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The Role of Common Agricultural Policy for Enhancing the Resilience of Rural Areas under the Current Global Challenges

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Abstract: Currently the new Common Agricultural Policy (CAP) for the period 2023-2027 proposes a series of development objectives that allow Member States to design their CAP Strategic Plans for enhancing the resilience of rural areas through targeted actions to increase agricultural production and food security, while supporting climate and environmental objectives. This paper aims to identify the concrete ways in which funding granted through the CAP can contribute to increasing the resilience of rural areas under the global current challenges brought by the COVID-19 crisis and by the war that Russia started in Ukraine, by analysing some key factors: CAP's role for boosting the competitiveness of European agriculture, supporting the growth and employment in rural areas, supporting farm income, financing the environmental objectives and, last but not least, finding solutions to increase food security. For this purpose, the latest statistics on CAP allocations for the two pillars (Pillar I – agriculture and markets and Pillar II – rural development) will be presented, as well as the evolutions of trade in agricultural products and agricultural production at EU-27 level in order to highlight how can CAP respond to the challenges brought by the pandemic, the war in Ukraine and the climate change, while financing the sustainable development of EU's rural areas and supporting a competitive agriculture in the Member States.

Key-Words: Common Agricultural Policy, rural areas resilience, COVID-19 crisis, Russo-Ukrainian war, EU Member States

JEL Classification: *Q01, Q15, Q2, Q28*

1 Introduction – the New Common Agriculture Policy key objectives for 2021-2027

The Common Agricultural Policy (CAP) represents not only one of the oldest common policies of the EU[1], but also the subject of many debates at the level of the European institutions, and in its six decades of existence, it has experienced a series of reforms that have transformed it from a market-oriented policy and direct production support into a true promoter of sustainable rural development and environmentally friendly agriculture (Brown et al., 2021; Czyżewski et al., 2021).

Some studies (Erjavek, 2021; Ţenea, 2021; Nègre, 2021) show that the successive reforms of the CAP contributed not only to the adaptability of this policy, offering adequate financing tools to farmers and to the European agricultural system according to the challenges they faced, but also to a more environmentally friendly approach of the agriculture in all the Member States.

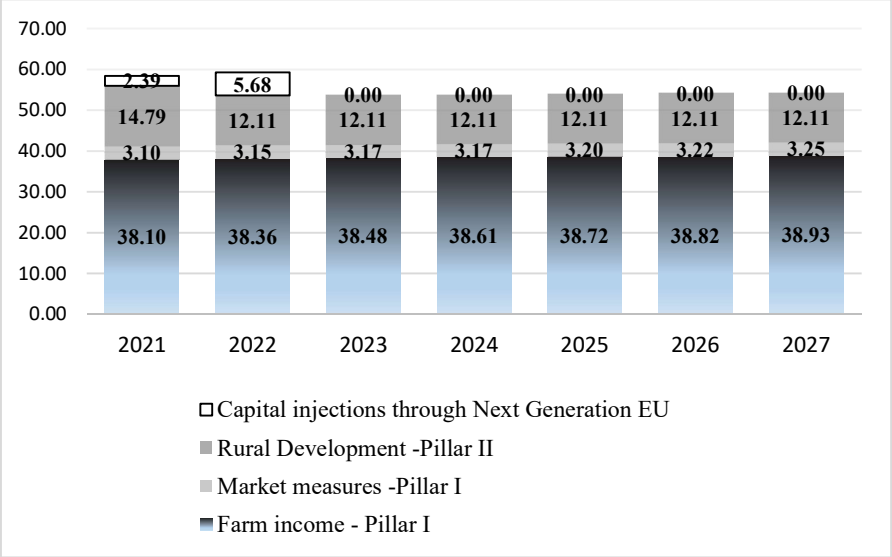
Given that EU agriculture generates more than 40 million jobs and is responsible for the food security of 500 million consumers, the CAP has the mission, in the post-pandemic period, to find the much-needed balance between avoiding a food security crisis and continuing its "greening" process for supporting the sustainable rural development. Regarding this goal, in the Communication of the European Commission on the future of the food and agriculture sector (European Commission, 2017) it is shown that the exposure to the various external shocks of the agricultural markets and the climate changes with the frequency and severity of the natural disasters caused by them can generate very high risks related to the resilience of the agricultural sector in particular with regard to the volatility of agricultural prices and the incomes of European farmers. As a result of these realities, although

[1] The Common Agricultural Policy was launched in 1962 and has the largest funding in the EU budget compared to all other common policies.

farmers are the ones who bear the final responsibility for drawing up their own development strategies for the farms they own, but also for improving their resilience, the European authorities have established, for the period 2023-2027, that they should create a unitary regulatory framework to guarantee adequate risk management, and this framework is represented by the CAP Strategic Plans, the latest funding instrument of the CAP that allows greater flexibility between the two pillars so that Member States can find solutions adequate and fast to the possible future crises that the agricultural sector and the European rural area will face.

Currently the CAP aims to guide the Member States in financing a modern, market-oriented agricultural sector that offers safe, affordable, high-quality and sustainably produced food while respecting consumer standards (environment, animal welfare, food safety, etc.). Also a main goal of CAP is to finance a series of measures and programs intended to support investments for the development of the sustainable rural economy. The total CAP budget for the period 2021-2027 amounts to EUR 386.7 billion, and the largest funds (EUR 291.1 billion) are allocated to Pillar I through the European Agricultural Guarantee Fund (EAGF) while for Pillar II EUR 95.5 billion are allocated through the European Agricultural Fund for Rural Development (EAFRD). If we analyse the evolution of CAP financing for the period 2021-2027 (see Graph 1), it can be seen that, although the financing for Pillar I remains the most significant, an important part of the funding is also allocated to Pillar II and this fact reflects the constant concern of the EU authorities for boosting the growth in rural areas and especially the sustainable growth (through climate and environmental actions financed within the rural development programs (RDPs) of the Member States).

Graph 1: CAP budget for the 2021-2027 financial framework (EUR billion)



Source: Author based on DG Agriculture & Rural Development data (2022).

As highlighted in Graph 1, the capital injections that were expected to be granted through the Next Generation EU instrument, in the context of the crisis generated by the COVID-19 pandemic, will not be granted after 2022.

It is important to specify that, in the multi-annual financial framework for the period 2021-2027, the element of novelty in the financing within the CAP is the Strategic Plan that each Member State will have to submit for approval to the European Commission, having, subsequently, the obligation to adjust it depending on the observations and recommendations received after the evaluation of the EU authorities. So far, starting with December 2021, a number of 13 Member States (see Table 3) have already submitted these plans, most of which have been approved with minor amendments. Funding from the CAP Strategic Plan is carried out from both pillars through the EAGF and EAFRD and must follow the principles of sustainability, but can also be directed towards specific objectives and challenges existing in the diverse rural areas of the Member States.

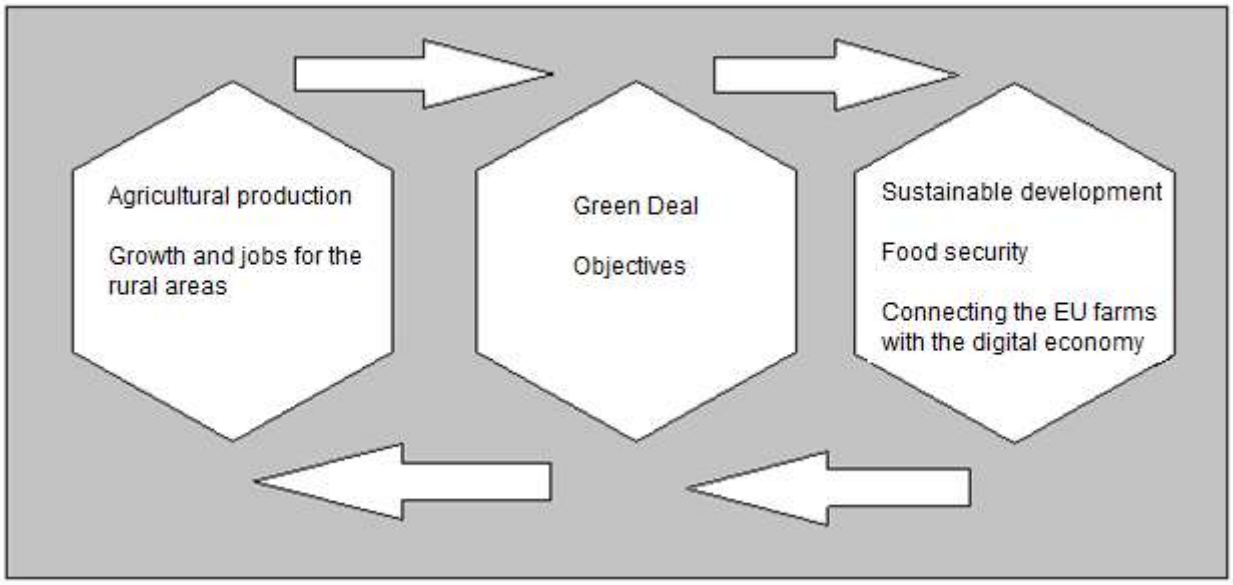
CAP Strategic Plans are almost unanimously considered in the recent literature (Matthews, 2019; Kremmydas & Tsiboukas, 2022; Azcárate & Folkeson, 2020) a welcome new addition to the CAP that has often been contested in the past (Henke et al., 2018) for the fact that it proposed an insufficiently flexible approach for rural areas, not taking into account the specific problems and existing differences, especially between the old and the new Member States.

The Regulation on CAP Strategic Plans (European Commission, 2021) adopted at the end of 2021 establishes a series of principles and rules to guide the Member States in drafting them so as to use EU funds for agriculture and rural development as efficiently as possible. In Regulation 2115/2021 on CAP Strategic Plans, it is stated that this new instrument has the role of preparing the Member States for both possible future crises (as it was the one generated by the COVID-19 pandemic) and for external shocks that can have a significant impact on the agricultural sector (such as the war initiated by the Russian Federation in Ukraine) thus contributing to the resilience of the EU's rural areas.

2 Measures for increasing the resilience of rural areas among the Member States under the current global outlook

Although it is implemented in a particularly difficult international context, marked both by the pandemic difficulties, but also by the domino effects of the war in Ukraine on agricultural markets and beyond, CAP aims to remain firmly aligned with the Green Deal objectives for the period 2021- 2027. However, the environmental ambitions of the CAP will not be easy to achieve, given that they may become difficult to be fully achieved by the Member States. However, given that climate change have become an indisputable reality in recent years, the CAP cannot abandon the greening process, but it is important to also contribute to the growth of EU food security (Figure 1).

Figure 1: CAP's objectives for increasing the resilience of EU's rural areas



Source: Own representation based on the studied literature.

As Figure 1 highlights, boosting employment and supporting production are key objectives of the CAP in the medium and long term, but they must be supported both by the modernization and integration of agricultural activities in the new digital world and by addressing the concerns for environmental protection and fighting climate change.

More concretely, the new CAP is expected to actively contribute to the achievement of the EU's energy and climate goals for 2030 while the European agricultural sector has a key role to play in meeting the target of a 40% reduction in greenhouse gas emissions. European agriculture must also contribute more to the EU's environmental goals, but these commitments cannot be fulfilled without the support and active participation of farmers, foresters and of the other rural actors who manage more than half of the EU's land and represent key users of the associated natural resources (agricultural and forest lands), as well as possible promoters of renewable energy sources and organic agriculture. For this reason, it is important that CAP Strategic Plans in all the Member States remain focused on a greater degree of environmental and climate ambition, but also to adequately respond to the concerns of European farmers regarding sustainable agricultural production.

The new CAP may respond to all these challenges of the future through a series of policies and actions such as:

✓ Supporting viable agricultural incomes and the resilience of the EU agricultural sector to enhance long-term food security and agricultural diversity, as well as to ensure the economic sustainability of agricultural production;

✓ Increasing competitiveness and supporting productivity by strengthening market orientation of farms both in the short term and in the long term, including by supporting investments in digitization at the level of agricultural holdings;

✓ Financing climate and environmental actions (in particular through Pillar II of the CAP) to actively contribute to mitigating climate change, including by reducing greenhouse gas emissions and improving carbon capture, as well as by promoting sustainable energy;

✓ Promoting sustainable development and efficient management of natural resources such as water, soil and air, including by reducing the dependence of the agricultural sector on the use of chemical fertilizers;

✓ Supporting the conservation of biodiversity and agricultural landscapes by financing eco-schemes that contribute to stopping and reversing the loss of biodiversity, improving ecosystem services and preserving habitats and landscapes;

✓ The contribution of rural development policies to structural change and generational renewal in rural regions by attracting and supporting young farmers by providing them with business facilities and other forms of financing (through Direct Payments);

✓ Promotion of employment, gender equality, including by increasing women's participation in agriculture, financing for social inclusion and local development in rural areas, as well as for the circular bio-economy and sustainable forestry;

✓ Preventing food crises by improving the response of EU agriculture to society's food and health demands, including the production of high quality, nutritious food produced in a sustainable way, to reduce food waste as well as to improve animal welfare and to combat antimicrobial resistance.

2.1. The role of Direct Payments and Rural Development Programmes (RDPs)

Although the new CAP remains a promoter of the green rural development, income support will continue to represent an important component of it (income and markets funding being much higher in all Member States compared to rural development, so as Table 1 highlights), however, the transparency regarding its awarding has been increased, along with the establishment of fairer criteria. By favouring small holdings, organic farms and small farmers, the new CAP aims to eliminate the monopoly of large farms that currently concentrate a large part of EU subsidies. This reality that shows that large farms are the "winners" of CAP support is highlighted by the fact that, along with the decrease in the size of the agricultural holding, there is also a decrease in the subsidies obtained, many of the "champion" states in terms of attracting Direct Payments being those with a tradition of large agricultural holdings (e.g. France, Italy) (Table 1).

Through its allocations, the CAP reaffirmed in 2020 the importance of supporting farmers' incomes because, without it, their earnings would be much lower and unstable, and a recent assessment shows that Direct Payments contribute up to 12% of the total income for two-thirds of European farms. The support granted through Direct Payments is even more vital when different agricultural sectors face a crisis, such as the pandemic or the current one generated by the war in Ukraine.

