findings of our research provide important information for policy makers both in the EU countries and Turkey.

Declarations

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What is the role of ecological footprint on renewable energy deployment? Sustainability perspective for EU region

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Abstract Because of the concerns about global warming, climate change and energy security, issues many countries try to increase the share of renewable energy sources. Renewable energy has become key to ensure sustainable economic development as well. Therefore, the current study aims to analyze the role of environmental degradation, GDP, energy import and urbanization on renewable energy deployment in 26 European Union countries by using panel data over the 1990-2018 period. Against this backdrop, we employed Ecological Footprint to represent environmental degradation in these countries. Our results indicate that while GDP per capita and urbanization are not a significant driver of RE deployment, energy import and EFP negatively affect RE deployment. On the contrary, increasing GDP and urbanization have a deterring impact in some EU countries (Romania, Czechia, and Denmark). Moreover, energy requirement of growing income is mostly met by non-renewable energy and environmental pressure is not a strong driver for renewable energy development in the EU countries. We provided some policy recommendations in the conclusion part.

Keywords: Renewable energy deployment, Ecological Footprint, European Union, sustainable economic development.

JEL: Q01, Q43, Q56

Introduction

Due to the environmental concerns, such as global warming, climate change and energy security issues, many countries try to replace fossil fuels with the renewable energy (hereafter REN) in their energy mix. As it is known, increasing fossil fuel utilization is seen as the major factor that worsens the environmental degradation. Energy fuels e economic activities but increasing production and consumption parallel with the rising income harms the environmental quality. As reported by IEA (2021), more than two thirds of GHG are attributed to the energy sector and fossil fuels constitute more than 80 % of total energy supply all over the world. Although global CO_2 emissions decreased due to Covid-19 pandemic in 2020, total emissions rebounded to pre-Covid 19 levels with a 4.8 % increase (Januta, 2021). As highlighted by the Brundtland Report in 1987, it is necessary to achieve sustainable economic development by setting up balance between economic growth and

environment (Salman and Hosny, 2021). Due to the energy security problems, limited proven fossil fuel reserves and increasing environmental deterioration, REN has become a major tool to ensure sustainable economic development. Moreover, since developments of REN technologies ensure mini grid systems and rural electrifications, it contributes to rural development as well. In this context, an increasing number of countries (around 165 countries in 2020) has put into force some incentive mechanisms such as FITs, taxes, quota, tradeable REN certificates, tendering, etc., to promote REN in their energy mix. As result of these efforts, the share of REN in global energy supply increased significantly. However, although IEA (2022) projects that REN will provide more than 32 % of global energy supply by 2024, there are significant differences in the share of REN in the energy mix among the different countries and REN's penetration progress is slow. Therefore, it is vital to explore the factors that determine REN development to ensure sustainable economic development.

Since REN has become a key factor in promoting environmental sustainability, the link between REN deployment and factors that affect the development of REN has been the focus of policy makers and researchers. There are many studies in the literature that empirically analyze REN deployment in different countries and/or country groups by using different econometric methodologies in the recent decades. The explanatory variables incorporated into these models can be grouped as socioeconomic factors, policy, and country specific factors (Acquire and Ibikunle, 2014; Marquez et.al., 2010). For example, one research strand investigates the role of incentive policies on REN development in some countries and/or country groups (see Menz and Vachon, 2006; Carley, 2009; Nicolini and Tavani, 2017, Liu et.al., 2019; Bölük and Kaplan, 2021; among others). These studies also investigated some control variables, such as Gross Domestic Product (GDP), energy import, energy prices, GHGs (proxied by CO_2 emissions) (see Liu et.al., 2019; Bölük and Kaplan, 2021). However, they revealed controversial results about the effectiveness of different kind of incentive policy schemes. Another research strand, however, focused on the impact of macro-economic and environmental variables on REN development by using linear econometric models. These studies generally found stimulating effect of GDP, energy import and energy and/or electricity consumption (see Sadorsky 2009; Gan and Smith, 2011; Omri and Nyugen, 2014; among others). In both research strands, environmental degradation was

represented by CO_2 emissions. However, emissions are only a specific part (air pollution) of environmental degradation and CO_2 cannot fully represent the environmental deterioration. Including the CO_2 emissions as the proxy of environmental deterioration is argued, as production-based approach and this method is criticized due to the lack of an aggregate measure of environmental quality (Bagliani et.al., 2008; Caglar et.al., 2021). Following the pioneering studies of Rees (1992) and Wackernagel and Rees (1996), it has been argued that EFP poses more comprehensive and composite environmental indicator than emissions and it is a more convenient tool to ensure environmental sustainability (Hassan et.al., 2019; Caglar et.al., 2021). Apart from the emissions, using more than 6000 units of data for every individual country, EFP presents consumption-based indicator, since it includes the stress of economic activities on cropland, grazing land, forest land, fishing grounds and built-up land on the Earth (Global Footprint Network, 2022).

Unlike the previous studies, this paper discusses the impact of EFP on REN deployment by including some control variables such as GDP and energy import. According to the best of our knowledge, this study is the first attempt that analyzes the role of EFP in REN deployment in energy economics. Our paper contributes to existing energy economics literature as following. First, we employ EFP, which is commonly accepted as more comprehensive indicator of environmental quality of economic activities and/or environmental sustainability. As discussed in detail under the "literature review", existing studies used CO_2 emissions to evaluate the impact of environmental pressure. Second, previous studies provide limited understanding related to determinants of REN development and reveal controversial results. What is more, determinants of REN deployment have not been studied enough empirically yet. Hence our results will provide hints about efficient policy design related to REN deployment. We focus on the EU countries over the 1990-2015 period since the EU desires to be leader in REN in the world. We employ panel data analysis. Since RE production and/or installed capacity can affect the future RE development, we included lag of dependent variable (REN) in our model. Therefore, a dynamic model is defined. It is also thought that it is useful to consider heterogeneity in order to reach country-specific results. Therefore, a dynamic and heterogeneous model was employed.

The rest of the paper is organized as follows. Section 2 summarizes the existing literature on drivers of RE development. Section 3 provides the data and econometric model

structure. Section 4 presents the results. Conclusion and some policy recommendations are given in the Section 5.

Theoretical premises

It appears that there are two main research strands in the literature on determinants of REN deployment. The drivers and/or stimulating factors have been studied since the beginning of 2000s. The first strand basically investigates the stimulating effect on implemented policy incentives on REN deployment. The earlier studies in this strand analyzed the role of one and/or few REN incentive tools on REN development in individual countries. In this context, while Verbruggen (2004) investigated the role of tradable certificate mechanism on REN installed capacity for Flenders, Birds et.al. (2005) demonstrated the stimulating effect of renewable portfolio standards (hereafter RPSs) and other financial incentives, such as state tax, on wind capacity in USA. Similarly, Wüstenhagen and Bilharz (2006), and Mitchell et.al. (2006) discussed the role of FITs on REN installed capacity development for Germany. In this strand, however, effectiveness of policy schemes on REN development has been started to be discussed empirically after the pioneering study of Menz and Vachon (2006). In their study, the authors analyzed the role of policy incentives on wind capacity in 39 states in the USA. By using panel data analysis, they found stimulating effects of REN policies (such as RPSs) on REN electricity capacity from wind. Another empirical study for the USA implemented by Carley (2009) found a positive impact of RPSs on REN power generation as well. While Menz and Vachon (2006), and Carley (2009) discuss either FITs or RPS for single country, some studies in this strand analyzed the effectiveness of many REN policy tools on REN development in some country groups. Dong (2012) demonstrated that FITs are a stronger incentive tool than RPS for wind power in 53 countries. Nicolini and Tavani (2017) compared the FIT and tradable green certificates for five largest European countries and found that 1% (Euro cent) increase in FIT rises the REN installed electricity capacity by around 18-26 %. Liu et.al. (2019) analyzed the role of REN incentives in 29 countries from the EU and OECD by using panel data analysis. Authors concluded that fiscal and financial incentives, R&D and policy supports are important mechanisms for REN development. Among the studies discussing the effects incentive policies on REN development, some have also questioned the effects several

control variables, such as income, population, energy prices, energy import, nuclear power, etc., in their models. For example, using Tobit regression for 30 countries, Kim and Park (2016) confirmed the positive impact of FITs, financial development, electricity consumption and GDP on REN. Moreover, authors highlighted the stimulating effect of international finance possibilities. Marquez and Fuinhas (2011) focused on the role of incentive policies in fostering REN installed capacity and found that FIT and policy process like strategic planning are effective policy devices for EU countries and Turkey. However, quota obligations, product labelling, R&D, CO_2 emissions and tradeable certificates were found to be insignificant schemes for RE in this study. Similarly, using dynamic panel data analysis, Bölük and Kaplan (2021) analyzed the effectiveness of a rich set of incentive policies including the "net metering" on REN development in the EU countries and Turkey. The authors found that among the other grants, tax, R&D, certification, and policy support have encouraging impact on REN deployment. Moreover, authors confirmed that fossil energy use, nuclear power and GDP stimulate the REN installed capacity in these countries.

Another empirical research strand studied the macroeconomic and/or microeconomic drivers of REN development. For example, using ECM and SUR, Sadorsky (2009) focused on the determinants of REN consumption for G7 countries and found that real income per capita, real oil prices and CO_2 emissions are important factors for REN. Similarly, Gan and Smith (2011) analyzed the drivers for OECD countries by using panel data analysis. The authors found that while GDP per capita increases the REN capacity, CO_2 emissions, energy prices and government policies have no significant impact on REN generation. Focusing on EU countries over the 1990-2004 period, Bengochea and Faet (2012) found positive relationship between high level of CO_2 emissions and REN generation. However, they found prices of fossil fuels to be insignificant for REN development. Pfeiffer and Mulder (2013) empirically proved that real GDP per capita, education level, government policies and electricity consumption level are the significant contributors of REN generation in 108 developing countries. By using global panel data covering the 64 countries for the 1990-2011 period, Omri and Nyugen (2014) found CO_2 emissions and trade openness are the major drivers for REN consumption. The authors, however, found smaller but negative impact of oil price increases on REN consumption. Smilarly, Ackah and Kizys (2015) found that while CO_2 emissions and energy prices deter REN generation, GDP per capita,

population, capital formation contribute to REN development in oil producing African countries. Li et.al. (2020) empirically proved positive role of eco-innovation and energy efficiency on REN installed capacity. Murshed et.al. (2021) found positive role of regional trade integration on REN development for South Asia. Przychodzen and Przychodzen (2020) attempted the determine the factors stimulating REN production in 27 transition countries in the 1990-2014 period and revealed that while GDP increase, government debt, unemployment and Kyoto Protocol contribute to REN production, CO_2 emissions and anti-competitive market conditions in energy markets limit REN development in these countries. Apart from the macro-economic factors, Chen et.al. (2021) highlighted the importance of democratic institutions. Using threshold panel data of 97 countries over the 1995-2015 period, authors demonstrated that while democratic institutions play vital role in REN investments, trade openness slows down REN development. Using panel ARDL for Sub-Saharan countries, de Silva et.al. (2018) found that while real income, energy use stimulates REN deployment, CO_2 emissions, energy prices, energy import and Kyoto agreement decreases REN consumption. Although many studies confirmed the stimulating effect of GDP, Akar (2016) found negative impact of economic growth for REN share for Balkan countries. Bourcet (2020) provides a detailed review of empirical literature that focusses on determinants of REN since 2000s.

As discussed above, previous studies provide little consensus on both the effectiveness of policy incentives and the role of other socio-economic and environmental determinants of REN development. Moreover, although many drivers have been discussed for REN consumption and/or REN installed capacity, the role of EFP has not been discussed by any empirical studies. This is a gap that our research paper aims to fill in the energy economic literature.

Methodology

In this study, a panel data model structure is proposed to understand how socio-economic factors and ecological pressure affect REN development in EU countries. The time interval has been determined on the basis of data availability. As a dependent variable, REN is used to represent REN development in energy mix. REN is represented by renewable energy consumption (measured as % of total final energy consumption).

EFP is defined as explanatory variable and per capita EFP data are obtained from Global Footprint Network (GFN, 2020). Moreover, socio-economic drivers as explanatory variables are arranged as GDP per capita (real GDP in terms of PPP based on 2017 USD, hereafter GDP), energy imports (net, % of energy use, hereafter EIMP) and urbanization (% of total population, hereafter URB). All data incorporated into our model have been compiled from the World Bank (2022). Data covers the 1990-2018 period from 26 countries. Summary statistics for data are given in Table 1.

Table 1. Summary Statistics

	ren_{it}	efp_{it}	gdp_{it}	$eimp_{it}$	urb_{it}
Obs.	754	712	726	670	754
Mean	14.872	5.523	35430.34	53.400	70.247
Std. Dev.	11.439	2.218	18475.5	27.673	11.814
Min.	0.335	1.74	9600.9	-65.694	47.915
Max.	52.892	17.78	120647.8	99.675	98.001

The data set is an unbalanced panel according to number of observations. The share of ren in total energy consumption is 14.87% on average. The minimum ren value is 0.34% (Cyprus), and the maximum value is 53% (Sweden). The average value of efp is 5.5, with a minimum value of 1.74 (Slovakia), and a maximum value of 17.78 (Luxembourg). The mean of gdp value of the overall panel is approximately $35,430. The minimum gdp value is approximately $9,601 (Latvia), while the maximum value is approximately $120,648 (Luxembourg). The average of eimp is 53.4%. The minimum value of this variable is approximately -65.7% (Denmark), while its maximum value is approximately 99.7% (Cyprus). Finally, for the summary statistics of the urb variable, the share in the total population is approximately 70%. The minimum urb value was approximately 48% (Portugal), and the maximum value was 98% (Belgium).

The main purpose of the current study is to reveal the effects of ecological pressure (represented by efp) and different socio-economic variables on ren development in the EU region. Our results will provide important implications for the sustainability aspect of the EU countries. For this purpose, we constructed a dynamic panel data model to examine ren development and some control variables. The variables in the model context are defined as follows:

(1) $$ren = f(efp, gdp, eimp, urb)$$

We also added the lag of ren in the model to make the econometric model dynamic. The model discussed in the study is defined as follows:

(2) $$ren = f(efp, gdp, eimp, urb)$$

In Eq.2, α is the constant, θ is the coefficient for dynamic variable, and the coefficients of the β are slope coefficients of independent variables. All coefficients are used as cross-sectional specific, assuming only unit effects in the model.

Some preliminary tests should be performed before estimating the model in equation (2). These statistical pre-tests are cross-sectional dependency, unit root, cointegration and slope homogeneity tests. The appropriate econometric method is determined based on the results of the pre-tests. The test results will be presented in the next section. In this section, the dynamic common correlated effects (DCCE) technique used in the study is mentioned.

In economic studies, dynamic models are widely used, because variables have significant persistence over time and react slowly to changes. A typical way to include the dynamic process in an analysis is to add the lagged dependent variable to the model (Vos and Everaert, 2019). However, due to the dynamic factors used, the problem of endogeneity may arise. The GMM method, which is frequently used in dynamic panel data analysis, is based on the homogeneity assumption. However, in practice, heterogeneity is a fairly common feature. MG and PMG estimators that take heterogeneity into account can be considered, but these estimators are not consistent due to their disregard for cross-sectional dependence (Turkay, 2017).

Therefore, another consideration in panel data is cross-sectional dependency. Since traditional methods ignore cross-sectional dependence, panel data analysis techniques developed in recent years take this problem into account. Because today, with the globalized economy, unobserved factors and shocks have important effects on the economies. ofcountries (Ali et al., 2020). DCCE, which is preferred in this study, is a technique that performs the estimation of dynamic heterogeneous panel data models that also take into account cross-sectional dependency. DCCE, developed by Chudik and Pesaran (2015), is based on MG by Pesaran ve Smith (1995), PMG by Pesaran et al. (1999) and CCE by Pesaran (2006) approaches (Arain et al., 2019). Chudik and Pesaran (2015) describe a dynamic structure by expanding CCE (Turkay, 2017). CCE estimator is robust

to nonstationarity, cointegration, structural breaks and serial correlation. However, it is not suitable for a dynamic specification (Chaudhry et al., 2022). Since the lagged dependent variable in CCE is not strictly exogeneity, CCE estimator is not consistent in dynamic panel models (Liddle and Huntington, 2020). Chudik and Pesaran (2015) added cross-sectional averages, in addition to making the estimator consistent. In this context, DCCE can be presented as follows:

$$(3) \qquad ren_{it} = \theta_i ren_{it-1} + \beta_{ki} X_{it}^{(k)} + \sum_{p=0}^{p_T} \delta_{kpi} \bar{X}_{t-p}^{(k)} + \sum_{p=0}^{p_T} \gamma_{pi} \bar{Y}_{t-p} + u_{it}$$

where X represents each independent variable in the model shown in equation (2) (k=1, 2, 3, 4). It also shows the cross-sectional averages $\bar{X}$ and $\bar{Y}$, while p_T is the lag of the cross-sectional averages. Finally, it should be noted that the DCCE method is suitable for unbalanced panels (Ditzen, 2016).

Results

First of all, the question whether there is cross-sectional dependence in variables is examined using LM and CD tests. The obtained results are important for determining the unit root test and estimation method to use. According to the results in Table 2, all variables have a cross-sectional dependence. Based on this result, second-generation unit root tests that take cross-sectional dependence into account should be implemented to examine the stationarity of the series.

Table 2. Cross-Sectional Dependence Tests

H_0: No CSD	ren_{it}	efp_{it}	gdp_{it}	$eimp_{it}$	urb_{it}
Breusch-Pagan LM	6301.5***	1874.6***	6902.9***	2719.5***	6471.3***
Pesaran CD	77.131***	27.051***	81.606***	6.866***	15.693***

Note: (*), (**) and (***) show the significance level at 10%, 5% and 1% respectively.

Pesaran's (2007) CIPS test is applied as a second-generation panel unit root test. Table 3 shows panel unit root test results at level and 1st difference of the series. The null hypothesis that there is no unit root at the level for ren and efp is rejected. However, gdp, eimp, and urb are stationary in the 1st differences. Therefore, all variables are stationary at the level and at the 1st difference and none of them is stationary at the 2nd difference.

Table 3. Pesaran (2007) CIPS Panel Unit Root Test

H_0: Unit Root	ren_{it}	efp_{it}	gdp_{it}	$eimp_{it}$	urb_{it}
Level	-1.784**	-3.307***	2.162	0.733	5.907
1st difference	-16.560***	-19.403***	-8.511***	-15.098***	-3.052***

Note: (*), (**) and (***) show the significance level at 10%, 5% and 1% respectively.

Second-generation panel cointegration tests should be preferred if there is a cross-sectional dependence to determine the cointegration relationships between the series. Error correction-based panel cointegration test based on Westerlund (2007) is conducted to determine whether there is a cointegration relationship between series. The null hypothesis that there is no cointegration could not be rejected for all test statistics (G_t, G_a, P_t and P_a), as seen Table 4. This result shows that there is no cointegration relationship between the series. Therefore, in order to estimate the equation (2), it is necessary to work with stationary series. Otherwise, the obtained estimation results would constitute a spurious regression. For this purpose, model estimation should be realized by taking into account the *gdp*, *eimp* and *urb* variables in the 1st difference according to the results in Table 3.

Table 4. Westerlund Error Correction-Based Panel Cointegration Test

H_0: No cointegration	Statistics	p-value	Robust p-value
G_t	-1.899	0.998	0.503
G_a	-4.055	1.000	0.913
P_t	-8.368	0.992	0.400
P_a	-3.535	1.000	0.633

An important point to consider in order to determine the estimation method is the cross-sectional dependence. The other important test is the slope homogeneity. For this purpose, Swamy (1970) $\widetilde{\Delta}$ and $\widetilde{\Delta}_{adj}$ tests of Pesaran and Yamagata (2008) are employed. According to the test results in Table 5, the null hypothesis of slope homogeneity is rejected. Therefore, heterogeneous panel data methods should be used instead of methods that assume the slope homogeneity.

Table 5. Slope Homogeneity Test

H_0: Slope Homogeneity	Statistics	p-value
Swamy	63237.05***	0,000
$\widetilde{\Delta}$	7.342***	0,000
$\widetilde{\Delta}_{adj}$	8.892***	0,000

Note: (***) shows the significance level at 1%.

In order to estimate equation (2), DCCE approach, which allows dynamic specification, as well as taking into account cross-sectional dependence and slope heterogeneity, is preferred. Panel mean group (MG) and country-specific DCCE estimation results are given in Table 6. According to MG estimation results, *efp* and *eimp* have statistically significant and negative effect on *ren*. However, the effect of *gdp* and *urb* variables on *ren* has not been determined. In addition, *ren* are highly permanent, highly affected by the past period. This result is also supported by country-specific estimation results. According to country-specific estimation results, the coefficient of the lagged *ren* is a statistically significant and positive sign, except for 7 of the 26 countries. In addition, *efp* in 6 countries (Croatia, Denmark, Greece, Ireland, Lithuania, and Spain) has a significant negative effect on *ren* in accordance with expectations. When looking at *gdp* results, it is only significant for 3 countries, but the coefficient signs are not in line with economic expectations. Because when there is an increase in *gdp*, *ren* is expected to increase. A similar incompatible result applies to the *urb* coefficients. Although the *urb* coefficients are significant for only 2 countries, it seems that the coefficients of urb are negatively marked. Finally, when the results of the *eimp* variable are examined, it is seen that the coefficient is significant in 12 countries. However, in 2 of these, *eimp*'s estimation results are positively marked in the opposite direction. In the results of the other 10 countries, it is determined that *eimp* had a negative effect on *ren* as expected.

Table 6. DCCE Results

Country	ren_{it-1}	efp_{it}	Δgdp_{it}	$\Delta eimp_{it}$	Δurb_{it}	C
Panel (MG)	0.603***	-0.721***	3.10e-05	-0.226***	-1.401	0.775
Austria	0.883***	0.993	-5.3E-06	-0.616***	-2.338	7.772
Belgium	0.826**	-0.209	2.1E-04	0.004	-1.567	-0.952
Bulgaria	0.286	-1.835	3.5E-04	-0.000	6.906	-9.102
Czechia	0.926***	0.485**	-3.7E-04*	0.072*	-2.905	-3.815
Croatia	0.596**	-5.252**	2.9E-04	-0.289*	-1.733	-0.502
Cyprus	0.498	-0.625	9.0E-05	-1.193***	-0.708	-4.077
Denmark	0.751***	-1.872***	-9.6E-04**	-0.069***	1.299	12.115
Estonia	0.140	0.430	-7.1E-04	-0.129	-15.039	28.078
Finland	0.324	-1.567	4.7E-04	-0.122	-3.078	7.786
France	0.653***	1.405	-4.1E-04	0.023	-5.781	5.135
Germany	0.899***	-0.726	2.8E-04	-0.216***	1.803	3.783
Greece	0.335***	-1.174***	1.7E-04	0.028	-0.674	13.451***
Hungary	0.584***	-0.338	-3.1E-04	-0.274	2.345	13.536
Ireland	0.860***	-0.521*	3.7E-05	-0.009	-4.322	-1.547
Italy	0.619***	-1.123	2.1E-04	-0.409***	0.855	-4.283

Latvia	0.896**	-0.727	1.3E-03	-0.361**	-5.970	-0.197
Lithuania	0.579**	-1.921***	-8.9E-05	-0.055	-7.139*	-12.004
Luxembourg	0.798**	-0.274	-4.3E-05	-0.637	-0.765	9.129
Netherlands	0.868***	-0.052	3.0E-04	0.022**	0.419	-3.326*
Poland	0.518*	-0.459	7.4E-04	-0.041	-4.722	10.604
Portugal	0.868***	-1.843	-3.1E-05	-0.778***	15.381	-4.898
Romania	0.277*	1.491	-1.5E-03**	-0.286	-10.122**	-58.168***
Slovakia	0.200	-1.156	9.3E-04	0.229	-0.063	-6.647
Slovenia	0.679*	0.273	-1.2E-03	-0.375**	-6.286	3.694
Spain	0.254	-2.502***	5.6E-06	-0.316***	7.651	13.966**
Sweden	0.563	0.361	-4.6E-04	-0.089	0.137	0.603

Note: (*), (**) and (***) show the significance level at 10%, 5% and 1% respectively.

Summary, recommendations

The purpose of this paper is to examine the effects of EFP, GDP, energy import, and urbanization on REN deployment in 26 EU countries. For this purpose, we constructed a panel data that covers the 1990-2018 period. Against backdrop of the available literature, our study analyzes the impact of EFP on REN deployment for the first time. Moreover, we provide country specific situation related to REN among the EU countries.

Based on the analysis, dynamic panel estimation indicates that REN deployment in previous years has positive and significant stimulating effect on the present REN level in the analyzed countries. Interestingly, our results indicate that while GDP per capita and urbanization are not significant drivers of REN deployment, and that energy import and EFP negatively affect REN deployment. These results show that increasing EFP (increasing environmental pressure) cannot create a strong incentive to the deployment of REN in the EU countries. This result implies that economic targets are more dominant than the environmental concerns, and that the energy requirement of growing income is met by non-renewable energy sources. Hence, growing fossil fuel consumption creates environmental degradation and/or pollution. Moreover, it seems that energy dependency is considerably high, and it leads a strong lobby effect in the EU countries. This situation may be the result of low cost of fossil fuels.

Like growing income, urbanization has no significant effect on RE development. Increasing urbanization, however, has a deterring impact on RE deployment in Romania and Lithuania. This means that higher rate of urbanization leads to fossil fuel use in energy mix. Like urbanization, increasing GDP has a negative and significant impact on REN

deployment in Czechia, Denmark, and Romania. Our results show that increasing GDP stimulates much more non-renewable energy consumption in output creation process in these countries.

Against expectations, GDP increase is not an important driver for RE deployment. We cannot say that richer countries will be in a better position for RE development. Hence, apart from the growing income, the EU should more widely implement a stronger and more efficient support mechanism, such as subsidies, FITs, R&D, green certificates, etc. Furthermore, the EU countries should increase the environmental awareness and financially support the R&D policies to eliminate the cost disadvantages of REN in energy mix towards sustainable economic growth.

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Earnings manipulations & related party transactions.
Empirical evidence from Italian family firms

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Abstract The literature has extensively investigated the phenomenon of earnings management, as this unethical practice considerably undermines the interests of firms' stakeholders, in particular of investors, as demonstrated by the financial scandals that have marked the last few decades.

The purpose of this paper is to investigate the possible association between earnings management (EM) and related party transactions (RPT). We study a sample of Italian non-financial listed family firms over the 2014–2019 period, controlling for the fixed effects of the company's industry and the year. We analyze the association between real earnings management (REM), as well as accrual-based earnings management (AEM), and related party transactions in family businesses. In doing so, we distinguish earnings manipulations perpetrated by exploiting accounting choices, as well as production cost, cash flow, and discretionary expenses-based earnings management. We control for certain governance characteristics and family business generational stage, leverage, size and performance in order to take into account the heterogeneity within family firms.

We find a significant negative relation between real earnings management perpetrated by overproduction and RPTs, as well as a significant positive relation between abnormal levels of discretionary expenses and RPTs. Moreover, our results indicate that CEO duality significantly increases the association between REM perpetrated via cash flow manipulations and RPTs, whilst firms in the first generational stage tend to use in a substitute way downward accrual-based earnings management and RPTs.

Keywords: related party transactions, accrual-based earnings management, real earnings management, family firms.

JEL: A1, D0, E0

1. Introduction

Scholars have approached the phenomenon of relations between related parties according to different theoretical approaches: the efficient transaction hypothesis and the agency theory (Marchini et al., 2018). According to the former, transactions between firms belonging to the same group reduce transactions cost and allow the company to raise capital without resorting to external financing (Jian and Wong, 2010; Pozzoli and Venuti, 2014). Under the agency perspective, related party transactions are a tool for extracting resources

from minority shareholders to the benefit of controlling shareholders, or a means for managers to achieve personal benefits to the detriment of shareholders (Mohammed, 2020; Marchini et al., 2018).

The large financial scandals that marked the third millennium are positioned in the latter framework, as they are characterized by related party transactions, generated by conflicts of interest, as well as by profit manipulation perpetrated *via* real (REM) or accrual-based earnings management (AEM).

Literature has widely engaged analyzing earnings management practices in terms of real earnings management – perpetrated *via* sales anticipation (Roychowdhury, 2006) or overproduction (Graham et al., 2005; Roychowdhury, 2006; Gunny, 2010; Tabassum, Kaleem, & Nazir, 2014) or discretionary expenses reduction (Roychowdhury, 2006; Graham et al., 2005), as well as *via* accrual based earnings management perpetrated by exploiting accounting choices (among others: Cohen et al., 2008; Gavana et al., 2019). There is evidence that EM is positively associated with the level of information asymmetry (Abad et al., 2018) and that it causes detriment for a firm's stakeholders (Lo, 2008). Research has also highlighted the effect of governance characteristics (Chung et al., 2002; Yeo et al., 2002; Davidson et al., 2005), pointing out the effect of family control (among others: Prencipe et al., 2008; Stockmans et al., 2010; Achleitner et al., 2014; Martin et al., 2016; Mnif & Cherif, 2020) on earnings manipulations. Literature has also pointed out the moderating effect of family business generational stage, board independence (Borralho et al., 2020; Bansal, 2021), and CEO duality (Chi et al., 2015) on earnings manipulations.

Scholars have investigated the possible association or tradeoff between real and accrual-based earnings management (Zang, 2012; Ipino and Parbonetti, 2017; Li, 2019), pointing out that family businesses treat REM and AEM as substitute rather than complementary tools for earnings manipulations (Achleitner et al., 2014).

For what concerns related party transactions, the literature has analyzed how the type of RPTs is associated with earnings management (Marchini et al., 2018). It has investigated the use of RPTs as a means for tunneling (Jian, 2003; Aharony et al., 2010) or propping, analyzing how organizational structures shape the ways companies use related party transactions in order to manipulate their performance (Jian and Wong, 2010),

or as a means for impressing management during Initial Public Offering processes (Chen et al., 2011).

A limited number of scholars has investigated how firms combine real or accrual-based earnings management with related party transaction, with partially different results, thus leaving room for further study (Alhadab et al., 2020; El-Helaly et al., 2018; Marchini et al., 2018; Munir et al., 2013). Some authors have investigated the effect of some governance characteristics on this possible association, such as ownership concentration (Munir et al., 2013), family and Institutional ownership (Alhadab et al., 2020).

A grained analysis of the possible association between EM and RPTs within family business is missing. This is a relevant literature gap, as family businesses are not a homogeneous group (Chua et al., 2012), and there is evidence that they present different behaviors in terms of earnings management (Gavana et al., 2019; Prencipe et al., 2008).

Therefore, our research question is "Which family business characteristics affect RPTs and the possible relationships between different types of EM and RPTs?"

We address the research question analyzing a sample of 85 Italian listed family firms for the period 2014-2019.

Italy is of interest, as on the one hand RPTs are strictly regulated by the "RPT Regulation", adopted in 2010 by the Italian securities regulator (Commissione Nazionale per le Società e la Borsa, CONSOB) with Resolution no. 17221/2010. On the other hand, the financial market is characterized by a prevalence of closely held companies, and relatively weak investor protection (Franks et al., 2011; La Porta et al., 1999), peculiarities that can stimulate agency conflicts resulting in earnings management, as well as opportunistic RPTs. The Italian context is also a particularly suitable ground for family business studies, as 75% of companies in the country are family owned (Barontini and Caprio, 2006).

We study the association between different types of real as well as accrual-based earnings management and RPTs within family firms, analyzing the possible moderating effect of family CEO duality, family members on board, family ownership and family business generational stage.

Results indicate that family firms tend to use RPTs as a substitute for real earnings management perpetrated by overproduction and RPTs and to associate abnormal levels

of discretionary expenses with RPTs. Moreover, our findings suggest that family CEO duality significantly increases the association between REM perpetrated via cash flow manipulations and RPTs, whilst firms in the first generational stage tend to use RPTs as a substitute of downward accrual-based earnings management.

This study contributes to family business study, providing evidence of family firms' heterogeneity in earnings manipulations through EM and RPTs.

The paper continues as follows: section 2 highlights the theoretical framework and the literary review; section 3 illustrates the data and methods; section 4 provides the results and discussion; section 5 concludes pointing out venues for future research.

2. Theoretical framework and literature review

Agency conflicts in family firms

Earnings manipulations derive from different types of agency conflicts: manager vs shareholders (first type), controlling shareholders vs minority shareholders (second type), debt agency conflicts (third type), tax related agency conflicts (fourth type) (Liu and Lu, 2007; Marburn et al., 2016; Gavana et al., 2019). According to literature, family control and influence shape the different types of agency conflicts.

The first type of agency conflict might result in earnings manipulation in order to increase a company's performance and achieve managerial incentives. Nevertheless, it might result in a reduction of current performance, in order to ensure the benchmark achievement in the following year. Family control and influence lowers agency conflicts between managers and shareholders, as across countries a large proportion of CEOs and Chairmen are the members of the controlling family (Bhaumik and Gregoriou, 2010), and the overlapping role of CEO and Chairman is more common in family than non-family companies (Cheung et al., 2000; Chen et al., 2005; Gavana et al., 2021). Nevertheless, because of management entrenchment, the agency conflicts between controlling and minority shareholders tend to be more severe in family businesses, than in non-family firms. Family firms' management might act in order to transfer profit to the controlling family to the expense of minority shareholders, particularly where a family's voting rights are significantly higher than its cash flow rights (Bertrand et al., 2002), as well as for institutional context characterized by a weak investor protection (Johnson et al., 2000).

On the other hand, the desire to maintain family control on the company and the trans-generational intent (Berrone et al., 2012; Gómez-Mejía et al., 2007) incentive downward earnings management operations in order to reduce the dividends distribution and increase a company self-financing.

Family control and influence weakens agency conflicts related to debt financing. Family firms are reliable debtors for lenders as they are risk averse, they pursue stability and avoid risky investment strategies, as well as they are less likely to incur financial distress, as compared to non-family companies (Naldi et al. 2007; Gottardo and Moisello, 2017). Moreover, family members are prone to secure the firm's debt with personal guarantees (Voordeckers and Steijvers, 2006), and this fact reduces the likelihood of contractual violations and favours the alignment of interests between the controlling family and debtholders (Steijvers et al., 2010). Empirical evidence shows that family firms issue more long-term debt than non-family businesses and this means that capital markets recognize the risk aversion of family owners and consider family-controlled firms less difficult to monitor (Croci et al., 2011). This leads to a lower cost of debt (Anderson et al., 2003) and can reduce the incentives for family businesses to inflate profits.

For what concerns the fourth type of conflict, the State requires companies to contribute to the financial coverage of citizens' needs and aspirations through the production of tax revenues. State and companies' interests are opposite, there is information asymmetry and this conflict might result in downward earnings management in order to reduce a firm's income taxes (Gavana et al., 2019). Family control might differently moderate this agency conflict. On the one hand, downward earnings management and the related tax reduction help to keep resources within the company, where the family's assets are concentrated. On the other hand, the sense of identification between the controlling family and the firm as well as the long-term perspective make family businesses very attentive to reputational aspects (Berrone et al., 2012). Therefore, the concern for reputational damage resulting from tax-related lawsuits can make family businesses much less tax aggressive than non-family businesses (Chen et al., 2010).

Related Party Transactions and Earnings Management

International Accounting Standard 24 defines a related party transaction as "a transfer of resources, services, or obligations between related parties, regardless

of whether a price is charged" (IAS 24: 9). In broad terms, related parties are companies belonging to the group of the reporting entity, its managers, majority shareholders and their close family members and, more generally, all the physical persons or legal entities with respect to whom any transaction could deviate from the logic of market.

According to the Agency Theory, RPTs may be implemented for the purpose of procuring personal benefits for managers or majority shareholders and/or to expropriate minority shareholders and creditors (Mohammed, 2020), and in business groups, the controlling shareholder can make it difficult to identify the related party by exploiting different shareholding structures (Ali et al., 2021). In this view, earnings management activities would be undertaken to conceal the expropriations perpetrated by insiders through RPTs or to increase the private benefits gained through RPTs (Marchini et al., 2018).

According to a number of studies (Chen et al., 2009; Nekhili and Cherif, 2011; Ge et al., 2010; Kohlbeck and Mayhew, 2010), there is a negative association between RPTs and a firm's financial performance or a firm's value. Furthermore, the announcement of related party acquisitions and sales of assets leads to a reduction of a firm's value (Cheung et al., 2009). Research has found that RPTs are used to inflate a firm's financial performance where there are incentives to meet earnings targets (Jan and Wong, 2010) and during the Initial Public Offering (IPO) process (Chen et al., 2011; Aharony et al., 2010), and that they negatively affect the quality of earnings (Rahmat et al., 2020; Kohlbeck and Mayhew, 2017; Munir et al., 2013).

Empirical research has analyzed the propension for firms to resort to RPTs, revealing that family businesses are more prone to engaging in RPTs than their non-family counterparts (Kholbeck et al., 2018), but this tendency diminishes as family involvement in management or ownership of the business increases (Fan and Yu, 2021). In business groups, RPTs are used as a mechanism to maintain family control in contexts where ownership succession is costly (Hwang and Kim, 2016). There is also evidence that RPTs reduce a firm's financial performance and this effect is more pronounced for family than non-family firms (Mohammed, 2020). The study by Kohlbeck et al. (2018) points out that RPTs with directors, officers, and major shareholders result in a decline in family firms' value, providing evidence that the market considers this type of transactions as opportunistic. As highlighted in the literature, second type agency conflicts are more

severe in family firms than in non-family businesses (Ali et al., 2007). Consistently, Yoong et al. (2015) demonstrate that the expropriation of minority shareholders by means of RPTs is stronger in family firms than in non-family businesses, although ownership concentration mitigates this expropriation in family firms more than in non-family ones.

The literature dealing with earnings management has analyzed this unethical practice in family firms compared to non-family businesses and, more recently, has investigated the different attitudes towards earnings manipulations of different types of family firms. In regards to accrual-based earnings management, several studies provide evidence that family firms are less prone to manage reported earnings than their non-family counterparts (Ali et. al, 2007; Prencipe et al., 2008; Cascino et al., 2010; Prencipe and Bar-Yosef, 2011; Gavana et. al, 2017). Opposite results have been detected in institutional setting characterized by weak legal and corporate governance systems, and opaque financial information (Fan and Wang, 2002; Chi et al., 2015). Since family firms are not a homogeneous group (Chua et al., 2012), research has taken into account different family firms' characteristics and their effect on earnings management behaviour. Family business controlled by the founding family or earlier generations are particularly reluctant to resort to earnings manipulations (Wang, 2006; Jiraporn and DaDalt, 2009; Martin et al., 2016; Boonleart-U-Thai and Sen, 2019; Suprianto et al., 2019). The possible explanation of these findings is that the founding family or earlier generations have more reputational concerns than later generations and the long-term survival of the firm is a non-financial priority that overrides short-term performance objectives. Earnings alterations, if detected, would harm the firm's and family's reputation, up to jeopardizing the survival of the company for future generations, and this risk reduces the incentives for earnings management. Notwithstanding, other studies (Bansal, 2021), also conducted on private family firms (Stockmans, 2010; Borralho et al., 2020) show that first-generation family firms are more likely to resort to earnings management due to the stronger desire to maintain control over the firm relative to subsequent-generation family firms.

The magnitude of earnings management in family firms also differs depending on the level of the family's involvement in firm management. When C-level positions are predominantly held by family members, the reputational concerns constrain opportunistic behaviors. Consistently with these findings, the literature shows that

non-family CEOs, compared to family CEOs, are more likely to use earnings management because they suffer higher pressures to meet the earnings targets to which the payment of their bonus is often related (Ferramosca and Allegrini, 2018; Yang, 2010).

Other studies focused on the effect of internal mechanisms of board monitoring on earnings management via board independence, CEO nonduality, and audit committee independence. The effectiveness of these corporate governance attributes in limiting earnings management seems to be lower in family than in non-family businesses, revealing the risk of collusion between independent directors and family owners, to the detriment of other shareholders (Jaggi and Leung, 2009; Prencipe and Bar-Yosef, 2011; Mohammad & Wasiuzzaman, 2020; Bansal, 2021). Research on the influence of board gender diversity on earnings management demonstrated that, generally, the presence of female directors on corporate boards positively contributes to mitigating earnings manipulations. Women, with their peculiar characteristics, may modify board behaviours, increasing the quality of financial information (Triky Damak, 2018; Gull et al., 2018; Zalata et al., 2022), and this result also holds for family firms (Abdullah and Ismail, 2016; Viera and Madaleno, 2019). However, a recent study shows a negative association between independent female directors and the extent of earnings management reverses for family-affiliated women directors, probably due to the propensity of family firms to select women directors for their family affiliation rather than for their skills and expertise (Mnif and Cherif, 2020).

External corporate governance mechanisms may also affect the level of earnings management in family firms. The study by Paiva et al. (2019) provides evidence that when the level of analyst coverage is low and, in turn, the risk for manipulating earnings to be discovered is low, family owners have incentives to resort to earnings management to extract private benefits from the firm. However, when family firms are in the spotlight of a high number of analysts, the worry of losing reputation prevails and the use of earnings management decreases.

Firms may manage reported earnings through real business activities, namely engaging in real earnings management (Roychowdhury, 2006). Recent studies have highlighted a tendency for firms to move from AEM to REM consequently to substantial changes in domestic accounting regime or other events, which has made accrual-based earnings management easier to detect (Chi et al., 2011; Zang, 2012; Ferentinou

and Anagnostopoulou, 2016; Ipino and Parbonetti, 2017). Regarding family firms, the fact that REM is hard to uncover may be an incentive for the controlling family to act opportunistically and use it to expropriate minority shareholders, particularly in an institutional setting with scant investor protection and poor corporate governance (Razzaque et al., 2016; Eng et al., 2019). On the contrary, Ghaleb et al. (2020) provide evidence that family firms are less likely to engage in REM than non-family business, suggesting the alignment of interests between the controlling family and minority shareholders.

The pursuit of non-financial goals affects the choice between AEM and REM in family firms. REM is a value-decreasing activity (Cohen et al., 2010), so family firms would be less prone to engaging in REM than in AEM, because the former is at odds with their long-term orientation and the aim to pass the business on to future generations (Achleinter et al., 2014). Gomez-Mejia et al. (2014) argue that when the controlling family prioritizes family control and influence over the firm, it might have incentive to manipulate earnings in order not to breach debt covenants or to meet analyst expectations. In this case, AEM is preferred because of the higher costs of REM. Conversely, where the controlling family prioritizes family identification with the firm, the concerns for family reputation should lead to prefering REM, as it is harder to detect. Consistently, family firms with high level of non-financial goals, voluntary moved from local GAAP to IFRS, have been found to prefer REM rather than AEM, in order to lower the risk to be discovered (Calabrò et al., 2020). Conversely, family firms characterized by less commitment in pursuing non-financial objectives have relatively fewer concerns about safeguarding their reputation and less incentive to implement value-decreasing practices, such as REM.

Few studies have investigated the possible relationship between RPTs and earnings management, and the results are mixed. In developing countries, research has demonstrated a positive association between RPTs and REM, finding that family ownership weakens this relationship (Haji-Abdullah and Wan-Hussin, 2015). RPTs can be used to expropriate minority shareholders and Indonesian firms with political connections have been found to hide tunnelling activities by resorting to earnings management (Habib et al., 2017). In the Jordan context, RPTs and accrual-based earnings management are negatively associated, and family ownership does not affect this

relationship (Alhadab et. al, 2020). El-Helaly et al. (2018) suggest that Greek listed companies use RPT as a substitute for REM, but this effect does not occur when companies are audited by a Big-four.

3. Data and Methods

The data sample comprised the family firms listed on the Italian stock exchange in 2019. We removed Banks, Insurance and other financial firms for their peculiarities. The data covers the period 2014–2019.

We hand-collected the data on RPTs from the notes to the financial statements. The accounting data was collected from Orbis, the global Bureau van Dijk database. Board characteristics derive from information available on the Orbis database.

Related party transactions are the sum of sales, purchases and outstanding balances between the company and its related parties (El-Helaly et al., 2018). For our analysis, we use as dependent variable the RPT-to-assets ratio. Explanatory variables include family firm characteristics and earnings management proxies. FCEOD is a dummy equal to 1 if a family member is the CEO and the chair of the board. FOWN is the family ownership measured as the sum of common shares held by family members. The dimension of the board (BDSIZE) is given by the number of members that sit on the board, while WBD is the percent of women members of the board, and FBD is the percent of family members that that sit on the board.

We proxy accrual-based earnings management (Kothari et al., 2005) with absolute or negative and positive discretionary accruals (ABSAEM, NAEM, PAEM) and real earnings management (El-Helaly et al., 2018)) with abnormal levels of cash flow from operations (REMCFO), abnormal levels of production costs (REMPROD) and abnormal levels of discretionary expenses (REMDEX). Firm size (SIZE) is measured as the log of assets. Return on Assets (ROA) is included as a control variable for the effects of performance. LEV is measured as financial debts scaled by assets. The market-to-book ratio (MKTBK) is also included as a control variable (Dechow et al., 2011). Finally, we control for firm's generational stage including a dummy (GSTAGE) that takes value 1 if the firm is less than 25 years old, and include dummies for year and industry effects.

We estimate the following model:

(1) $$RPT_{i,t} = \beta_0 + \sum\beta_h\, Governance_{i,t,} + \beta_j EM_{i,t,} + \sum\beta_k X_{k,i,t} + \varepsilon_{i,t}$$

where:

$RPT_{i,t}$ = related party transactions

$Governance_{i,t}$ = governance characteristics

$EM_{i,t}$ = proxy of real and accrual earnings management

$X_{k,i,t}$ = other control variables

We also estimate a second model to incorporate the possible interaction effects between earnings management proxies and governance characteristics.

The models are estimated using Generalized Least Squares (GLS) with firm level clustering, in this way the standard errors are robust for the presence of correlations across firms, while in order to control for year and industry fixed effects, we include year and industry dummies.

4. Results and Discussion

Table 1 shows the descriptive statistics for our sample of family firms. In the period 2014-2019, the mean value of related party transactions is 5.2 percent of assets. The negative and positive accrual earnings management proxies have mean values of -5.3 and 6.2 percent, while the mean values of real earnings management are close to zero.

Table 1. Descriptive Statistics

	Mean Value	Standard Deviation
NAEM	-.053	.062
PAEM	.062	.080
REMCFO	.005	.084
REMPROD	.015	.249
REMDEX	-.013	.232
RPTs	.052	.077
ROA	.061	.107
MKTBK	.814	.885
WBD	.318	.145
FOWN	.586	.139
FCEOD	.374	.484
FBD	.263	.150
SIZE	12.64	1.75
BSIZE	9.79	3.22
LEV	.282	.153
GSTAGE	.320	.467

Table 2 displays the Pearson correlation coefficients for the variables used in this study, the results suggest that multicollinearity is not a serious problem for the results of our regression models.

Table 2. Pearson Correlation coefficients

	REMCFO	REMPROD	REMDISX	RPT	ROA	MKTBK	WBD	FOWN	FCEOD	FBD	SIZE	BSIZE	LEV	GSTAGE
ABSDA	-.001	.034	-.025	.013	-.061	.028	-.049	-.043	-.072	-.061	**-.106**	**-.103**	.034	.028
NAEM	**-.121**	.015	.013	.011	.077	.031	.056	-.028	**.121**	**.133**	.067	.080	-.050	-.031
PAEM	-.069	.059	-.043	.045	-.040	.021	-.043	**-.117**	-.032	.009	**-.144**	**-.116**	.010	.029
REMCFO		**.187**	-.005	.051	**.337**	**.320**	**-.089**	-.009	-.027	-.015	-.022	.057	**-.168**	.034
REMPROD			**-.793**	**-.141**	**.255**	**.238**	-.037	-.021	**.104**	-.074	-.046	.006	**-.196**	.037
REMDEX				**.120**	-.027	**-.104**	.009	.006	-.066	.061	**.109**	.020	**.130**	-.057
RPT					-.096	**-.135**	**.166**	**.102**	.044	-.054	**-.129**	-.060	**.152**	.023
ROA						**.395**	-.045	-.072	**.085**	.049	.044	**.097**	**-.248**	-.028
MKTBK							**-.102**	.001	.027	**-.125**	-.029	**.135**	**-.324**	-.013
WBD								**-.104**	-.072	**.090**	**.151**	**.127**	**.158**	**-.153**
FOWN									.078	**.167**	**-.231**	**-.165**	.040	.001
FCEOD										**.261**	**-.118**	**-.162**	-.040	.037
FBD											**-.292**	**-.343**	-.001	.046
SIZE												**.520**	.036	**-.171**
BSIZE													-.050	**-.132**
LEV														-.030

bold indicates that the estimated correlation coefficient is significant at the 5% level.

For what concerns the first part of the research question, "Which family business characteristics affect RPTs?", we find that some firm characteristic might shape RPTs within family firms. The results in Table 3 show that the presence of women on the board as well as family ownership significantly and positively affect the level of related party transactions. The latter evidence is consistent with the literature reporting that the likelihood of RPTs is higher for companies with high concentration of ownership (Songhua et al., 2010). Moreover, as the family ownership share raises, the amount of family assets within the family increases. Therefore, second type agency conflicts rise as well as incentives for earnings manipulations. There is evidence that, in general, family firms are less prone to use accrual-based earnings management because it is less difficult to detect than real earnings management (Lin and Shen, 2015). Nevertheless, the perpetuation of the family bond to the business through succession is the main objective for family firms (Berrone et al., 2012), so they might be concerned in using REM, as it puts at risk future performance, and they might choose to manipulate earnings by the means of RPTs.

Leverage tends to increase RPTs, but the effect is weakly significant, only when we control for the effect of accrual-based earnings management. This effect is consistent with the evidence that recourse to debt capital incentives profit manipulation, but in family

businesses this effect is weak because they present lower third-type agency conflicts than non-family businesses (Steijvers et al. 2010).

Conversely, our findings point out that the percentage of family members on board as well as firm size have a significant and negative effect on RPTs. The presence of numerous family members on the board lowers first and third type agency conflicts, but at the same time generates entrenchment raising second type agency conflicts, so we may suppose that the lowering effect is related to reputational concerns. Larger firms are more visible and the concern for reputational drawbacks - related to opportunistic RPTs - on a family's image is stronger (Gottardo and Moisello, 2017). Family firms are characterized by a strong identification between the owning family and the business, as the latter reflects the family image (Berrone et al., 2012). When numerous family members sit on the board, the stronger sense of identification raises the reputational concerns and it might limit a massive use of RPTs to protect the perceived reputation of the company.

Table 3. Family firms related party transactions, governance and earnings management

INT	.01(.07)	.03(.07)	.03(.07)	.02(.07)	.02(.08)	.02(.07)
REMCFO	.00(.06)					
REMPROD		-.04(.02)**				
REMDEX			.04(.02)**			
ABSAEM				-.03(.04)		
NAEM					.13(.09)	
PAEM						-.00(.04)
BDSIZE	-.00(.00)	-.00(.00)	-.00(.00)	-.00(.00)	-.00(.00)	-.00(.00)
WBD	.12(.06)*	.11(.06)*	.11(.06)*	.12(.06)*	.15(.07)**	.09(.06)
FCEOD	.01(.01)	.01(.01)	.01(.01)	.01(.01)	.02(.02)	.01(.01)
FOWN	.00(.00)**	.00(.00)**	.00(.00)**	.00(.00)**	.00(.00)**	-.00(.00)
FBD	-.10(.05)**	-.10(.05)**	-.10(.05)**	-.10(.05)**	-.17(.07)**	-.05(.03)
ROA	.00(.05)	.01(.05)	-.00(.05)	-.00(.05)	-.03(.05)	-.01(.07)
SIZE	-.01(.00)	-.01(.00)*	-.01(.00)*	-.01(.00)	-.00(.01)	-.01(.00)
LEV	.06(.04)	.05(.03)	.05(.04)	.06(.04)	.02(.04)	.10(.04)**
GSTAGE	-.01(.01)	.01(.01)	.01(.01)	.01(.01)	.01(.02)	.01(.01)
MKTBK	-.00(.01)	-.00(.01)	-.00(.01)	-.00(.01)	-.00(.01)	.00(.01)
INDUSTRY						
YEAR						
obs	523	515	523	523	285	238
R2	.22	.24	.23	.22	.28	.29

***, **, * indicate that the estimated coefficients are significant at the 1, 5, and 10% levels, respectively.

For what concerns the second part of the research question, results do not indicate a systematic association between EM and RPTs, but, where there is a relationship, it differs according to the type of earnings management and it can be moderated by some governance characteristics. Our results point out a significant negative relationship between real earnings management perpetrated *via* overproduction, which suggests family firms tend to use this form of real earnings management and related party transactions in a substitutive way. Conversely, we find a significant positive relationship between real earnings management *via* abnormal levels of discretionary expenses and related party transactions. This evidence indicates that family companies are prone to combine the reduction of discretionary expenses with related party transactions in order to manipulate profits.

Controlling for the interactions between different form of earnings management and the level of family ownership or the weight of the family on the board, we find that the moderating effects of these governance characteristics are never significant.

Conversely, results indicate that where a family member holds the overlapping roles of CEO and Chairman of the board, family firms tend to associate real earnings management perpetrated through sales anticipations and related party transactions, suggesting that, in this case, cash flow manipulations are implemented through transactions with related parties.

Table 4. Related party transactions, governance and earnings management with interaction effects

INT	.02(.07)	.04(.07)	.03(.07)	.02(.07)	.02(.08)	.04(.08)
REMCFO	.14(.15)					
REMPROD		.01(.07)				
REMDEX			.04(.08)			
ABSAEM				-.01(.20)		
NAEM					-.04(.28)	
PAEM						-.13(.34)
BDSIZE	.00(.00)	-.00(.00)	-.00(.00)	-.00(.00)	-.00(.00)	.00(.00)
WBD	.11(.06)*	.11(.06)*	.12(.06)*	.11(.06)*	.15(.07)**	.07(.06)
FCEOD	.01(.01)	.01(.01)	.01(.01)	.02(.02)	.03(.02)	.01(.01)
FOWN	.00(.00)**	.00(.00)**	.00(.00)**	.00(.00)**	.00(.00)**	.00(.00)
FBD	-.10(.05)**	-.11(.05)**	-.11(.05)**	-.14(.05)**	-.20(.09)**	-.09(.04)**
ROA	.01(.05)	.01(.05)	-.02(.05)	-.00(.05)	-.04(.05)	.01(.07)
SIZE	-.01(.00)*	-.01(.00)*	-.01(.00)*	-.01(.00)	-.00(.00)	-.01(.00)
LEV	.06(.04)*	.04(.03)	.05(.04)	.06(.04)*	.03(.04)	.10(.04)**
GSTAGE	.00(.01)	.01(.01)	-.01(.00)	-.00(.01)	-.01(.02)	-.01(.02)

MKTBK	-.00(.01)	.00(.01)	-.00(.01)	-.00(.01)	-.00(.01)	.00(.01)
EM*FCEOD	.33(.12)***	.01(.05)	.00(.06)	-15(.13)	.24(.25)	-.08(.14)
EM*FOWN	-.00(.00)	-.00(.00)	.00(.00)	-.00(.00)	.01(.01)	-.00(.00)
EM*FBD	-.40(.44)	-.11(.13)	.09(.15)	.75(.56)	-.45(.65)	.85(.71)
EM*GSTAGE	-.05(.11)	.01(.05)	-.03(.05)	.15(.11)	-.31(.16)*	.31(.21)
INDUSTRY						
YEAR						
obs	523	515	523	523	285	238
R2	.24	.24	.24	.23	.30	.31

***, **, * indicate that the estimated coefficients are significant at the 1, 5, and 10% levels, respectively.

Our empirical evidence highlights a significant moderating effect of family business generational stage on the relationship between downward accrual earnings management and RPTs. During the first generational stage, family firms are generally leaded by the founder, the desire to pass on the company to future generations is very high, but at the same time a young company needs resources for growth (Gersick et al., 1997; Le Breton and Miller, 2013). The goal of maintaining family control over the business for dynastic succession makes family businesses reluctant to open capital to outsiders (Gottardo and Moisello, 2019) and it can incentivize the use of profit manipulation to reduce dividends, as well as income taxes, and retain resources for self-financing. Our findings suggests that firms in the first generational stage tend to use as substitutes earnings reduction perpetrated by exploiting accounting choices and transactions with related parties, in order to retain resources inside the company.

Conclusions

This paper contributes to fill the literature gap related, on the one hand, to the determinants of opportunistic RPTs in family business and, on the other hand, to the heterogeneity of the relationship between different form of EM and RPTs within family companies.

The findings point out that ownership concentration and visibility, in terms of firm size and presence of the family on the board, affect RPTs in opposite ways. Results also highlight that the relationship between EM and RPTs is not systematic and it depends on how earnings management is carried out and, in case of cash flow REM and downward AEM, the relationship is moderated, respectively, by family CEO duality and family business generational stage.

In common with empirical research, this study presents limitations. Given the size of our sample, our models control only for the effect of the first generational stage. We focused on this stage in order to take into account the founder effect. Nevertheless, it could be of interest to also control for a specific effect of later generational stages, as the literature indicates that each generational stage differs in terms of relevance of family firms' non-financial goals and in terms of the effect of family presence on the board (Gersick et al., 1997; Le Breton and Miller, 2013).

Moreover, our models control for the effect of board gender diversity, pointing out a significant positive effect of the presence of women on the board on RPTs. Further studies could deepen this analysis, taking into consideration specific characteristics of women on the board.

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Evaluation of the Work of National Nature Parks: an Integrated Approach

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Annotation: National nature parks are the most common nature reserves in the world. These include protected areas that are part of the nature reserve fund of Ukraine. They allow free access to tourists. Usually, national parks preserve the historical and cultural heritage of the region, as well as are unique natural areas with picturesque nature. In Ukraine, 56 national nature parks have been created, covering an area of 1,399,161 hectares, which is 31% of the total area of the nature reserve fund. It is important to evaluate the work of national parks, to create a kind of a rating of these environmental institutions. There are different approaches to assessing the work of environmental institutions and methods that make it possible to assess the environmental safety of an enterprise. To determine the socio-ecological and economic assessment, we have adopted a methodology that allows us to consider the problems in the complex at each hierarchical level (micro-, meso-, macro-), identify risks of eco-destruction, forecast environmental changes under the influence of economic activity, assess economic opportunities development and ensuring acceptable quality of living conditions of people, human development under natural resource and environmental constraints. To calculate the proposed method, 9 indicators were used, which standardized and separately calculated the ecological status, socio-demographic status and economic status of national nature parks, as well as a comprehensive indicator. Calculations were made according to the proposed method for 2013. It was established that 4 parks have a high level of socio-ecological and economic security - Holosiivskyi, Buzkyi grad, Dermansko-Ostrozkyi, Vyzhnytskyi, sufficient − 17 parks, low − 18, critical − 3 parks (Podilsky Tovtry, Dvorichansky, Kremenets Mountains).

Keywords: National Nature Parks, Socio-Ecological and Economic Security of the Park, Comprehensive Assessment of the Park.

JEL: H 550, E 240

Introduction

The term «national park» first appeared in the United States, where it originated in the second half of the XIX century. Today, the national nature park is the most common nature reserve in the world. In Ukraine, the first national nature park (Carpathian) was established in the Ivano-Frankivsk region in 1980 on an area of 50,300 hectares. The number of parks began to grow in the 1990s, when legislation was drafted. To date, 56 national nature parks have been created in Ukraine, covering an area of 1.4 million hectares, which

is 31% of the total area of the nature reserve fund of Ukraine. Parks are actively working on the tasks: environmental protection, creating conditions for tourism development, conducting research and environmental education (Law of Ukraine, 1992). It is important to evaluate the work of national nature parks, especially to conduct a comprehensive assessment, as parks are public institutions and, accordingly, along with environmental and social functions, conduct economic activities.

Literature review

Today, when conducting a comprehensive assessment of the work of national nature parks, special attention should be paid to the environmental safety of the nature protection institution. The main approaches that can be used in this case may be:

- indicator, which is based on a system of indicators that describe the state of various components and levels of environmental safety;

- resource, which takes into account the efficiency of the available resources of the park.

This approach allows to identify their level by determining the most efficient use of resources necessary for the functioning of the system, which on the one hand allows to achieve the goals, and on the other - does not lead to loss of economic stability of the system and does not lead to environmental minimizes environmental risks;

- effective, in which the criteria are to reduce costs and losses associated with the destructive effects of the park on the environment;

- systemic, which allows to combine all of the above, but has a significant advantage as a research tool, as it allows to consider environmental security as a complex integrated system, to identify internal and external links, development problems.

There are enough developments that make it possible to assess the environmental safety of an enterprise. It is proposed to determine on the basis:

- general economic effect of a set of environmental measures, including averted economic losses from environmental pollution; increase in economic (monetary) valuation of natural resources as a result of their conservation or improvement; increase in sales revenue from full utilization of raw materials, reduction of negative impact on the environment (NPS), saving and preventing loss of natural resources, improving

environmental comfort, living conditions, human well-being, their health, meeting intangible human needs, maintenance of ecological balance (V.K. Zbarsky, 2008);

- integrated criterion of averted economic damage and additional income from the greening of production, proposed (S.M. Smirnaya, 2006);

- analysis of the dynamics of pollution by enterprises of the natural environment, proposed (V.A. Shpylovy, 2006);

- integrated indicator of the general level of environmental safety of the enterprise, which is based on three partial integrated coefficients: environmental damage; the impact of economic factors; the impact of environmental and economic factors (Y.V. Radevich, 2017);

- security of basic business processes using the generalized desirability function (I.V. Fedotova, 2017);

- integrated criterion, which includes the following components - ensuring health and normal human life, conservation, reproduction and productivity of natural resources of the agrosphere, balanced development and sustainability of agroecosystems (O.I. Shkuratov, 2016).

At the same time, the use of different methods of assessing the environmental safety of the enterprise:

- component, which involves identifying factors and relevant indicators that affect the level of environmental safety of the enterprise;

- index, which allows to correlate the indicators in one set, to measure the impact of individual factors on the generalizing (complex) indicator. Group and integrated indices should be used in assessing the environmental safety of enterprises. The first allows to assess its specific aspect, represented by homogeneous elements. They can be summarized, which makes it possible to obtain an aggregate assessment of environmental safety of the enterprise. This aggregate assessment is compared with its maximum possible value and on the basis of certain deviations one can get an idea of the level of environmental safety of the enterprise;

- expert (score), which is based on environmental certification and certification of the management system, which consists in assessing the environmental safety of the enterprise with the involvement of experts, as the use of statistical methods is impossible. Assessment

of environmental safety of the enterprise is carried out on the basis of qualitative determination of the probability of occurrence of risk events and the study of factors that affect it;

- rating, which is used in assessing the environmental safety of several enterprises and determines the position of each of them in the overall rating on the basis of a single integrated indicator; allows to evaluate the results of activities for a certain period (assessment of the dynamics of development) and compare its position in the ranking among other objects;

- comparative analysis based on comparing the values of individual groups of similar indicators of environmental safety with each other. The most common are comparisons with industry-wide environmental safety indicators, comparisons with competitors' environmental safety indicators, comparisons of reporting and planned environmental safety indicators;

- balance, which provides for the formation of material, raw materials, energy balances for the enterprise as a whole, individual shops, sections, technological processes;

- normative, based on the application of scientifically sound standards of consumption of raw materials, energy, specific norms of waste generation within the adopted policy of enterprise resource management or resource security policy;

- instrumental, which involves the use of the results of measuring the qualitative and quantitative characteristics of emissions of pollutants using certified devices and approved methods of analysis;

- estimated, which provides a quantitative assessment of environmental safety based on a system of indicators obtained both theoretically and empirically.