EU data highlight that Romania, although with a fragmented agricultural property, managed to place itself high in the ranking of the states that attracted large subsidies in the form of Direct Payments, having an average CAP financing (through both pillars) of EUR 3.1 billion in 2020.

Table 1: CAP funding in the Member States in 2020[2]

Member States	Direct payments	Market measures	Rural development	Total
	1 000 EUR	1 000 EUR	1 000 EUR	1 000 EUR
Belgium	481 836	60 758	102 723	**645 317**
Bulgaria	781 855	18 386	338 990	**1 139 231**
Czech Republic	855 832	16 537	321 615	**1 193 984**
Denmark	814 070	12 212	151 589	**977 871**
Germany	4 768 123	117 256	1 394 589	**6 279 967**
Estonia	142 536	1 476	129 177	**273 189**

[2]The year for which we have the latest available data.

Member States	Direct payments	Market measures	Rural development	Total
	1 000 EUR	1 000 EUR	1 000 EUR	1 000 EUR
Ireland	1 201 194	59 338	312 570	**1 573 102**
Greece	1 982 609	59 445	698 261	**2 740 315**
Spain	5 125 093	599 856	1 183 394	**6 908 343**
France	6 909 823	550 551	1 987 740	**9 448 114**
Croatia	317 338	13 061	282 343	**612 741**
Italy	3 599 133	677 514	1 501 763	**5 778 411**
Cyprus	48 125	5 922	18 881	**72 929**
Latvia	277 306	3 048	161 492	**441 846**
Lithuania	480 492	3 344	264 151	**747 987**
Luxembourg	32 841	556	14 511	**47 909**
Hungary	1 266 719	40 211	486 663	**1 793 593**
Malta	5 117	344	13 859	**19 320**
Netherlands	666 190	22 583	147 976	**836 749**
Austria	691 597	22 298	567 266	**1 281 161**
Poland	3 402 201	25 553	1 187 301	**4 615 055**
Portugal	680 228	107 898	582 456	**1 370 581**
Romania	1 912 461	65 671	1 139 927	**3 118 059**
Slovenia	133 869	7 022	120 721	**261 611**
Slovakia	447 758	11 255	214 525	**673 538**
Finland	523 450	6 473	344 777	**874 699**
Sweden	686 818	11 875	249 819	**948 511**
EU-27	38 234 612	2 520 441	13 919 080	**54 674 132**

Source: DG Agricultural&Rural Development data (2020).

Support through Direct Payments was all the more necessary as, in the first year of the pandemic, farmers' incomes decreased in many of the Member States (Table 2), and the CAP funding contributed to reducing this imbalance.

Table 2: The evolution of agricultural income in the Member States (index of the real income of factors in agriculture per annual work unit (AWU)[3]

Member State	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Belgium	89.34	109.4	87.67	83.71	92.74	82.49	88.98	79.1	91.86	84.16
Bulgaria	115.64	133.37	162.01	173.46	158.97	189.45	223.76	221.89	250.38	246.21
Czech Republic	134.84	133.73	135.08	155.37	137.98	155.74	151.09	144.75	150.92	150.26
Denmark	112.38	153.5	106.69	109.21	69.52	67.08	106.01	90.33	105.8	106.43
Germany	118.14	105.61	122.84	116.96	82.64	87.21	118.18	85.09	117.53	100.4
Estonia	124.39	143.43	132.74	123.76	100.41	63.04	106.32	82.19	108.91	112.62
Ireland	127.98	115.05	118.93	122.67	119.41	122.83	151.98	134.8	135.49	140.68
Greece	89.07	91.51	84.21	89.9	96.32	85.67	98.35	96.9	106.74	114.38
Spain	101.19	102.74	112.88	118.57	125.24	135.84	134.51	132.14	127.94	144.6
France	104.58	105.27	89.54	101.83	107.16	93.42	108.85	123.95	115.99	107.12
Croatia	95.5	81.72	90.47	78.28	105.76	117.67	117.8	125.29	132.47	150
Italy	117.23	124.18	146.62	134.46	130.75	127.27	130.83	146.74	141.03	134.14
Cyprus	74.93	103.56	102.59	94.84	122.73	122.82	123.38	118.58	121.64	126.35

[3] This measure corresponds to the real net value added at factor cost of agriculture per total AWU.

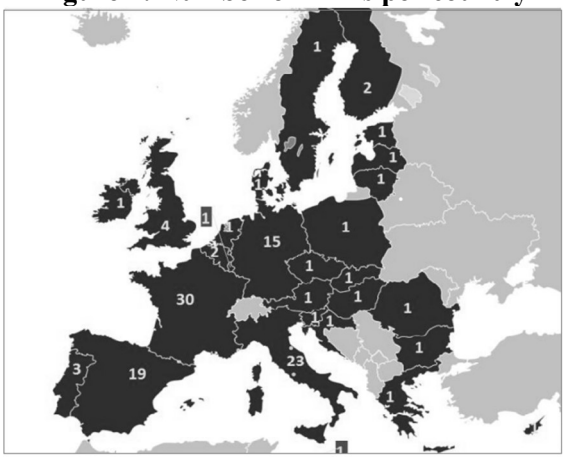
Member State	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Latvia	95.82	115.29	103.99	115.62	131.17	119.57	147.7	131.24	166.22	177.98
Lithuania	125.89	156.77	138.44	125.76	135.36	112.72	140.4	105.41	138.4	180.23
Luxembourg	99.81	105.25	90.66	118.81	98.97	90.64	114.76	122.86	118.25	118.34
Hungary	149.33	137.9	151.68	161.15	152.58	162.89	165.25	170.05	183.06	204.24
Malta	87.85	83.01	80.16	78.89	93.59	68.83	62.93	83.52	82.55	83.43
Netherland	85.56	92.3	103.64	99.53	101.64	102.4	112.57	93.79	95.73	90.83
Austria	114.14	107.39	95.05	88.96	84.22	94.97	106.15	100.48	94.69	99.84
Poland	113.77	106.22	114.81	95.64	96.9	124.41	142.89	133.77	139.92	141.44
Portugal	86.03	92.44	105.94	107.16	116.36	125.7	131	131.03	138.82	134.12
Romania	129.06	96.13	113.56	123.94	116.22	119.99	136.01	138.37	139.97	120.65
Slovenia	114.01	90.72	91.14	103.21	114.1	104.45	97.5	135.56	120.16	127.5
Slovakia	118.62	133.62	130.25	143.33	142.84	173.43	205.69	201.55	189.13	193.49
Finland	86.38	88.29	86.21	83.02	67.92	76.41	80.67	80.37	90.06	91.61
Sweden	102.88	102.18	92.5	101.48	107.14	97.46	115.91	91.97	107.04	110.43
EU-27	**108.28**	**107.27**	**111.25**	**112.6**	**110.36**	**112.42**	**126.27**	**124.54**	**128.8**	**127.2**

Source: DG Agricultural&Rural Development data (2020).

In the case of Romania, the pandemic led to a significant decrease in agricultural income (Table 2), after, in the period 2017-2019, it had registered a constant increase. Given the previously presented, the following evidence must be emphasized: the role of the CAP and especially of the new Strategic Plans for the period 2022-2027 will be crucial in guiding the agricultural sector and farmers both towards the imperatives of sustainable development, but also towards the requirements of ensuring food security, and this goal is all the more urgent, since the war in Ukraine, with its impact on Ukrainian agricultural exports, has dramatically changed the balance regarding the supply of food and agricultural products for many Member States.

As for RDPs approved during 2014- 2020, the data from DG Agricultural & Rural Development are showing a number of 118 programmes adopted in the EU (see Figure 2) and with a budget that amounted to roughly EUR 100 billion. Under the CAP transitional regulation (adopted on 23 December 2020), RDPs have been conditionally extended for 2021 and 2022.

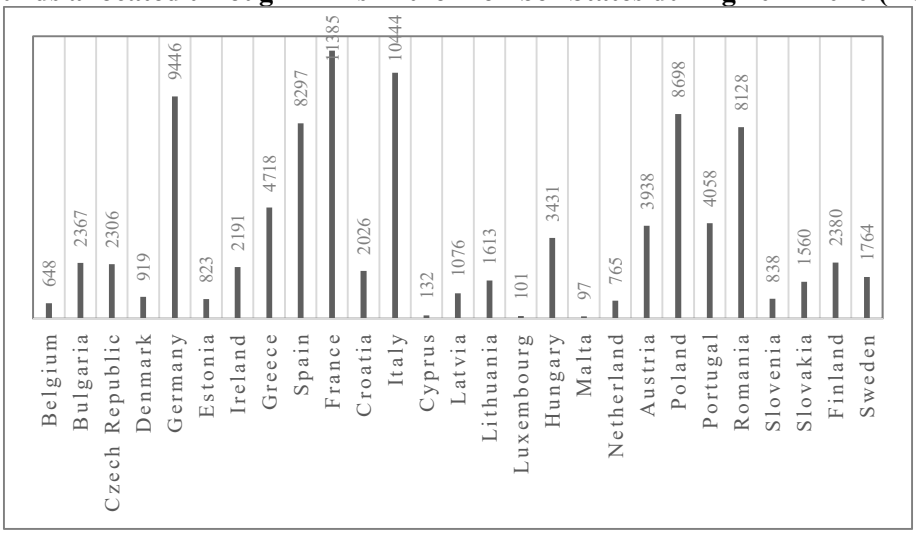
Figure 2: Number of RDPs per country



Source: DG Agricultural&Rural Development data (2020).

It should be noted that from 2023 onwards, all new rural development actions will be incorporated into national CAP Strategic Plans while each of those plans must be built around key social, environmental and economic objectives for EU agriculture, forestry, and rural areas.

Graph 2: Funds allocated through RDPs in the Member States during 2014-2020 (EUR million)



Source: Author based on DG Agricultural&Rural Development data (2020).

As shown by the Graph 2 the champions on allocating funds through RDP are France, Italy and Germany, while Romania ranks also on a good position in the EU hierarchy.

2.2. The role of CAP Strategic Plans for green development and food security

Some authors (Kelly & Mceldowney, 2019) show that through the model of achieving the objectives proposed by the current CAP, the EU sets the basic parameters in terms of policies (general objectives, general types of intervention, basic requirements), while Member States are responsible for how they meet the objectives and reach the agreed targets. The objectives of the CAP are limited to the obligations inscribed in the EU Treaty, but also to the already agreed targets, for example, regarding the environment and climate change, as well as for other European policies. When preparing CAP Strategic Plans, the Member States have an obligation to take into account the EU environment and climate legislation and policies. At the same time, EU states also have the obligation to provide credible monitoring and reporting on the results achieved on the basis of their CAP Strategic Plan.

Thus, some studies (Erjavec, 2018) show that the Member States have the possibility to adapt CAP interventions to intensify their contribution to the achievement of EU objectives while having at the same time a stronger influence in designing the compliance and control framework applicable to beneficiaries (including controls and penalties for Direct Payments financing).

Table 3: Overview of approved CAP Strategic Plans of the Member States

Member State	Date of approval	Green development	Food Security
Ireland	8 September 2022	**For the eco-schemes are allocated EUR 1.49 billion and for environmental and climate actions under RDP EUR 1.04 billion.**	Ireland will support the development of the arable agriculture sector. In particular, Irish farmers growing protein crops (such as peas, beans and soya) will receive bonuses to improve their competitiveness. **The total allocation for Direct Payments will be of EUR 5.93 billion.**
Finland	8 September 2022	**For the eco-schemes are allocated EUR 430 million and for environmental and climate actions under RDP EUR 1.02 billion.**	Finland's plan supports food security in the context of new threats induced by the war in Ukraine. To this end, to protect agricultural incomes and production levels, 16.9% of the total Direct Payments will be allocated for coupled support. **The total allocation for Direct Payments will be of EUR 2.61 billion.**
Portugal	8 September 2022		Portugal will allocate EUR 320 million to small farms and EUR

Member State	Date of approval	Green development	Food Security
		For the eco-schemes are allocated EUR 874 million and for environmental and climate actions under RDP EUR 1.05 billion.	690 million to farms in sectors facing difficulties – especially beef, dairy, and rice crops – to increase food security. **The total allocation for Direct Payments will be of EUR 3.48 billion.**
Poland	8 September 2022	**For the eco-schemes are allocated EUR 4.33 billion for environmental and climate actions under RDP EUR 2.04 billion.**	Poland will finance production in the agricultural sectors facing difficulties: the livestock sector, protein crops, and the crops of sugar beet, potatoes, tomatoes, strawberries, hops, flax and hemp fiber. **The total allocation for Direct Payments will be of EUR 17.32 billion.**
Spain	8 September 2022	**For the eco-schemes are allocated EUR 5.5 billion for environmental and climate actions under RDP EUR 2.5 billion.**	Spain will prioritize basic income support for farmers who engage in sustainable agricultural practices, and this type of Direct Payments will cover 86.4% of the agricultural area used. **The total allocation for Direct Payments will be of EUR 24.4 billion.**
Denmark	8 September 2022	**For the eco-schemes are allocated EUR 819 million and for environmental and climate actions under RDP EUR 430 million.**	A total of EUR 203 million will be paid in support to farms facing specific challenges related to the current difficulties caused by the Ukrainian war to prevent the risk of reduced production. **The total allocation for Direct Payments will be of EUR 4.11 billion.**
France	8 September 2022	**For the eco-schemes are allocated EUR 8.5 billion for environmental and climate actions under RDP EUR 4.12 billion.**	For the period 2023-2027, the financial support given to farmers is more targeted and fairer. EUR 3.5 billion will be allocated to redistributive payments, which will strengthen income support for small and medium-sized farms. **The total allocation for Direct Payments will be of EUR 34.2 billion.**
Luxembourg	15 September 2022	**For the eco-schemes are allocated EUR 40.9 million for environmental and climate actions under RDP EUR 45.5 million.**	The CAP Strategic Plan will favour direct support to farmers to ensure a viable income and strengthen the resilience and competitiveness of the entire sector, while ensuring sustainable development. **The total allocation for Direct Payments will be of EUR 163 million.**
Austria	15 September 2022	**For the eco-schemes are allocated EUR 500 million for environmental and climate actions under RDP EUR 1.52 billion.**	The CAP plan will provide support through sectoral interventions in the fruit and vegetable, bee products, wine, beef and veal, milk and milk products, sheep, goat and pig sectors. **The total allocation for Direct Payments will be of EUR 3.38 billion.**
Sweden	28 October 2022	**For the eco-schemes are allocated EUR 679 million and for environmental and climate actions under RDP EUR 658 million.**	Sweden is building **a fairer and simpler system of financial support for farmers**. Income support will help to maintain farmers' incomes, and a total of EUR 2 billion (covering