These methods are the basis of approaches to assessing the level of environmental safety. Despite the differences in the application of different systems of indicators and indicators, the fundamental difference is determined by the criterion underlying the methodology. Such techniques are:

- methodology based on the calculation of possible damage to the population and natural objects;

- methods of direct measurement of the level of environmental safety;

- comparative methods, which provide for the comparison of the actual level of pollution with standards, with a loss from the activities of other economic systems;

- method of absolute assessment of the level of environmental safety, based on the calculation of damage to the population and NPS in a certain area for a certain period of time;

- method of relative assessment of the level of environmental safety of the enterprise, which involves determining the contribution of the enterprise to the total pollution of the NPS.

The synthetic approach is based on the system of socio-ecological and economic security of an enterprise, the methodological foundations of which have been developed (Cherchik LM 2016). risks of eco-destruction, make forecasts of changes in the natural environment under the influence of economic activity, assess opportunities for economic development and ensure acceptable quality of living conditions of people, human development with natural resource and environmental constraints. The paper (KOLENDA NV, 2013) defines the basic provisions of the concept of forming a system of socio-ecological and economic assessment of objects:

1. The economic system is a component of social system, its security subsystem, so economic activity should be aimed at producing socially useful goods and services, ensuring material prosperity, well-being, comfort and security of people, which is possible not only with high economic, but also social and environmental safety.

2. The social system is formed and developed within the natural system. Their interaction deforms the natural system and creates a certain ecosystem, the quality of which is dynamic and largely determined by human economic activity, i.e. there is a close relationship and interdependence between them, which necessitates preservation of ecosystems, prevention of degradation and therefore environmental security.

3. The ecological system is the environment of the population, largely determining the quality of life, as well as the environment of economic activity, which draws on natural resources, uses spatial and assimilation potential, which are limited and therefore require efficient use, and thus requires finding innovative

technologies. technological and managerial solutions to ensure a high level of man-made, as part of economic security.

E.C. Harrington in his work (The Desirability Function. Industrial Quality Control, 1965) studied the effect of quality control system on the state of biodiversity and desirability function. The scientist believes that effective control is the right method to prevent or reverse harm to the global ecosystem.

The authors A. Yakymchuk, N. Popadynets, A. Valyukh, T. Skrypko, K. Levkov in their scientific work (Rural "green" tourism as a driver of local economy development in the process of decentralization of power, 2021) emphasize that the natural resources of the nature-preserves remain invaluable financially, as a result of which the economy loses its income every year. These scientists confirm the thesis of ecologically balanced tourism, which should be developed in national nature parks and other categories of nature-protected fund. It is tourism that is able to bring significant revenues to the budgets of local communities. It is also a tool for economic development. The analysis of the works showed that each of them takes into account the influence of factors specific to a particular area, direction of activity, a certain aspect of safety, the level of the object of study. For enterprises of the forestry industry, L.M. Cherchyk proposed her own approach to the assessment of environmental and economic safety (Cherchyk L., 2019), which is based on the choice of performance indicators of enterprises, their standardization and calculation of relevant indices.

Methodology

The methodological basis of the study is the publications of domestic and foreign scientists in the field of nature reserves and environmental protection. The methodological basis of the study is the publications of domestic and foreign scientists in the field of nature reserves and environmental protection. We have used a new synthetic approach to study the work of national nature parks, as a set of the following scientific approaches: system-structural, process, institutional, hierarchical and functional. The economic system is a component of social, its security subsystem, so economic activity should be aimed at producing socially useful goods and services, ensuring material prosperity, well-being, comfort and security of people, which is possible not only with high economic, but also social and environmental security. The social system is formed and developed within the

natural environment. Their interaction distorts the natural system and creates a certain ecosystem, the quality of which is dynamic and largely determined by human economic activity, i.e. there is a close relationship and interdependence of each of them, which necessitates preservation of ecosystems,as well as prevention of degradation and therefore environmental safety.

In Ukraine, when zoning national natural parks, four zones are distinguished: a protected zone, a zone of regulated and stationary recreation, and an economic zone. In the protected zone, any economic activity is prohibited, it is impossible for tourists to visit natural objects there, the protection regime must be strictly observed there. Such zones can partially be used for educational work, educational activities among schoolchildren and young people, students, based on the observance of ecological paths. Many researchers and scientists pay attention to this (Polsun J., 2017; Yakymchuk A., 2021).

The ecological system is the living environment of the population, largely determines the quality of life, as well as the environment of economic activity, which draws on natural resources, uses spatial and assimilation potential, which are limited and therefore require efficient use, amd thus requires innovative technological management decisions to ensure a high level of man-made, as part of economic security.

Figure 1. Comprehensive assessment of the work of the national nature park.
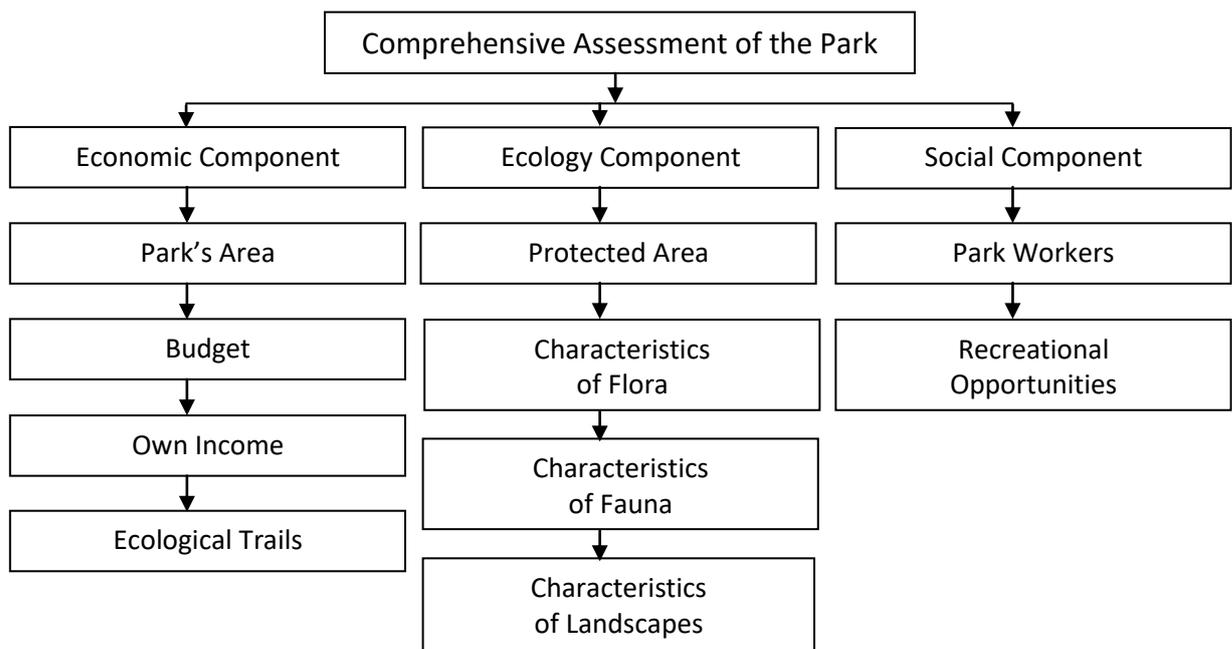
Source: own research.

Our analysis of the work of national nature parks made it possible to identify the following features:

- economic security – protection of economic interests from possible threats; sustainability and stability of the park, which is realized through ensuring a decent standard of living for employees; the possibility of development that allows to quickly adapt to internal and external threats;

- social security – dependence on personal needs, interests and desires of park employees; focus on avoiding, preventing, reducing threats and risks to the social component of public life; focus on the effective functioning, reproduction and development of the social system; focus on obtaining relevant results, including the comfort of living in society in all its aspects;

- environmental safety - preservation of nature reserves; protection of interests from threats caused by natural and anthropogenic factors; ensuring the reproduction of natural resource potential; guarantee of minimal anthropogenic impact; maintaining health and ensuring safe living in the NPC.

- Components of socio-ecological and economic security:

- environmental – safety of living conditions and the absence of environmental risk as a guarantee of protection of nature reserves and the absence of hazards associated with the state of the environment;

- social – employment security, which will determine the guarantee of human employment; food security as an opportunity to buy and consume quality, safe food; housing security, the opportunity to improve their living conditions; safety of health, education, culture, recreation; economic – as a guarantee of preservation and improvement of the material condition of micro-, meso- and macro-level objects.

- The methodology for comprehensive NPP assessment should include:

  1. identification of groups of indicators that should be included in the assessment;

  2. definition of approaches to standardization of indicators;

  3. standardization of indicators in order to move to indices (for each group);

  4. definition of approaches to calculation of group indices;

5. assessment of environmental and economic safety of NNP by its main components (groups, indicators);

6. determination of the integrated indicator of socio-ecological and economic security;

7. verification of the reliability of evaluation results and formulation of conclusions.

The authors propose to use the following indicators to assess the socio-ecological and economic safety of national parks (Table 1).

Table 1. Indicators of assessment of socio-ecological and economic safety of the park

Criterion	Indexes
Ecology	Number of plants listed in the Green Paper
	Number of plants listed in the Red Book
	Number of animals listed in the Red Book
Economy	The area is provided for use
	The cost of maintaining the park in total
	Own income
	Number of tourist routes
Social	Number of employees
	Number of visitors to the park

Source: own research.

To standardize the indicators taking into account the environmental criterion, the authors proposed to take into account:

K_{1i} – is the share of the number of plant groups KPZK_i, listed in the Green Paper per 1000 ha of park area F_i, provided to it for permanent use:

(1)
$$K_{1i}=\frac{\text{KPZK}_i}{F_i} * 1000$$

K_{2i} – specific weight of the number of plant groups listed in the Red Book KRChK_i per 1000 ha of park area F_i, given to him for permanent use:

(2)
$$K_{2i}=\frac{\text{KRChK}_i}{F_i} * 1000$$

K_{3i} – is the specific weight of the number of animal species KTChK_i. listed in the Red Book of Ukraine per 1000 hectares of park area, provided for permanent use.

(3)
$$K_{3i}=\frac{\text{KTChK}_i}{F_i} * 1000$$

To standardize the indicators, taking into account the economic factor, we calculated:

K_{4i} – total maintenance costs of the park BB_i, per 1000 ha of the park F_i, provided for use:

(4)
$$K_{4i} = \frac{BB_i}{F_i} * 1000$$

K_{5i} own revenues OR_i per 1000 ha of park F_i, provided for use:

(5)
$$K_{5i} = \frac{OR_i}{F_i} * 1000$$

K_{6i} – the number of tourist routes in the park KM_i per 1000 ha of the park F_i, provided for use:

(6)
$$K_{6i} = \frac{KM_i}{F_i} * 1000$$

K_{7i} – the share of own revenues OR_i y in total costs BB_i in maintenance of the park:

(7)
$$K_{7i} = \frac{OR_i}{BB_i}$$

K_{8i} – is the ratio of the park area F_i, provided for own use to the total park area FB_i:

(8)
$$K_{8i} = \frac{F_i}{FB_i}$$

To standardize sociological indicators were calculated:

K_{9i} – the amount of park area F_i, provided for use based on the number of employees in the park KP_i

(9)
$$K_{9i} = \frac{F_i}{KP_i}$$

K_{10i} – the number of visitors to the park NV_i, per 1000 ha of park area F_i, provided for permanent use:

(10)
$$K_{10i} = \frac{NV_i}{F_i} * 1000$$

where *I* – serial number of the park.

The assessment of the ecological state of NNP can be determined taking into account the indicators of ecological state of NNP development P_i, their relation to the maximum indicator P_{maxi}, which is among NNP of Ukraine and taking into account the importance of this indicator γ_i.

(11)
$$I_{ES} = \sum_{i=1}^{k} \frac{P_i}{P_{maxi}} \gamma_i$$

Assessment of the economic condition of the NNP :

(12)
$$I_E = \sum_{i=1}^{n} \frac{E_i}{E_{maxi}} \alpha_i$$

where E_i – indicators of the economic condition of the NNP, E_{maxi} – the maximum indicator of the economic condition, α_i – the weight of the indicator.

We determine the assessment of socio-demographic status by the formula:

(13)
$$I_{SDS} = \sum_{i=1}^{m} \frac{C_i}{C_{maxi}} \beta_i$$

where C_i – is the indicator of socio-demographic status, C_{maxi} – is the maximum value of the indicator of socio-demographic status, β_i – the weight of the indicator of socio-economic status.

Then the assessment of the socio-ecological-economic state of development of the national nature park is an integral characteristic of the state of the economic system, as the system includes a number of subsystems – social, environmental, economic components. That is:

(14) $$I_{NPP} = I_E + I_{SDS} + I_{ES.}$$

where I_{NPP} – integrated assessment of socio-ecological and economic condition of the National Nature Park, I_e – assessment of economic condition of NPP, I_{SDS} – assessment of social status, I_{ES} – assessment of ecological and recreational condition.

The model for determining the integrated indicator of environmental and economic security will work as follows: group indices are defined as the sum of individual indices divided by their number; The integral index of environmental and economic security of the enterprise is defined as the sum of group indices divided by their number. The results of the interpretation of the assessment imply the transfer of quantitative indicators to the qualitative safety of the feature (high, sufficient, low, critical).

Results and discussion

The higher the value of the integrated indicator, the higher the level of environmental and economic security of the enterprise. Based on the desirability function (Harrington, 1965), thresholds set out levels of environmental and economic security. The classic Harrington scale assumes a distribution of 5 level attribute quality: very high

1.00-0.81; high 0.80-0.64; enough 0.63-0.38 ; low 0.37-0.21; critical 0.37-0.21. S. Dovbnya, N. Gichova (Dovbnya S.B, Gichova, N.Yu., 2008) used a scale of four levels, which we took as a basis (Table 2). To use this scale of intervals, we use the given estimates to the maximum value.

Table 2. Scale of intervals of indices for levels of socio-ecological and economic assessment of the enterprise

Level of assessment	Values of indicators
High	1-0.75
Sufficient	from 0.75 to 0.5
Low	from 0.5 to 0.25
Critical	Less than 0.25

Source: (Dovbnya SB, Gichova N.Yu.. 2008).

Calculations of socio-ecological and economic security of all national parks of Ukraine, according to their activities in 2013 (Reserves and National Parks of Ukraine in 2013, 2014). The assessment of the socio-ecological-economic state of development of national natural parks and the assessment of the ecological, socio-demographic and economic state of the NNP are determined to the maximum value. The following values of weights were taken into account in the calculations

$$1=2=3=0,33$$
$$1=2=3=4=5=0.2$$
$$i=i=0.5.$$

Under such conditions, it was determined that 3 parks have a high level of socio-ecological and economic security – Holosiivskyi, Buzkyi grad, Dermansko-Ostrozkyi, sufficient – 10 parks, low – 26, critical 3 parks (Podilsky Tovtry, Dvorichansky, Kremenets mountains). In the table 3 the rating of the national natural parks of Ukraine has been given with the scores calculated according to the methodology proposed by the authors. (Table 3).

Table 3. The Results of assessment of the socio-ecological and economic state

of development of National Natural Parks

High	Sufficient	Low	Critical
Holosiivskyi (1,00) , Buzkyi grad (0,84), Dermansko-Ostrozkyi (0,76)	Vyzhnytskyi (0,74), Holy Mountains (0,7) Velykyi Luh (0,62), Halytskyi (0,61), Azovo-Syvashskyi (0,61), Charivna Havan' (0,56), Pryazovskyi (0,55), Prypiat-Stokhid (0,52), Karpatskyi (0,51), Meotyda (0,5),	Yavorivskyi (0,48), Biloberezzia Sviatoslava (0,46), Gutsulshchyna (0,46), Zacharovanyi Krai (0,44), Shatskyi (0,43), Uzhanskyi (0,42), Desniansko-Starogutskyi (0,42), Cheremoshskyi (0,42) Pivnichne Podillia (0,41), Tuzlovski Lymany (0,41), Nyzhnosylskyi (0,41), Pyriatynskyi (0,41), Homilshanski Lisy (0,39), Verkhovynskyi (0,39), Karmeliukove Podillia (0,38), Nyzhniodnistrovskyi (0,37), Synevyr (0,36), Dzharylhatskyi (0,35), Mezynskyi (0,35), Dnistrovskyi Kanion (0,34), Skolivski Beskydy (0,32), Hetmanskyi (0,32), Khotynskyi (0,31), Oleshivski Pisky (0,29), Ichnianskyi (0,27), Slobozhanskyi (0,25)	Podilsky Tovtry (0,24), Dvorichansky (0,22), Kremenets mountains (0,19)

Source: own work based on the proposed methodology.

In addition, the ecological, economic and socio-demographic results of the maximum assessment of the state of development of each park were determined. Thus, the ecological assessment is the highest in Derman-Ostroh Park (0,76), socio-demographic – NPP „Holy Mountains" (0,7), economic – NPP "Vyzhnytskyi" (0,74). Since parks have their own zoning, regulation within these zones is necessary today. According to research by practitioners of biodiversity conservation, for effective protection of biodiversity, it is necessary to preserve at least 10% of the area of a certain ecosystem, biome, natural zone, landscape, plant group. In the national natural parks of Ukraine, the regime favorable to the preservation of biodiversity and landscapes is maintained only within the protected areas. Accordingly, for the preservation of landscapes and biodiversity, for example, forest-steppe and steppe pines, it is necessary that at least 10% of the entire area of this type of landscape should be included in the protected areas of national natural parks.

Summary, recommendations

The proposed approach to the socio-ecological and economic assessment of the work of national nature parks provides an opportunity for the park to assess the state of affairs and identify ways and prospects to improve its work. The assessment of the results of the park's activity includes the work of the national park according to three groups of indicators (ecological, social and economic) and takes into account 10 parameters of the park's work. A high rating of the park's work will be in the case when high group indicators are achieved. Such an author's approach is comprehensive and will help the park identify weaknesses and seek solutions to these problems. When designing and operating parks, it is necessary to take into account their zoning. The most important is the protected zone, where rare species of flora and fauna are preserved. Such zones should be quite large compared to the area of the park and commensurate with them at least 10-20% of the total territory of each individual park. There is no unified system of functional zoning of national natural parks in the world, although most environmental protection organizations dealing with these issues in different countries of the world refer to the recommendations of the International Union for Conservation of Nature (IUCN). In one of the reports of this organization, it is stated that in order to objectively combine the functions of nature protection and preservation of biodiversity and meeting the recreational needs of people, zones are created in which various management goals are established and the intensity of economic activity changes naturally.

The proposed approach provides an opportunity to evaluate the ratings of the park by a separate group of indicators. It is advisable to make such an assessment for each year, as there are indicators (economic status) that change every year. It is important to form a rating of parks, which would provide an opportunity to assess the effectiveness of each team. This is a common task of the country in global environmental policy. To this end, mechanisms and approaches have been developed to identify, confirm and monitor the state of national parks in the general system of nature protection. However, for most of the last 30 years, the debate has focused on conservation goals and focused on meeting the demand for funding for conservation programs and strategies, ie finding investment to activate certain conservation mechanisms and expand them to broader programs. There are many joint projects and grant programs between Ukraine and Poland that help

preserve the unique natural heritage and biodiversity of national parks. They are a significant financial incentive for nature conservation. In modern conditions, only significant investments in national natural parks of Ukraine will help preserve these valuable places for future enerations.

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Energy security of the country: case for Ukraine and EU

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Abstract: The core goal Green Deal Policy is providing energy security for countries' green growth. Moreover, the ongoing political crisis and countries' energy dependence necessitate the development of effective instruments for providing energy security. The paper aimed to estimate the countries' energy security to identify energy security's core drivers and bottlenecks in the EU and Ukraine. The study contained two main stages: 1) bibliometric analysis – to identify the scientific background on the abovementioned issues and develop the theoretical framework of the investigation; 2) to estimate the energy security of the country. The findings of bibliometric analysis (co-occurrence criteria) confirmed the growth of the papers' number, which focused on the investigation of energy security. Thus, the papers' number has increased 2.5 times over the past five years. The results allowed to identify the three core triggers that affect energy security: environmental (greenhouse gas emissions, environmental quality, etc.), institutional (efficiency of public administration, infrastructure development, etc.) and behavioural (society willingness to adopt energy and resource-saving lifestyles, considering environmental factors in decision-making, etc.). The objects of the investigation are the EU countries and Ukraine (as the potential EU member). The data for the years 2000-2020 were obtained from Eurostat, World Data Bank, Ukrstat, OECD. The study applied the method based on the MARKAL model to estimate the energy security of the countries, as well as Godric-Prescott and Butterworth filters to consider the indicators' fluctuation of energy security. The findings concluded that Ukraine (as the potential EU member) should converge with EU policies in the energy sector to increase energy security. Moreover, Ukraine should adopt EU practices to extend green energy technologies, promote a green mind and lifestyle among society, and create supporting instruments for developing alternative energy.

Keywords: energy policy, energy efficiency, green growth, green deal, renewable energy, sustainable development.

JEL: P18; P28; P48; Q43; Q48

Introduction

Energy security is one of the milestones of a country's sustainable development. Considering the International Energy Agency (IEA), energy security is access to the energy sources with affordable prices on the regular base without disruptions [IEA, 2022]. In this case, all European Union countries try to change the energy balance structure on the way to increase the share of renewable energy in total energy consumption. Thus, the electricity power stations which used the coal, nuclear and hydro are in the decline from year to year.

At the same time, the effective policy and institutional regulations could provide reliable energy access during the transformation of country's energy balance. The energy issues are being intensified by the political conflicts. There is a need for relevant instruments to identify the bottlenecks in energy system and policy, and mechanisms to overcome them. In this direction, the EU countries have accepted the European Green Policy, which declared the step-by-step decarbonisation of EU economy. Thus, they are going to decline greenhouse gas emissions by 55% by 2030 [A European Green Deal, 2022]. At the same time, there is a need for empirical justification of rational balance between traditional and renewable energies in the country's energy balance structure. In this case, it is actual to develop appropriate approaches to forecasting the country's energy balance structure with the purpose to define an effective way of changing it and guaranteeing energy security.

Theoretical premises

Energy security is well investigated and widely used, however, the there are no unified approaches to defining it [Kruyt et al., 2009; Ellabban et al., 2014; Goldthau & Sovacool, 2012]. It could be explained that energy security depends on the country's location, available resources, and vast range of dimensions (ecological, technical rediness of the energy system, economy development, social progress, institutional efficiency, etc.). A study by Ang et al. [2015] based on 83 definitions concluded that meaning of energy security depends on the context. Thus, the study by Ang et al. [2015] defined energy security through seven core dimensions: energy availability; energy infrastructure; energy price; social consequences; environment; energy management and energy efficiency. Winzer C. (2012) defined energy security considering the group of risk sources: technical, human, and natural. The paper by Kruyt et al. [2009] highlighted that it is security from the access to supply of energy.

To identify the core factors that influence energy security, the study applied the bibliometric analysis using the benchmarks Scopus and Web of Science Tools Analysis. The methodology of analyses was based on the studies by Lyulyov et al. [2020]; Ziabina et al. [2020]; Soliman et al. [2021]; Us et al. [2020]. The following thresholds were chosen: keywords – energy, environment, energy security, institutions, infrastructure, greenhouse

gas emissions, green mind, green lifestyle; boolean operators – or, and in different combinations; time – 1990-2021; language – English.

At the first stage, all publications were published to exclude the duplicates from Scopus and Web of Science. Afterwards, 11 401 publications were included in the analysis. The findings confirmed that the number of publications on energy security have been increasing for the past five years (figure 1a). In 2021, 1024 papers were published, which is higher by 40% compared to the year 2015. It has been noted that the scientists from the United States of America published the highest number of the papers – 2063, from China – 1324 papers, and from the United Kingdom – 1085 papers (Figure 1b). Sovacool B. K. has the most powerful scientific background in the investigations on energy security – 83 papers for the years 1990-2021. Thus, the most cited studies by Köhler et al. [2019]; Sovacool [2016, 2008, 2014]; Sovacool et al. [2018, 2019] focused on the analysis of the ways to overcome energy issues in countries. It should be noted that Chinese Academy of Science is prolific among institutions which focused research on energy security (Fig. 1d).

Figure 1. The visualisation of publication activity on energy security for 1991-2021
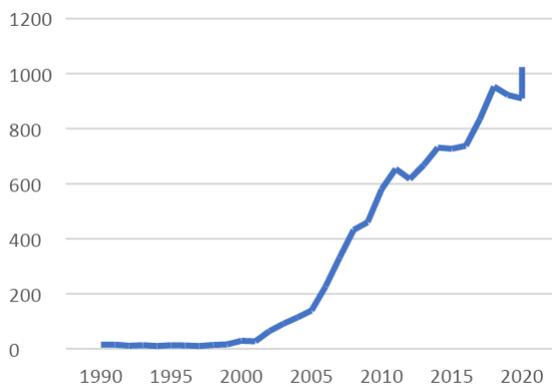
(a) – number of publications on energy security for 1990-2021
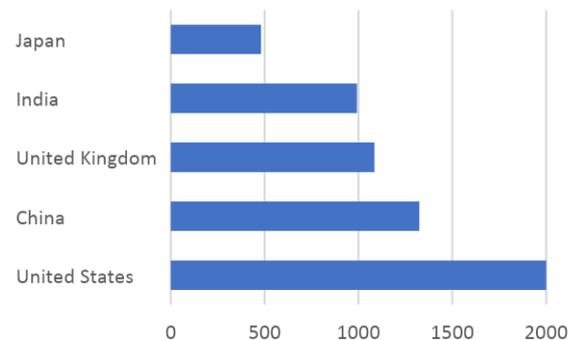
(b) – the TOP-5 countries in the investigation of energy security
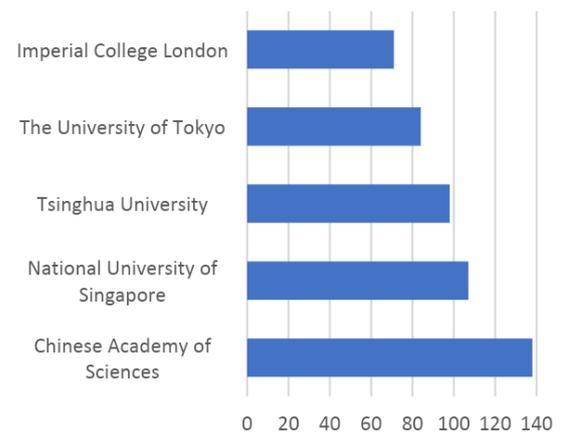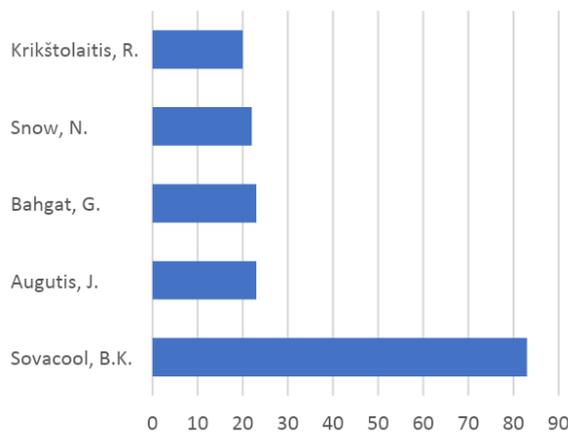
*(c) – the TOP-5 authors in the investigation of energy
security*

*(d) – the TOP-5 institutions in the investigation of
energy security*

Using VOSviewer version 1.6.18 allowed conducting the co-occurrence analysis of the
selected papers. Figure 2 visualises the findings of co-occurrence analysis by country for the
years 1991-2021.

Figure 2. The visualisation of co-occurrence analysis by country for 1991-2021
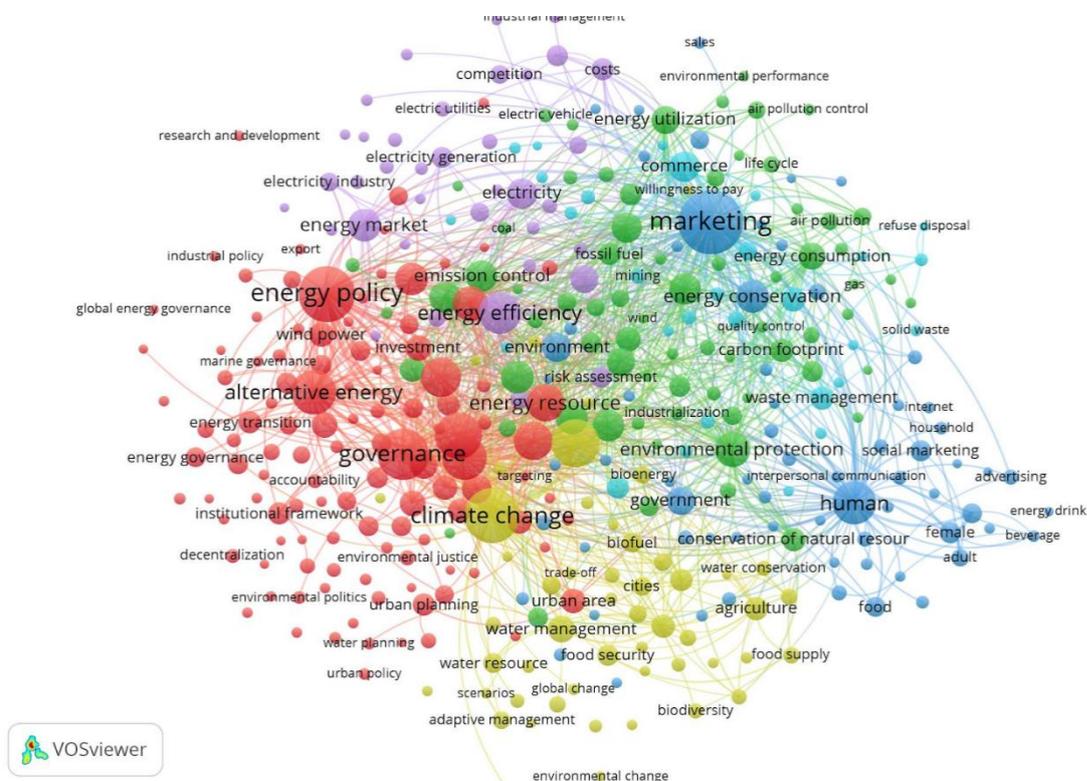
The findings of the co-occurrence analysis allocated five core clusters in the
investigation of energy security. **The biggest was red cluster, which merged the following**

keywords: energy governance, institutional framework, infrastructure development, etc.
Thus, Sovacool & Mukherjee [2011] confirmes that providing energy security could be realised without relevant infrastructure and effective government management. At the same time, Correljé & van der Linde [2006] highlighted that the EU should reorient and update its energy policy, rebuild its structure, and reinforce the energy governance. Furthermore, the study by Goldthau & Sovacool [2012] identified that limitation in the provision of energy security was due to the complexity of energy governance (vertical and horizontal complexity) and the lowest level of the energy system's resilience. They confirmed the necessity to update and reorient the energy policy, considering new issues related to the decarbonization of the economic development. The studies by Szulecki et al. [2016], Alagpuria [2021], Dzwigol et al. [2021], Kharazishvili et al. [2021] highlighted that energy security of the EU countries depended on efficiency of national and common EU governance. Thus, they allocated the key issues in providing energy security and mechanism to overcame them.

The purple cluster focused on the analysis of electricity generation and technical issues of the energy system. Thus, most EU countries try to change the energy structure, eliminating traditional sources and enlarging the scope of renewable energy in the country's energy balance. The study by Wang et al. [2011] confirmed that energy security in Pakistan is related to the affordability of renewable energy in the country. Thus, they justified that the countries with developed infrastructure for renewable energy had the higher level of the energy security. However, based on the interview in Finland, France and the United Kingdom, the study by Teräväinen et al. [2011] justified the necessity to develop nuclear energy and new nuclear power stations. Daniel Yergin [2006] concluded that energy security required the diversification of energy sources. Furthermore, he confirmed the necessity of changes in the energy balance structure through developing the "clean coal", and a new generation of nuclear power and renewable energy, as they become more competitive. Yergin [2006] highlighted that it required the relevant energy infrastructure and investment. The paper by Ellabban et al. [2014] confirmed that high price of traditional energy recourse had the negative impact on the country's energy security. In this case, the scientists proved the necessity of alternative energy development. The paper by Ellabban et al. [2014] highlighted the advantages and disadvantages of renewable energy under the types

(solar, wind, hydro and etc.). Moreover, they concluded that enlarging the scope of renewable energy could not be effective without the development of smart grid technologies. The scientists Asif & Muneer [2007] analysed five countries that have an impact the world energy market (the USA, India, China, Russia, the United Kingdom) and confirmed that alternative energy (solar, wind, biomass, etc.) could satisfy the ongoing and future energy demand without declining of energy security.

The green cluster penetrated all clusters and contained the following keywords: greenhouse gas emissions, environmental quality, protection, etc. Thus, the study by Owusu & Asumadu-Sarkodie [2016] defined energy security as uninterrupted energy supply for stable economy development. Besides, they confirmed that providing energy security requires extending the scope of renewable energy. Furthermore, other studies by Owusu & Asumadu-Sarkodie [2016]; Formankova et al. [2018]; Sotnyk et al. [2018]; Miskiewicz [2020]; Chygryn et al. [2015]; Fila et al. [2020] identified that renewable energy allowed to reduce greenhouse gas emissions and mitigate the climate changes. Jacobson M. [2009] highlighted that most environmental issues and global warming were caused by the exhaust from the combustion of solid, liquid, and gaseous substances during energy production and use. These issues could be overcome by introducing cardinal changes in the energy sector. Besides, as the demand and the price of fossil-fuels has been increasing from year to year, the government should develop new approaches to providing undisrupted energy supply, which is the basis of energy security. Jacobson M. [2009] found that developing green energy allowed to reduce the negative impact on the environment and people health. The study allocated the positive impact of green energy on health and environment by the types (solar, wind, hydro and etc.) and stages of the life circle (generation and use).

The blue cluster merged the following keywords: marketing, behaviour, green mind, etc. The study by Anable et al. [2012] emphasised the social and cultural gaps that restrict the spreading of renewable energy and reduce energy security. Taking the transport sector of the United Kingdom as an example, they explained that without relevant demand for renewable energy, the supply could not be increased. Using the logit model, the study by Zainudin et al. [2016] confirmed that behavioral (perceived of product advantages and control negative behaviour), social (household's size), and economic (household's income)

dimensions have a significant impact on the consumers' willingness to pay for energy saving products. In this case, the authors Zainudin et al. [2016] highlighted the role of green marketing in promotion of green technologies, including green energy. Qian, L. and Yin, J. [2017] analysed the role of ethical value in spreading of renewable energy and energy-efficient technologies. With their findings, they confirmed that the green policy and social marketing should pay attention to cultural values to promote the energy efficiency technology and resource-saving lifestyles. Using the ptobit and tobit models, the Slovenian scientists analysed the willingness to pay for green electricity. Considering the findings, the age and household's size had a negative statistically significant impact on the willingness to pay for green electricity. However, income, education, and green awareness had a positive statistically significant impact on the willingness to pay for green electricity Zorić & Hrovatin [2012].

To sum up, the results allowed to identify the three core triggers that affect energy security and should involve due to the energy security assessment: institutional (efficiency of public administration, infrastructure development, etc.), environmental (greenhouse gas emissions, environmental quality, etc.), and behavioural (society's willingness to adopt energy and resource-saving lifestyles, considering environmental factors in decision-making, etc.).

Methodology

Ukraine identified the European vector of development. It necessitates the implementation of energy policy aimed at improving the energy efficiency of the national economy, as this not only corresponds to rapid integration with the EU in this area, but also, above all, reduces the destructive impact on the environment. It is the main condition for achieving the Sustainable Development Goals of the country. It should be noted that providing energy security allowed achieving sustainable energy supply, reducing greenhouse gas emissions, increasing security of supply, and reducing the cost of energy imports, but also has increased the competitiveness of the national economy. Table 1 contains the dimensions of the country's energy efficiency as a core indicator of energy security.

Table 1. The variables for the assessment of the country's energy efficiency

Variables	Symbols
The share of renewable energy sources in the power industry	x1e
The share of renewable energy in heating and cooling	x2e
The share of renewable energy sources in transport	x3e
Primary and final energy consumption (reduction)	x4e
Energy intensity per unit of GDP (decrease)	x5e
Fuel consumption for electricity and heat production (gradual reduction of coal use (both hard and brown))	x6e
Primary energy consumption	x7e
The share of renewable energy in final energy consumption	x8e
Coefficient of dependence of energy imports on solid fossil fuels	x9e

Source: own work.

The country's import-export energy balance, which largely depends on the effectiveness of its international policy/relations, plays an important role in meeting demand and determining the structure of electricity production, as well as the electricity at the wholesale market. The following indicators were used to estimate "efficiency of international relations" of the integrated indicator of energy security: net balance of import-export of electricity ((x1f); the dependence of the country on energy imports (x2f) (calculated as the total amount of energy imported from other countries to gross domestic energy consumption).

Stable and secure electricity supply depends on the development of the national energy system. In addition, its level determines the possibility of cross-border connections and entry into the unified European energy market. It allows attracting additional sources of energy supply. Furthermore, it catalyzes the internal market development, reduces energy prices, as well as limits the negative effects of threats and restrictions. Increasing the capacity of cross-border connections between member states of the single energy market should be done primarily through the optimal use of existing connections and the removal of barriers to market access. It should consider national systems, changing the rule of providing capacity between states, optimizing methods of providing with the capacity of market participants, etc. The key indicators of measuring the "internal energy market" of the integrated energy indicator are: System Average Interruption Duration Index, SAIDI *(x1in),* share of the energy losses (x2in).

Assumptions about the interdependence of macroeconomic and energy indicators, in particular the MARKAL-MACRO model, play an important role in the systemic approach to the study of a country's energy security. This model was developed to estimate the decarbonization impact on GDP growth in the United Kingdom [Manne & Wene, 1992]. The parameters in the model were capital, labour, and energy resources:

(1) $$Y_t = C_t + I_t + EC_t$$

where Y_t, C_t, I_t, and EC_t are the production, consumption, investment, and energy costs in period t.

The model contains the indicators of the energy system covering from the energy production, energy import / export, conversion, transmission, and distribution for final consumption. Thus, the energy forecasting depends on positive and negative fluctuations of labour forces, capital, and volume of output. At the same time, in contrast to the existing model, which allows, along with traditional indicators of energy system development, considering indicators of change in international and national social and economic development (efficiency of international relations and implementation of energy policy, human security). Thus, the assessment of energy security along with indicators of fuel and energy sector should consider economic, environmental, and resource constraints (labor, capital). Therefore, the integrated indicator of energy security considers the indicators of measurement "macroeconomics, health care, environment, employment and education, skills and social impact" (Table 2).

Table 2. The variables for the assessment of a country's energy security

Variables	Symbols
CO_2 emissions per capita	x1m
Ozone concentration	x2m
The waste generated	x3m
The average minimum wage	x4m
The current costs of environmental protection	x5m
The cost of electricity	x6m
The cost of natural gas	x7m
The share of household expenditures on housing and utilities	x8m

Source: own work.

The study applied the entropy method to determine the influence of the indicators of each of the vectors on the integrated energy security index. This approach allows to consider the maximum / minimum values of indicators of energy security vectors and to eliminate the subjective nature of its assessment.

Step 1: the normalization of initial parameters is carried out:

Positive indicator:

(2) $$x_{ij}^* = \frac{x_{ij} - m_j}{M_j - m_j}$$

Negative indicator:

(3) $$x_{ij}^* = \frac{M_j - x_{ij}}{M_j - m_j}$$

where $M_j = \max x_{ij}$, $m_j = \min x_{ij}$.

Step 2: Calculate the indicator weight:

(4) $$p_{ij} = x_{ij} / \sum_{i=1}^{n} x_{ij}$$

Step 3: Calculate the information entropy of each component based on the specific gravity:

(5) $$e_j = -\frac{1}{\ln n} \sum_{i=1}^{m} p_{ij} \ln p_{ij}$$

Step 4: Calculate the information entropy redundancy:

(6) $$d_j = 1 - e_j$$

Step 5: Calculate the weights of each indicator:

(7) $$w_j = \frac{d_j}{\sum_{i=1}^{n} d_j}$$

Step 6: The assessment of integrated energy security index using the taxonomic method:

(8) $$IEC = I_e + I_f + I_{in} + I_m = \sum_{j=1}^{n} x_{ej}^* + \sum_{i=1}^{n} x_{fj}^* + \sum_{i=1}^{n} x_{inj}^* + \sum_{i=1}^{n} x_{mj}$$

where IEC – integrated energy security index; Ie, If, Iin, Im – sub-indexes' vectors of "energy efficiency", "efficiency of international relations", "internal energy market", "macroeconomics, health care, environment, employment and education, skills and social impact".

The IEC should be in neasure between 0-1 (Table 3). The lagest value of IEC indicates the higher level of energy security, and the lower value IEC – smaller level of energy security.

Table 3. The threshold of a country's energy security

Interval	Country's energy security
0,75 ≤ IEC< 1	High
0,5 ≤ IEC< 0,75	Average
0 ≤ IEC< 0,5	Low

Source: own work.

Results

Table 4 contains the findings of the indicators' weights of the integrated energy security index.

Table 4. The indicators' weights of a country's energy security

indicators	x1e	x2e	x3e	x4e	x5e	x6e	x7e	x8e	x9e	x1f	x2f
wj	0.058	0.056	0.045	0.065	0.062	0.066	0.062	0.097	0.058	0.056	0.045
	x1in	x2in	x1m	x2m	x3m	x4m	x5m	x16m	x7m	x8m	
wj	0.038	0.038	0.033	0.012	0.006	0.070	0.042	0.039	0.024	0.021	

Source: own work.

Empirical calculations of indicators' normalized values of energy security vectors considering their weighting factors allowed calculating their integral level, using the taxonomic method. Figure 3 contains the findings of integrated energy security index for Ukraine for the 2000–2020 years.

Figure 3. The findings of the country's energy security index for Ukraine for the 2000–2020 years.
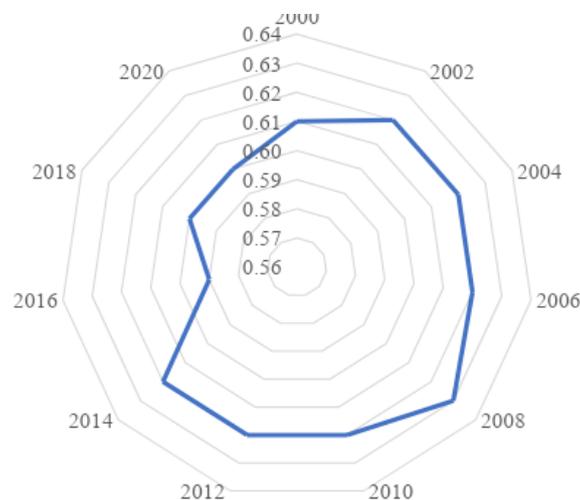
The findings (Figure 4) confirmed the uneven fluctuations of the country's energy security index, which occured, in particular, in 2004-2008 and 2014-2018. Relevant negative changes occurred during the two political crises (2004 – Orange Revolution, 2014 – Revolution of Dignity), which led to economic downturns and the loss of part of Ukraine.

In the context of energy security, it is important to assess the level of asynchrony of state energy policy with European practices to implement the energy efficient component of the European Green Deal Policy and the speed of its response to exogenous and endogenous changes in the national economy. This approach is based on the theoretical principles of the σ- and β-convergence, considering the economic development of the country, its openness and involvement in globalization. Estimation of σ-convergence of vectors:

(9)
$$\sigma_t^c = (1/n \sum_{i=1}^{n} \left(\ln x_{ij,t} - \ln \overline{x_{ij,t}} \right)^2)^{1/2}$$

where x_{ij} – the i-th indicator of the vector of the country's energy security in the t-th year; n – number of countries to calculate group convergence.

Estimation of β- convergence of vectors:

(10)
$$\ln (x_{ij,t}/x_{ij,t-1}) = C + \beta \ln(x_{ij,t-1}) + \delta F_{it} + \varepsilon_{it}$$

where Fit – explanation variable of parameters' fluctuations of the country's energy security index (economy openness, involvement in globalization processes, the efficiency of public administration, etc.)

Summary, recommendations

The summarising of theoretical background on analysis of energy security allowed allocated five core scientific directions. Thus, it allowed to define the significant indicators that should be considered under energy security assessment. The study applied the MARKAL model for energy security assessment. It allows considering changes in the international and national conditions of a country's socio-economic development (efficiency of international relations and implementation of energy policy, human security).

According to the findings, the integrated energy security index had the highest value in 2008 – 0.628 points, and the lowest value in 2016 – 0.594 points. It was provoked by the military and political instability in Ukraine, which significantly slowed down the

transformation of the country's transition from export-raw materials to resource-innovation models, as well as reforms to ensure a green structure of energy consumption. In addition, during the study period 2000–2020, the level of the integrated energy security index of the national economy was characterized by fluctuations that occured in 2004–2008 and 2014–2018.

The findings confirmed that Ukraine (as the potential EU member) should converge with the EU policies in the energy sector to increase energy security. Moreover, Ukraine should adopt EU practices to extend green energy technologies, promote green thinking and lifestyle among society, and develop supporting instruments for developing alternative energy.

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IT Companies: Trends and Outlook

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Abstract: The paper aims to explore the income stability of 9 IT companies that are high tech leaders, and to single out the group of the most attractive ones among them. Hence, the authors conducted an analysis of the dynamics of the actual and projected level of the net income. The scholars selected Alphabet, Apple, Cisco System, Microsoft, Dell Technologies, HP Enterprise, IVM, Ericsson, and Huawei for the research. The given study used heuristic analysis, as well as least squares, confidence intervals and clustering, in order to evaluate the companies' performance. The research revealed that Alphabet, Apple, Cisco System, Microsoft Dell Technologies, IVM, and Huawei enjoyed the increasing dynamics of net income, whereas the indicators of HP Enterprise, Ericsson had decreasing dynamics both in actual and forecast values. The paper determined the width of the confidence interval, which certified that Apple, Cisco System, Dell Technologies, and Huawei are the most stable companies. At the same time, Microsoft, HP Enterprise, IVM, and Ericsson experience the highest fluctuations. Simultaneously, the unfavourable position of the HP Enterprise and Ericsson is intensified by the fact that these companies have negative dynamics of the actual value of net income and its forecast. There is a number of reasons for this situation, however the major one is the transfer of capital to other enterprises.

Key words: high technology (high tech), innovative developments, net income, IT companies, forecast, confidence interval.

JEL: C 15, F 23, O 33

Introduction

Currently, high technology is not a well-defined issue and there is no unified vision of the prospects for its development. Nevertheless, cutting-edge technologies and various innovations are perceived as the major factors of economic success of many countries, driving them towards increasing competitiveness (Varavva, 2021; Klapkiv et. al., 2020). The impact of information and communication technology (ICT) on the development of society is increasingly noticeable, as most of them relate to the field of digitalization and communication (Trynchuk, 2017; Zhao et. al., 2019). In general, modern innovative developments include the following: artificial intelligence (AI), Internet of Things (IoT),

big data, blockchain, 5G, 3D printing, robotics, unmanned aerial vehicle (UAV) - commonly known as drones, genome editing, nanotechnology, and Solar PV (Afrifa et. al., 2022; Stirbu, 2014; Tsygankova et. al., 2021). High technology increases the level of labour productivity and the quality of people's lives. Artificial intelligence in combination with robotics changes the business landscape and transforms production. 3D printing techniques make unit production much cheaper, faster and of higher quality; it can automatically prototype new products (Borremans et. al., 2018).

The adoption of high technology by developing countries allows them to take a big step into the future. Advanced technology allows modern companies to achieve certain results, despite the low capital investments, resources, and opportunities (Khrapkina et. al., 2021). High technology enables the economy of less developed countries to achieve significant successful development in certain areas of the national economy (Arkhipov et. al., 2017). In Nigeria, for instance, the farmers managed to achieve significant results in smart agriculture thanks to the use of the Internet of Things. In Colombia, 3D printing and scanning have opened up enormous possibilities for the representatives of light industry to revolutionise the fashion industry. Therefore, the analysis of the experience of using high technology in certain areas of the economy and their implementation in economic reality is an important direction of fundamental and applied scientific research.

Theoretical premises

During the last decade, various papers related to the impact of high technology on the activities of individual companies and on the development of countries have been published in the economic literature. According to the data of PubMed (a free resource supporting the search and retrieval of biomedical and life sciences literature) alone, from 2011 to 2021, more than 444,000 papers that discussed the impact of high technology on the modern world were published (Fig. 1).

Figure 1. Dynamics of the Number of Publications Related to High Technology
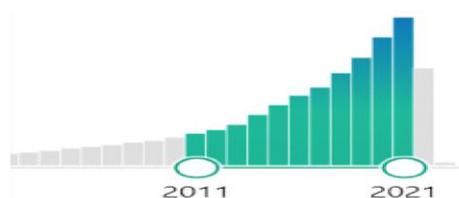
Source: own study, the data are available for download from (PubMed, URL: https://pubmed.ncbi.nlm.nih.gov)

The relevant studies demonstrate that in the vast majority of cases scientists are interested in the development changes that the use of high technology can cause in countries. In particular, in their article, F. Caselli and W.J. Coleman (Caselli and Coleman, 2006) determine cross-country differences regarding the use of advanced technologies in the aggregate production function, when skilled and unskilled labour are imperfect substitutes. The scholars found that there is a dependence between the skills of workers and the technologies of the economy in different countries. Countries having high GDP use skilled labour more often and more efficiently than countries having low GDP. Moreover, these countries use unskilled labour relatively less efficiently. This trend is particularly evident in the field of IT technologies and in the activity of IT corporations in certain countries (Calabrese et. al., 2021). The low efficiency of the use of unskilled labour is explained by the fact that rich countries, which are skilled-labour abundant, choose technologies that are best suited to skilled workers; at the same time, poor countries, which are unskilled-labour abundant, choose technologies more appropriate to unskilled workers (Egorova et. al., 2022). The scientists also focus on alternative explanations, such as capital-skill complementarity and differences in schooling quality (Mitić et. al., 2017).

In his 'Identification of the Technology Frontier' E. Balatsky (Balatsky, 2021) examines the innovation market. The author introduces the concept of a technology frontier. He understands it as the relative productivity of labour relative to the technological leader – the United States. The scholar investigates the conditions under which it is justified for developing economies to move from large-scale borrowing of foreign new technologies to their independent development within the country. The application of the econometric model in order to determine the specified frontier continues the ideas of J. Schumpeter regarding two innovation stages: invention and diffusion of a new technology. The scientists established that both types of costs depend on relative labour productivity. To improve the accuracy of the calculations, countries were clustered into two groups: advanced, for which the technology frontier has been crossed and their own developments of new technologies prevail, and developing, for which the problem of the technology frontier remains important. The assessment showed that the current value of the technology frontier is in the region of 70% of labour productivity in the United States. Furthermore, this value tends to increase, which creates additional difficulties for the transition of catching-up countries

in the field of high-tech development. This is particularly relevant for the IT sphere. US investments in this field make the lag behind the countries of the digital periphery more and more significant.

A study on the contribution of imitation activities and innovative research effort on productivity growth for the US companies and some European leading economies (Pérez et al., 2015) is also worth attention. Having this in mind, the author carried out a comparative analysis with two model specifications. In the first group, the scholar studied the results of companies that actively used R&D efforts in their activities, and the second – those that saved on such works. Taking into account the method of determining the technological frontier, it was possible to determine the leading countries from among the researched technological companies. This study was conducted for a 50-year horizon, and thus it shows the establishment of uniformities in the long-term period.

Chinese scientists studied the importance of innovation in combination with intellectual property for different countries. Scientists state that the intellectual property right (IPR) protection with regard to innovative technologies significantly affects the transfer of technologies from one country to another (Zheng et al., 2020). The scientists from Tunisia, who managed to assert that lead users (LUs) who possess advanced skills and valuable knowledge can contribute to enhance new successful innovations, and hence, enable companies to gain short and long-term profits (Marzouki and Belkahla, 2020), reached a similar conclusion.

B. Guler was interested in studying the effects of innovations in information technology on the mortgage and housing markets. The scientist modelled the situation on the mortgage market, where he studied the impact of idiosyncratic income, as well as moving and house price shocks. The research proved that the IT improvement can rationalize the loosening of mortgage loan conditions, which in turn could even mitigate financial crises (Guler, 2015).

IT are also widely used in the environmental sphere. Italian scientists studied whether various types of information and communication technologies adoption and other innovation practices (techno-organisational change and training courses) are complementary inputs with respect to the adoption of specific environmental innovations. They have managed to discover that complementarities exist between technological

innovation and both adoption of information and communication technologies management systems and information and communication technologies for cooperation with clients (Antonioli et al., 2018).

B. H. Hall and C. Helmers focused on determining methods to stimulate innovation and diffusion of climate-change related technologies. The publication investigated the characteristics of 238 patents on 90 inventions contributed by major multinational innovators to the "Eco-Patent Commons". The research revealed that the cost of these innovations is not meaningfully important for the stimulation and spread of innovations in the field of green technologies. Therefore, one can state that there is not only an increase in social consciousness regarding climate protection in society, but also a desire to accelerate these processes by introducing available technologies regardless of the availability of funds to pay for their use (Hall and Helmers, 2013).

Studies of the localisation of technology parks and their impact on the activities of surrounding companies have gained great importance. After analysing the impact of various characteristics of science and technology parks (STPs) on the productivity of their tenants, the scientists found that firms located near science and technology parks demonstrate higher productivity and also achieve higher results of their activities (Albahari et al., 2018).

Simultaneously, there are publications that show the presence of obstacles in the diffusion of innovative technologies in poor regions. Nonetheless, such local communities are hardly involved in the innovation development and they are a minority. Therefore, the development assistance received by Finnish private enterprises for the development of their innovative processes did not bring the expected results in the development of the region. As a result, innovation activities of the Finnish companies focus on an educated wealthy minority and rather developed markets of middle-income countries (Hooli, 2021).

In this aspect, there is also very relevant research on the maturity of IT companies to digital transformation use (Vovk and Zyza, 2013). Companies try to keep abreast of the latest innovations and cutting-edge technologies, but not all of them are ready to implement them. German scientists have identified five dimensions that need to be evaluated for maturity through a number of additional criteria. These dimensions include corporate

culture, openness to collaboration (ecosystem), operations (internal processes), management, and business strategy (Gollhardt et al., 2020).

Numerous publications devoted to the impact of advanced technologies on the economic, ecological, and social development of society show that the impact of these ICT covers almost all domains of human life and radically changes them. Those countries that do not just follow the general trend of innovation development, but lead it, determining where the world should go, will indicate the main vector of global development. At the same time, the more actively technological changes are introduced, the more companies try to keep in touch with the latest innovations and technologies. Even though companies differ in their approaches to transformation in detail, the success of their development can always be evaluated basing on quantitative indicators, the key of which is the net income of companies.

The aforementioned finding prompted the analysis of the dynamics of net income of 9 companies, which are considered world leaders in the IT sphere. The main objective of the analysis was to establish the stability of their income in a 5-year perspective and to single out a group of the most attractive ones among them. The analysis of global `IT market trends presented in this article is considered a case study. We have not analysed quantitative indicators and trends of IT development in the global dimension by world regions, sub-regions or individual economies. The authors have focused on analysing the performance of leading IT corporations, examining the shift in one of their key performance indicators: net income.

Methodology

Since high technologies primarily affect the IT sphere, we selected 9 companies (Alphabet, Apple, Cisco System, Microsoft, Dell Technologies, HP Enterprise, IVM, Ericsson, Huawei) that actively use such information technologies as artificial intelligence, Internet of things, Big data, Blockchain, and 5G for our research.

The given study used heuristic analysis, which involved ranking of the companies depending on their income stability, in order to evaluate the companies' performance. The choice of the revenue indicator is justified by the fact that it is revenue that is the

key indicator that reflects the performance of companies in the markets and that affects the competitiveness of companies.

In this paper, the methodology used is the Statista business data platform (Statista business data platform, 2021) for the graphs and charts of the companies' net income dynamics, and the least squares method for a 5-year forecast. Aiming to determine the accuracy of the forecasting model, the confidence interval was 95%, which means that 95% of future points are expected to fall within this radius from the forecasted result (with normal distribution). The methodology also included grouping of the companies basing on the determined data regarding the percentage of the width of the confidence interval to the value of the forecast for the next year. Given that one group consisted of the companies which behaviour can be predicted and those companies for which there cannot be a qualitative forecast.

Results

Nowadays, in the modern market environment, the most common advanced technologies are divided into 2 blocks: information technologies and technologies of the real economy (Fig. 2).

Figure 2. Most Common Advanced Technologies
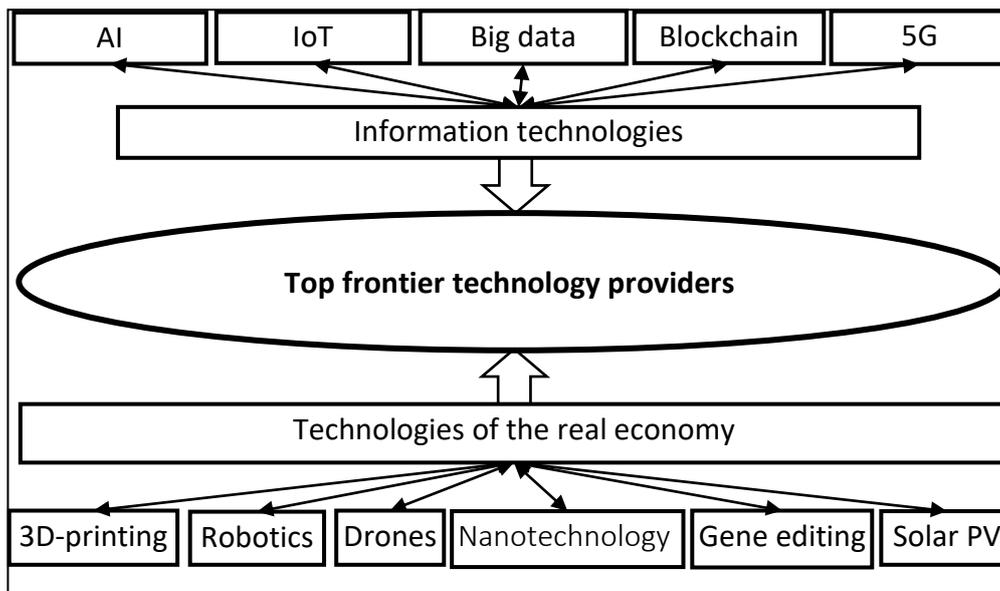
Source: own study, based on United Nations (2021)

Artificial intelligence (AI) is commonly defined as the capability of machines to replicate the cognitive abilities that were previously performed by the human brain. Specific applications of AI that focus on narrow tasks are now widely available and can be used, for example, for virtual assistants in smartphones, suggestions based on customer's online purchasing habits, solutions for credit card fraud or spam detection, etc. New versions of AI are based on machine learning and use large data sets. Let's analyse the net income dynamics for 2 companies that widely use AI in their products (Fig. 3).

Figure 3. Net Income Dynamics and Forecast for the Companies

Working with Artificial Intelligence (in billion U.S. dollars)

Alphabet
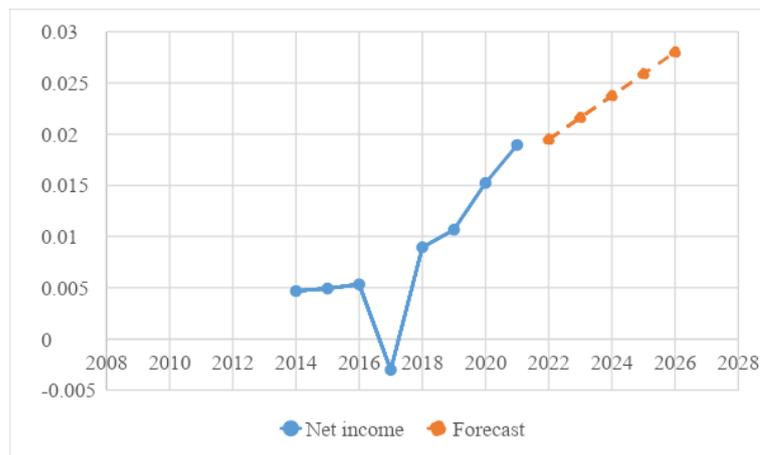
Apple
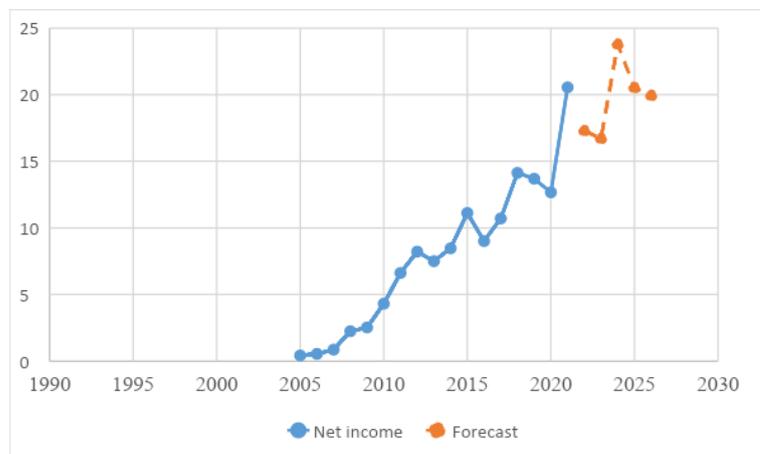
Source: own study, based on Statista business data platform (2021) Technology & Telecommunications, Annual revenue of Alphabet from 2011 to 2021 & Global revenue of Apple from 2004 to 2021

Figure 3 demonstrates the dynamics of the net income of the most successful companies in this sector and its forecast for the next 5 years.

It is also obvious that both companies are showing a gradual increase in net income. This indicates their strong position in the market. Alphabet's forecast curve is rapidly climbing due to improved internet market conditions in artificial intelligence (with the exception of 2017, when the European Commission fined Alphabet €2.42 billion for antitrust violations). Apple's forecast curve shows some growth in 2017, which may be due to technological blunders by its main competitor; in particular, Samsung was unable to offset the negative effects of the release of the failed Galaxy Note 7 base model, which led to a significant drop in sales.

Alphabet's confidence interval is very significant (according to the forecast, 2×48.90% of the predicted value in the next year), which is evident through a noticeable decrease in net income in 2016-2017. There is a 14% decrease compared to last year. Cost per click (the amount Alphabet charge advertisers) has dropped significantly year-on-year, and Alphabet attributes this trend to the shift toward mobile devices and the growing importance of YouTube ads, which perform lower than desktop ads. Simultaneously, the company's earnings report indicated that Google's traffic acquisition costs as a percentage of revenue will continue to grow however the pace will slow later this year. General Google expenses, including the payments to phone makers like Apple that use its services, have reached $6.45 billion, or 24% of Google's ad revenue. This is 33% more than last year. In the interim, investors are concerned that further increases in these expenses could reduce Google's revenues (D'Onfro, 2019).

As evidenced by the forecast, Apple, despite its ups and downs, generally has positive dynamics. The confidence interval illustrating the deviation is only 2×15.19%. The iPhone maker has been able to keep up the unprecedented growth of the past 15 years. In its last fiscal year, which ended September 25, Apple delivered 33% revenue growth to $365.8 billion thanks to strong demand for 5G iPhone upgrades. But that growth spurt came after a year of single-digit sales growth and the 2019 fiscal year when Apple's sales declined.