Member State	Date of approval	Green development	Food Security
			approximately 2.9 million hectares) will be paid by the EU. **The total allocation for Direct Payments will be of EUR 3.43.**
Slovenia	28 October 2022	**For the eco-schemes are allocated EUR 101 million and for environmental and climate actions under RDP EUR 327 million.**	To contribute to a fairer distribution of financial support through Direct payments, Slovenia will introduce the so-called redistributive payment, which will shift part of the support from larger to smaller agricultural holdings. In total, 5.9% (EUR 38 million in the period 2023-2027) of the Direct Payment envelope has been allocated for this purpose. **The total allocation for Direct Payments will be of EUR 657 million.**
Croatia	28 October 2022	**For the eco-schemes are allocated EUR 468 million and for environmental and climate actions under RDP 539 EUR million.**	The Croatian Plan will reinforce efforts to reduce the income gap between small and medium sized farms on the one hand, and larger agricultural holdings on the other. To stabilise the income of smaller and medium-sized farms, 20% of the direct payments envelope will be redistributed to all small and medium farmers for their first 30 hectares of agricultural land. **The total allocation for Direct Payments will be of EUR 1.87 billion.**
Hungary	8 November 2022	**For the eco-schemes are allocated EUR 468 million and for environmental and climate actions under RDP 539 EUR million.**	Hungary offers a range of interventions aimed not only at securing a fair income for farmers, but also achieving a fairer distribution of financial support amongst them. The Plan finances roughly 5 million hectares of agricultural land via this scheme and farmers receive around EUR 150/hectare. **The total allocation for Direct Payments will be of EUR 6.63 billion.**

Source: Author based on documents relating to the approval of the CAP Strategic Plans. https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans/approved-csp-0_en?page=0

As may be seen from the table above, the Member States that have so far received approval from the European Commission for their CAP Strategic Plans have preferred to use more Pillar II for environmental objectives whose funding exceeds that allocated to eco-schemes (from Pillar I), while for food security the Direct Payments were favoured to support the incomes of small farms and the production in sectors that experienced difficulties, either because of the COVID-19 crisis or generated by the current war in Ukraine.

3 Food security in EU - challenges brought by the Ukrainian war

The year 2022 marked both the end of the COVID-19 pandemic and the emergence of a new major crisis that affected the entire global economic climate through its reverberations: the outbreak of the war in Ukraine as a result of the military aggression initiated by the Russian Federation on February 24, 2022. For the EU, the consequences of the war crisis were primarily generated by the need to impose multiple sanctions on the Russian Federation. In return a series of sanctions were also imposed by the Russian Federation while the war made difficult for EU farmers to have access to fertilisers and also led to a severe contraction of Ukraine's agricultural products exports to EU. Faced with the danger of a global food crisis, the EU has allowed a larger flexibility in

the CAP Strategic Plans so that, as we have shown in the previous section of this chapter, they can more effectively support agricultural production and European farmers in difficulty.

Despite all the challenges induced by the war in Ukraine, the latest statistics and EU reports show that the agricultural sector has demonstrated its resilience and ability to absorb the shock of external crises, but both production and agricultural trade have been affected by the consequences of the economic uncertainty generated by the repercussions of the war both in the field of the energy crisis and of other vital inputs (e.g .fertilizers).
Thus, in the most recently published report on the evolution of agricultural markets in the EU (European Commission, 2022), it is shown that, in addition to the significant increase in energy prices, the EU agricultural sector is affected by the insufficient availability of fertilizers, but also by the expected increase in their cost for the next season, because the fertilizer industries need natural gas to produce ammonia and other nitrogen products, and under these conditions, there may be significant reductions in agricultural production if fertilizer prices become too high. The report also states that insufficient availability of nitrogen fertilizers not only affects crop production but also other agro-food sectors like beverage and food processing sectors. Under these conditions, European Commission forecast are showing that production prices of agricultural goods are expected to continue to influence food prices, that will remain historically high in 2023 as well, while the European farmers will be under double pressure from processors and distributors who want to preserve their profits, and from consumers who, faced with ever higher food prices, could reduce their demand. Moreover, such a reduction in demand is already expected in several sectors for the end of 2022, but some changes in consumer preferences could be favourable to EU farmers (more retail purchases for the traditional products at low prices to the detriment of the existing "branded" ones in large hypermarket).

Considering all the challenges listed above, in the following we will briefly present the most relevant trends regarding agricultural production in the EU, highlighting the performances, but also the areas in which progress is still needed to fully ensure food security in the EU.

At the EU-27 level, the combined effects of the 2022 summer drought and fertilizer shortages led to a reduction in agricultural production for certain types of crops (maize production experiencing the largest drop), but the agricultural production as a whole has proved its resilience, with certain types of crops, for example broad beans and sugar beet, even registering significant increases (Table 4).

Table 4: EU cereal production during 2016-2022 (tonnes/hectare)

	2016	2017	2018	2019	2020	2021	2022(f)
Soft wheat	5.4	5.9	5.4	6.0	5.8	6.0	5.8
Durum wheat	3.5	3.5	3.5	3.5	3.5	3.5	3.4
Rye	3.9	3.8	3.2	3.9	4.3	4.2	4.3
Barley	4.8	4.8	4.5	5.0	4.9	5.1	5.0
Oats	3.0	2.9	2.7	2.9	3.3	2.9	3.2
Maize	7.4	7.9	8.4	7.9	7.3	7.9	6.4
Triticale	4.1	4.2	3.8	4.1	4.5	4.4	4.4
Sorghum	5.6	5.3	5.6	5.3	5.2	5.4	4.3
Others	2.7	2.9	2.5	2.7	3.1	3.0	2.8
Cereals	5.2	5.5	5.2	5.6	5.5	5.7	5.3
Rapeseed	3.1	3.2	2.8	3.0	3.1	3.2	3.2
Sunflower	2.1	2.4	2.5	2.4	2.0	2.4	2.0
Soya beans	3.0	2.8	3.0	3.0	2.8	2.8	2.4
Linseed	1.5	1.6	1.6	1.8	1.7	1.7	1.7
Oilseeds	2.7	2.9	2.7	2.7	2.7	2.8	2.6
Field peas	2.5	2.6	2.3	2.6	2.4	2.4	2.5
Broad beans	2.7	2.8	2.1	2.5	2.8	2.4	2.6
Lupins	1.7	1.6	1.2	1.2	1.5	1.6	1.3
Other dry pulses and protein crop	1.6	1.3	1.4	1.1	1.5	1.6	1.5
Protein crops	2.2	2.2	1.9	2.0	2.1	2.1	2.1
Sugar beet	75.6	81.6	69.0	73.8	68.6	76.1	77.9

Source: Author based on „Short term Outlook for EU agricultural markets in 2022".

Regarding the dairy sector, EU statistics show that the drought in the summer of 2022 worsening the availability and quality of grass, in addition to lower yields of the main feed crops, determined a fall in EU milk production (-0.5%), driven by lower livestock yield.

The meat production sector was also affected in 2022 by several external events, including African swine fever, which had a negative impact on pork meat production (Table 5). European Commission forecast are showing that while EU poultry production growth continues to be limited by high input prices – especially feed and energy – but also by highly pathogenic avian influenza, despite historically low sheep and goat flocks, slaughters are not expected to decrease in 2022 and EU imports should pick up in 2022 and 2023, but still below pre-pandemic levels, leading to high prices for sheep and goat meat.

Table 5: EU meat production in the period 2018-2023 (thousand tonnes)

	2018	2019	2020	2021	2022	2023 (forecasts)
Total meat production	44 447	44 430	44 678	44 683	43 301	43 096
Pork	23 205	23 039	23 242	23 654	22 471	22 324
Beef	7 310	7 197	7 136	7 096	7 024	7 018
Poultry	13 300	13 549	13 673	13 304	13 177	13 125
Sheep and goat	632	646	628	629	628	629

Source: Author based on „Short term Outlook for EU agricultural markets in 2022".

As seen from EU statistics, the biggest production declines are forecast to occur in 2023 for pork and poultry but the security of supply for these types of meat will not diminish, being supplemented by increased imports.

The most recently published statistics, dated 26 October 2022, on EU agricultural trade (European Commission, 2022) show that, although difficult climatic conditions have led to additional pressures on EU agricultural production EU is still among the top global grain exporters, indicating that European agriculture has proven resilient to the shock of external crises as a result of existing production and market support instruments under the CAP.

4 Conclusion

The new CAP for the period 2021-2027 was launched amid a global outlook marked by the challenges and difficulties induced by the COVID-19 crisis, and also by the imperative to align with the climate and environmental objectives proposed through Green Deal. The occurrence, at the beginning of 2022, of the war provoked by the Russian Federation in Ukraine added new pressures and difficulties for the EU agricultural sector, especially in terms of food security.

As a result of this fact, the European Commission has allowed to the Member States to use the CAP Strategic Plans to minimize the challenges for food security through a series of measures, both from Pillar I (through Direct Payments), as well as from Pillar II (through the Rural Development Programs), so that agricultural production is supported (especially crops affected by the increase in energy prices and the insufficiency of fertilizers), as well as animal breeders.

The CAP Strategic Plans approved so far highlight that, although the Member States that designed them and subject them to the approval of the European Commission, remained faithful to the ecological ambitions of the CAP, prioritizing eco-schemes (in Pillar I) and climate and environmental measures (in Pillar II), they also managed to provide adequate measures to combat future food security crises by granting support for farmers' incomes and production.

The data published by the European Commission show that although the production of certain cereals and types of meat (poultry) were affected by the drought of the summer of 2022 and by the difficulties induced by the war in Ukraine, the EU will not face in the near future any food shortage as a result of the support measures for domestic production from CAP Strategic Plans, while imports will compensate the various reductions in production.

CAP, the oldest common policy and the beneficiary of the largest funding from the EU budget, has proven its effectiveness in supporting the resilience of rural areas and food security through its various funding instruments, but above all through its adaptability which has allowed Member States to redefine some of their

funding priorities in order to adequately respond to the current challenges brought the current global economic and geo-political context.

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The Russian Banking System during the Covid-19 Crisis and the Central Bank's Stabilisation Measures[1]

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Abstract: The COVID-19 pandemic has significantly affected the financial situation of the individuals and companies in the Russian Federation, as a result of the mobility restrictions and lockdowns. In this context, banking system has played an important role in financing the economy. To avoid a credit crunch and to facilitate economic recovery, the Bank of Russia has adopted a wide range of stabilization measures, as cutting the key rate, easing banking capital and liquidity regulations, providing extensive liquidity, new lending facilities to banks etc. The purpose of this article is to analyse the Central Bank's response to the pandemic and to assess the financial stability of the banking system in the Russian Federation during the COVID-19 crisis. To achieve this goal, a chronology of the main measures adopted during the pandemic by the Bank of Russia is presented. In addition, the main indicators of the banking stability are analysed, namely, the level of capitalization and liquidity, the return on capital and assets, but also the quality of bank loans.

Key-Words: COVID-19 pandemic, Russian Federation, banking system, Bank of Russia, indicators of the banking stability, demand for loans

JEL Classification: G01, G21, G28

1 Introduction

The COVID-19 pandemic has significantly affected the financial situation of the individuals and companies in the Russian Federation. Major companies faced a severe drop in profits and a rise in debt levels. In addition, the decline in international oil prices and the forced reduction in oil production under the OPEC agreement in October 2020 had a negative impact on the financial position of companies in the oil and natural gas sector.

However, the Russian Federation entered the crisis under the conditions of a solid fiscal framework and substantial public policy space, which allowed the authorities to respond with quick and effective measures to recover the economy. At the same time, the fiscal consolidation that took place after the 2014 crisis helped achieve low levels of indebtedness, as well as increase contributions to the National Welfare Fund. Moreover, the consolidation took place amid the implementation of new fiscal rules, which reduced uncertainty and disconnected the budget from the volatility of international oil prices. As a result, the economy of the Russian Federation managed to reach a growth rate of 4.8% in 2021, after a decrease of 2.7% in the pandemic year (IMF, 2022). According to IMF estimates (2020), fiscal measures to respond to the pandemic crisis reached about 3.5% of GDP, or about 4.5% if extrabudgetary measures are included. The extensive measures adopted in the form of social and unemployment aid supported the incomes of households in difficulty. While fiscal support measures for companies significantly eased liquidity and solvency pressures. In addition, to avoid a credit crunch and to facilitate economic recovery, the Bank of Russia has adopted a wide range of stabilization measures, as cutting the key rate, easing banking capital and liquidity regulations, providing extensive liquidity and new lending

[1] This article is based on a more comprehensive research undertaken by the author within the study *Sistemul financiar al Federaţiei Ruse în condiţiile crizelor financiare şi economice*/*The financial system of the Russian Federation under the conditions of the financial and economic crises*, coordinated by Dr. Dorina CLICHICI, included in the research program of the Romanian Academy in 2022.

facilities to banks, etc. As a result, the banking sector has managed to provide credit to individuals and companies in difficulty, while remaining stable at the same time.

2 Financial stabilization measures adopted by the Bank of Russia during the pandemic

To mitigate the effects of the pandemic on the banking sector and to avoid a credit crunch, the Bank of Russia intervened through a series of stabilization measures (Table 1). The monetary authority relaxed the regulations regarding loan classification and provisioning, stimulated the restructuring of loans granted to debtors in difficulty and facilitated the provision of loans to the population and companies. In order to free up additional resources in the banking system, it relaxed the macroprudential requirements for the creation of capital buffers and credit risk weighting. Due to Central Bank lending facilities and extensive liquidity operations, banks continued to provide credit to the economy. In addition, against the background of high volatility of the foreign exchange market, borrowers had the opportunity to convert loans into rubles, which helped reduce exposure to foreign currency loans. According to the IMF (2020), monetary and macroprudential policy measures implemented by the Bank of Russia contributed to limiting the economic decline in 2020.