The bull case for Apple is that it has built an ecosystem of a billion consumers who spend money on services and that it is well-positioned for future categories like self-driving cars and augmented reality. Moreover, Apple (NASDAQ:AAPL) is trading at about 30 times its

expected 12-month earnings, according to Refinitiv data. At the beginning of 2021, this factor was 32. Hal Eddins, chief economist at Apple shareholder Capital Investment Counsel, said Apple has been a "safety stock" through the pandemic and that investors are likely expecting solid future sales.

Some analysts believe Apple has plenty of room to grow in the coming years, with future products such as the Apple Car (Stephen, 2022).

The Internet of Things (IoT), sometimes referred to as the Internet of Objects, is a concept of a network consisting of interconnected physical devices that have built-in transmitters, as well as software that allows automatic transmission and exchange of data between the physical world and computer systems. At the same time, it uses standard communication protocols. In addition to transmitters, a network may have actuators embedded in physical objects and interconnected through wired or wireless networks. The noted interconnected devices, which have the ability to read data and actuate, programming, and identification function, also make it possible to eliminate the need for human participation in many processes, due to the use of intelligent interfaces. Such companies as Cisco System and Microsoft are among the most powerful companies in this field (Fig. 4).

Figure 4. Net Income Dynamics and Forecast for the Most Successful Companies in the Field of Artificial Intelligence (in billion U.S. dollars)
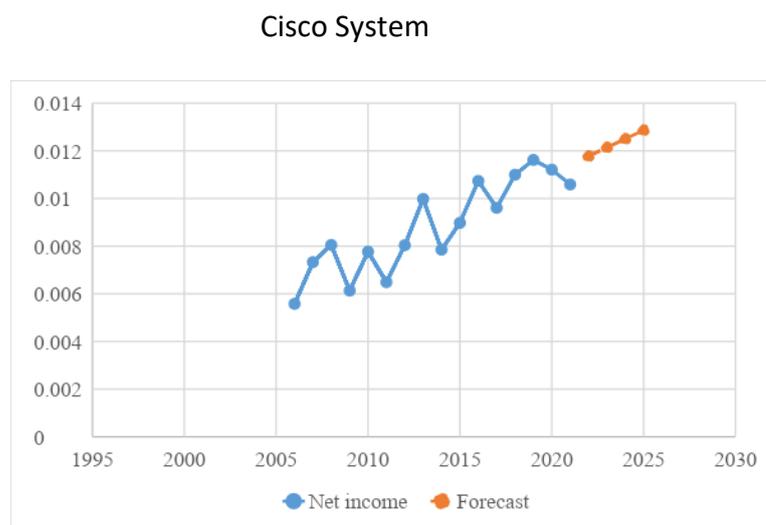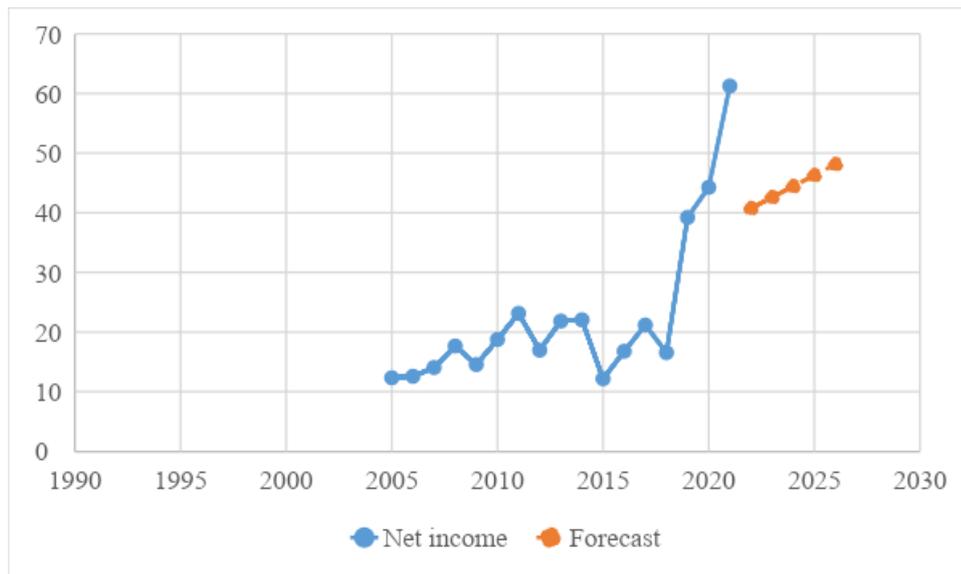
Cisco System

Microsoft

*Source: own study, based on Statista business data platform (2021), Technology & Telecommunications, Cisco
Systems' revenue worldwide from 2006 to 2021 & Microsoft's revenue from 2015 to 2021 financial years, by
segment*

The charts show the net income increase in both companies. In Cisco System, the growth occurs with noticeable fluctuations, possibly due to negative consumer attitudes towards the company after the dot-com crash in 2004. Since 2005, the company has begun to pick up sales again, but with a more measured and deliberate strategy. The presence of a number of established business platforms and technologies that have continued to perform effectively despite the overall industry downturn has played a large positive role in this. Overall, Cisco System shows growth in the forecast. The confidence interval is 2×15.04% of the predicted value, which indicates a good approximation and the absence of highly noticeable fluctuations. A detailed analysis confirms that the largest revenues of Cisco Systems are still generated in the countries of North and South Americas, particularly, the total revenue generated by the company in 2020 was $29.29 billion, a 5% decrease from the previous year. In EMEA (Europe, Middle-East, and Africa), sales decreased by 3% and amounted to $12.66 billion, and in APJC (Asia Pacific, Japan, and China), sales decreased by 6% and amounted to $7.35 billion.

Cisco reported that 2020 fiscal year net income fell to $11.21 billion from $11.62 billion. Along with the financial report, Cisco announced a restructuring plan that included a voluntary early retirement programme with compensation and job cuts. About $900

million has been allocated for these events. At a conference with analysts, Cisco Systems CEO Chuck Robbins said that the company aims to reduce its annual expenses by $1 billion (Company Cisco Systems, 2022).

The analysis revealed that Microsoft's results show different dynamics. Until 2019, the financial situation of the company was stable. However, starting from 2019, we have been observing a rapid rise in indicators, thanks to a series of acquisitions by other AI data companies. The forecast curve has also gone up. The behaviour of net income is very unpredictable, as one can see from the graph and the confidence interval ($2 \times 46.4\%$ of the predicted value). As of today, Microsoft's market capitalisation of the IT sector is tremendous, making its shares quite important on the New York Stock Exchange. The corporation has successfully survived several crises. The period from 2007 to 2013 was particularly complicated for the company. Currently, the company's securities are showing a confident growth. For most stock market investors, Microsoft assets are one of the most desirable ones. They are blue chip stocks. By using them in trade, one can make a steady profit.

The next type of advanced technology is Big data. Big Data is a combination of structured and unstructured data of huge volumes and significant diversity, effectively processed by horizontally scalable software tools. The technology appeared in the 2000s and it is an alternative to traditional database management systems and business intelligence (BI) solutions.

In a broad sense, big data is spoken of as a social and economic phenomenon associated with the emergence of technological capabilities to analyse vast amount of data, and in some problem areas – the entire world's volume of data.

Traditionally, the three Vs are singled out as defining characteristics for big data, namely: volume (in the sense of the amount of physical volume), velocity (in the sense of both the growth rate and the need for high-speed processing and obtaining results), and variety (in the sense of the possibility of simultaneous processing of various types of structured and semi-structured data); later, there were multiple variations and interpretations of this feature. Dell Technologies and HP Enterprise are among the leaders in the field of Big data. Let's take a look at their dynamics and forecast (Fig. 5).

Figure 5. Net Income Dynamics and Forecast for the Most Successful Companies in the Field of Big Data (in billion U.S. dollars)
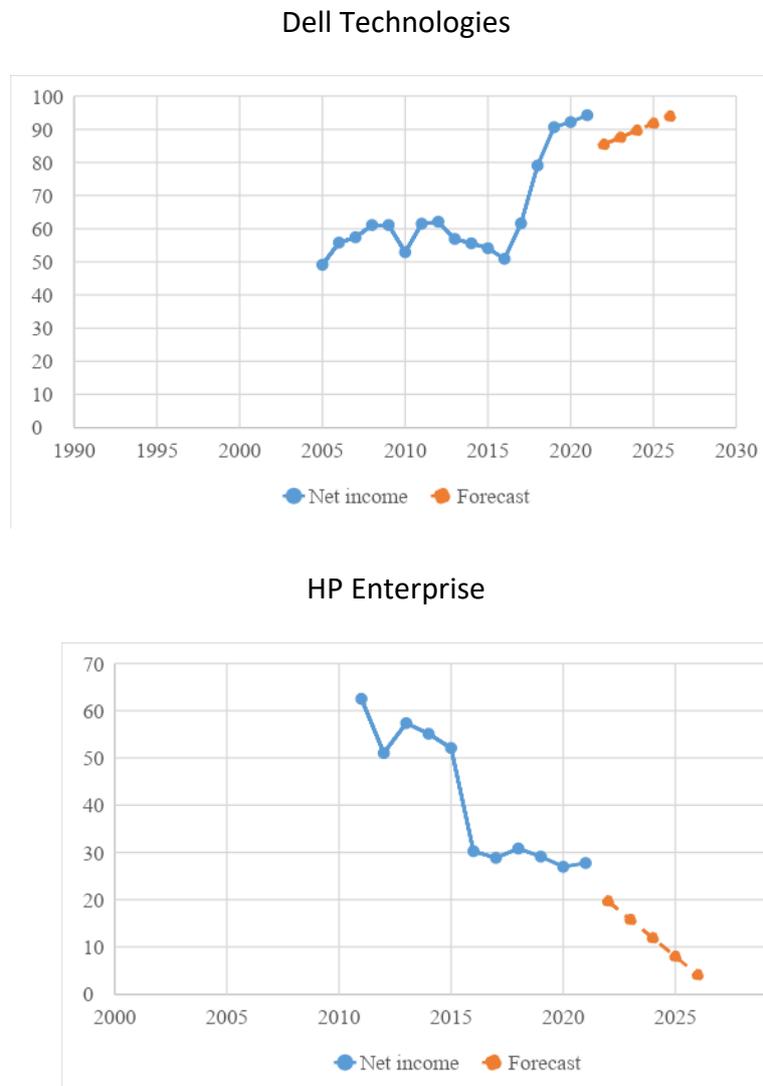
Dell Technologies

HP Enterprise

Source: own study, based on Statista business data platform (2021), Technology & Telecommunications, Dell Technologies net revenue worldwide from 1996 to 2022 & HP (Hewlett Packard Enterprise's) net revenue from 2011 to 2021

It is quite evident that in terms of net income, Dell Technologies remained about the same level until 2016. Starting from 2016, this indicator began to increase sharply. This is due to Dell Technologies' acquisition of EMC. On September 7, 2016, Dell Technologies announced completion of the acquisition of EMC Corporation. The acquired EMC became part of the renewed Dell Technologies Corporation as a subsidiary company named "Dell EMC". Dell's units dealing with the sales of enterprise servers, data storage systems, and some other devices related to the corporate market were transferred to Dell

EMC. The forecast curve is an upward straight line. The value of the confidence interval is moderate (approximately 2×23% of the predicted value).

We would like to study the graph depicting the dynamics of HP Enterprise net income. We could notice that its income drastically fell in 2016 and gradually continues to fall. This forecast is negative, because there has been a split of parent company Hewlett-Packard to separate activities with Big Data. The difference in the confidence interval is extremely significant (2×61.78% relative to the forecast). Here are the reasons for this sharp drop in 2016. In May 2016, the Company announced a tax-free spin-off and merger of its Enterprise Services business (with a turnover of $19 billion, formed from the EDS company) with competing Computer Sciences Corporation ("CSC"). This caused a negative forecast of the net income dynamics of this company.

The next advanced technology we will analyse is Blockchain. This segment of the high-tech market has such leaders as Microsoft, whose graph was presented above, and IBM. The first step we would like to take is to analyse the graph of the IBM net income dynamics (Fig. 6).

Figure 6. Net Income Dynamics and Forecast for the Most Successful Companies in the Field of Blockchain (in billion U.S. dollars)
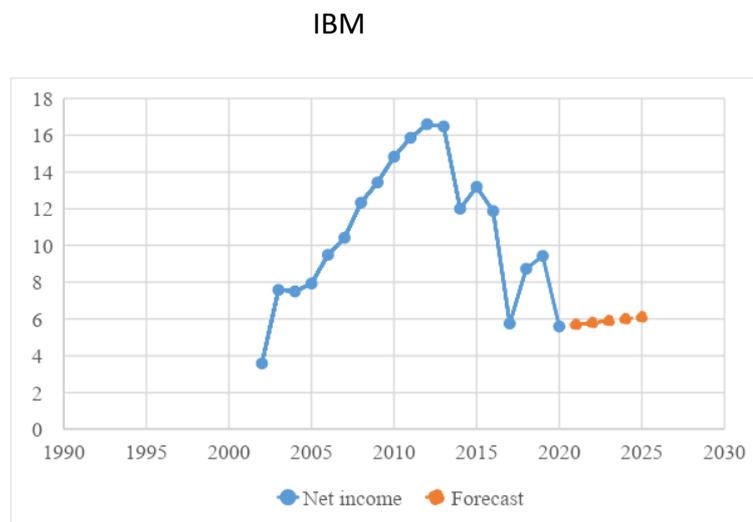
IBM

Source: own study, based on Statista business data platform (2021), Technology & Telecommunications, IBM revenue worldwide from 1999 to 2021

The patterns represented in the figure show that, until 2012, the IT company enjoyed steady growth. Then the curve rolls down in a noticeable wave-like fall. Afterwards,

the projected straight line signals moderate growth. However, the confidence interval is very large, i.e. 2×111.75%. The overall decline in net income since 2013 is related to IBM's acquisition of SoftLayer Technologies, a large international hosting provider, which operated 13 data centres in the United States, Singapore and Amsterdam, most of them in co-location facilities, for about $2 billion. The other reason is related to another investment: in 2014 IBM announced that it would invest $1.2 billion in expansion of its global private cloud network including the construction of 15 more data centres as part of the IBM's cloud strategy.

The last but not the least technology we will analyse is 5G. Companies such as Ericsson and Huawei are the leaders in the implementation of this technology (Fig.7).

Figure 7. Net Income Dynamics and Forecast for the Most Successful Companies in the Field of 5G (in billion U.S. dollars)
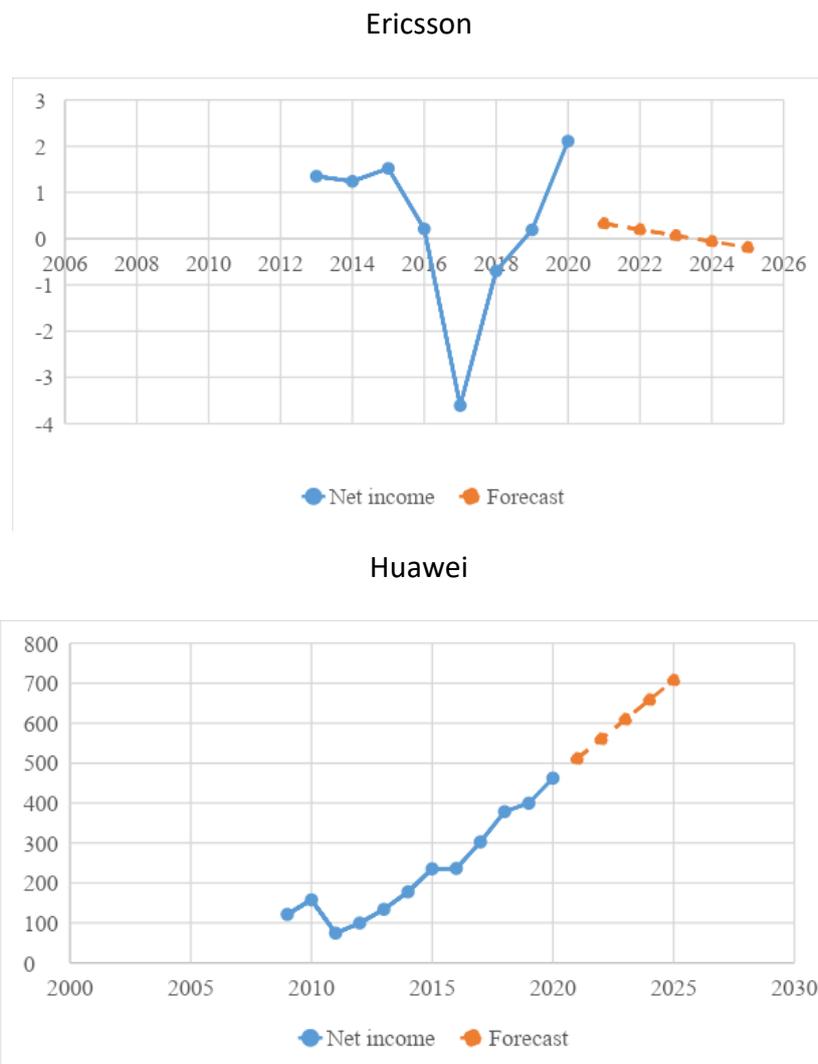
Ericsson

Huawei

Source: own study, based on Statista business data platform (2021), Technology & Telecommunications, Ericsson - statistics & facts & Huawei's revenue by business segment from 2009 to 2021

The presented net income graph for the first company shows a negative forecast, which is due to a sharp decrease in this indicator in 2017, due to restructuring charges and customer project adjustments. At the same time, write-down of assets and restructuring charges totalled SEK 13.4 billion. The width of the confidence interval is equal to 2x350%, which indicates that it is impossible of make a realistic forecast.

As for Huawei, a Chinese company, we can see an unstoppable increase in its net income. The forecast shows the same dynamics. At the same time, the width of the confidence interval is equal to 218.6 %. Huawei advocates openness, collaboration, and shared success. Through joint innovation with the customers and partners, the company is expanding the value of ICT to foster a healthy and symbiotic industry ecosystem. Huawei is an active member of more than 600 standards organisations, industry alliances, and open source communities, where they work with their peers to develop mainstream standards and drive the industry forward.

Despite a challenging business environment in the context of the COVID-19 pandemic, Huawei has remained committed to a globalised and diversified supply chain – one that doesn't rely on any single country or region, but instead leverages global resources to ensure supply continuity. As a member of the ICT community, Huawei has been doing everything they can to support the ongoing fight against the pandemic. The company continues to work closely with their customers to ensure the stable operations of more than 1,500 networks across over 170 countries and regions, and has been actively using ICT technology to assist the pandemic response in local communities (Huawei Investment & Holding Co, 2020).

Huawei works with carriers to build networks that deliver the best possible experiences. According to multiple third-party test reports on 5G network experience in large cities released in 2020, the best 5G networks in Seoul, Amsterdam, Madrid, Zurich, Hong Kong, and Riyadh were all built by Huawei. 5G devices for consumers have been developing rapidly, with more than 270 5G smartphone models available on the global market by the end of 2020. The diverse device ecosystem and the low latency and high bandwidth inherent in 5G networks have resulted in numerous Huawei 5G service innovations (Huawei Investment & Holding Co, 2020).

The conducted analysis of the actual and projected income of Alphabet, Apple, Cisco System, Microsoft, Dell Technologies, HP Enterprise, IVM, Ericsson, and Huawei allows us to determine the stability of the net income dynamics for each of these companies. Basing on the width of the confidence interval, we will divide the companies into groups (Table 1).

Table 1. Distribution of the IT Companies Depending on the Forecast Accuracy

Company	The width of the confidence interval is less than 2×30 %	The width of the confidence interval varies from 231 % to 2×100 %	The width of the confidence interval is over 2×100%
Alphabet		V	
Apple	V		
Cisco System	V		
Microsoft			V
Dell Technologies	V		
HP Enterprise			V
IBM			V
Ericsson			V
Huawei	V		

Source: own study

Thus, we were able to determine the companies that are more stable in the market of advanced technologies, namely, Apple, Cisco System, Dell Technologies, and Huawei. The activities of these companies are managed and can be traced over time. The economic stability of their activities makes these companies attractive to customers and investors. Alphabet is less stable. Their customers and technology development partners can deal with the management of this company only after the careful research of the company state. It is most difficult to predict the state of such companies as Microsoft, HP Enterprise, IBM, and Ericsson in today's market. Therefore, other market participants should be very careful about cooperation with these companies.

Summary

After the comprehensive analysis of the dynamics of the actual and projected net income of 9 IT companies that widely use artificial intelligence, Internet of Things, Big data, Blockchain, and 5G in their activities, we singled out 3 groups of companies. The study revealed that among the analysed companies Alphabet, Apple, Cisco System, Microsoft Dell

Technologies, IVM, and Huawei have an upward forecast curve, which indicates the successful development of these companies. At the same time, HP Enterprise and Ericsson show a decline in their net income forecast. The decrease in this economic indicator at HP Enterprise is explained by the spin-off and merger of the part of its assets with the competing Computer Sciences Corporation in 2016. The deterioration of the market situation at Ericsson occurred due to the due to restructuring charges and customer project adjustments in April 2017.

After all, for customers and partners of the companies, it is critical not only to determine the general trend of the companies' net income, but also the degree of fluctuation of this indicator. The thorough evaluation of the width of the confidence interval within the framework of the forecast of these companies indicated that Apple, Cisco System, Dell Technologies, and Huawei have the smallest fluctuations. This fact signposts a stable increase in their net income, inoculates these companies against challenges and sends their partners and investors an important message that builds confidence in them. Such companies as Microsoft, HP Enterprise, IVM, Ericsson have extremely high fluctuations in their financial indicators. Simultaneously, the financial and economic condition of HP Enterprise and Ericsson is complicated by the negative dynamics of the net income of these companies. In this case, Alphabet takes an intermediate position.

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Challenges and Opportunities of Online Higher Education during the COVID-19 Pandemic in Romania – a Framework for Sustainable Education

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Abstract: This study focuses on challenges and opportunities of online teaching in Romania as the key factors in adapting education to digital age for accomplishing one of the sustainable development goals of the European Commission. An online survey was used as a quantitative method of data collection, and data were collected through an online questionnaire from a sample of Romanian university teachers. The research questions concerned the following topics: 1) How was the preparation for online teaching organised before pandemic period; 2) What challenges related to emergency remote teaching were faced in 2020; 3) What are the actual challenges (2021) and future perspectives of online teaching; 4) What digital infrastructures and tools for teaching were used. The findings reflect that the most frequent challenges faced were related to students' engagement and with ICT infrastructure.

These results support the importance of how the emergent disruptions caused by the COVID-19 pandemic could be used as an opportunity to reshape the role of online teaching for Education in Digital Age.

Key words: online teaching, higher education, sustainability, online education.

JEL: E0, H0, I2

Introduction

The COVID 19 pandemic, which started in the first part of 2020, determined a forced move of teaching activity to the online environment for most universities in Romania and in the world. This unplanned transition to online education generated a series of challenges for students and teachers, who had to adapt to the teaching and learning process in the new organizational and communication framework.

Despite these challenges, the experience of online teaching also allowed the identification of opportunities that universities can use in the future for quality higher education adapted to the digital age. Romanian universities have used different educational

technologies to allow access to the educational process for students in the context of limiting educational activities on their campuses.

According to some authors (Barbour, 2018; Taie et al., 2019), there is a real need in the specialty literature to explore the online teaching and learning experiences from process and outcome perspectives, including teaching and assessment practices, and learning outcomes.

More than the theoretical aspects, according to the the Commission's holistic approach for sustainability and the Sustainable Development Goals (SDGs), one of its priorities is established as Europe fit for the digital age – Quality Education. In the Brundtland Commission report of the United Nations, sustainability is presented as "the key element in meeting present needs without affecting future needs" (Brundtland, 1987). In recent years, the concept of sustainability is analyzed not only from an environmental perspective, but also from a social and economic perspective (Marcon `et al., 2017).

The Digital Education Action Plan (2021-2027) is a renewed European Union (EU) policy initiative to support the sustainable and effective adaptation of the education and training systems of the EU Member States to the digital age. The Digital Education Action Plan offers a long-term strategic vision for high-quality, inclusive and accessible European digital education, addresses the challenges and opportunities of the COVID-19 pandemic, which has led to the unprecedented use of technology for education and training purposes, seeks stronger cooperation at the EU level on digital education and underscores the importance of working together across sectors to bring education into the digital age, presents opportunities, including improved quality and quantity of teaching concerning digital technologies, and support for the digitalisation of teaching methods and pedagogies, as well as the provision of infrastructure required for inclusive and resilient remote learning.

The present study focuses on challenges and opportunities of online teaching in Romania as the key factors in adapting education to digital age for accomplishing one of the sustainable development goals of the European Commission.

Literature Review

Online teaching was defined by Ko and Rossen (2004) as "conducting a course partially or entirely through the Internet". Online teaching, referred to as virtual learning, cyber learning, and e-Learning, is the form of learning where individuals are not physically present in a classroom, and where instruction and content are conveyed primarily over the Internet (Schwirzke et al., 2018; Thoms & Eryilmaz, 2014).

Online teaching brings about many challenges over traditional teaching methods, including enhancing students' motivation, interaction, and communication (Amasha et al., 2018; Thoms & Eryilmaz, 2014). According to Searls, the greatest disadvantage of online learning is its isolating and impersonal nature (Searls, 2012). Additional barriers include I) inadequate technology access, II) lack of equipment and infrastructure, III) teachers' time management due to increased workload, iv) teachers' and students' technological skills, v) teachers' self- efficacy in navigating online environments, and vi) lack of or ineffective teacher training (Barril, 2018; Ferri et al., 2020; Recker et al., 2013; Simonson et al., 2009; Tinoca & Oliveira, 2013).

Abdelraheem (2003) listed the potentials and characteristics of Web-based learning environments as follows: 1) Relevant and well-designed challenging activities could be designed in Webbased learning environments; 2) Adequate and timely feedback from instructors in rich environments for student interaction could be achieved; 3) Enabling active engagement in construction of knowledge with an easy-to-use and powerful navigation system; 4) Deep learning could be encouraged through question design and links to thought provoking sources; 5) Student learning could be self-paced to suit the individual needs of each student; 6) Student autonomy could be encouraged since the student is in charge of his or her own learning; 7) Students are given the opportunity to study various other points of view via online resources, including Web sites that they can seek out for themselves. In addition, research shows that online learning promotes self-learning and develops an understanding of learning styles (Hoven, 1999).

According to Hodges et al. (2020), emergency remote teaching (ERT) is defined as "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" and they claimed the opinion that planned online teaching activities differ

from online courses organized as a response to an emergency as during pandemic happened.

Hodges et al. (2020) state that effective online learning and quality online teaching require careful instructional design, planning, and development, as well as an investment in the support systems. These conditions are mostly absent in emergency shifts, which may reduce the quality of online courses in emergency situations, such as the COVID-19 pandemic.

Online teaching poses unique challenges, such as the lack of experience and preparation, as well as institutional and technological challenges (Bao 2020). Therefore, integrating the use of ICT into the teaching programme has become a fundamental pillar in the preparation of prospective teachers (Bahcivan et al. 2019).

New digital technologies used in education trigger the need to search for new teaching strategies and approaches as a response to the shifts in student learning methods (Compton 2009). Previous research (Downing and Dyment's, 2013) reported a lack of confidence and competence regarding the required technological skills to teach online at the beginning of the transition to online teaching.

Additionally, a concept known as integration in online teaching has a fundamental value in predicting the quality of learning outcomes as a result of preparation (Cosmas-Quinn, 2011). Integration refers to the alignment of online tools with the requirements of the course.

Even though initial teacher education in the virtual setting has a relatively short history (Clarke, 2013), most of the early research on this topic has overlooked how the virtual teaching placement experience has offered opportunities and challenges for prospective teachers to learn how to teach. Course redesigning is a major challenge in online teaching, and this often becomes an intimidating experience for the untrained (Vitale, 2010). Despite these challenges, the purpose of online teaching is to fulfil its goals without compromising on the quality of education (Conroy et al., 2020).

In his study, Dhawn analysed the strengths, weaknesses, opportunities, and challenges of online teaching during the COVID-19 pandemic (Dhawan, 2020). In addition to the strengths, such as location, flexibility, the availability of a wide range of content for different audiences, and opportunities to adopt innovative pedagogical approaches,

weaknesses such as learners' capabilities and confidence level, challenges related to digital literacy, unequal distribution of IT infrastructure, digital divide, and quality education were also reported.

The findings of a study conducted in Chile (Sepulveda-Escobar, Morrison, 2020) suggest that despite the opportunity to discover and learn new technologies, the challenges prospective teachers encountered outweighed the benefits overall. The lack of previous experiences in the subfield of virtual education, the lack of preparation by their teacher education programme, and the possible lack of expertise from the university supervisors might have also directly contributed to making this experience more challenging and frustrating.

According to a study carried out by a group of Romanian researchers (Lup, Mitrea, 2020), students evaluated online courses unfavourably compared to face-to-face ones. According to the study's findings, the majority (59%) consider them worse or much worse, while only 15% find them better or much better than face-to-face. Among the student complaints are the large amount of individual work required by online courses, the sedentary nature associated with them, the lack of interaction with colleagues and access to libraries for documentation. The advantages of online courses include greater participation in activities, especially from students enrolled in master's programs, flexible schedules, punctuality to classes, the possibility of online course registration and the fact that they feel more relaxed during classes as a result of the environment in which they take place.

Research Methodology

In order to collect the necessary data, survey based on questionnaire was used. The online questionnaire was chosen because it allows the collection of different data, such as facts, behavioural information, attitudes, and opinions (Dornyei, 2007), all necessary information to answer the research questions. The survey has been conducted from June to September 2021 in Romania. The sample was formed by 67 teachers from 10 Romanian Universities. In the period preceding the mailing of questionnaires (May 2021), a list of HEIs was determined, along with identification of Departments and Institutes to which the questionnaires were sent. In total, questionnaires were sent to 40 HEI Romanian entities

with the request to distribute the questionnaires among their employees. Within the mailed questionnaires, 10 were addressed to universities of technical profile, 20 to comprehensive universities with different educational profiles, and 10 to natural science and pedagogical universities. The invitation to take part in the survey was also posted on the website of the University and Faculty of Economics, and on the Faculty's social profiles.

The respondents included representatives of 10 of the largest HEI's in Romania. 78% of respondents belonged to the group of establisher/permanent position, 16% have intermediate/temporary position and 6% were at the early career stage. This is also reflected in the age structure of the respondents, with the largest group being 40-49 years old (45%), followed by 30-39 years old (37%). People of 50-59 years old constituted 17% of respondents, whereas people between 60-79 years old constituted 1%. In regards to gender, the sample was consisted in 65% of women and 34% of men. Respondents worked at variety of Faculties, represented almost all fields of study, except for arts, medicine, music, natural sciences, and political sciences.

The research questions concerned the following topics: 1) How was the preparation for online teaching organised before pandemic period; 2) What challenges related to emergency remote teaching were faced in 2020; 3) Which are the actual challenges (2021) and future perspectives of online teaching; 4) What digital infrastructures and tools for teaching were used.

Results

Starting from March 25, 2020, after all the organizational processes have ended (creating student and teacher accounts, having training meetings with teachers, communicating the information to students, etc.) the teachers at universities in Romania were required to teach online, using the officially recognized teaching platforms in their university: Microsoft Teams, Zoom, Google Meets, Google Classroom, or Moodle. This situation was commonly referred to as "e-learning" or "online learning". In almost all universities in Romania, remote teaching was conducted starting from March 25, 2020, for the entire summer semester 2019/2020 and the entire academic year 2020/2021. It's worth mentioning that not all the universities in Romania worked the same. Starting with the summer semester 2019-2020, some universities adopted a hybrid system of teaching.