Table 1: Financial stabilization measures adopted by the Bank of Russia in response to the COVID-19 crisis

Date of adoption	The objective pursued	Description of the measure
10.02.2020	Alleviating disinflationary pressures and facilitating lending	• Cutting the key rate from the 6.25% to 6%.
9.03.2020	Stabilization of the financial market and the exchange rate of the ruble	• Suspending the purchase of foreign currency within the budget mechanism for a period of 30 days; • Active sale of foreign currency on the domestic foreign exchange market; to increase the supply of US dollars in the banking market, the limit on foreign exchange swap operations was increased to 5 billion dollars; • Liquidity injection into the banking system, in order to avoid disrupting the banking activity and supporting lending.
17.03.2020	Facilitating lending to the small and medium enterprises (SMEs)	• Approving the new refinancing mechanism for SMEs, with a limit of 175 billion rubles. The interest rate for these refinancing operations was reduced from 6% to 4%, and the maximum level of the interest rate applied to SMEs by banks being limited to 8.5%.
20.03.2020	Supporting the population, the economy and the financial sector during the pandemic (selection)	• Recommending that credit institutions restructure debt and refrain from applying penalties and fines on loans to individual borrowers; • Entitling credit institutions not to recognise such loans as restructured for the purpose of creating reserves and not to apply macroprudential add-ons to such loans until 30 September 2020; • Entitling credit institutions not to increase reserves on loans to individual borrowers in the case of worsening of their financial standing and/or debt servicing quality, until 30 September 2020; • Expanding the refinancing programme for SMEs, beyond the currently operational limit of 175 billion rubles, an

Date of adoption	The objective pursued	Description of the measure
		additional funding of 500 billion rubles will be available, effective from 23 March 2020. • Offering easier conditions for providing irrevocable credit lines to credit institutions until 1 April 2021; the irrevocable credit line fee was be reduced from 0.5 to 0.15%; • Retaining the national countercyclical capital buffer at zero per cent; • Postponing several amendments to the regulation of credit institutions, **easing regulatory and supervisory burden for financial institutions.**
27.03.2020	Supporting vulnerable industries, retailers, financial institutions, and SMEs (selection)	• Recommending that credit institutions approve applications from retailers for debt restructuring due to an income reduction from 1 March 2020, also not to charge any increased interest, fines or penalties; • Allowing credit institutions not to classify such loans as restructured ones for loss provisioning purposes until 30 September 2020; • Recommending credit history bureaus not to record debt restructuring cases under such loans, aimed at preventing the deterioration of borrowers' credit histories; • Expanding the earlier approved package of measures aimed at supporting lending to SMEs, transport and tourism sectors (including hotel business) to the following industries: public catering; arts, sports and leisure; conference and exhibition organising; educational services etc.; • Allowing creditors not to deteriorate the debt servicing of vulnerable industries' quality assessments until 30 September 2020, regardless of the assessments of borrowers' financial standing; • Amid intensified volatility in the foreign exchange market, borrowers were encouraged to request their banks to change the currency of their loans to rubles, which will help reduce their credit exposure; • Easing the regulation of liquidity of systemically important credit institutions, by reducing the liquidity coverage ratio and raising the maximum aggregate limit under irrevocable credit lines from 1.5 to 5 trillion rubles. • Expanding the SME refinancing program by 150 billion rubles to ensure uninterrupted fulfilment of wage payment obligations
03.04.2020	Facilitating mortgage lending and the SMEs (selection)	• Individual borrowers who find themselves in a difficult situation can take advantage of credit holidays, which allowed postponing payments on mortgage loans for up to 6 months; • Cancelling add-ons to risk weights for mortgage loans issued before 1 April 2020, which allowed banks to absorb credit losses in excess of 100 billion rubles;

Date of adoption	The objective pursued	Description of the measure
		• Easing the requirements for the minimum rating of credit institutions for their participation in the new mechanism of SMEs lending support; • Expanding the Lombard List and soften the requirements for the liquidity of securities used by credit institutions in their refinancing operations;
17.04.2020	Measures to protect households, support lending to economy, and temporarily ease foreign exchange control (selection)	• Easing of prudential requirements for risk ratios related to standard mortgages to help reduce mortgage interest rates; • Expanding support programs for SMEs, by completing the framework for granting concessional loans to credit institutions, with factoring agreements. • In cases when borrowers' financial standing deteriorates due to the new coronavirus infection, the Bank of Russia allowed banks to use the assessment of financial standing, and/or a loan quality category, determined as of 1March 2020.
27.04.2020	Alleviating disinflationary pressures and facilitating lending	• Cutting the key rate from 6.0% to 5.5%.
22.06.2020	Alleviating disinflationary pressures and facilitating lending	• Cutting the key rate from 5,5% to 4,5%.
26.06.2020	Extending the effective period of the regulatory easing (selection)	• **Through 30 September 2020,** banks could open bank accounts to clients without the personal presence of an individual; • Cancelling of penalty measures for the violation of the deadlines for the transmission of information by banks to the exchange control authorities.
27.07.2020	Alleviating disinflationary pressures and facilitating lending	• Cutting the key rate from 4,5% to 4,25%.
10.08.2020	Extending regulatory easing and implementing new countercyclical measures to support the economy (selection)	• **Through 31 December 2020**, credit institutions continued to restructure loans to individuals facing a material decline in their incomes and not to charge any penalties and fines on restructured loans; • **Through 31 December 2020**, credit institutions restructured loans by converting them from foreign currency to rubles if relevant applications are received from borrowers; • **Through 31 December 2020**, credit institutions did not enforce the mortgage if an individual borrower fails on his/her obligations due to a material decline in his/her income; • Loss provisioning for loans restructured before or on 31 December 2020 was completed **by 1 July 2021;** • **Through 31 December 2020**, credit institutions were allowed not to apply macroprudential add-ons for loans granted to borrowers with confirmed COVID-19.

Date of adoption	The objective pursued	Description of the measure
18.12.2020	Extending regulatory easing (selection)	• **Retaining the value of the countercyclical capital buffer rate for the capital adequacy ratio of Russian credit institutions at zero per cent of risk-weighted assets, and leaving unchanged macroprudential add-ons to risk weights for calculating capital adequacy ratios;** • **Extending through 1 April 2021 its recommendation to financial organisations related to restructuring of loans to individuals and SMEs confronted with an epidemic-induced deterioration in their financial position.**

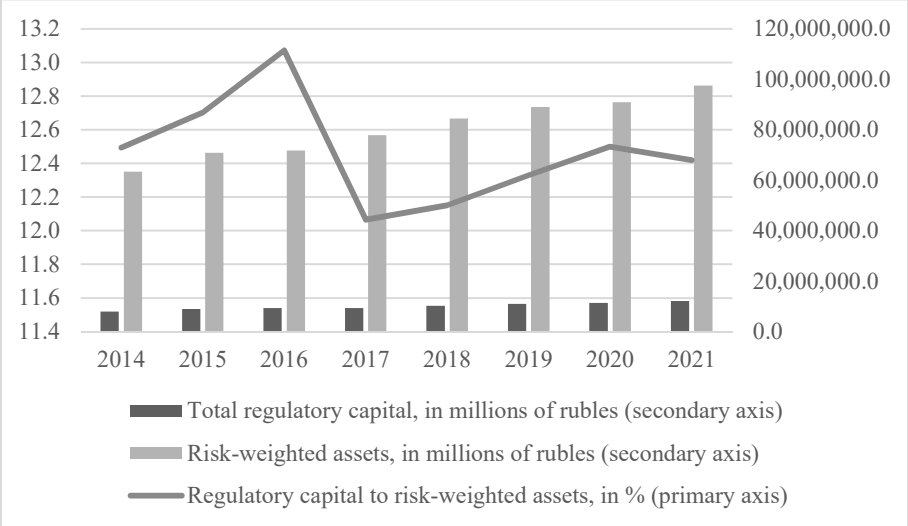
Source: author's summary based on Bank of Russia press releases (2020).

The four successive cuts in the key rate in 2020 (Table 1), totalling 200 basis points, helped reduce funding costs and facilitate lending. Also, in September 2020, the banking sector had achieved a significant stability space in the form of the capital buffer of 5.5 trillion rubles, as well as the macroprudential capital buffer of 0.6 trillion rubles. Both the level of capitalization and that of profitability allowed the banking sector to restructure and provide loans the population and companies. In December 2020, the value of restructured loans of households and companies amounted to more than 6.5 trillion rubles (Bank of Russia, 2020).

3 Assessing the financial stability of the Russian banking system during the COVID-19 crisis

Russian banks faced the challenges of the pandemic from a position of strength. The banking system held an adequate level of capital and liquidity in the years leading up to this crisis (Figure 1), but also of capital buffers for systemic banks and anti-cyclical capital. At the same time, profitability reached its pre-crisis peak, so the decline in 2020 was offset by a rebound in 2021 (Figure 2 and Figure 3). The high level of capitalization allowed banks to form sufficient provisions for loan losses, reducing the risk generated by non-performing loans.
Considering the wide range of stabilization measures adopted by central bank, the equity ratio maintained its upward trend during 2020, reaching the level of 12.5% (Figure 1). This was well above the level established by the prudential requirements of the central bank, of 8%.

Figure 1: The equity ratio, in the period 2014-2021 (by components)

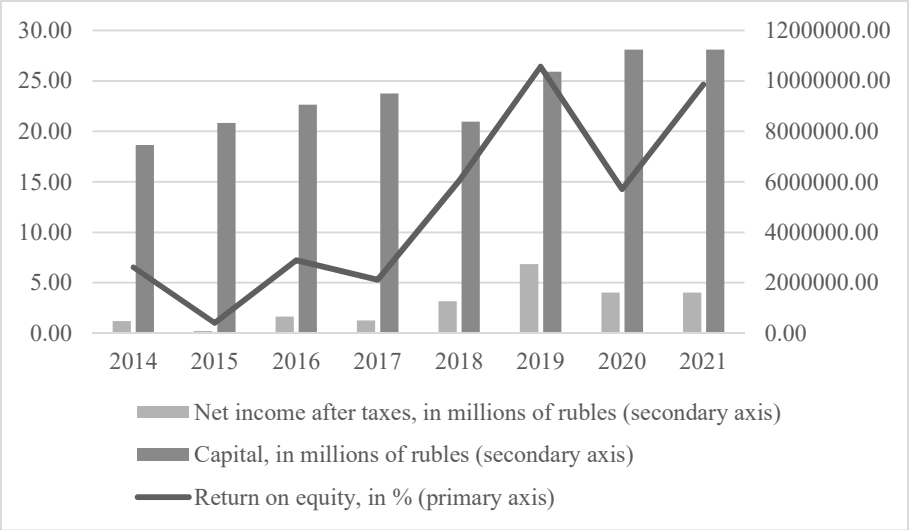


Source: Author's representation based on International Monetary Fund data (2022).

At the same time, the COVID-19 pandemic negatively affected the bank profitability, as the net income after taxes dropped by 41% in 2020. Return on equity (ROE) fell almost twofold, from 26.4% in 2019 to 14.3%

in 2020 (Figure 2). At the same time, due to the economic recovery of the Russian Federation in 2021, banks recorded an increase in ROE, reaching almost the record pre-pandemic level.

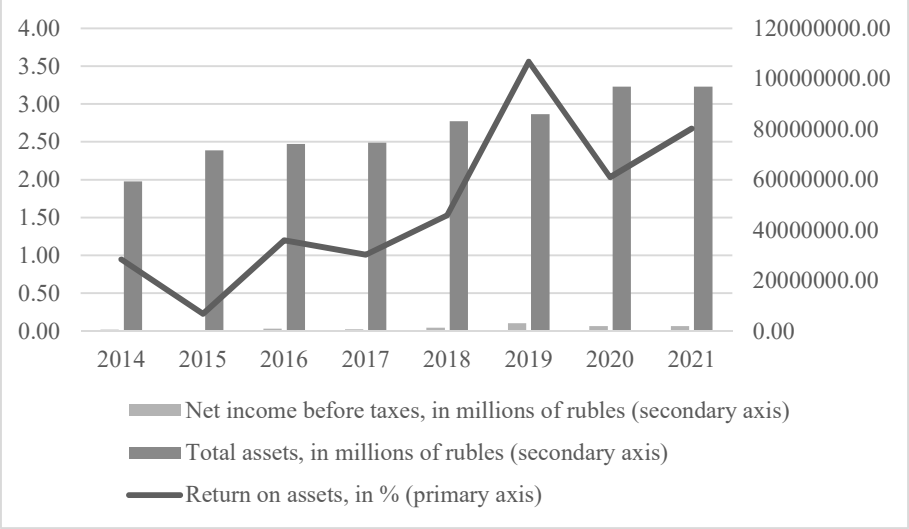
Figure 2: Return on equity, in the period 2014-2021 (by components)



Source: Author's representation based on International Monetary Fund data (2022).

The return on assets (ROA) followed an evolution close to that of ROE, decreasing in 2020 to the level of 2.03%, as the net income before taxes dropped by 35%. Although the economic downturn of 2020 affected the profits generated by banking assets, the economic recovery in 2021 determined a rise in assets profitability to 2.7% (Figure 3).

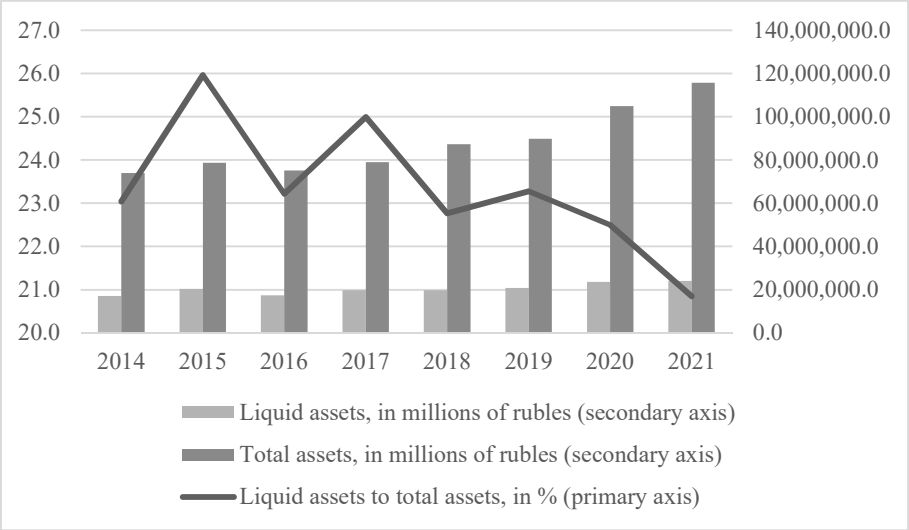
Figure 3: Return on assets, in the period 2014-2021 (by components)



Source: Author's representation based on International Monetary Fund data (2022).