That meant that all the theoretical courses were taught online, while the seminars and laboratories were taught on-site, especially in the case of computer science, engineering, medicine, sports specializations as they require much more the contact between the professor and the student while teaching-learning process. This was possible because of the university autonomy and as part of the learning outcomes covered by the curriculum can be achieved through classes conducted with the use of distance learning methods and techniques (like philology or economics). These classes could be conducted using infrastructure and software that ensure synchronous and asynchronous interaction between students and teachers. It is important that classes conducted with the use of methods and techniques of distance education may be implemented if it is allowed by the specificity of education in a particular field of study.

Quantitative data obtained from the questionnaire was analysed in order to provide an overview of the challenges and opportunities on online teaching in Romania during the pandemic. The results of the survey show that distance learning was used in Romania in moderation. It was predominantly used in educational institutions that had taught distance learning. 33% of respondents used moderately and 37% did not use online teaching at all. In the previous period, students from Romania used online education only in accessing courses. In Romania, the public education system did not provide for the use of online examination. Students could also attend a certain number of lessons from remote locations (12%), participated in online written exams (7%), and had access to video/recording of registered lectures. Live streaming or online oral exams have not been practically applied. Almost 83% of those who responded that they used the online system did so for part-time education - distance learning. Live streaming lessons was offered for 5% of students.

In the pre-pandemic period, online platforms were used monthly in teaching by 21.3% of those interviewed, but these people are generally the ones who took classes in part-time education. Most of the interviewees used it less than once a semester or never. Analyzing the answers regarding online teaching methods, it was observed that approximately 64% of respondents used presentations and videos animations. Presentations were often used before the pandemic. Online discussions were used by approximative 18% of respondents and polls were used by 15% of respondents. Among other forms of online education mentioned were: e-mail counselling sessions, forum discussions, Skype, sharing

didactic materials, Google Sheets, Google Forms, Google Docs. Some respondents also used electronic tools to create e-learning content or to organize online ad-hoc tutorials navigated by peers. It is interesting that the respondents also mentioned games among the tools used. The results show a link with the predominant form of pre-pandemic education.

For the Romanian respondents, a challenge associated with the transition to online teaching was engagement of students during lessons (e.g. motivation, activation, making students reactive and mentally focused); this was described as a" big challenge" by 52% of respondents and it was identified as significant and moderately challenging by 36% of them. Other challenges faced were related to the work done in front of the computer. Most interviewees mention increased fatigue from prolonged activities on screen ("Significantly challenging" for 54% of respondents) and problems related to ergonomics in remote learning (for 33% of the respondents). Another important issue for the teachers was to get the students involved in the lessons. This issue was rated as a significant challenge by 54% and as moderately significant by 35% respondents.

The big challenge of this period was related to students' assessment and evaluation of their knowledge. However, over 66% of academic staff reported challenges related to conducting examinations, of which 28% rated them as significant. Teachers also reported problems related to the verification of students' identity, 52% of which describing it as significant. Oher challenges that were mentioned by interviewees were related to: Internet connection - irregular, poor (16.4% rated it as significant and 22.4% evaluated it as high), digital equipment used in teaching (e.g. availability/use/plugging of laptop, web camera, screen, etc.) which was rated as significant by 14% of respondents and high by 28% of them. Some teachers reported problems in the absence of licenses. This led to limited access to teaching platforms (e.g. 40 min on Zoom). Internet access was good, and this has not been considered a challenge for teachers. As it is known, Romania is in the third place in the EU when it comes to the Internet, as its Internet infrastructure is a new one and the most of the Internet users use optical fibre and the speed of internet is very good.

From the analysis of the answers provided, it can be observed that most universities have been concerned with providing support to teachers in the transition to online teaching: 65% of respondents mentioned that they had assistance from the university and 59% of them had assistance from their faculty or department. The support received from

colleagues, university authorities or others was also helpful, although almost 59 % of the respondents said that they had received support from the ICT Department. However, a considerable percentage (49%) searched for information on their own.

Universities have taken steps to overcome the difficulties and ease the work of teachers. In general, the activities focused on acquiring new knowledge on the use of IT tools in distance learning and organizing courses for the platforms used in the university. Even if some platforms were known, the courses offered made the work more efficient. Teachers should learn to organize their classes and materials more efficiently. For those who needed specific equipment, halls were equipped within the university. Many teachers who did not have the necessary equipment (camera or microphone) decided to buy it at that time without waiting for support from the university. The quality of internet connections to remote work was also improved by buying better packages.

As far as the conduct of exams and tests were concerned, which was a major problem, some lecturers decided to change the form from written exams to oral exams, some introduced a series of micro-projects instead of the former big projects. In terms of examining students, there was a need for openness from both teachers and students. Examination forms have been changed where possible.

While in the first year of online teaching the higher percentages were in the "significantly challenging" column, in the second year of remote teaching, Romanian respondents showed a small reduction in the challenges they faced. As the percentages in the first column decreased, the ones in the "moderately challenging" and "slightly challenging" increased. For 47.6%, fatigue from prolonged activities on screen remained slightly challenging as well as increased workload due to organization of online teaching (31.3%). Online teaching methods and techniques became moderately challenging (36.4%) or slightly challenging (37.9) or at all (12.1%). Communication with students (e.g. keeping the contact with them) was considered moderately challenging by 43.9%, while slightly challenging by 33.3%, and not challenging at all by 7.6%. Also, scheduling with other professional activities from remote (e.g. research) was considered moderately challenging by 43.9%, while slightly challenging by 24.2%, and not challenging at all by 16.7%. Even the engagement of students during lessons (e.g. motivation, activation, making students reactive and mentally focused) became less challenging. As we can see from the figure bellow, it was

considered moderately challenging by 41.8%, while slightly challenging by 16.4%, and not challenging at all by 9.0%, while only 32.8% still consider it to be significantly challenging (Figure 1).

**Figure 1.** Challenges for online teaching during May – July 2021
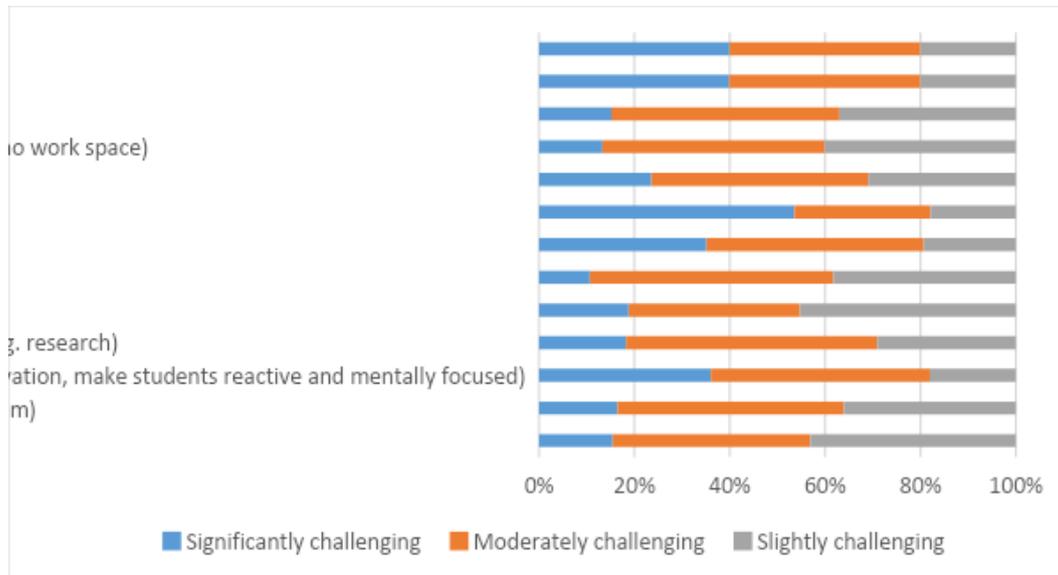
Most probably, the trainings that were organized for each university and their own experience during the last two semesters brought an increase in the skills of academic staff in the use of ICT tools. It can be observed from the Figure 2 that most of the problems reported in the previous period decreased significantly. Internet connection (irregular, poor) was still significantly challenging only for 6.10% (10% less than in 2020), for 28.80% it was moderately challenging, while for 39.40% it was slightly challenging, and not at all challenging for 24.2%. Most of the respondents considered conducting examinations (36.9%) and accessibility related to ICT (36%) to be moderately challenging, followed by verifying student identity (33.9%) and software and applications (33.3%), while the option slightly challenging was chosen for Internet connection (irregular, poor) (39.4%), software and applications (37.9%), licenses for software and applications (29.7%). On the opposite side, digital equipment used in teaching (e.g., availability /use/plugging of laptop, web camera, screen etc.) is considered less challenging.

Figure 2. Challenges related to ICT
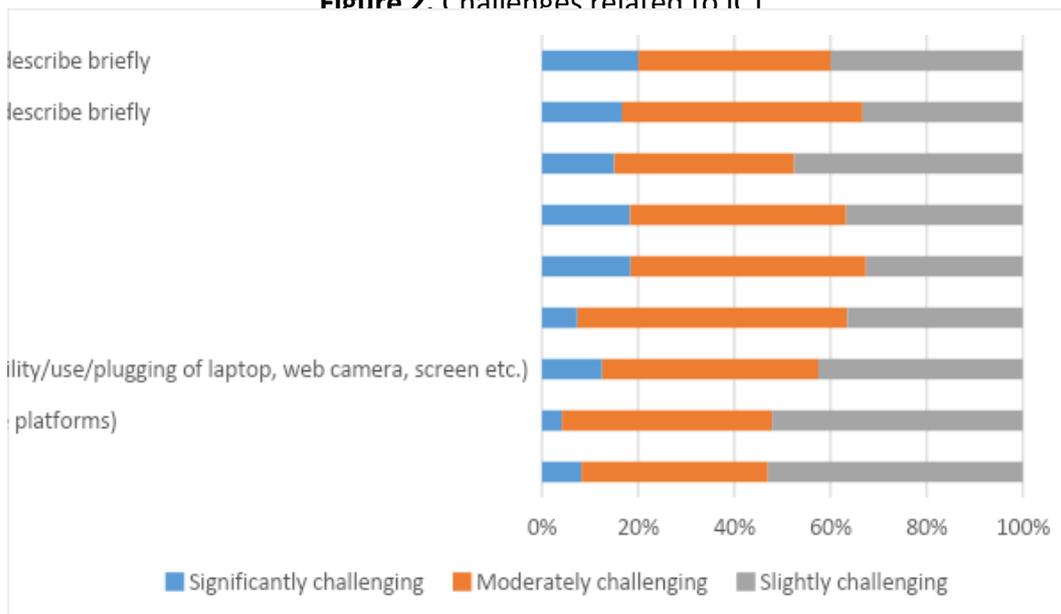
For Romanian respondents, the biggest challenge during this period was online teaching of content related to laboratory work (reported by almost 35% of respondents). This is the case especially for medicine, engineering, and sports specializations. Moreover, content related to fieldwork posed a significant challenge for 30.7% of respondents. The teaching staff (24.5%) also reported to be significantly challenged teaching students' general skills like ability to work independently, problem solving skills, data acquisition, and data production skills.

Figure 3. Challenges related to teaching online certain skills and contents for the students
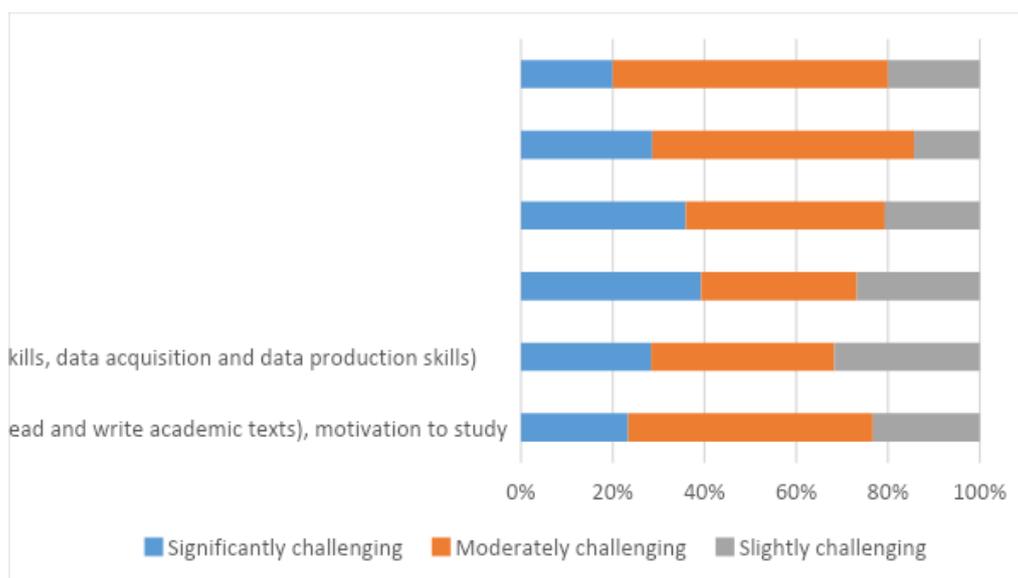
When analysing the information relating to the teaching methods used, as it was expected, presentations remained the most preferred way of teaching (95.50% in 2021, compared with 63.90% before the pandemic), followed by online discussions in pairs or in working groups (59.70% in 2021, compared with 18.00% before pandemic), which has had the most significant change if compared with the period before pandemic (the difference is 41.70%), as it can be observed in the figured bellow. Furthermore, an important change can be observed in the case of online discussion on the subject (56.70% in 2021, compared with 16.40% before the pandemic), which means that even more teachers (40.30%) stated to use this way of teaching. Also, the use of whiteboard (with 31%), the use of videos and animations (with 19.90%), the use of polls (with 18%), and the use of games (with 16.50%) increased if compared with the period before the pandemic.

Other ways of online teaching mentioned by Romanian teachers are discussions in forums, discussions on Skype, sharing materials, Google Sheets, Google Forms, Google Docs.

Figure 4. Online teaching methods used
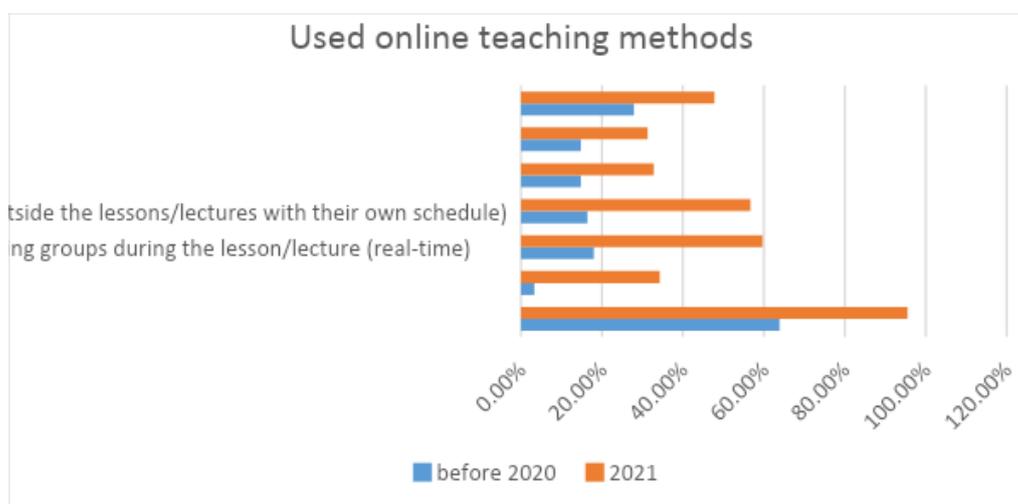
Almost half of the respondents mentioned the practices that they consider to be successful and effective methods used by them during online teaching. Among of them, the most frequent or unique ones were:

- Personalized written feedback on the activities, homework or exams, with additional verbal communication session;
- More intense use of audio-video resources in order to stimulate the formulation of opinions;

- Giving greater importance to the ongoing evaluation;

- Providing course materials in different formats (ppt, pdf, audio-video recordings);

- Random selection of a student to continue an idea during the course;

- Multiplying the applied activities to the detriment of the theoretical ones;

- Changing of emphasis from final, summative, theoretical evaluation to continuous, formative, applied evaluation;

- Completing the evaluation with forms of self-evaluation and inter-evaluation;

- Keeping permanent contact with the students and engaging them in different activities;

- Maintaining students' attention using polls made with Kahoot and awarding points in seminars for the winners;

- Using different videos on YouTube or other websites to maintain students' attention and make sure they will get the information in a more funny or animated way;

- Convincing the students to keep their cameras on significantly improved communication and their engagement;

- Using online whiteboard and challenging students to also use it, in the interactive parts of the courses and seminars;

- Asking students to present their works online to the other students and assessing their works and their involvement with additional points that contributed to the final mark.

Romanian respondents appreciated online education also as a positive experience and more than 33% intend to use online teaching both from their home or from the university premises if it is allowed by legislation. Only 11% of the respondents stated that they do not intend to continue with on-line teaching.

Figure 5. Plans to use online teaching as additional method to traditional class
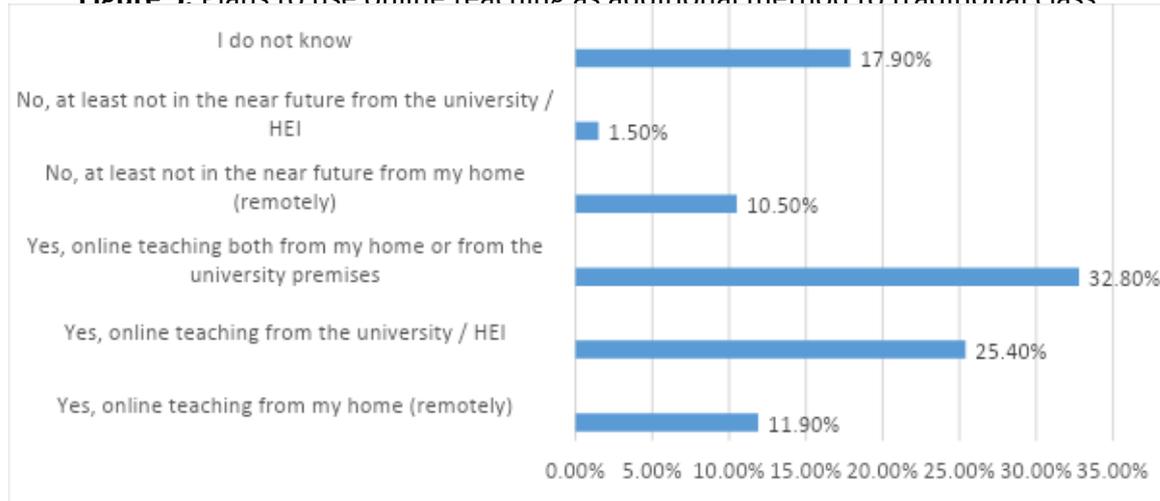
Teachers say they will continue to use the online platform to manage student homework, provide written feedback and achieve faster communication with students. They want to stimulate the team activity (projects) of the students by using the facilities of the online platforms. They will use online learning resources to ensure faster transmission of additional resources and alternative ways of providing specific learning materials. They want to encourage participation in webinars conducted by people outside the university. It is better for students that work or at the master courses as long as their presence is higher online. Teachers want to continue participating in online teaching development programs. Preparation is desired for online teaching methods (33.3%), students' activation online (37%), verification of knowledge (34%).

Conclusions

The aim of this study was to explore the challenges and opportunities that arose during online teaching in Romanian universities during the COVID-19 pandemic. Although before the pandemic online teaching was partially used by teacher from Romanian universities, especially for uploading course materials and for communicating with students, study findings revealed important challenges they faced: engagement of the students during classes (e.g. motivation, activation, making students reactive and mentally focused), the sedentary desk work, students' assessment and evaluation of their knowledge, other challenges related to ICT (Internet Connection, lack of necessary equipment). The aspect that was considered the most negative and challenging during the emergency online

teaching was the lack of interaction with pupils, which might affect their professional development (Flores and Gago, 2020). Most universities have been concerned with providing support to teachers in the transition to online teaching in terms of using IT tools in online teaching and organizing courses for the platforms used in the university. While in the first year of online teaching (2020) the higher percentages were in the "significantly challenging" column, in the second year of remote teaching (2021), Romanian respondents showed a small reduction in the challenges they faced.

Despite the challenges presented, student teachers suggested that this unique experience would contribute positively, at least to a certain extent, to their future careers. Based on the findings of this study, Romanian respondents appreciated online education as a positive experience and 33% of them intend to use online teaching both from home or from the university premises. Teachers mentioned that they will continue to use the online platform to manage student homework, provide written feedback, and achieve faster communication with students. Moreover, they want to stimulate the team activity (projects) of the students by using the facilities of the online platforms and they will use online learning resources to ensure a faster transmission of additional resources and alternative ways of providing specific learning materials.

Although the findings presented in this study share similarities with those of other researchers (e.g. Flores and Gago, 2020, in Portugal; Moorhouse, 2020, in Korea; Bao, 2020, in China), the findings cannot be necessarily generalised to all higher education institutions in Romania, since the number of participants in this study was relatively low. These results support the importance of how the emergent disruptions caused by the COVID-19 pandemic could be used as an opportunity to reshape the role of online teaching for Education in Digital Age.

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Participation and Position of Agrarian Sectors in Global Value Chains in Selected Countries in the Central and Eastern Europe

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Abstract: This article investigates the effects of fragmentation of production on the agrarian sectors in selected countries in Central and Eastern Europe (Czech. Rep., Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Rep., Slovenia, Bulgaria, Croatia and Romania) between 1995 and 2018. The participation index and the position index are used to evaluate the form of integration of the agrarian sectors in these countries into global value chains (GVC). The results suggest that most evaluated countries increased participation in GVC through the time period. EU membership led to increasing participation in GVC. Participation in agrarian global value chains has not expanded since the Great Recession. On average, the position of global value chains in these countries is shifting more downstream with a few outliers (e.g. Slovakia, Estonia, Latvia, and Croatia). The growing integration of the agrarian sectors in countries in the Central and Eastern Europe into the GVC increases the influence of the vertical division of labor/tasks and creates a new set of factors influencing the development of agrarian sectors in these countries.

Key words: fragmentation, value added, CEE countries, global value chain

JEL: F14, F15

Introduction

World trade and production are increasingly structured around "global value chains" (GVCs). A value chain identifies the full range of activities that firms undertake to bring a product or a service from its conception to its end use by final consumers and takes place in numerous locations in different countries (Gereffi, 2014). The food and agriculture sectors are no exceptions and are increasingly integrated into global value chains as well (De Backerand and Miroudot, 2013; Kowalski et al., 2015; Greenville et al., 2017; OECD, 2020; Montalbano and Nenci, 2020).

The research on firm GVC participation, including its drivers and implications for economies in general (e.g. Gereffi, 2014; Fernandes et al., 2020; Reddy et al., 2021), in countries of Central and Eastern Europe (Cieślik et al. 2016; Cieślik, 2017; Cieślik 2019a; Cieślik et al. 2019b) and specifically in agricultural and food sectors (e.g. Lim, 2021; Montalbano and Nenci, 2022) has experienced a rapid rise in the last decade.

Gereffi (2014) showed that contemporary globalization has been marked by significant shifts in the organization and governance of global industries. Furthermore, the organization of the global economy entered another phase, with transformations that are reshaping the governance structures of both GVCs and global capitalism at various levels. He concluded that there are various drivers behind these changes, like, i.e. (1) the end of the Washington Consensus and the rise of centers of economic and political power; (2) a combination of geographic consolidation and value chain concentration in the global supply base; (3) new patterns of strategic coordination among value chain actors and (4) a shift in the end markets of many GVCs accelerated by the economic crisis of 2008–09, which is redefining regional geographies of investment and trade. Fernandes et al. (2020) noted that the past decades have witnessed big changes in international trade with the rise of global value chains (GVCs) and some countries, such as China, Poland, and Vietnam rode the tide, while other countries, many in the African region, faltered. Fernandes et al. (2020) studied the determinants of countries' GVC participation using a panel database of more than 100 countries from 1990 to 2015. They found that factor endowments, geography, political stability, liberal trade policies, foreign direct investment and domestic industrial capacity are very important in determining GVC participation, and these factors matter more for GVC trade than traditional trade. Reddy et al. (2021) studied the relationship between financial constraints and firm participation in global value chains (GVC) in the Indian manufacturing sector for the period 2001–2016. They found that firms that were relatively more financially constrained were more likely to become a part of GVC during the studied period.

Cieślik et al. (2016) and Cieślik (2017) investigated the transformation of foreign trade in 10 CEE countries and gave special focus to the role these countries began to play in global value chains in the period between 2000 and 2009. They concluded that post-socialist countries differ in the levels of their participation in GVCs and countries that have stronger links with Western European countries, especially with Germany, are more integrated. Also, a large share of post-socialist countries' exports passes through Western European GVCs and most exporters in Central and Eastern Europe are positioned in downstream segments of production rather than upstream markets. Furthermore, Cieślik (2019a) analyzed the CEE countries' connections to production networks in the electronics industry

and found CEE states' dependence on Chinese electronics industry exports. She concluded that in electronics industry exports, the CEE countries have become more dependent on Chinese value added than on the EU's value added recently. Cieślik et al. (2019b) evaluated the economic potential of CEE countries and also we assessed the role of CEE states in international production linkages. The authors tested the hypothesis that the higher economic potential expressed in a more business-friendly economy is found in countries most involved in GVC in the context of foreign trade exchange. Results indicated that the relation between economic potential and the involvement of GVCs is not obvious and depends on many factors.

Lim (2021) noted that since the mid-1900s, agricultural global value chains have grown rapidly and transformed the nature of agri-food production around the world, but little is known about how participation in agricultural GVCs changes the structure of participating economies. To address this shortcoming, he used a constructed panel dataset from 155 countries for the period 1991- 2015 and found that, in response to high agricultural GVC participation, both GDP and employment shares in the agricultural and services sectors increase, and that both factors decrease in the manufacturing sector. He concluded that modern agrarian economies are leapfrogging the manufacturing sector to directly develop their agriculture and services sectors through their participation in agricultural GVCs.

Montalbano and Nenci (2022) used measures of GVCs participation and positioning from the EORA panel data for the period 1995–2015 and tested their effects on changes in agriculture value added per worker. They found that changes in GVC participation are, on average and ceteris paribus, positively associated with changes in agriculture value added per worker. Mixed results were found on the effects of countries' positioning along the value chain.

In recent paper, Elia et al. (2021) have stressed that the COVID-19 pandemic is expected to trigger a reconfiguration of global value chains according to four alternative trajectories as reshoring, regionalization, replication, and diversification.

An evaluation of agriculture and food sectors in Eastern and Central European countries has not received similar attention. To fill this research gap, this study aims to investigate the effects of fragmentation of production on the agrarian sectors in selected

countries in Central and Eastern Europe between 1995 and 2018. In this study, we focus on the form of integration (participation and position) of the agrarian sectors in the global value chains of these countries.

Theoretical premises

Technological progress, cost, access to resources and markets, as well as trade policy reforms have facilitated the geographical fragmentation of production processes across the globe according to the comparative advantage of the locations (De Backerand and Miroudot, 2013).

According to P. Dicken, the production of any product involves a complex delivery of individual activities and transactions across space and time. Such a nexus of interconnected functions and operations through which goods and services are produced and distributed has become both organizationally and geographically more complex. Global value chains not only integrate firms (and parts of firms) into structures, which blurs traditional organizational boundaries, but also integrates national and local economies in ways which have enormous implications for their economic development (Dicken, 2011).

Figure 1. Interconnecting dimensions in a globalizing economy
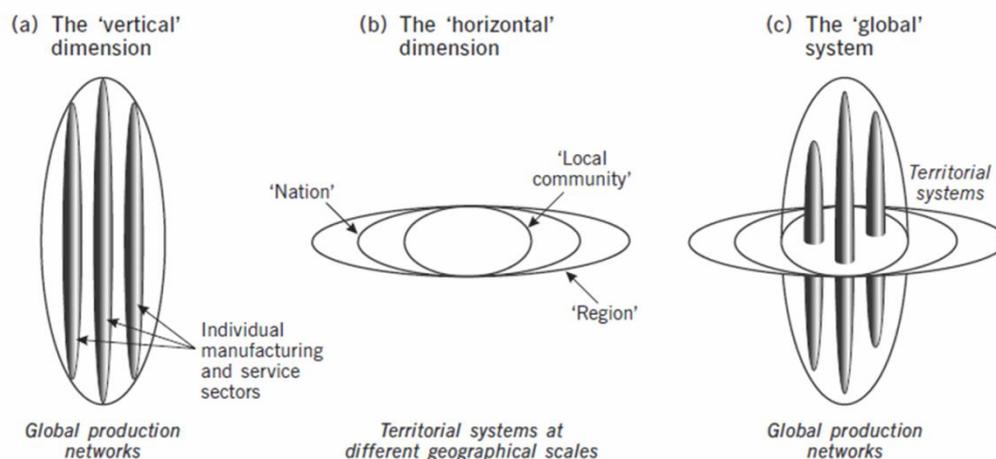
Source: Dicken (2011)

Figure 1 captures the major dimensions of these relationships. Individual production networks can be regarded as vertically organized structures configured across increasingly extensive geographical scales. Cutting across these vertical structures are the territorially

defined political-economic systems which, again, are manifested at different geographical scales (Dicken, 2011). The growing integration of the sector/region in the GVC also increases the influence of this vertical system and creates new set of factors influencing the sector/region.

Methodology

Data comes from The Trade in Value Added (TiVA) database, 2021 edition (TiVa, 2022). TiVa is a collection of measures that can provide insights into global production networks and supply chains beyond what is possible with conventional trade statistics. The TiVA database contains a selection of principal indicators that track the origins of value added in exports, imports and final demand for the years 1995-2018. Indicators are available for 45 industries within a hierarchy based on ISIC Rev. 4. The indicators are derived from the 2018 version of OECD's Inter-Country Input-Output Database (Martins Guilhoto et al., 2022). Data for the following countries in the Central and Eastern Europe are available in the database: the Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Poland (PL), Slovak (SK), Slovenia (SI), Bulgaria (BG), Croatia (HR), and Romania (RO).

The use of the international input-output table by TiVA allows decomposing gross trade into value added components. The decomposition of gross exports provides information about domestic value added (DVA), foreign value added (FVA) content of exports, and domestic value added sent to third economies (IV).

Domestic value added embodied in gross exports (DVA; or $EXGR\_DVA_{c, i, p}$ in TiVA) refers to the domestic value added content of exports, by industry i in country/region c to partner country/region p and represents the exported value added that has been generated anywhere in the domestic economy (i.e. not just by the exporting industry).

Foreign value added embodied in gross exports (FVA; $EXGR\_FVA_{c,i}$) refers to the value of intermediate goods and services that are embodied in a domestic industry's exports. The value added can come from any foreign industry upstream in the production chain.

Domestic value added sent to third economies (IV; $EXGR\_DVAFXSH_{c,i}$) represents the country c domestic value added content embodied in the gross exports of industry i in foreign countries. It is often considered as a measure of 'forward linkages' in analyses of GVCs.

Following Koopman et al. (2010), Johnson and Noguera (2012), Borin and Mancini (2020), these metrics (DVA, FVA and IV) can be used to measure of GVC participation (1) and GVC position (2).

(1)
$$GVC_{participation} = \frac{FVA + IV}{Export_{gross}}$$

The GVC participation index indicates the share of country's export that is part of multi-stage trade process. The higher the value of index the higher is the country's participation in GVC.

The measure of GVC participation can be used together with the GVC position index. That allows indication of location (vertical specialization) of the country in the production chain.

(2)
$$GVC_{position} = log\left(1 + \frac{IV}{Export_{gross}}\right) - log\left(1 + \frac{FVA}{Export_{gross}}\right)$$

The positive value (IV is higher than FVA) means the country lies upstream in the GVC. The negative (IV is smaller than FVA) value signals the country lies downstream in the GVC. The country that exports raw materials or intermediate products lies upstream in the GVC; the country that uses a large portion of import intermediate products to produce final goods for export lies downstream in the GVC.

Results

The first potential consequence of a sector/country integrating into the global value chain is decreasing the share of domestic value added in its gross exports, indicating a larger proportion of foreign value added in gross export and stronger linkages within global value chains (Cieślik et al. 2016). Figure 2 (a and b) presents the levels and changes in the share of domestic value added in the gross agrarian export of each selected country in the Central and Eastern Europe. The countries analysed showed different shares of domestic value added in the gross agrarian exports. Beacause of better visibility of similar and different trends among analysed countries, we present them in two graphs, divided into those that show a similar development (Fig. 2a) and outliers (Fig. 2b).

At the beginning of the period (1995), the highest share of DVA in the gross agrarian export (indicating lowest levels of integration into the GVA) was revealed in the case of Romania, Bulgaria, and Hungary. Contrary, the the lowest shares were revealed

in Slovakia and Estonia; indicating already higher levels of integration into the GVC before the accession into the European union when compared to other countries in the Central and Eastern Europe.
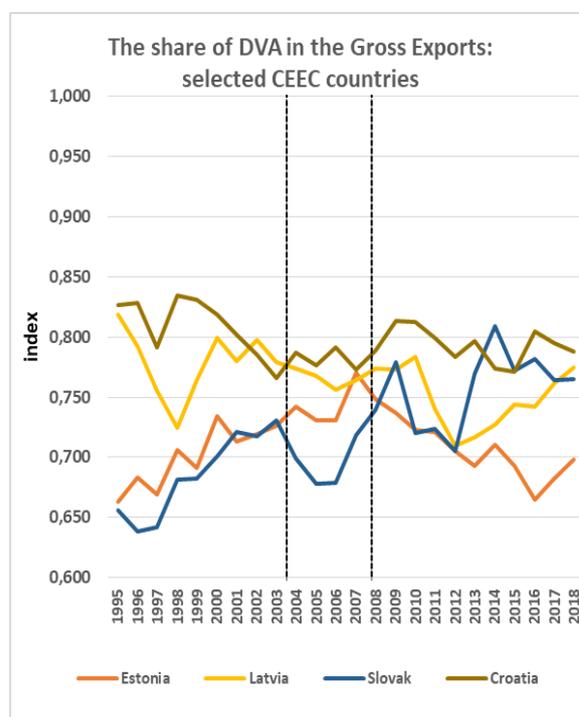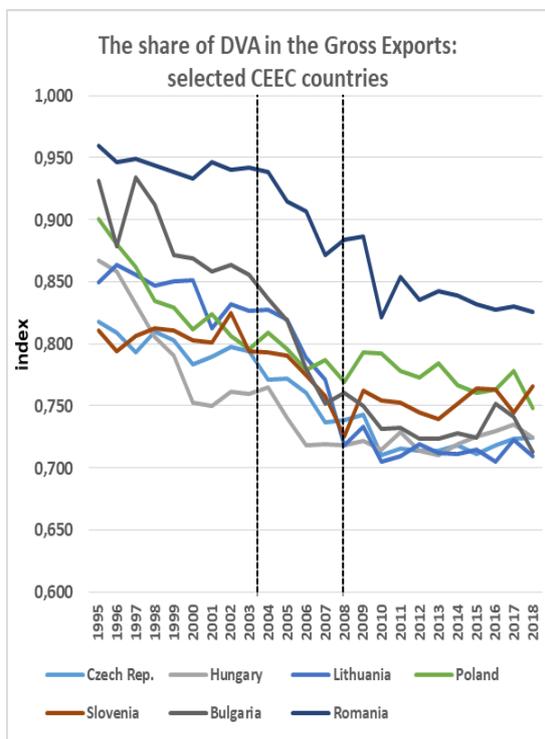
Selected countries also showed different trends and changes of domestic value added in gross agrarian exports during the period between 1995 and 2018.

Generally, group of countries consisting of the Czech Republic, Hungary, Lithuania, Poland, Slovenia, Bulgaria, and Romania showed an increasing share of foreign value added in their gross agrarian exports until the Great Recession (Fig. 2a). The accession into the European Union in 2004 enhanced the integration into the GVC as can be seen in the case of Slovenia, Czech Republic, and Lithuania. Since the Great Recession, the domestic value added in the gross agrarian exports has been stagnating. This suggests that since the Great Recession, agrarian sectors of these countries are not increasing its level of integration into the GVC anymore.

Figure 2. The share of Domestic value added (DVA) in the gross agrarian exports
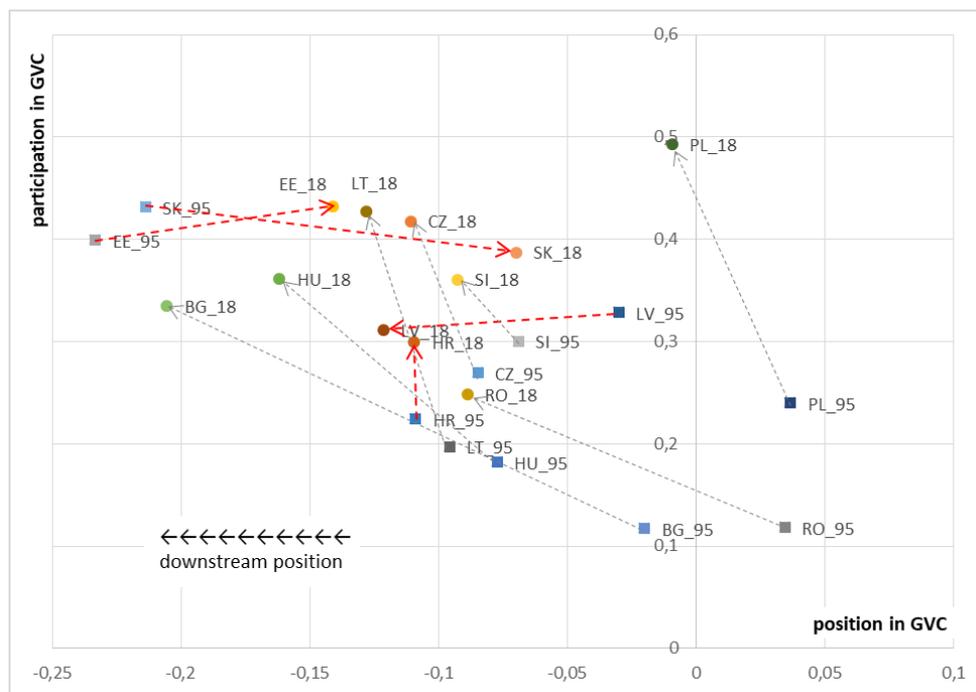
a. (b)

Source: own calculations, data from TiVA (http://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm).

There are few outliers (Estonia, Latvia, Slovakia, and Croatia) among the analysed countries when compared to the previous group (Fig. 2b). Estonia diminished its integration into the GVC from 1995 to the Great Recession, but after the recession the trend is opposite and Estonia's share of DVA in the gross agrarian export is decreasing. Slovakia's share of DVA in the gross agrarian export fluctuates during the period, but reveals an increasing trend. Latvia shows periods of drops and stagnation of DVA in the gross agrarian export. Croatia's share of DVA in the gross agrarian export remains mostly the same since the beginning of millennia and there is no visible significant influence of accession into the European Union in 2013.

Although the share of DVA in the gross agrarian export already provides information about the level and change in integration into the GVC, the indicators of participation and position in GVC allow assessing the form of integration in more detail (Fig. 3).

Majority of analysed countries had increased its participation in GVC and had downstream position in the GVC in 1995 and also had moved more downstream during the period till 2018. In other words, countries in the Central and Eastern Europe started to use relatively a large portion of import intermediates to create its agrarian exports. There are few exeption to such a conclusion.

Figure 3. The shifting patterns of GVC participation and position

Source: own calculations, data from TiVA (http://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm).

Poland and Romania were positioned upstream in the GVC in 1995, but these two countries have changed their relative position from the upstream one to the downstream one during the period, up until 2018.

Slovakia and Estonia are still positioned downstream in the GVC, but these two countries are relatively moving upstream. It potentially means that Slovakia and Estonia increasingly export raw materials or initially processed intermediate products.

Latvia is moving more downstream in the GVC as the majority of other countries the Central and Eastern Europe, but the level of participation slightly decreased. Crotia increased its participation in GVC, but its position remaind same when compare 1995 and 2018.

Summary, recommendations

This study investigated the effects of fragmentation of production on the agrarian sectors in selected countries in the Central and Eastern Europe between 1995 and 2018. The focus was specifically on the form of integration (participation and position) of the agrarian sectors in the global value chains of these countries.

We found that agrarian sectors in countries in the Central and Eastern Europe differ in the levels of their participation in the GVC. A majority of analysed countries had increased agrarian sectoral participation in GVCs and had downstream position in the GVC. What is more, these countries had moved more downstream in the GVC during the period between 1995 and 2018. This means that agrarian sectors in these countries started to use relatively larger portion of imported intermediate products as inputs to produce its agrarian exports. These conclusions are in line with Cieślik (2016, 2017, 2019b), who analysed the integration into the GVC at the level of overall economy in the Central and Eastern Europe.

The findings in this study can help inform agricultural trade policy makers when assessing the nature of liberalization and structural transformation of agrarian sectors in their countries, as well as when assessing the potential benefits and risks.

There are a few next steps for this research. First, the historical interpretations of the changing position in the GVC relative to our findings lead to additional questions to inquiry. For example, a country like Slovakia, where its share of DVA in gross exports increases as well as its position going from downstream to upstream may not be interpreted as simply moving away from focusing on processing nearly finished products in the GVC to early stages

of processing. Rather, with the growing share of DVA in the GVC over the period, it could mean that upstream parts of the the agrarian GVC are being added to the existing downstream portfolio of businesses in Slovakia, rather that a substitution away from downstream.

Furthermore, an increasing interest in Regional Value Chains (RVCs) (cf. Elia et al, 2021; Kersan-Škabić and Belullo, 2021) has gained momentum due to the increasing protectionism that has resurfaced among several global powers, as well as the need to have redundant regional and domestic supply chains for critical supplies exposed by the pandemic. Understanding the relative participation between Central and Eastern European countries to the rest of Europe vs the Rest of the World will be important for future strategic position of Central and Eastern European counties.

There is also space for further research in this area to identify the underlaying factors influencing the participation and position, to asses the effects of participation and position in the GVC on structural transformation and change in productivity, etc.

Acknowledgement

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Competitive development of the economy based on the system
of labor force motivation indicators

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Abstract. One of the most pressing and urgent tasks of a modern leader is to stimulate labor activity, since it is labor resources that are the driving force of any economic processes. Such stimulation is possible by building an effective motivation system based on motivational factors. In turn, the motivation system should provide:
  - a way of attracting labor activity and retaining highly qualified personnel with the highest level of human capital;
  - the formation of a corporate culture, taking into account the social responsibility of business;
  - achievement of the strategic development goals of the organization on the basis of building a system of sustainable competitive advantages.

The relevance of these issues is also confirmed by the need to ensure the growth of labor productivity caused by the rapid reduction in the number of labor resources in Ukraine, due to the demographic crisis of previous years.

In view of the above, the purpose of this research is to study the competitive development of the economy based on a system of indicators of labor force motivation.

Keywords: Demographic Crisis, Labor Force Motivation, System of Indicators.

JEL: A1, G0, J0

1. Introduction

It is known from personnel management that the driving force of any economic processes is labor resources. Since the management process is continuous due to the need for constant decision-making, stimulating labor activity is one of the most pressing and urgent tasks of a modern manager. Such stimulation is possible by building an effective

motivation system based on motivational factors. In turn, the motivation system in any enterprise should providea way of:

- attracting and retaining highly qualified personnel with the highest level of human capital;

- formation of corporate culture, taking into account the social responsibility of the business;

- achieving the strategic goals of the organization's development on the basis of building a system of sustainable competitive advantages.

Such scientists as A. N. Baksalova, A. S. Bilichenko, A. A. Klimchuk, A. M. Mikhailov, V. V. Yarmosh [1-4], and others were engaged in the analysis and classification of modern methods of personnel motivation in their works. To a large extent, their scientific developments are based on the results of world experience and are based on the works of foreign authors.

The issues of effective management of economic objects due to motivation and stimulation of labor force were studied by such domestic scientists as: V. M. Grineva, S. T. Duda, N. M. Zayarnaya, H. R. Kitsak, V. V. Korolkov, V. M. Nizhnik, A. A. Harun, I. A. Shevchuk [5-9, 15-17], and others.

The general features of these studies are the direction of management efforts and orientation to a specific person. In this regard, the vast majority of works in this area, as an object of management, considers a separate enterprise operating in a market economy. On the other hand, the quantitative and qualitative composition of the labor force, their living conditions, psycho-emotional state and, accordingly, the level of motivation can influence not only the competitive development of business entities, but also the state and dynamics of the development of individual industries and the economy as a whole.

For example, the creation of competitive working conditions is a motivating factor for the activation of labor migration of the population. Unfortunately, to date, the problem of motivation of labor resources at the industry level has hardly been investigated through certain objective reasons, which are discussed below. The relevance of these issues is also confirmed by the need to ensure the growth of labor productivity due to the rapid reduction in the number of labor resources in Ukraine, as a result of the demographic crisis of the previous years.

Considering the above, the purpose of this study is to investigate the competitive development of the economy based on a system of indicators of labor force motivation.

2. Materials and methods

Based on the work of foreign scientists, A. A. Klimchuk and A. M. Mikhailov conducted a deep analysis and generalization of existing theories of employee motivation [3]. According to the proposed classification, all theories of motivation that exist today can be divided into 3 groups:

- meaningful approach - proceeds from the fact that each person has a hierarchy of needs, the satisfaction of which leads to an increase in the motivation of their work. The most famous representatives of this approach are: F. Taylor's theory of scientific management, E. Mayo's social theory, A. Maslow's theory of needs, theories "X", "Y" and "Z" by D. McGregor and V. Ouchi. Along with the classification of needs, they also study methods of meeting them;

- procedural approach - recognizes the existence of needs, but states that the main motivational factors are each individual's perception of a particular situation and expectations of reward based on social comparisons and past experience. This approach includes: the theory of expectations by V. Vroom, the theory of justice by S. Adams, the theory of social comparisons by L. Festinger, the theory of typical variables and individual choice by T. Parson, and others;

- behavioral approach-based on the identification of factors that directly affect the behavior of people. These factors include: the close circle of the environment, national and cultural characteristics, the level of participation, economic and social status, working conditions, life experience, and so on. The most famous scientific developments are: D. Mccleland's theory of acquired needs, F. Hertzberg's two-factor theory, K. Levin's field theory, D. Lockwood's theory of work orientation, and so on.

Thus, it can be noted that today, among the scientists who have studied this problem, there is no single and agreed point of view regarding the most effective tools for motivating workers. In practice, this leads to the fact that the form and methods of employee motivation depend on the management style of their managers.

From the point of view of statistical and economic modeling, the use of these approaches also has significant drawbacks, in particular, the impossibility of a quantitative assessment of the phenomenon under study. At best, we will have a multi-priority ordinal scale based on individual surveys.

Within the framework of this study and taking into account these prerequisites, the following factors were included in the composition of motivational factors, or those that are indicators of the level of motivation of the workforce and directly affect the productivity and competitiveness of enterprises in the industry:

Employee turnover is a generalized indicator that characterizes the rate at which an enterprise or industry loses its employees and is calculated using the formula:

(1)
$$M_1 = \frac{NE_D}{\overline{NE}} \times 100\%$$

Where M_1 - staff turnover, %; NE_D –the number of dismissed full-time employees during the reporting period, thousand. Person; $\overline{NE}$ - average annual number of employees.

This indicator takes values from 0% to 100% and should be minimized. A high level of staff turnover indicates low motivation and vice versa.

Economic development in Ukraine during 2013-2019 was characterized by prolonged crisis phenomena in all sectors. This, in turn, led to irregular operation of enterprises and, as a result, problems with timely payment of wages. Since the level of per capita income in Ukraine for decades remained at one of the lowest levels among the countries of Western Europe, in our opinion, this factor is one of the main ones that directly affect the motivation of employees. Among the possible manifestations are:

- an increase in the number of employees on unpaid leave;
- transfer of employees to a part-time work week;
- the deficit of the payroll and the growth of the level of debt.

For their quantitative assessment, the following indicators were used in this study:

$$M_2 = \frac{NE_L}{\overline{NE}} \times 100\%$$

(2)
$$M_3 = \frac{NE_{PT}}{\overline{NE}} \times 100\%$$

$$M_4 = \frac{W_A}{WF} \times 100\%$$

Where M_2, NE_L- the share and number of employees on unpaid leave, respectively; M_3, NE_{PT} - the proportion and number of employees transferred to part-time workweeks, respectively; M_4- the level of wages arrears relative to the monthly fund, %; W_a - wage arrears at the end of the reporting period, mln. UAH; WF - the average monthly wage fund in the reporting period, mln. UAH

All of the above indicators of the level of motivation should be minimized.

Even if the enterprises of the industry work rhythmically, and employees receive their wages on time and in full, this does not mean that they are necessarily satisfied with its amount. Although the level of satisfaction with income is always subjective, socio-economic statistics keep records of the indicators of the subsistence level and the actual subsistence minimum. Comparison of the average level of wages in the enterprise, or in the region with the maximum permissible level, especially when the advantage is insignificant, is also an important motivational factor.

(3) $$M_5 = \frac{W}{SM_A} \times 100\%$$

Where M_5 - the ratio of wages to the actual subsistence minimum, %; W - the average monthly wage, UAH; SM_A -the actual subsistence minimum, UAH.

This indicator should be maximized.

Each industry has its own specifics of production activities, often associated with harmful working conditions. The exceptions are wholesale and retail trade, financial, insurance, professional, scientific and technical activities, education, health care and the provision of other types of services. All other sectors of the economy have a negative impact on the life and health of employees, which cannot but reduce the motivation to work. This indicator will look like:

This indicator will look like:

$$M_6 = \frac{NE_H}{\overline{NE}} \times 100\%$$

Where M_6, NE_H - the share and number of employees with harmful working conditions, respectively.

3. Results

We studied the dynamics of motivational factors by type of economic activity in Ukraine in 2013-2019. The choice of this period was determined by the available data of the State Statistics Service of Ukraine in the open access [10]. In 2013, the system of indicators for labor statistics in Ukraine underwent certain changes. Therefore, the possibility of conducting a retrospective analysis on earlier periods is limited. Table 1 shows the results of a generalized analysis of the dynamics of M_1 and M_2 indicators by type of economic activity in 2013-2019.

Table 1. Dynamics of staff turnover and part of the number of employees on unpaid leave in 2013-2019

	M_1, %		M_2, %	
	2019	Absolute change, %	2019	Absolute change, %
1	2	3	4	5
Agriculture	54.8%	-5.8%	0.3%	-0.3%
The mining industry	21.0%	-0.3%	0.5%	+0.1%
Processing industry	35.7%	+2.6%	0.8%	-2.7%
Supply of electricity, gas	23.6%	+2.2%	0.4%	+0.3%
Water supply, sewerage and waste	24.6%	-3.1%	0.2%	-0.1%
Construction	51.5%	-0.2%	0.3%	-5.7%
Wholesale and retail trade	53.2%	+0.5%	0.1%	-0.2%
Transport, warehousing	33.2%	+5.5%	0.1%	-0.4%
Financial and insurance activities	36.4%	+2.2%	0.2%	0.0%
Professional, scientific and technical activities	33.2%	+5.0%	0.1%	-0.1%
Education	17.4%	+4.5%	0.0%	0.0%
Health care	19.5%	-0.8%	0.0%	0.0%
Provision of other types of services	40.8%	+9.7%	0.1%	-0.4%
Total	32.7%	+2.9%	0.2%	-0.7%

Columns (2) and (4) of Table 1 show the results of calculating these indicators according to the data of 2019, and columns (3) and (5) show their total absolute growth during 2013-2019. As it can be seen, the staff turnover in 2019 is 32.7% on average in the economy. At the same time, it increased by 2.9%, which indicates a general negative trend of reducing the level of labor motivation. This was the case in most economic activities. That is, the socio-economic conditions contributed to the increase in the outflow of labor. The worst situation was observed in agriculture, where M_1 = 54.8%. The main reason for this is the seasonal nature of labor. Also, high turnover was in trade (53.2%) and

construction (51.6%). On the other hand, the education sector (17.4%) and the health sector (19.5%) have a low percentage of dismissed employees.

As noted above, financial problems due to inefficient operating activities due to the economic crisis and the loss of solvency in many domestic enterprises often led to a forced reduction in the wage fund. Accordingly, the share of full-time employees on leave without pay in 2019 was M_2 = 0.24%. At the same time, the worst situation occurred in the processing (0.82%) and mining (0.49%) industries. Education (0.01%) and healthcare (0.05%) were again among the most successful areas in this indicator, due to the high proportion of enterprises and public sector organizations. The data in column (5) shows that significant progress has been made in this direction in recent years, in particular in construction (-5.7%) and the processing industry (-2.7%).

According to the motivational factors discussed above, the following indicators, the dynamics of which is shown in Table 2, are the share of employees transferred to a part-time working weeks and the level of wage arrears.

Table 2. Dynamics of the share of workers transferred to part-time workweeks and levels of wage arrears in 2013-2019

	M_3, %		M_4, %	
	2019	Absolute change, %	2019	Absolute change, %
Agriculture	0.7%	-5.0%	0.8%	-1.2%
The mining industry	1.9%	-2.5%	24.1%	+22.8%
Processing industry	6.2%	-12.9%	11.4%	+6.1%
Supply of electricity, gas	2.9%	-3.5%	1.0%	+0.6%
Water supply, sewerage and waste	0.5%	-5.5%	4.1%	+1.5%
Construction	1.1%	-20.4%	2.4%	-5.3%
Wholesale and retail trade	0.2%	-2.4%	0.5%	0.0%
Transport, warehousing	1.7%	-25.3%	2.8%	-4.5%
Financial and insurance activities	0.4%	-1.6%	1.6%	-0.2%
Professional, scientific and technical activities	1.3%	-2.3%	1.9%	-0.3%
Education	0.0%	-0.1%	0.1%	0.0%
Health care	0.1%	-0.4%	0.3%	+0.1%
Provision of other types of services	0.5%	-2.8%	0.2%	-0.2%
Total	1.7%	-6.0%	3.9%	+1.4%

Data in Table 2 indicates that in 2019 among full-time employees, only M_3 = 1.7% were transferred to part-time work. Moreover, since 2013, this indicator has decreased by 6%, which has little positive effect on the motivation of labor in all types of economic activity

without exception. The most vulnerable were, again, the industrial enterprises: mining (1.9%), processing (6.2%), and electricity and gas suppliers (2.9%). During the study period, the overall improvement in this indicator occurred in transport (-25.3%) and in construction (-20.4%). In the health education sectors, the share of part-time workers was almost 0%.

The average national level of wage arrears in 2019 was M_4 = 3.9% of the monthly fund. Although this indicator has tended to improve since 2015, the economic crisis of 2014-2015 was much more severe. Therefore, the level of 2013 for M_4 at the end of the study period was not reached. The industrial sector of the economy suffered the most from this. Thus, in the mining industry, the level of wage arrears increased by 22.8% to 24.1%, and in the processing industry by 6.1% to 11.4%. Comparison of the calculated values and dynamics of the motivational factors M_2, M_3, and M_4 showed the presence of a complex problem of these types of activities in this area of analysis. Given that the share of the mining and processing industry in the country's GDP is about 26%, this may affect labor productivity and the competitiveness of the economy as a whole. Similarly, the lowest levels of debt were found in education (0.1%), other services (0.2%), and health (0.3%).

The dynamics of the last two motivational factors, M_5 and M_6 in 2013-2019, in the context of types of economic activity, are shown in Table 3.

Table 3. Dynamics of the ratio of the average wage to the actual subsistence minimum and the share of full-time employees with harmful working conditions in 2013-2019

	M_5, %		M_6, %	
	2019	Absolute change, %	2019	Absolute change, %
Agriculture	206%	+9.2%	10.1%	+2.6%
The mining industry	364%	-79.4%	66.2%	-5.9%
Processing industry	256%	-21.9%	26.6%	-0.7%
Supply of electricity, gas	326%	-53.2%	34.2%	+0.6%
Water supply, sewerage and waste	195%	-38.3%	31.8%	+1.0%
Construction	218%	-9.7%	16.9%	+0.7%
Wholesale and retail trade	251%	-2.1%	–	–
Transport, warehousing	272%	-29.7%	23.8%	-0.2%
Financial and insurance activities	370%	-72.8%	–	–
Professional, scientific and technical activities	310%	+0.1%	–	–
Education	189%	-37.9%	–	–
Health care	163%	-35.8%	–	–
Provision of other types of services	259%	-37.2%	–	–
Total	244%	-30.5%	11.2%	-0.8%

In the world practice, several approaches are used to determine the amount of the subsistence minimum. In Ukraine, the subsistence minimum is understood as the cost estimate of the consumer basket, taking into account the minimum set of food and non-food goods and services necessary to preserve human health and ensure its vital activity [11].

On the other hand, the actual subsistence minimum is calculated on the basis of average prices for consumer goods and services, as well as tariffs for housing and communal services. Given these definitions, it is the actual subsistence minimum that is more consistent with the actual amount of necessary expenditures, per capita. Therefore, it was taken as the basis for calculating the M_5 indicator. At the end of 2013, it was UAH 1,188 and at the end of 2019 – UAH 4,296.

In the economy as a whole, the average salary of full-time employees at the end of the reporting period exceeded the actual subsistence minimum by M_5 = 2.44 times. However, this is 30.5% less than in 2013, which means that there are negative trends in the redistribution of public spending in favor of priority goods and services, which cannot have an additional motivating effect. The highest level of the M_5 index in 2019 was typical for financial and insurance activities (370%), the extractive industry (364%), and the supply of electricity and gas (326%). The lowest level occurred in healthcare (163%) and education (189%).

Some economic activities are related to harmful working conditions that directly affect the health of full-time employees and life expectancy. This weakens the motivation to work, especially in middle age, when the health status of people begins to gradually deteriorate. In the whole country, the share of such workers is about M_6 = 11.2%. At the same time, the most harmful conditions are traditionally characteristic of the industrial sector of the economy. For example, in the mining industry at the end of the period, this indicator exceeded 66%.

Thus, we analyzed the current state and dynamics of labor motivation indicators in 2013-2019 in the context of economic activities. The next stage of the analysis should be to determine their impact on the competitive development of the economy.

The concept of competitiveness of the national economy on the basis of foreign experience has been studied by many domestic scientists, among whom should be mentioned: Ya. B. Bazilyuk, M. A. Kizim, E. M. Kryachko, A. A. Shvidanenko, and others

[12-14]. The analysis of the interpretations allows us to conclude that competitiveness is always based on competitive advantages, the composition of which directly depends on the goals of the study. Thus, competitiveness is a relative concept that is subject to a system of national priorities. In determining them, we will proceed from the following problems that require urgent solutions:

- technological backwardness in most sectors of the economy, especially those related to material production;
- the lack of sustainable economic growth that would allow improving the standard of living of the population;
- an open economy implies free competition for consumers in both domestic and foreign markets. The goal of strengthening the position of domestic producers in foreign markets is to improve the balance of payments and ensure solvent demand for products.

According to this, we will consider the following indicators as indicators of the competitiveness of the national economy:

The share of value added in total output. In its economic essence, the share of value added is a criterion for the efficiency of social production, which directly depends on the technological development of individual industries and the country's economy as a whole. It is the use of modern technologies in all areas that is the source of rapid economic growth.

The rate of economic growth. The only way to improve the lives of the population is to ensure sustainable development. Despite the economic crisis of 2014-2015, as a result of which the physical volume of Ukraine's GDP decreased by 14.8%, the gap from the level of 2013 at the end of the reporting period was still 3.5%. It should also be noted that it is the countries with a small GDP per capita that have the greatest potential for rapid development. On the other hand, it is much more difficult for developed countries to maintain high GDP growth rates.

The share of net exports in total output. The country's balance of payments is one of the most important factors for ensuring the stability of the national currency. The export of products to foreign markets reduces the dependence of national producers on the crisis phenomena within the country. The competitiveness of domestic products in terms of technical and economic parameters directly affects the value of exports, and so on.

The study of the available statistical dependencies between the set of motivational factors and the specified indicators of competitive development of the economy allowed us to identify certain quantitative patterns between them. In particular, such dependencies occurred between the factors of motivation of labor resources and the sectoral rates of economic growth. At the same time, there was no sustained impact on the share of industry value added and net exports.

Directly, motivational factors can influence the average level of labor productivity of employees. Which, in turn, determines the sectoral rates of economic growth, taking into account the dynamics of the number of labor resources.

(5) $$RO_i = RNE_i \times RP_i$$

Where RO_i, RNE_i, and RP_i are, respectively, the growth rates of the physical volume of output, the number of employees, and labor productivity for each type of economic activity.

The search for functional relationships between the growth rates of labor productivity for each type of economic activity and the corresponding motivational factors in this study was performed using regression-correlation analysis, taking into account certain prerequisites and criteria.

The statistical database of observations is based on semi-annual data from 2013-2019. That is why the number of factors in each regression model was limited to two, which were selected using linear correlation coefficients. The variational analysis of the input data showed that with a confidence of 90%, they can be used for regression analysis.

Verification of the adequacy of all the constructed dependencies was performed using the Fisher criterion and with 90% confidence confirmed its compliance for each specific case. Also, a necessary stage of the analysis was to check the statistical significance of all the coefficients of the obtained regression using the Student's t- criterion. According to the results of these tests, not for all types of economic activity, the list of which is given in Table 1, it was possible to establish a stable relationship between motivational factors and the dynamics of labor productivity.

The final stage of the regression analysis involved checking the unaccounted vestiges for compliance with the normal distribution law using the Pearson's criterion χ^2.

The essence of this criterion, as well as the previous ones, assumed a comparison of the calculated values χ^2 with the critical level.

In agriculture, the most important motivational factors affecting the productivity of full-time workers were the ratio of wages to the actual subsistence minimum and harmful working conditions. The corresponding constructed dependency has the form:

$$RP_A = 1{,}0579 + 0{,}1930M_5 - 3{,}8073M_6,$$

Where RP_A is the rate of labor productivity growth per one full-time employee in agriculture.

According to the results of statistical verification of the input data, it was not possible to identify adequate regression dependencies for such types of economic activities as: supply of electricity, gas and steam, wholesale and retail trade, transport and warehousing, professional, scientific and technical activities, and so on. For all other types of activity, the influence of motivational factors on the growth rate of labor productivity is represented by a system of equations (7)-(14).

(7) $$RP_{MI} = 2{,}9703 - 0{,}7184M_4 - 2{,}6254M_6$$

(8) $$RP_{PI} = 4{,}9774 - 1{,}9799M_1 - 12{,}2448M_6$$

(9) $$RP_{WS} = 0{,}9385 - 1{,}1274M_3 + 0{,}0577M_6$$

(10) $$RP_C = 1{,}2223 - 0{,}1072M_1 - 0{,}8773M_3$$

(11) $$RP_F = 1{,}3950 - 25{,}8209M_2 - 11{,}0488M_4$$

(12) $$RP_E = 1{,}1177 - 0{,}4398M_1 - 23{,}2048M_2$$

(13) $$RP_{HC} = 1{,}2278 - 0{,}9912M_1 - 12{,}1712M_2$$

(14) $$RP_{OS} = 1{,}1137 - 0{,}9440M_2 - 0{,}7339M_3$$

Where RP_{MI}, RP_{PI}, RP_{WS}, RP_C, RP_F, RP_E, RP_{HC}, RP_{OS} –the growth rate of labor productivity per full-time employee in the mining industry, processing industry, water supply and waste management, construction, financial and insurance activities, education, healthcare, and other types of services, respectively.