Another important indicator that reflects the resilience of the banking system to crises and episodes of withdrawal of deposits is the ratio of liquid assets. It determines the ability of banks to meet their short-term financial obligations, i.e., cash demands. Since banks operate with resources drawn from other entities, their ability to meet repayment demands on these resources is paramount and must be carefully analysed. Banking institutions that have a ratio of liquid assets below the 20% threshold are inclined to face liquidity shortfalls and could potentially experience difficulties in the event of a liquidity crisis and deposit withdrawals (Monahov, 2020). The pandemic determined a decline in the ratio of liquid assets, both in 2020 and 2021, to 22.5% and, respectively, to 20.8% (Figure 4). Although it contracted, these levels were still above the threshold, reflecting a high level of resilience of the banking system to possible withdrawals of deposits.

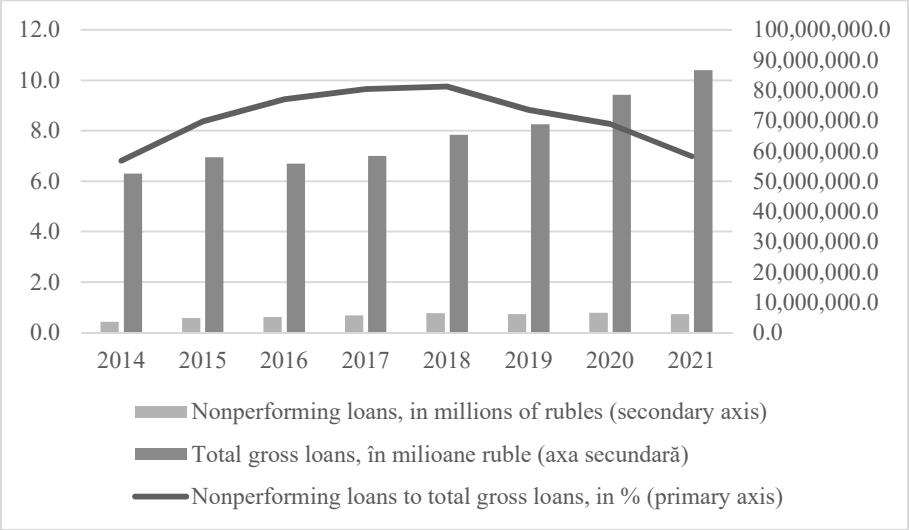
Figure 4: Liquid assets ratio, in the period 2014-2021 (by components)



Source: Author's representation based on International Monetary Fund data (2022).

Although the financial situation of debtors worsened during the pandemic as a result of lockdowns, the measures adopted by the Bank of Russia, namely loans restructuring, easing of prudential requirements related to restructured loans, postponing payments on mortgage loans for up to 6 months etc., helped to avoid a credit crunch and a deterioration of assets quality. The IMF data (2022) shows that the rate of non-performing loans decreased during the pandemic, from 8.8% in 2019 to 8.3% in 2021 (Figure 5). Moreover, it continued to fall in 2021, reaching the level of only 7%.

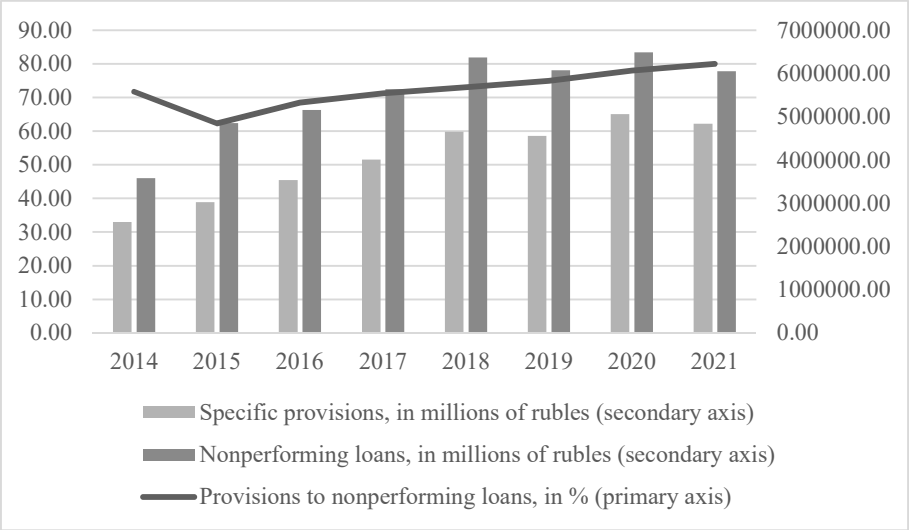
Figure 5: Nonperforming loans ratio, in the period 2014-2021 (by components)



Source: Author's representation based on International Monetary Fund data (2022).

At the same time, Russian banks managed to create solid provisions to non-performing loans during pre-pandemic years, as a result of the adequate level of capitalization. In the context of COVID-19 crisis, they increased slightly, from 74.9% in 2019 to 78.02% in 2020, reflecting a significant credit risk cushion (Figure 6). More than that, banks succeeded to maintain this upward trend in 2021.

Figure 6: Provisions to nonperforming loans, in the period 2014-2021 (by components)



Source: Author's representation based on International Monetary Fund data (2022).

After the shock of the pandemic crisis, the Russian banking system faced new challenges under the conditions of the Russian Federation's invasion of Ukraine. In the first quarter of 2022, as a consequence of the largest number of financial and trade sanctions globally imposed by Western countries on a state, Russian banks faced massive withdrawals of deposits, rising funding costs and declining lending activity (Bank of Russia, 2022a). The uncertainty related to the extent of the effects of Western sanctions on the Russian economy, but also the severe collapse of the ruble, generated panic among the population and a severe liquidity crisis, which peaked in March 2022. The amount of funds withdrawn from current and deposit accounts since the beginning of the year reached the level of 7,005 billion rubles, i.e., 20% of the total amount of resources attracted from the population (Bank of Russia, 2022b). However, the situation has stabilized, starting from June, as the effects of the Bank of Russia and the government's measures started to have a visible effect (Bank of Russia, 2022c). Along with the key rate cutting, an upward trend in the demand for loans from the population can be observed. In addition, the high level of capitalization and the relaxation of capital buffer requirements allowed banks to absorb loan losses. However, the sanctions imposed by Western countries most likely would have a negative long-term effect on the Russian economy, with the risk of damaging the banking system.

4 Conclusions

In conclusion, in order to avoid disruptions in the banking activity and to support lending, the Bank of Russia adopted measures aimed at stabilizing the financial system, initiating an extensive liquidity injection into the banking system, providing new lending facilities to banks, temporarily relaxing prudential requirements, etc. In this context, the banking system has managed to remain sufficiently capitalized so that it could cover banking losses and risks. Also, the banks recorded a high level of resilience to possible deposit withdrawals, as liquid assets ratio stayed above the minimum liquidity requirement during 2020-2021. However, the profitability of the Russian banking sector suffered in the context of the COVID-19 crisis, as the bank net income fell. In addition, although the financial situation of debtors worsened during the pandemic as a result of lockdowns, the measures adopted by the Bank of Russia, namely loans restructuring, easing of prudential requirements related to restructured loans, postponing payments on mortgage loans for up to 6 months etc., helped to avoid a credit crunch and a deterioration of assets quality. At the same time, Russian banks managed to create solid provisions for non-performing loans, as a result of the adequate level of capitalization. In 2022, the financial system of the Russian Federation was severely affected by international sanctions, imposed as a result of the Russian invasion in Ukraine. In this context, the central bank and the executive authorities adopted significant measures to reduce the volatility on the stock exchange and the foreign exchange market, but also to ensure the stability of the banking system. To limit the devaluation of the national currency, with a significant part of the central bank's international foreign exchange reserves frozen, the central bank carried out unprecedented liquidity and refinancing operations, while the executive authorities adopted a series of capital restrictions. In addition, to

stabilize the stock exchange market, it suspended trading on the stock exchange market for several weeks, while to increase the banking system resilience it relaxed prudential supervision.

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Digital and Green Transition in the EU27 from an Econometric Perspective

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Abstract: The pandemic and, currently, the war in Ukraine revealed the fragility of the linear economic system that depends on external supply chains and emphasised the need to achieve strategic autonomy regarding the critical resources for the economy and people. Since energy has become a burning issue nowadays, based on data provided by Eurostat and the European Commission, the paper analyses the relationship between the real GDP per capita, the electricity production capacities for renewables and wastes (wind, solar and solid biofuels), and the Digital Economy and Society Index. It aims to identify possible connections between prosperity, digitalisation, and green energy sources in an attempt to understand how to achieve strategic autonomy. The research identified several statistically significant relationships between the GDP per capita, DESI and the components of electricity production capacities for renewables and wastes.

Key-Words: - Econometric Modelling, DESI, solar, wind, biofuels, energy

JEL Classification: - C1, O13, Q4, Q5.

1. Literature review

Parra, Pérez-Pons, and González (2020) identified that an increase in technology in different areas implies an improvement in per capita GDP. Olczyk and Kuc-Czarnecka (2022) also revealed that economic growth, measured by GDP per capita, can be well explained by DESI. Gherghina, Paşa, and Onofrei (2021) modelled the relationship between DESI, the real GDP growth rate and the real GDP per capita. They found that the correlation between DESI values and real GDP growth rate was very weak, as explained by the convergence, and highlighted a strong and statistically relevant correlation between DESI and real GDP per capita. Regarding DESI components, Stremousova and Buchinskaia (2019) argue that the most significant factors for the growth of per capita GDP are mobile and fixed broadband subscriptions. Their research confirmed that digitalisation's economic effect depends on the Internet connection's level of development.

Yang, Ran, Wu, Irfan & Ahmad (2021) prove that the development of the digital economy tends to decrease the impact of coal-based energy structures on carbon emissions. They found the trend is more evident in resourceless provinces and eastern China and not evident in resource-based cities and central and western China.

Shahbaz, Wang, Dong and Zhao (2022) found that the digitalisation of the economy positively affects the generation and consumption of renewable energy. Thus, a 1% increase in the digital economy could increase the renewable energy consumption structure by 0.021% and the renewable energy generation structure by 0.106%. The researchers identified regional heterogeneities in the effect of digitalisation on energy transition, with the rich countries benefiting the most from the digital transition.

2. Methodology

The paper does ex-post quantitative research on some of the indicators available at the statistical office of the European Union and at the European Commission, displayed below (Tables 1 to 5). It examines the DESI overall index score, the real GDP per capita and the electricity production capacities for renewables and wastes (wind, solar and solid biofuels) for Finland, Denmark, Germany, Bulgaria, Romania and the EU27, using comparative and econometrical methods.

The research uses Microsoft Excel's functions (Data, Data Analysis, Correlation and Regression) to assess the relationships between the above indicators.

The methodology consists of calculating the correlation coefficients, testing the statistical significance of the linear relationship at a 95% confidence level using null and alternate hypotheses, calculating the coefficient of determination, writing the regression equation and interpreting the results.

3. The dynamics of the analysed indicators

According to the experts of the European Commission (2022a), "the Digital Economy and Society Index (DESI) is a composite index that summarises relevant indicators on Europe's digital performance and tracks the evolution of EU Member States, across five main dimensions: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology, Digital Public Services." Electricity production capacities for renewables and wastes (wind, solar and solid biofuels) refer, according to Eurostat (2022a), to the following variables: total capacity (MWe), capacity by the source of electricity production (MWe), capacity by type of generation in power plants using combustible fuels (MWe).

Between 2016 and 2022, at the EU level, the value of DESI increased by 48.08% (Table 1). Between 2019 and 2022, the progress was also significant, 21.33, respectively. From the analysed countries, Bulgaria recorded the highest increase between 2016 and 2022 (45.09%), followed by Romania (42.99% and Finland 40.53%).

Table 1. DESI overall index score per country in 2022, weighted score (0 to 100)

Country/Year	2016	2017	2018	2019	2020	2021	2022
Finland	49.52	52.06	55.04	58.13	62.8	67.15	69.60
Denmark	50.14	53.33	54.83	57.92	61.78	70.06	69.33
Germany	38.05	39.94	42.21	45.08	49.05	54.07	52.88
European Union	35.3	37.91	40.65	43.08	46.28	50.71	52.28
Bulgaria	25.97	28.11	30.89	32.72	34.43	36.83	37.68
Romania	21.39	23.21	25.68	27.08	29.98	32.87	30.58

Source: Author's own representation, based on the European Commission (2022b).

Between 2019 and 2022, Finland experienced the highest increase in the value of the DESI overall index (19.72%), followed by Denmark (19.70%) and Germany (17.31%).

The leader of the EU27 ranking in 2022 is Finland (69.60), followed by Denmark (69.33). Germany ranks 13th (52.88), Bulgaria 26th (37.68) and Romania 27th (30.58).

Between 2016 and 2021, the GDP per capita in the EU27 increased by only 5.45%, but between 2020 and 2021, it increased by 5.33% (Table 2). Romania registered the highest increase in our selection between 2016 and 2021 (24.35%), followed by Bulgaria (13.20%) and Denmark (7.04%). Romania records the highest increase in the GDP per capita between 2020 and 2021 (5.88%), followed by Bulgaria (4.86%) and Denmark (4.43%).

Table 2. Real GDP per capita, Chain linked volumes (2010), euro

Country/Year	2016	2017	2018	2019	2020	2021
Denmark	46,720	47,740	48,450	48,970	47,890	50,010
Finland	35,330	36,380	36,740	37,150	36,270	37,280
Germany	34,610	35,410	35,650	35,950	34,590	35,480
European Union	26,400	27,100	27,600	28,040	26,430	27,840
Romania	7,680	8,360	8,920	9,300	9,020	9,550
Bulgaria	5,910	6,120	6,330	6,630	6,380	6,690

Source: Author's own representation, based on Eurostat (2022b).