The resulting equations (6)-(14) can be used to calculate the reserves of labor productivity growth by meeting the motivational needs of the labor force. Figure 1 shows

the results of such an assessment, provided that the values of motivational factors improve by 5%.

Figure 1. The results of calculating the reserve for the growth of labor productivity by type of economic activity
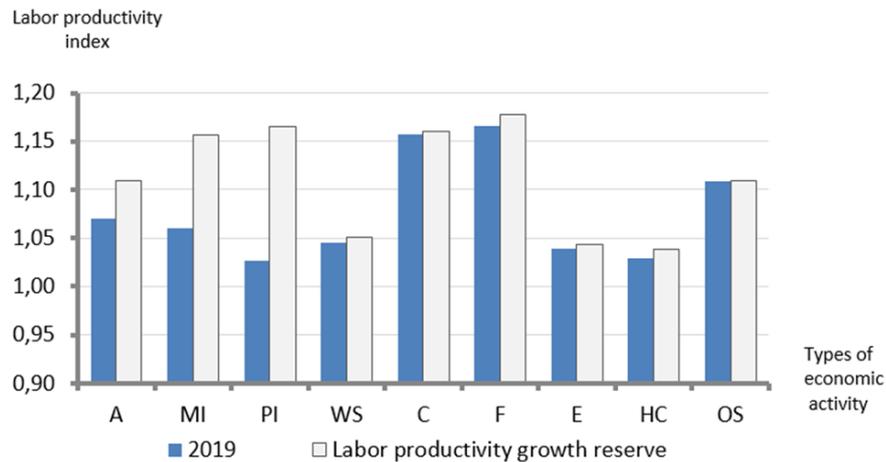
As can be seen from Fig. 1, the largest reserves for the growth of labor productivity, per worker, are in:

- the processing industry, where the highest dependence of the effective indicator of $⟦RP⟧\_PI$ was on staff turnover and a high proportion of harmful labor;
- mining industry, where the $⟦RP⟧\_MI$ indicator depended on the level of wage arrears and a high share of harmful and life-threatening production, and so on.

This, accordingly, will have a positive impact on the industry's economic growth rates.

3. Conclusions

The scientific novelty of this work is creating of a system of regression equations for the dependence of industrial labor productivity on motivational factors, in contrast to existing approaches, establishes a quantitative relationship between these indicators and allows to determine the reserves of competitive economic development.

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Forecast of Agricultural Production in Ukraine Under Martial Law: Results of the Regression Analysis

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Abstract: Due to Russia's aggressive invasion, Ukraine is losing not only infrastructure and industrial facilities, but also sown areas. This situation will have a negative impact on food security not only in Ukraine, but also in Europe, the Middle Eastm and North Africa. According to official data of the State Statistics Service of Ukraine, regional military administrations, and from open sources, in 2022 Ukraine could not sow a significant area of crops, which according to authors' estimates could be 75%, 50%, or 25%. Therefore, the issue of providing agricultural products not only to Ukraine, but also to partner countries that import Ukrainian grains, vegetables and other crops is of practical interest. It is obvious that crop losses are significant if 75%, 50%, or 25% of the lands of a particular region are active in combat, and it is impossible to conduct a sowing campaign. The relationship between the volume of production (gross harvest) of cereals and legumes and their sown area on the basis of many years of research has been done on the basis of correlation-regression modeling for more than thirty years. According to FAO estimates, between 20% and 30% of fields used for growing crops in Ukraine, such as winter cereals, maize, or sunflower, may not be sown or will remain unharvested during the 2022-2023 season. In addition, crop yields are expected to decline by 10% due to the delayed or missed fertilizer application times, inability to control possible diseases, pests, delayed harvesting, lack of manpower or infrastructure capacity for autumn harvesting. According to Ukrainian experts, in 2022 the sown area in Ukraine is 78% of last year's figures, and the total area under crops decreased by 2.5 million hectares. In this work. made on the basis of an analytical method, the forecast of productivity in the conditions of military aggression of Russia against Ukraine at change of sown territories has been formed. Management of agriculture is now an important area that covers not only the science of food production, but also the practical activities of creating an agricultural product. A set of measures for economic stimulation of agricultural cultivation of important crops has been developed, the foundations for the development of partnership between the government and agricultural business and the population have been formed. The best principles of decentralization reform, such as the Republic of Poland in the field of agricultural production, have been applied.

Keywords: Crops, Sown area, Economy, Cereals, Legumes, Correlation-Regression Modeling, Martial Law.

JEL: Q 1, Q 13, Q17, F16, M38

Introduction

Ukraine provides grain crops to many countries around the world. Therefore, a reduction in crop yields will affect food security in the world's poorest countries. All this requires the development of a mechanism for maintaining sown areas at least at the level of 2021 in Ukraine and the joint progress of European countries against the aggression of the Russian Federation.

During the war, farmers seek to increase the area under crops and change their structure in relatively peaceful regions where there are no active hostilities. For example, this year, the farmers of Lviv region want to increase the sown area. Additionally, the areas that have been deforested will be used. The total sown area will be over 707 thousand hectares. In particular, spring crops are planned to be sown on an area of 440 thousand hectares, which is 5 thousand hectares more than last year. The structure of sown areas will depend on the supply of imported resources and parts for agricultural machinery. In case of shortage of imported seeds, farmers will sow those crops whose seeds are in stock.

The main *objectives* of this work are the integration of different knowledge of the field of cultivation and evaluation of economic indicators of sales of agricultural products and research from different sectoral, managerial, military, political, economic points of view and the development of an effective system for crop yields in modern military conditions of Ukraine, including the introduction of international experience in food security in the context of sustainable development. The *object* of this article is the sown area and yield of grain crops in Ukraine in the current state of martial law during the Russian aggression. The *subject* of research is the process of overcoming the food crisis based on the combined efforts of Poland and Ukraine, as well as the development of international trade between Ukraine and the European Union. The main *purpose* of this article is to establish the relationship between simple sowing of cereals and yield, as well as forecasting yields in Ukraine in the near future for different authors' scenarios of sowing areas – 75%, 50%, and 25%. Important for Ukraine is Poland's positive experience in developing international trade and improving food security, comparing the economic performance of the two countries and developing recommendations for promoting food security and overcoming the food crisis.

Theoretical premises

As the world population grows, global food production is projected to double by 2050 to feed the population. All this requires an increase in the harvest and the search for new areas for planting agricultural crops. In addition, the cultivation of agricultural products faces the negative impact of such factors as climate change, the reduction of biodiversity, the deterioration of soil and water quality, and the demands of the world market are steadily growing. New effective mechanisms for stimulating the activities of farmers in the cultivation of agricultural products are needed. It is worth noting that, at the same time, EU agricultural policy has changed significantly in recent years in line with the need to help farmers overcome these challenges and respond to changing attitudes and expectations. The current EU agricultural policy covers a wide range of areas and instruments, including economic, organizational, food quality, traceability, trade and promotion of EU agricultural products. Developed countries promote and protect the development of agricultural business. The EU has long supported its farmers financially and encouraged sustainable and environmentally friendly farming, as well as a significant increase in investment in rural development. EU institutions cooperate in the formation of food and agricultural policy, its implementation, monitoring and evaluation. National and local authorities form and enforce laws agreed at the EU level. Through the EU budget, funds are provided to member states in accordance with rules established at the EU level. The EU also monitors how these laws are applied, how effective they are, and coordinates the necessary overdue changes (Vibrant rural areas and quality agricultural products, 2022).

As noted by scientists W. Edwards, P. Duffy, existing problems related to the state of the environment and climate significantly affect the state of agricultural production. Because the cultivation of crops has always involved exploitation of resources such as water, soil and energy. Challenges regarding the necessary increase in production must be overcome to feed the growing world population. This must be done while preserving resources for future generations, so it is worth finding such sustainable methods of farming. At the same time, farmers should be aware of the need to preserve the environment, have a long-term view of tireless methods of soil cultivation, when deciding which technologies to use and which products to produce. Farmers cannot and should not give up profit, so they

need to find a balance and adapt their production methods according to the sustainable development of their territories (Edwards W., Duffy P., 2014).

Researchers K. Garbach, F.A.J. DeClerck emphasize that hydrological services, namely flow regulation and the need for water treatment, must be considered when growing agricultural crops. In their opinion, in general, agricultural production depends on many ecosystem services, primarily water-related, from water supply to water quality and treatment and flood protection. Because agroecosystems are the main consumers of groundwater and surface water, they account for approximately 70-90% of freshwater use worldwide. Scientists consider irrigation to be the main consumptive use of water, as water is not returned directly to rivers and streams (Garbach K., DeClerck F.A.J., 2014).

Russia's military aggression against Ukraine makes fundamentally new demands on the spring sowing campaign in Ukraine in 2022. According to FAO estimates, between 20% and 30% of fields used for growing crops such as winter cereals, maize or sunflower in Ukraine may not be sown or remain unharvested during the 2022-2023 season. In addition, crop yields are expected to decline by 10% due to the delayed or missed fertilizer application times, inability to control possible diseases, pests, delayed harvesting, lack of manpower or infrastructure capacity for autumn harvesting (Проблемні аспекти посівної кампанії в Україні, 2022). Management of agriculture is now an important area that covers not only the science of food production, but also the practical activities of creating an agricultural product. This concept is quite broad and also includes farming techniques, domestication of animals, and general food processing. There is a lot of agricultural work that requires guidance, especially on projects that work in scientific disciplines and with agricultural work. Given the changing dynamics of world food production, this area is now one of the fastest growing in the world.

Literature Review

A large number of scientists have studied and are currently studying ways to provide the population with food produced by agriculture. Agro-industrial production of the crop industry occupies a prominent place in the structure of consumption. David Leclere believes that climate is now one of the promising factors in European agricultural production. According to the researcher, the demand for agricultural products will increase with the

increase of the world's population and the share of disposable income. Global trade in agricultural products will also increase, and ongoing research and development will help increase agricultural yields. Future agricultural harvests will also be affected by such factor as climate change (Leclere, D., 2022).

Moreover as M. Kriesberg points out; in LDCs the consumer frequently spends in excess of fifty percent of the household's income on basic foodstuffs – much of which is inadequate both in quality and nutritional content. By contrast Americans on food spend approximately twelve percent of their total disposable income. In Western Europe the figure ranges from about sixteen to nineteen percent of disposable income. Furthermore, whereas in developed countries the poor are relatively few in number, and therefore it is economically possible to establish special food distribution programmes to meet their needs, the scale of poverty in most LDCs is such that the commercial marketing system must be relied upon to perform the task of food distribution to poor and not-so-poor alike. This being so, it is imperative that the marketing system performs efficiently (Kriesberg, M., 1974). G. Dixie suggests that as countries experience economic growth, their rate of urbanisation tends to increase substantially (Dixie, G., 1989). Famous scientist P. Rosson conceives of agricultural and food marketing systems as consisting of four main sub-systems: distribution, production, consumption and regulatory (Rosson, P., 1974). P. Kotler emphasizes that: "ost firms practice the selling concept when they have overcapacity. Their immediate aim is to sell what they can make rather than to make what they can sell". There is no denying that 'high pressure selling' is practiced, where the interests of the consumer are far from foremost in the mind of the seller (Kotler, P., 1988).

The EU produces around 300 million tonnes of cereals per year and it is traditionally a net exporter. Cereals in the EU are not only used for food and feed, but also as feedstock for the bio economy (European Commission, Agri-food data portal).

Methodology

This paper analyzes the impact of the transformation of the agricultural production regime, the dynamics of sown areas on the efficiency of agricultural production of farmers based on the model of correlation-regression analysis, classical theory of division of labor and specialization, transaction costs and cooperation. The work is based on real statistical

indicators of agricultural production and their analysis of data for 1991-2021. The methodology of the statistical survey is the official data of the State Statistics Committee of Ukraine. The model of agricultural production allowed to predict the yield of grain crops under martial law in Ukraine. Such a long-term model should be used when assessing food security indicators for management decisions and regulating the area of land allocated for different crops. The methodology of this article is based on the correlation-regression model of the dependence of crop yields on their sown areas in compliance with national security indicators. Farmers involved in the agricultural division of labor and cooperatives are transforming their agricultural production from a traditional self-sufficient way to a specialized and intensive one. The agricultural division of labor, measured by farmers' participation in the agricultural division of labor at the stages of production or in agricultural production, and agricultural cooperatives, measured by farmers' participation in farmers' cooperatives, have a significant and positive effect on their agricultural production after endogenous adjustment. The originality of the work is based on a unified basis for the analysis of the impact of the transformation of the regime of agricultural production of farmers on the efficiency of their production in modern military conditions in Ukraine. The methodological basis of this article is the publications of domestic and foreign scientists in the field of agricultural production and public administration.

An interdependence between the volume of production (gross harvest) of cereals and legumes in Ukraine and their sown areas on the basis of correlation-regression modeling (years 1991-2021) has been detected. The relationship between the volume of production of cereals and legumes in Ukraine and their sown areas in is close to linear, so in this case, as a relationship between variables, it is advisable to choose a linear function.

The selective linear regression function in this case will look like:

(1)
$$\hat{y} = b_0 + b_1 x$$

whereas $\hat{y}$ – estimation of mathematical expectation of the dependent variable model (volume of production (gross harvest) of cereals and legumes in Ukraine); x – independent model variable (sown areas of cereals and legumes in Ukraine); b, b – selective regression parameters.

The research methodology is based on the assessment of international trade between Ukraine, Poland, and other European Union countries in order to assess the current

state and place of agricultural production of cereals and legumes. According to EU concepts and definitions, non-EU trade statistics (trade between the EU Member States and non-EU countries) do not record exchanges related to transit goods placed in customs warehouses or temporary admission (for fairs, temporary exhibitions, tests, etc.). This is known as "special trade". The partner is the country of final destination of the goods for export and the country of origin for import.

Results

In many developing countries, including Ukraine, agriculture is the largest separate sector of the national economy. Agriculture typically employs more than 50 % of the workforce, and industry and trade depend on agricultural resources as a source of raw materials. It is obvious that the development of agriculture and marketing systems that affect it are the basis of the process of economic growth of each state. Economic development itself gives impetus to more sophisticated and effective marketing systems. While population growth rates in developing countries average about three percent per year, their cities increase their population by about four percent annually. Of course, this means that the number of people in cities in need of agricultural products will double in a quarter of a century. This has clear implications for agricultural production and marketing systems that direct this production and distribute products to places of consumption. The value of subsistence farming is likely to decline as farmers respond to the opportunities offered by development and urbanization. As a result, the number of farms will decrease with a simultaneous increase in their size; and agriculture is likely to become less labor-intensive and more capital-intensive (Agricultural and Food Marketing Management, 2022).

In 2022, in the conditions of the Russian war, Ukraine managed to sow a significant area of crops. Of course, compared to 2021, all indicators of crops in the territories are significantly lower. The area under sunflower is 4.27 million hectares (87% of the planned 4.93 million hectares), corn – 4.41 million hectares (91% of 4.85 million hectares), spring barley – 928.4 thousand hectares 91% of 1.02 million hectares), spring wheat – 189.3 thousand hectares (99.7% of 189.6 thousand hectares), oats – 156.9 thousand hectares (96% of 163.6 thousand hectares). peas – 125.9 thousand hectares (86% of 145.7 thousand

hectares). The sown area under potatoes in Ukraine in 2022 is 1.11 million hectares (93% of 1.19 million hectares), soybeans – 1.15 thousand hectares (92% of 1.25 million has), sugar beet – 182.1 thousand ha (88% of 206.9 thousand ha), spring rape – 31.7 thousand ha (plan implemented), millet – 41.3 thousand ha (66% of 62.3 thousand ha), buckwheat – 57.7 thousand hectares (70% of 81.6 thousand ha). It is noted that the sown area has already amounted to 78% of last year's figures, in which 16.92 million hectares were sown. Also, according to the Ministry of Agrarian Policy, in 2021 winter crops were sown for the 2022 harvest on a total area of 7.7 million ha, including 6.5 million ha of winter wheat, 1 million hectares of barley and 0.16 million hectares wheat. Throught the war, about a third of the area could not be sown, but sown areas could be increased if the fields were cleared of destroyed military equipment (Посівна в Україні підходить до завершення, 2022).

In Ukraine, the sowing campaign in 2022 has a number of important features:

1. the need to reseed frozen crops, which are expected to be in demand in domestic and foreign markets (especially socially important cereals);

2. restricting the export of certain food groups (oats, millet, buckwheat, sugar, rye) introduced by Ukraine in connection with the martial law;

3. inability to conduct field work in those areas with active hostilities (southern and eastern regions of Ukraine);

4. violation of the logistics of supply of fuels and lubricants, fertilizers, and seeds for field work;

5. change in regional domestic demand due to the relocation of a significant number of people forced to flee their homes due to active hostilities and the destruction of social infrastructure.

Thus, the sown area of winter crops for the harvest of 2022 in Ukraine as a whole was 0.5% higher than in 2021. Rapeseed crops increased by 39.7%, while the area under other winter crops decreased: wheat – by 2.6%, rye – by 34.9%, barley – by 10.4%. The structure of sown areas of winter crops for the harvest of 2022 has been investigated. Sown areas of winter wheat for the harvest of 2022 in In Sumy region the area of crops was 2.6% of total crops in Ukraine Odessa – 8.4%, Mykolaiv – 6.7%, Kherson – 7.0%, Kharkiv – 8.8%, Zaporizhia – 10%, in total it is 43.4%. The sown area for the harvest of winter rye in 2022 in general in the specified areas makes 11,4% (Kharkiv and Kherson – 2.1%, in the Sumy – 5.1%;

Nikolaev area – 0,1%, Odessa – 0,4%, Zaporizhia – 1,7%), barley – 65.8% (in Sumy – 0.4%, Kharkiv – 1.3%, Zaporozhye – 8.2%, Kherson – 10.8%, Mykolaiv – 20.0%, Odessa – 25.2%), rape – 40.7% (in Kharkiv – 1.1%, Sumy – 2.0%, Kherson – 7.2%, Mykolaiv 8.3%), Zaporizhia 8.8%, Odessa 13.2%) of the total in Ukraine.

In 2021, the EU countries remained the main supplier of agricultural products to Ukraine. In 2021, Ukraine imported 8.2 billion $ worth of agricultural products, 19% more than in 2020, when imports amounted to 6.9 billion $. Total imports from these countries reached 4,217 million $ (3,554 million $ in 2020). The share of EU products in the structure of total agricultural imports last year was 51.6%. Although purchases from other regions increased, the absolute and relative rates of imports from those regions were much lower. Imports of food products from Asia amounted to 1,533 million $ (18.7% of total imports), from Latin America – 634 million $ (7.8%), from CIS countries at 343 million $ (4.2%), and from Africa at 342 million $ (4.2%) (Ukrainian imports of agricultural products, 2021).

According to the United Nations COMTRADE database on international trade (Poland Imports from Ukraine, 2022), Poland imports from Ukraine amounted to 5.04 billion $ during 2021 (Fig. 1). In 2021, Poland has imported from Ukraine cereal, flour, starch, milk preparations and products for the total value of 15,55 mln dollars. The exports, imports and trade balance between the EU and Ukraine have been analyzed from 2011 to 2021. EU exports to Ukraine were highest in 2021 (28 billion €) and lowest in 2015 (14 billion €). In 2011, the EU had a trade surplus with Ukraine of 6 billion €. The trade surplus remained throughout the whole period, reaching 4 billion € in 2021. EU imports from Ukraine were highest in 2021 (24 billion €) and lowest in 2015 (13 billion €). Both exports to and imports from Ukraine increased between 2011 and 2021 (Ukraine-EU – international trade in goods statistics, 2022). The analytical data show that 58.6% of products exported from Ukraine were bought by importers in: China (14.4% of the global total), Poland (7%), Russia (5.5%), Turkey (4.9%), Germany (4.2%), India (4%), Italy (3.9%), Netherlands (3.7%), Egypt (3.3%), Belarus (2.7%), Hungary (2.5%), and Spain (also 2.5%).

Figure 1. Dynamics of Polish import from Ukraine, 2012-2021
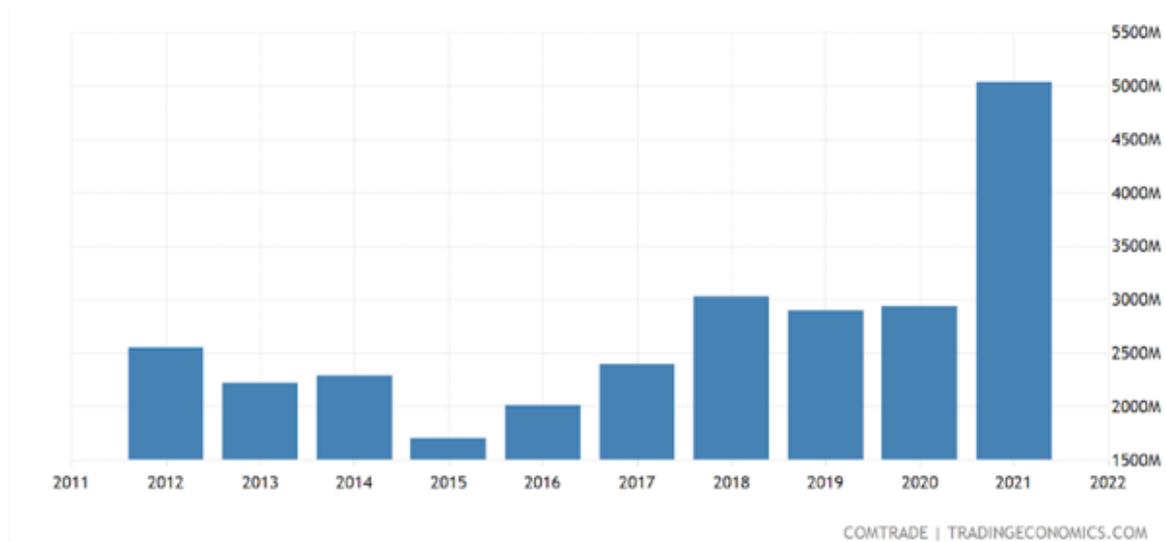
Source: from the data (Poland Imports from Ukraine, 2022).

Figure 2. Dynamics of international trade between European Union and Ukraine, 2011-2021
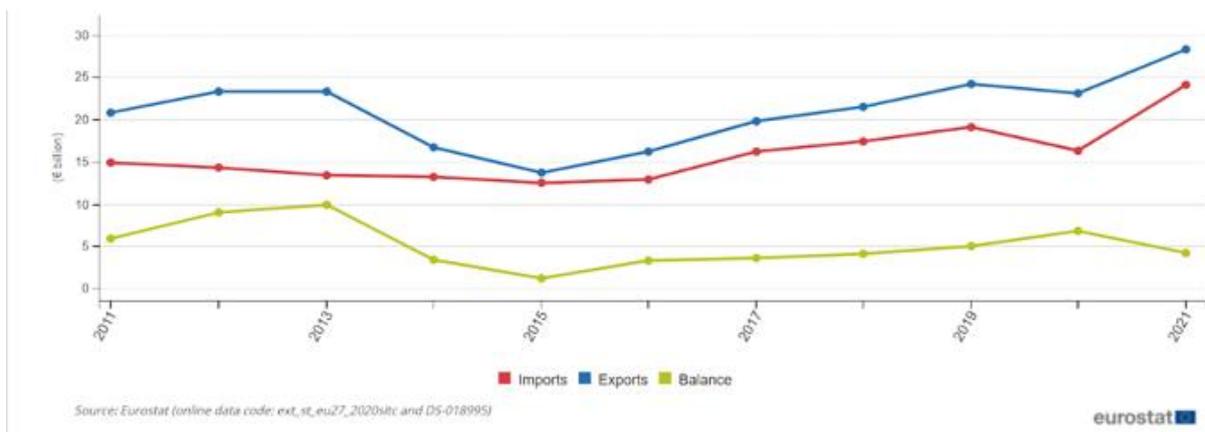
Source: from the data (Ukraine-EU – international trade in goods statistics, 2022).

A sovereign state in Eastern Europe, Ukraine exported 68.9 billion $ worth of goods around the globe in 2021. From 2020 to 2021, the value of Ukraine's exports accelerated by 33.4%. The five most valuable exported products from Ukraine generated 41.9% of the Eastern European country's total international sales in 2021. At the more detailed 4-digit Harmonized Tariff System (HTS) code level, Ukraine's top money-making shipments were for: iron ores or concentrates, sunflower-seed or sanfflower oil, corn, wheat and semi-finished products made from iron or non-alloy steel. That dollar amount reflects a 51.7% increase since 2017. Based on the average exchange rate for 2021, the Ukrainian hryvnia depreciated by 2.6% against the US dollar since 2017 and fell by 1.2% from 2020 to 2021.

Ukraine's weaker local currency makes its exports paid for in stronger $ relatively less expensive for international buyers (Ukraine's Top 10 Exports, 2021).

In this work, an interdependence between the volume of production (gross harvest) of cereals and legumes in Ukraine and their sown area on the basis of correlation-regression modeling (1991-2021 years) has been detected (table 1).

Table 1. Regression model of interdependence between the volume gross harvest of cereals and legumes in Ukraine and their sown area (1991-2021 years)

Results (indicators) of modeling	Sowing area of agricultural crops (cereals and legumes), thousand hectares (x)	Volume of production (gross harvest) of agricultural crops (cereals and legumes), thousand tons (Y)		
Yield forecast for 2022, thousand tons (Y)	60198,38	**1991**	14671 (x)	38674 (y)
Year	**1992**	**1993**	**1994**	**1995**	**1996**
x	13903	14305	13527	14152	13248
y	38537	45623	35497	33930	24571
Year	**1997**	**1998**	**1999**	**2000**	**2001**
x	15051	13718	13154	13646	15586
y	35472	26471	24581	24459	39706
Year	**2002**	**2003**	**2004**	**2005**	**2006**
x	15448	12495	15434	15005	14515
y	38804	20234	41809	38016	34258
Year	**2007**	**2008**	**2009**	**2010**	**2011**
x	15115	15636	15837	15090	15724
y	29295	53290	46028	39271	56747
Year	**2012**	**2013**	**2014**	**2015**	**2016**
x	15449	16210	14801	14739	14401
y	46216	63051	63859	60126	66088
Year	**2017**	**2018**	**2019**	**2020**	**2021**
x	14624	14839	15318	15392	15995
y	61917	70057	75143	64933	86010
Indicators	**df**	**SS**	**MS**	**Fisher's Cr. (F)**	**Significance F**
Regression	1	3266775247	3266775247	17.89677884	0,00021328
The rest	29	5293493484	182534258.1	F_{cr}	4.182964
Total	30	8560268731		t_{cr}	2.045229642
Standard Error	*t*-Statistics		*P*-Meaning	**Coefficients**	**Upper 95%**
6.936926579	−3.072099665		0.004590022	b_o=−122541	−40960,3178
0.186223649	4.230458466		0.00021328	b_1= 11.424812	16.94817679
Multiple Correlation coefficient R	**Coefficient of Determination R-square**		**Normalized R-square**	**Standard Error**	**Observations of Analysis**
0.617755	0.381621		0.360297	13510.52	31

Source: own work.

The authors estimate the planned harvest of cereals and legumes in Ukraine according to three scenarios. Such scenarios are possible due to forecasts of yield in Ukraine for the near future for various sown areas – 75%, 50%, or 25%. Based on modeling, the authors calculated the yield forecast for 2022, which is 60.2 million tons in regular conditions. So, then we calculate on this basis the amount of harvested crop in martial law: 75% (45.1 million tons); 50% – 30.1 million tons; 25% – 15.1 million tons.

According to the results of Table 1, the correlation model obtained in this study of the dependence of volume of production (gross harvest) of cereals and legumes in Ukraine and their sown area on the basis of correlation-regression modeling (1991-2021 years) has the form:

(1) $$Y=-122541x +11,43$$

To find estimates of the parameters of the model b, b used the value of the sowing area of agricultural crops (cereals and legumes) and volume of production (gross harvest) of agricultural crops in Ukraine, for 1991-2021. As a result of calculations, the values of the model parameters were obtained $b=-122541$; $b=11.423$. Since Fisher's criterion is $F=17.896$, which is more than its critical value of $F=4.183$, the model is adequate and statistically significant. Since the values of $b=-122541$ and $b=11.424812$ are greater than its critical value, $t=2.045$, which also confirms the adequacy and significance of this regression model.

The degree of closeness of the linear relationship between the model variables was estimated using the correlation coefficient ($R=0.62$), it was concluded that there is a close linear relationship between the indicators of the model.

The scientific result of this study is that the authors were able to predict the yield of crops in Ukraine in 2022, which will be 60.2 million tons. This is much less than in 2021. However, given the loss of sown areas under martial law in Ukraine, the actual harvest will be even smaller and will range between 50-75%, according to the authors, it will be only a 30.1-45.15 million tons. Under the conditions of martial law in Ukraine, the growing agricultural crops have deteriorated. The area of crops has decreased, there are crop losses due to drought, rodents, it is difficult to harvest under of mining fields by Russian aggressors. The sowing campaign was significantly complicated in Ukraine in 2022, the price of plant growth stimulants, pesticides, and herbicides increased significantly. This is an extremely unfavorable situation that will hinder the export of these crops to the markets of the

European Union and other countries. Due to the decrease in harvests, there is a threat of a humanitarian disaster, a decrease in the volume of exports of products of the agricultural sector, and there remains a threat of famine in poor countries due to the non-export of finished products and crops.

Summary, recommendations

The authors summarize the state of the agricultural production of Ukraine in conditions of war in order to implement the best Polish experience. The results of the analysis show that the Poland has developed trade relations with world countries, but needs to import quality Ukrainian grain crops. Therefore, today it is extremely important to preserve and increase the Ukrainian grain harvest in the face of Russian aggression to avoid famine in poor countries.

The authors predict the yield of crops in Ukraine in 2022, which will be 60.2 million tons in regular conditions. Given the loss of sown areas under martial law in Ukraine into account, the actual harvest will be even much smaller (50-75%), it will be only a 30.1 - 45.2 million tons. This is an extremely unfavorable situation that will hinder the export of these crops to the markets of the European Union and other countries. According to the authors' estimates, the planned harvest can fluctuate to three scenarios of yield in Ukraine for various sown areas – 75%, 50%, or 25%. So, the amount of harvested crop: 45.1 million tons (75%); 30.1 million tons (50%); 15.1 million tons (25%).

During seasonal field work, it is proposed to use agricultural machinery on a cooperative basis, in particular at the level of inter-municipal cooperation, to increase the intensity of equipment use by attracting IDP who have relevant practical knowledge as operators of machinery. Today, in conditions of uncertainty, storage and primary processing of agricultural products are of special importance in Ukraine. Therefore, in this aspect, it is advisable to use the results of decentralization and increase the capacity of communities, as happened in the Republic of Poland at the time. In particular, it is necessary to conduct an inventory of the property complex transferred to the ownership of communities in order to possibly re-profile individual facilities for storage, refrigeration and other facilities for storage and primary processing of agricultural raw materials in them.

According to the Ministry of Agrarian Policy of Ukraine, sowing in 2022 is the most difficult in the history of independent Ukraine. It began later, due to the long winter and the destruction of oil depots by Russian missiles and troops. This paper develops measures to improve agricultural production. In particular, the most important thing today is to buy basic means of production: fuel, mineral fertilizers, plant protection products. According to the Ministry of Agrarian Policy and Food of Ukraine, mineral fertilizers have already been purchased in proportion of 80%. It is worth noting that this is enough to get a yield above average. In such circumstances, public-private partnership programs will be effective in addressing food security in Ukraine and around the world. The authors of the article also propose to develop a state program to compensate for interest on loans to cover any costs associated with agricultural activities. State regulation of agricultural activities is also essential. After all, the government will supply fuel and lubricants to enterprises that agree to sow crops defined by the state, as well as forward state and local purchases of new crops. All this will allow adjusting the structure of sown areas of crops in accordance with the priorities of meeting the domestic and foreign markets with important social foods.

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