Regarding the GDP per capita, in 2021, the leader of the EU27 hierarchy is Luxembourg (84,490 euros per capita). With 50,010 euro per capita, Denmark ranks 3rd in the EU27, followed by Finland (37,280 euro per capita) and 6th, Germany (35,850 euro per capita) the 9th. Romania and Bulgaria close the ranking with 9,550 euros per capita and 26th and 6,690 euros per capita and 27th, respectively.

The EU27 wind electricity production capacities increased by 28.24% between 2016 and 2020 (Table 3). The growth rate in just one year between 2019 and 2020 is significant, namely 5.88%. The highest increase between 2016-2020, among the five analysed countries was recorded in Finland (65.24%), followed by Germany

(25.80%) and Denmark (19.34%). Romania experienced a decrease in wind electricity production capacities between 2016 and 2020 (-0.41%), while Bulgaria increased its capacities by just 0.54%.

Table 3. Wind - Electricity production capacities for renewables and wastes (WEP), megawatt

Country/Year	2016	2017	2018	2019	2020
European Union	138,010.88	148,920.39	157,166.76	167,162.15	176,985.20
Germany	49,435.00	55,580.00	58,721.00	60,742.00	62,188.00
Denmark	5,245.14	5,488.95	6,115.05	6,102.94	6,259.46
Romania	3,025.00	3,029.80	3,032.26	3,037.52	3,012.53
Finland	1,565.00	2,044.00	2,041.00	2,284.00	2,586.00
Bulgaria	699.00	698.39	698.92	703.12	702.80

Source: Author's own representation, based on Eurostat (2022c).

The EU27 ranking for 2020 regarding wind electricity production capacity was led by Germany (176,985 megawatts). Denmark ranked eighth (6,259 megawatts) and Finland the 15th (2,586 megawatts), while Romania 14th (3,013 megawatts) and Bulgaria 17th (703 megawatts).

The EU27 solar electricity production capacities increased by 51.31% between 2016 and 2020 (Table 4). Finland`s capacity grew by 715.38%, Denmark`s by 53.27% and Germany`s by 32.06% in the same timeframe. Bulgaria and Romania experienced lower growth rates (6.75% and 0.77%, respectively).

Table 4. Solar - Electricity production capacities for renewables and wastes (SEP), megawatt

Country/Year	2016	2017	2018	2019	2020
European Union	91,498.80	96,231.81	104,052.25	120,221.82	138,442.69
Germany	40,679.00	42,293.00	45,158.00	48,914.00	53,721.00
Romania	1,372.00	1,374.20	1,385.91	1,397.80	1,382.63
Denmark	850.95	906.35	998.00	1,080.00	1,304.29
Bulgaria	1,028.00	1,035.57	1,032.68	1,047.95	1,097.36
Finland	39.00	82.00	140.00	222.00	318.00

Source: Author's own representation, based on Eurostat (2022c).

In 2020, Germany ranked first in the EU27 hierarchy regarding solar electricity production capacities (53,721 megawatts). Romania ranked 12th (1,383 megawatts), Denmark 13th (1,304 megawatts), Bulgaria 16th (1,097 megawatts) and Finland 19th (318 megawatts).

The EU27 solid biofuel electricity production capacities grew by 8.42% between 2016 and 2020 (Table 5). Denmark registered the highest increase rate (43.91%), followed by Finland (39.78%) and Romania (26.95%). In the same period, Bulgaria experienced a contraction of 20.72% and Germany of only 0.19%.

Table 5. Solid biofuels - Electricity production capacities for renewables and wastes (SBEP), megawatt

Country/Year	2016	2017	2018	2019	2020
European Union	14,351.84	15,037.22	15,558.12	15,749.93	15,560.78
Finland	1,747.00	1,966.00	1,966.00	1,963.00	2,442.00
Germany	1,600.00	1,601.00	1,585.00	1,598.00	1,597.00
Denmark	1,031.70	1,501.26	1,484.66	1,501.26	1,484.66
Romania	107.00	118.88	119.28	118.77	135.83
Bulgaria	19.00	22.97	33.02	23.51	15.06

Source: Author's own representation, based on Eurostat (2022c).

Sweden ranked first in 2020, within the EU27 countries, regarding the solid biofuel electricity production capacities (2,942 megawatts), followed by Finland, second (2,442 megawatts), Germany third (1,597 megawatts) and Denmark fourth (1,485 megawatts). Romania ranked 17th (136 megawatts), and Bulgaria 23rd (15 megawatts).

4. Econometric analysis of the relationship between real GDP per capita and DESI in Romania (example)

The correlation coefficient of the relationship between real GDP per capita and DESI is calculated using Data Analysis and Correlation under Microsoft Excel and the data in Table 6. The results are displayed in Table 7.

Table 6. Real GDP per capita, in euro, and DESI, weighted score (0 to 100) in Romania

Year	Real GDP per capita	DESI
2016	7,680	21.39
2017	8,360	23.21
2018	8,920	25.68
2019	9,300	27.08
2020	9,020	29.98
2021	9,550	32.87

Source: Tables 1 and 2.

Table 7. Correlation coefficient

	GDP per capita	*DESI*
GDP per capita	1	
DESI	0.890143982	1

Source: Author's own representation

The value of r is 0.89. It means a robust linear relationship between the analysed indicators with a positive slope. Therefore, if one indicator increases, the other increases too (See Chart 1).

The linear relationship between the analysed indicators is tested at a 95% confidence level (0.05 level of significance) to see if it is statistically significant.

The null hypothesis (H_0) implies no statistically significant linear relationship in Romania between the real GDP per capita and DESI.

The alternate hypothesis (H_a) supports a statistically significant linear relationship between the two variables.

H_0: $\rho = 0$. H_a: $\rho \neq 0$.

The regression statistics are displayed in Table 8.

Table 8. Regression Statistics of the relationship between real GDP per capita and DESI in Romania

Correlation coefficient **r**	0.890143982			
r^2	0.792356309			
Adjusted **r^2**	0.740445386			
Standard Error	2.165808971			
Observations	6			
	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-22.18010641	12.54275	-1.768361136	0.151729345
PIB/locuitor	0.005551526	0.001421	3.906887315	0.017439627

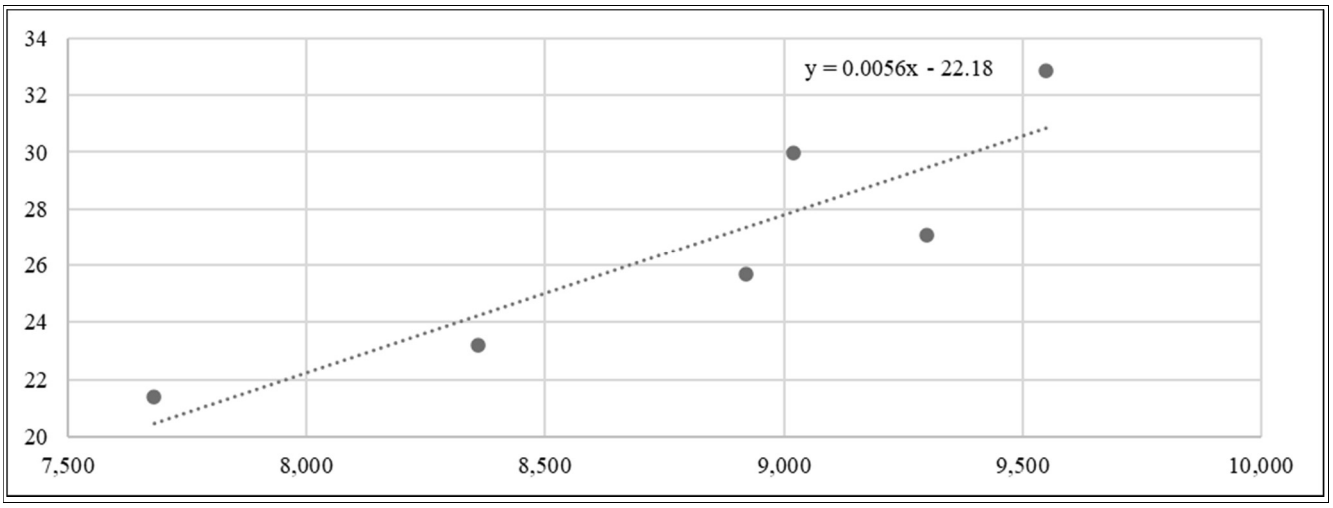
Source: Author's own representation

Since P-value is smaller than the significance level: $\alpha = 0.05$, the null hypothesis (H_0) is rejected (See Table 8).

Therefore, we are 95% confident that there is a statistically significant linear relationship in Romania between the real GDP per capita and the value of DESI.

The coefficient of determination (r^2) is 0.7924. That implies that the relationship between the analysed variables explains 79.24% of the variation in the value of DESI. It does not mean that one variable causes the other.

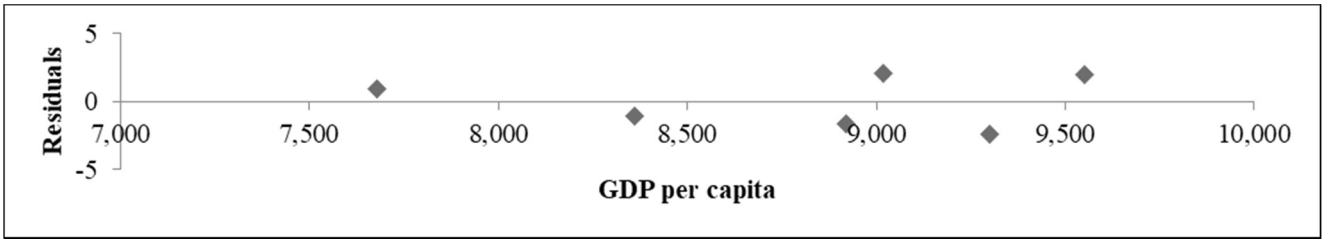
Chart 1. Relationship between real GDP per capita and DESI in Romania



Source: Author's own representation

According to the model, for one additional euro in GDP per capita, the DESI in Romania could increase by 0.005551526 points. The equation of the sample regression line is displayed on scatter Chart 1.
The residual plot shows that the prediction equation is a good fit for the data because the points are scattered randomly around the horizontal axis, and there seems to be no pattern to the points (Chart 2).

Chart 2. Residual Plot



Source: Author's own representation

The same methodology is applied for the pairs of variables in the case of EU27, Bulgaria, Finland, Denmark, and Germany, using the data in tables 1 to 5. The results are displayed below (Tables 9-15.

Table 9. Relationship between real GDP per capita and DESI

Country	r	r^2	*P-value*	Slope (b_1)
European Union	0.418877993	0.175458773	0.408430920	
Bulgaria	0.914491695	0.836295060	0.010654901	0.012387510
Romania	0.890143982	0.792356309	0.017439627	0.005551526
Finland	0.683349880	0.466967058	0.134526122	
Germany	0.121664348	0.014802214	0.818403928	
Denmark	0.835748372	0.698475342	0.038252256	0.005270536

Source: Author's own representation

In Table 9, besides Romania only in Bulgaria and Denmark, the analysed relationship was statistically significant at a level of confidence of 95%, with robust correlation coefficients and relevant coefficients of determination (P-value < $\alpha = 0.05$).

According to the identified models, and the selected samples, for one additional euro in the GDP per capita, the DESI could increase by 0.012387510 points in Bulgaria and by 0.005270536 in Denmark.

Table 10. Relationship between real GDP per capita and wind electricity production capacities (WEP)

Country	r	r^2	*P-value*	Slope (b_1)
European Union	0.216684978	0.046952380	0.726282547	N/A
Bulgaria	0.777746075	0.604888958	0.121498709	N/A

Romania	0.164713377	0.027130497	0.791232611	N/A
Finland	0.618471224	0.382506655	0.266107896	N/A
Germany	0.361255831	0.130505776	0.550245081	N/A
Denmark	0.786341348	0.618332715	0.114678388	N/A

Source: Author's own representation

Regarding the relationship between GDP per capita and wind electricity production capacities, no statistically significant relationship is identified in any of the analysed countries, even if Bulgaria and Denmark have robust correlation coefficients, and Finland recorded a moderate correlation coefficient between the analysed indicators.

Table 11. Relationship between real GDP per capita and solar electricity production capacities (SEP)

Country	r	r^2	*P-value*	Slope (b_1)
European Union	0.009436397	0.000089046	0.987985384	N/A
Bulgaria	0.437603026	0.191496408	0.461158703	N/A
Romania	0.885883271	0.784789171	0.045475826	0.014183369
Finland	0.495995929	0.246011962	0.395423211	N/A
Germany	-0.044265290	0.001959416	0.943658093	N/A
Denmark	0.441626573	0.195034030	0.456557353	N/A

Source: Author's own representation

Only Romania registers a statistically significant linear relationship between real GDP per capita and solar electricity production capacities. For one additional euro in the GDP per capita, solar energy production capacities could increase by 0.014183369 megawatts, according to the identified model, based on the given sample.

Table 12. Relationship between GDP per capita and solid biofuels electricity production capacities (SBEP)

Country	r	r^2	*P-value*	Slope (b_1)
European Union	0.638034394	0.407087888	0.246729617	N/A
Bulgaria	0.186672447	0.034846602	0.763708948	N/A
Romania	0.672355432	0.452061827	0.213721826	N/A
Finland	0.255030763	0.065040690	0.678839863	N/A
Germany	-0.339836020	0.115488520	0.575786432	N/A
Denmark	0.441626573	0.195034030	0.456557353	N/A

Source: Author's own representation

Again, no statistically significant relationship between GDP per capita and solid biofuel electricity production is identified in any of the analysed countries, even if, in the case of the EU and Romania, there is a moderate correlation coefficient.

Table 13. Relationship between DESI and wind electricity production capacities (WEP)

Country	r	r^2	*P-value*	Slope (b_1)
European Union	0.998467641	0.996937631	0.000071990	3,538.587143282
Bulgaria	0.825395623	0.681277935	0.085251470	N/A
Romania	-0.358664405	0.128640156	0.553323413	N/A
Finland	0.955600626	0.913172557	0.011155408	69.012707341
Germany	0.908183573	0.824797402	0.032933731	1059.305946605
Denmark	0.885721122	0.784501906	0.045571634	88.911655801

Source: Author's own representation

Concerning the relationship between DESI and wind electricity production capacities, there are four statistically significant linear relations in the EU, Finland, Germany, and Denmark, since P-value is smaller than the significance level: $\alpha = 0.05$, and there are strong correlation coefficients.

According to the model, one unit increase in DESI could increase the capacities with 3,538.5 megawatts in the EU, 68,01 megawatts in Finland, 1,059,3 megawatts in Germany and 88.9 megawatts in Denmark. In the case of Bulgaria, there is a strong linear correlation between the indicators without statistical significance. In Romania, there is a weak correlation, with a negative slope, meaning if DESI increases, WEP decreases, but there is no statistical relevance of the relationship.

Table 14. Relationship between DESI and solar electricity production capacities (SEP)

Country	r	r^2	*P-value*	Slope (b_1)
European Union	0.973664039	0.948021660	0.005110160	4,362.332694920
Bulgaria	0.794243453	0.630822662	0.108513660	N/A
Romania	0.634743239	0.402898979	0.249961978	N/A
Finland	0.997937778	0.995879808	0.000112384	21.466765720
Germany	0.998727094	0.997455808	0.000054506	1210.485926951
Denmark	0.979468855	0.959359239	0.003520559	39.087771811

Source: Author's own representation

As to the relationship between DESI and solar energy production capacities, there are also four statistically significant linear relationships in the EU, Finland, Germany, and Denmark. Romania registers a moderate correlation coefficient without statistical significance.

Therefore, an increase of one unit in DESI would generate, according to the models, a boost of 4,362 megawatts in the EU, 21.4 megawatts in Finland, 1,210,5 megawatts in Germany and 39.1 megawatts in Denmark.

Table 15. Relationship between DESI and solid biofuels electricity production capacities (SBEP)

Country	r	r^2	*P-value*	Slope (b_1)
European Union	0.855234966	0.731426848	0.064664602	N/A
Bulgaria	-0.088299478	0.007796798	0.887719878	N/A
Romania	0.907749795	0.824009691	0.033165169	2.791371632
Finland	0.897909283	0.806241080	0.038552128	44.213719202
Germany	-0.143165542	0.020496372	0.818340593	N/A
Denmark	0.979468855	0.959359239	0.003520559	39.087771811

Source: Author's own representation

The analysis identifies three statistically significant linear relations at a level of confidence of 95% in the case of Romania, Finland, and Denmark with strong correlation coefficients. According to the analysed samples, the models reveal increases in SBEP by 2.79 megawatts in Romania, 44.2 megawatts in Finland and 39 megawatts in Denmark, following one unit increase in DESI.

5. Conclusion

In general, in the timeframe of this research, the analysed countries improved their performances regarding the selected indicators. Some exceptions occurred; Romania`s wind electricity production capacities or Bulgaria`s and Germany`s solid biofuel electricity production capacities decreased.

Regarding the relationship between GDP per capita and DESI, the analysis revealed that only three out of the five countries investigated proved to record statistically significant linear relations at a level of confidence of 95%, namely Bulgaria, Denmark, and Romania. The relationship between the analysed variables explained a high percentage of the variation in the value of DESI.

As to the relationship between real GDP per capita and the electricity production capacities for renewables and wastes (wind, solar and solid biofuels), there were no statistically significant relationships identified in all the five countries and the EU27, except Romania`s relationship between GDP per capita and solar electricity production capacities.

From all the analysed entities, Romania had the best statistics concerning the relationships between GDP per capita with DESI and GDP per capita and electricity production capacities for renewables and wastes. Romania ranked 12th in the EU27 regarding solar electricity production capacities but 26th in GDP per capita. There was a statistically significant relationship between DESI and wind electricity production in Germany, Finland, and Denmark. The relationship between the variables explained, to a high degree, the variation in the value of WEP (there are robust coefficients of determination). Though there were strong correlation coefficients in the case of Romania and Bulgaria, the relationships were not statistically significant. Romania ranked 14th regarding the capacities for wind electricity production, while Bulgaria 17th.

Germany, Finland, and Denmark had statistically significant relationships between DESI and solar electricity production capacities, with high correlation coefficients and a high percentage of the variation in the SEP value explained by the relationship between the variables. Though Romania and Bulgaria have strong correlation coefficients, the relationship is not relevant from a statistical standpoint. It is worth mentioning that Romania ranked 12th regarding solar electricity production capacities, better than Denmark, Bulgaria, and Finland.

Denmark, Romania, and Finland recorded statistically significant relations between DESI and SBEP, with high coefficients of determination. Romania ranked 17th in the EU as to solid biofuel electricity production capacities.

Out of seven investigated relationships, in the case of Romania, three proved to be statistically significant. The higher the GDP per capita, the better the DESI score. It does not mean that one variable causes the other. The same applies to the relationships between DESI and SEP and DESI and SBEP.
The relationship between GDP per capita and SBEP proved statistically insignificant in all the analysed countries.

In conclusion, the more prosperous the country, the better the value of DESI, and the better the value of DESI, the higher the electricity production capacities for renewables and wastes (wind, solar, solid biofuels) with variations from one country to another, depending on the country specifics.

Further analyses should investigate the relationships between the components of DESI and electricity production capacities for renewable and wastes to identify which are more statistically significant.

The main limitation of the research is the limited number of observations used for the regressions.

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Fragmentation and Concentration within the International Payments System – Risks, Challenges, Opportunities

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Abstract: This paper underscores the dynamic and complex context of international payments, with the aim to identify specific forces, risks and challenges behind current megatrends. It underlines also the opposite tendencies of fragmentation and concentration within the international payments system. Fragmentation is due to three main categories of factors: differences in regulation, difficulties of interoperability and lack of common standards; variety of participants, with different objectives and goals; geopolitical tensions, which may lead to the emergence of parallel payment systems, which do not interact with each other. Concentration within the international payments system is reflected by the market power of specific private actors, especially big technology companies (BigTechs), but also financial technology actors (FinTechs). This concentration is also evidenced by the overwhelming share held by the most used currencies in global payments. Our paper argues that the ideal international payments system should provide fast, cheap, safe, transparent and cyber resilient services. At the same time, financial stability, deterrence of illegal activities and the level playing field should be ensured. The qualitative analysis that is the basis of this paper takes into account multiple perspectives, including demand side, supply side and regulators.

Key-words: international payments system, fragmentation, concentration, digital currencies, cryptocurrencies, stablecoins, sanctions

JEL codes: E42, E51, E52, E58, F33, O33.

1. Introduction[1]

The global payments ecosystem is one of the few sectors demonstrating resilience at present, in spite of the macroeconomic and geopolitical changes. The outlook for global payments through 2026 is remarkably favourable, with projected average annual revenue growth of 9%. It is worth noting that in 2021, the payments

[1] The paper is based on the authors' results of the research carried out as a part of the study *6.5.8 The digital revolution of the international payments system. New tools, actors and partnerships*, coordinated by CSII Iulia Monica Oehler-Șincai, PhD.

industry revenues rebounded strongly, growing at an 11% rate, reaching a new high of $2.1 trillion globally (Mckinsey & Company, 2022).

Another characteristic of the global payment ecosystem is complexity. In the global payments, non-bank actors have been continuously increasing their role. These are mainly non-traditional players, especially BigTechs[2] and Financial Technology Companies (FinTechs). Some of them offer supper applications or multi-purpose platforms, exempli gratia the Chinese WeChat, Singaporean Grab or Indonesian Gojek. They meet all consumer needs in one digital place, both for financial and non-financial goals. These super applications are a part of the daily life of many users around the world. In this way, the digitalization of everyday activities is becoming a reality (Oehler-Șincai, 2022a).

Besides them, there is also the world of decentralized finance (DeFi), where cryptocurrencies such as Bitcoin, Ether, Tether are generated, stored and traded. In parallel, over 100 central banks are exploring digital currencies as a potential solution to challenges such as illicit financial activities, low financial inclusion and unregulated cryptocurrencies (Capgemini, 2022).

Together with resilience and complexity, another attribute of the payments landscape is dynamism, as regards partnerships, new software solutions and evolving payment methods (Ampenberger et al., 2022). FinTechs, which are nimble, agile and flexible, cooperate with financial institutions, including banks.

Such changes are accompanied by two contrary trends: one of higher market concentration, the other of increased market fragmentation, both with specific risks, but also opportunities. These new drifts represent an impetus for the regulators to better control the market, but also a catalyst for new partnerships and initiatives, some of them involving both public and private actors.

Against this backdrop, the aim of this paper is to analyse the forces, risks and challenges behind these trends. Starting from these considerations the remaining part of the paper is structured as follows. The first section offers various examples of concentration within the international payments system. The second one reviews the parallel payment systems developed as alternative to the SWIFT system[3], focusing on the role played by financial sanctions in conceiving of such alternatives. The third one approaches the fragmentation from the point of view of digital currencies (central bank digital currencies, stablecoins[4], cryptocurrencies), highlighting the use of blockchain technology in international payments.

2. Examples of concentration within the international payments system

In the literature there is a lot of evidence pointing to market power concentration of specific private actors. BigTechs are among them. They have become "substantial players" in payments in both advanced and emerging market economies. For instance, BigTechs account for more than 90% of mobile payments in China. Worldwide, BigTech credit increased by 40% in 2020 alone, to a global total of over USD 700 billion. They compete with banks for loans to small and medium sized enterprises (Gambacorta et al., 2022).

BigTechs, with their "walled gardens"[5] and "data-network-activities" (DNA) loop[6], are sources of efficiency but also of risks. They can help increase the efficiency of the financial sector and accelerate financial inclusion, but may also generate risks for the financial sector (from the perspective of fair competition, consumer protection, data security or cyber security, among others) (Oehler-Șincai, 2022a).

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[2] BigTechs are large technology conglomerates with extensive customer networks with core businesses in social media, telecommunications, internet search and e-commerce. Relevant examples are the following: American companies Amazon, Google-Alphabet, Apple, Meta (Facebook), Microsoft and the Chinese Alibaba and Tencent with its WeChat. Please consult: https://www.imf.org/en/News/Articles/2021/06/16/sp061721-bigtech-in-financial-services.

[3] The Society for Worldwide Interbank Financial Telecommunication was founded in 1973 with headquarters in Belgium, when a number of 239 banks from 15 countries got together to solve the common problem of communication regarding cross-border payments. At present, SWIFT "is accelerating flows to achieve instant processing between 4 billion accounts and 11,000 institutions in more than 200 countries – while maintaining unrivalled security, reliability and resiliency" (SWIFT, 2022a and 2022b).

[4] A stablecoin is a cryptocurrency that is collateralized by an underlying asset. Its value is pegged to a fiat currency like the U.S. dollar or euro, other cryptocurrencies, or a commodity like gold. In this way it is avoided the price volatility of traditional cryptocurrencies (Bains, Ismail, Melo and Sugimoto, 2022).

[5] Closed platform with a total control owned by the provider.

[6] Autogenerating more and more valuable data for the platform provider.

In the last decade, BigTechs and FinTechs expanded the range of financial services from payments to consumer lending, insurance, wealth management and more recently to banking. Due to an enabling regulatory environment, BigTechs and FinTechs have even obtained a banking licence in various jurisdictions. BigTechs that operate with a banking licence are overwhelmingly concentrated in Asia, led by China, while in the US, BigTechs do not own banks and only a few diversified FinTechs operate with a banking licence. In the European Union (EU), diversified FinTechs and a few BigTechs have banking licences, but also some partner with existing banks (Zamil and Lawson, 2022).

Hundreds of "digital-first banks" have appeared in the past few years, based on the cooperation between FinTechs and banks. This is enabled by a new business model: Banking as a Service (BaaS), combined with Application Programming Interfaces (API) (a connection between a third-party application and a bank) and Open Banking (which allows third-party providers of financial services to access data and credentials of banking customers) (Glazier, 2022; Agarwal, 2022). Digital-first banks do not have branches and only exist online, due to partnerships with existing banks, which offers a bank's charter necessary for regulatory compliance (Glazier, 2022). This enables on the one hand the banks to become more competitive, while on the other hand increases the market power of already strong BigTechs.

One can remark also the dominance of several payment service providers. In Europe, for instance, PayPal dominates online payments, while Visa and Mastercard handle more than 2/3 of the card payment transactions (Panetta, 2020). All these mentioned companies are FinTechs.[7]

The concentration within the international payments system is also reflected in the overwhelming share held by the most used currencies in global payments. In July 2022, USD, the most active currency for global payments by value, and EUR, the second one, detained a share of 41.19% and respectively 35.49% (SWIFT, 2022c).

Whether too much concentration or too much fragmentation are harmful should be decided from multiple perspectives, including those of consumers, business sector and the financial system as a whole. The relevant questions to answer in this regard include the following: Are the provided services fast, cheap, safe, transparent, cyber resilient? Are the financial stability and the level playing field ensured? Who are the losers?

3. The international payments system, faced with a growing risk of fragmentation - parallel payment systems

Through its mechanisms, infrastructures, participants and rules, the international payments system enables international transfer of funds among different jurisdictions, playing an important role in promoting international changes. However, due to differences in regulation, and challenges regarding interoperability and adoption of common standards, the international payments system is highly fragmented (Stefanovski, 2019). Besides, there are various participants in international payments system that range from Fintech start-ups to global banks. Currently, under the impact of geopolitical tensions and digitalisation, the international payments system faces even a growing risk of fragmentation (Georgieva, 2022). Exclusion of Russia from the SWIFT system following the invasion of Ukraine may determine countries to develop their own payment systems to reduce dependence on external systems (World Bank Group, 2022a).

Payment innovations have the potential of "lowering transaction costs, increasing transaction speed, and improving access and transparency". Nevertheless, besides its "significant economic benefits" this "revolution" can lead also to major risks, which need to be addressed carefully (Gopinath, 2022).

Over the past few years, geopolitical tensions between Russia and the West have continuously increased in intensity, culminating with the Russian Federation's invasion of Ukraine on 24 February 2022. Previously, Russia recognised the areas of the Donetsk and Luhansk oblasts of Ukraine as independent and sent troops into the region. These actions have attracted a number of sanctions from the EU and its allies including financial sanctions. Among other punitive measures, the Western authorities banned some Russian banks from the SWIFT network in order to limit the Russia' capacity to finance the war (Table 1).

[7] Please consult: https://thefinancialtechnologyreport.com/the-top-100-financial-technology-companies-of-2022/.

Table 1: Main financial sanctions adopted by the European Union against the Russian Federation in 2022

Date of adoption	Sanctions
23 February	• Restrictions on Russian Federation's access to the capital and financial markets and services of the EU.
2 March	• Exclusion from the SWIFT system of seven Russian banks: Bank Otkritie, Novikombank, Promsvyazbank, Rossiya Bank, Sovcombank, Vnesheconombank and VTB Bank. • Ban on supply of euro banknotes to Russia. • Ban on investing in projects co-financed by the Russian Direct Investment Fund.
8 April	• Full transaction ban on four Russian banks, representing 23% of the Russian banking sector.
3 June	• Exclusion from the SWIFT system of three other banks: Sberbank, the largest bank in Russia, Credit Bank of Moscow and Russian Agricultural Bank.

Source: Authors' summary based on the timeline provided by the Council of the European Union (2022a; 2022b).

It is worth noting that banks in Russia were not the first ones sanctioned with exclusion from SWIFT. On 15 March 2012, SWIFT announced that, following a decision of the European Council, the EU-sanctioned Iranian banks would be disconnected from SWIFT beginning with 17 March 2012 (SWIFT, 2012). Subsequently, in 2014, SWIFT faced pressures to disconnect Russian and Iranian financial institutions from its network, but it mentioned that "it has no authority to make sanctions decisions" and, therefore, must comply with EU regulation (being incorporated under Belgian law) (Swift, 2014). In 2017, SWIFT announced that North Korean banks under United Nations sanctions are suspended from the system (Wagstaff, Bergin, 2017). In 2022, in addition to the above-mentioned banks in the Russian Federation, some Belarusian banks were also disconnected from SWIFT: **Belagroprombank, Bank Dabrabyt,** and the **Development Bank of the Republic of Belarus**, including their Belarusian subsidiaries (Council of the European Union, 2022a; 2022b).

Against this background, alternative payments system to SWIFT have begun to develop. In 2012, China decided to create its cross-border interbank payment system CIPS (Cross-Border Interbank Payment Systems), for international transfers of yuan-denominated transactions. Even if its main goal is to promote yuan internationalisation, this initiative is also "an alternative to the western SWIFT payment system" (BOFIT, 2021). During October 2022, 7 new financial institutions were admitted as CIPS participants; as a result, the total number of CIPS participants reached 1353, among which, 1276 as indirect participants and only 77 as direct participants (CIPS, 2022). In 2020, China's international payments system CIPS processed 2.2 million payment transactions (BOFIT, 2021).

The Financial Messaging System of the Bank of Russia (SPFS), which has more than 400 users, operates since 2014 (Bank of Russia, 2022). The Central Bank of Russia decided to create its own financial messaging system after the threats with Russia exclusion from the SWIFT network in 2014 (Irabor, 2022).

But few financial institutions use CIPS and SPFS compared to SWIFT, which also benefits from a well-established experience. However, it was reported that Russia cooperates with China to connect to its payment system CIPS while India takes into consideration to use the Russian system SPFS for payments in rubles (Hotten, 2022). It was also reported that the Russian Federation intends to expand the use of its SPFS to other countries including Turkey and Iran (Irabor, 2022), which is another jurisdiction confronting with severe sanctions.

In order to circumvent the US sanctions against Iran, the EU has created the INTEX (Instrument in Support of Trade Exchanges) mechanism intended to allow firms in Europe to exchange goods with their counterparts in Iran without transferring euros between parties through banks (Deutsche Welle, 2019). In fact, the special purpose vehicle INSTEX operates "as a barter arrangement operating outside of the US-dominated global financial system" (Winter, 2019). Initially, it was expected to address trade with essential goods like medical products and food. However, it was not expected to involve oil-related transactions too (Winter, 2019).

Nevertheless, the development of alternative payments systems may rise the cost of cross-border payments (World Bank Group, 2022b), with negative impact on financial services consumers.

4. Fragmentation of international payment system under the digital currencies impact

4.1. Private digital currencies

An alternative to traditional payment systems, increasingly discussed in the context of the above, are private digital currencies (cryptocurrencies and stablecoins). Although they are not currently widely used for this purpose, they have properties that make them suitable for international payments, being differentiated from other types of instruments. Digital currencies allow payments to be made directly (peer-to-peer), without intermediaries, transparently and securely (Dijmărescu el al., 2022). There are currently around 21.600 such coins and tokens (the top 10 in terms of importance are worth USD 128 billion) (Coinmarketcap, 2022), many of them being able to serve as a means of payment in their ecosystem (Table 2). Among them, 559 crypto projects operate in the field of decentralized finance (DeFi) (Coinmarketcap, 2022), also fulfilling other functions, which are generally characteristic of financial institutions.

Table 2: Traded volume of the 10 most valuable cryptocurrencies (as of November 2, 2022)

Ranking	Digital currency	Traded volume/24h (USD)
1.	**Bitcoin**	38.364.996.760
2.	**Ethereum**	14.540.163.570
3.	**Tether**	55.124.047.053
4.	**BNB**	1.162.942.207
5.	**USD Coin**	3.262.558.882
6.	**XRP**	1.149.480.114
7.	**Binance USD**	6.742.878.968
8.	**Dogecoin**	6.497.393.260
9.	**Cardano**	475.367.227
10.	**Solana**	705.578.030
Total		**128.025.406.071**

Source: Authors, based on Coinmarketcap (2022).

All of these can be used in international payments thanks to the *blockchain technology*. Having its own operating principles, it makes possible the existence of digital money (mainly in the form of cryptocurrencies) and settlement platforms, providing users specific experiences, different from those with traditional payment instruments. They all derive from the way that blockchain technology is "built". It basically works as a distributed ledger where, among others, data related to digital currency transactions can be recorded in a specific way (Sarmah, 2018). As its name suggests, in a blockchain such data is organized in the form of "blocks" which, recorded chronologically and linked to other similar sets by cryptography, determine a "chain of blocks" structure. To be registered in the distributed ledger, the "blocks" representing transactions are subjected to a validation process, based on specific rules, carried out by the network members (called "nodes") that support the blockchain, through consensus mechanisms (OECD, 2022). That means that, in the case of blockchain technology, cross-border payments can be made directly (peer-to-peer), without intermediaries, in a decentralized and anonymous way, with maximum transparency (transactions registered in a blockchain can be searched and verified at any time, by anyone), and under increased security conditions (transactions have associated *timestamps* and are signed with cryptographic keys, ensuring resistance to cyber-attacks, data theft, manipulation etc.).

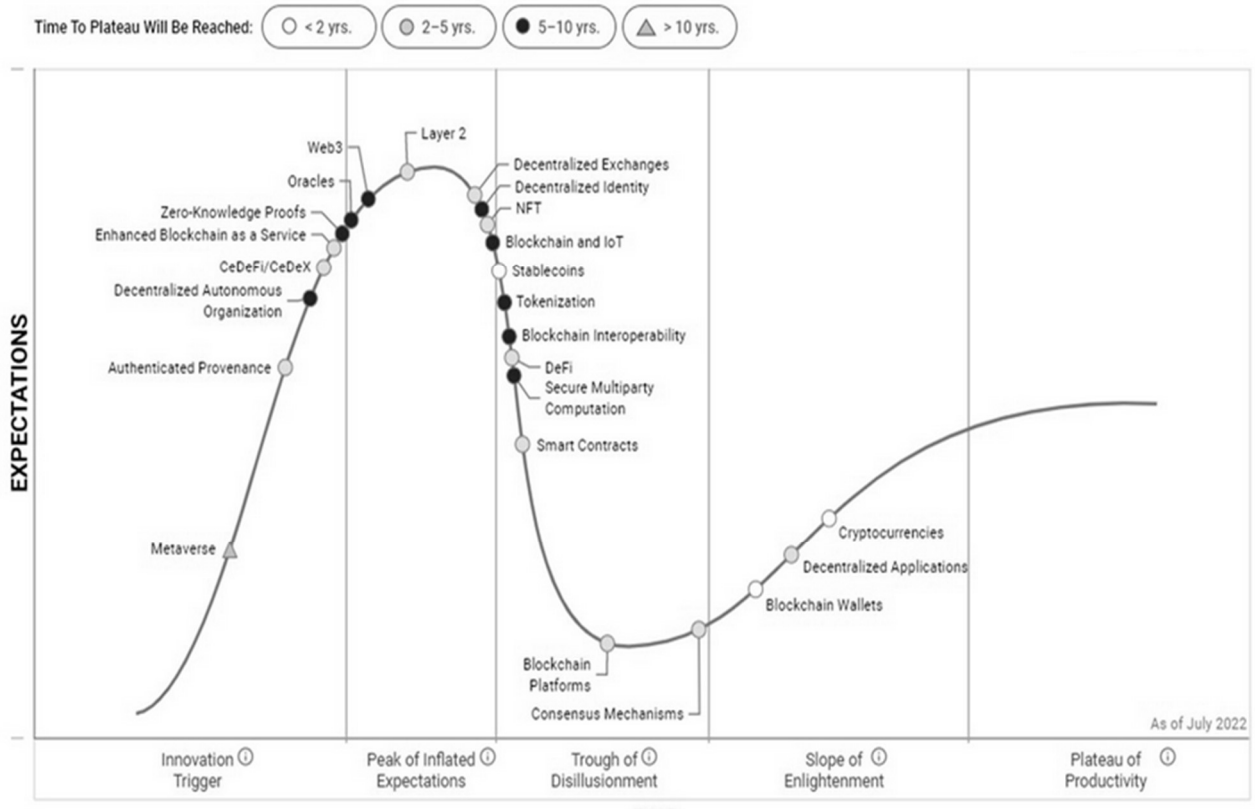
Given the technical aspects presented above, blockchain technology is seen as having the potential to significantly transform the field of cross-border payments (and finance in general), being the first to allow transactions without intermediaries in the digital field. This is because blockchain solves the problem of *double spending*. From a practical perspective, double spending, which hindered virtual currencies working until blockchain, refers to the fact that in digital transactions the information (the data) attached can be replicated, multiplied infinitely (and not transferred), being recorded both in the account of the beneficiary as well as the payer (OECD, 2022). Thus, the same money can be spent several times. The blockchain solves this problem by introducing the operation of verifying and confirming transactions (by mining, in the case of Bitcoin). Following this, the transaction is entered in the register with the consent of the majority of network members, becomes immutable, the associated data cannot be deleted or modified, and is compared with previous transactions, ensuring the fidelity of its entry.

With this, from a particular point of view, blockchain technology is seen as introducing a new stage in the use of the Internet. If in its early days, it facilitated the transmission of information anywhere in the world, with the blockchain, the international exchange of value (cryptocurrencies, digital assets, etc.), directly (peer-to-peer), without intermediaries, is enabled (Swan and Filippi, 2017).

Against this background, the emergence of the blockchain was a facilitator for the digitalization of cross-border payments, overcoming a series of inconveniences determined by the high costs deriving from currency exchange and transaction processing, the lack of interoperability between platforms and financial institutions, which makes the needed time for settlement to be significant etc. Added to these is the specific advantage of elimination of risks associated with the existence of intermediaries. With blockchain, settlement of transactions can be done directly (avoiding correspondent banks and clearing houses), quickly, securely and with minimal expenses.

Although not yet a widely adopted technology, blockchain, in terms of payments, has moved beyond its initial stage (Figure 1). As the latest Gartner Report on blockchain technology cycles shows, among all its applications, cryptocurrencies and digital wallets are at the most advanced stage from this point of view (Litan, 2022).

Figure 1. Stage of evolution of blockchain technology, by use cases, in 2022



Source: Litan (2022).

Under these circumstances, blockchain has seen an increase in popularity in recent years. This has led to an increasing number of entrepreneurs gaining confidence in its potential. According to a 2021 Deloitte Report, based on a survey among them, more than 80% of representatives of companies in the financial sector are confident in technology in general, tending to accept it more and more, and expect that the importance of digital assets, including those specific to payments, to increase considerably (Deloitte, 2021). The same respondents appreciate, in this context, 78%, that, in the next 2 years, they will particularly have a major impact on their businesses, and 76% believe that in a 10-year horizon, digital money will replace mostly fiat currency. Last but not least, in the category of those who use, in a generic sense, blockchain-based solutions, 44% use them to make payments.

As interest in cryptocurrencies and blockchain has been growing, investment in payments projects has also increased. In 2021, for example, spending on developing blockchain-based projects for payments and

settlements amounted to $1.05 billion, accounting for 15.9% of total global investment ($6.6 billion) (forecasts made in April 2021) (IDC, 2021).

An aspect to mention is that, beyond the benefits presented, the use of blockchain technology, in the form of cryptocurrencies and stablecoins, in payments, also involves risks. These risks derive mainly from their functioning without permission, that allows anyone to access the network, and from their anonymity (Makarov and Schoar, 2022). Thus, cryptocurrencies become difficult to supervise by the authorities. In the case of cryptocurrencies (this is not the case with stablecoins), for example, because they do not have guarantees from a central bank, a risk is that they are speculated and have significant price variations (volatility), which can cause losses to holders and can affect financial stability. Therefore, they are currently used mainly as speculative assets and not as currency (they do not perform the functions of money; this does not mean that they cannot be used to make payments). Beyond these, being easy to access and anonymous, they are frequently used in money laundering, illicit activities, tax evasion etc.

In this context, the issue of regulating these instruments, which are currently outside the law in many jurisdictions, is increasingly being discussed. From this perspective, the challenge that arises, however, is how to reduce the negative impact on consumers, the financial system and the economy in general, without diminishing the advantages they bring and without inhibiting the capacity for innovation.

4.2. Central bank digital currencies

At present, around 105 countries, representing more than 95% of the gross world product, are exploring or testing a central bank digital currency (CBDC) (Atlantic Council, 2022). The CBDC projects are focusing mainly on retail or universal access CBDCs (rCBDC); however they coexist with a second set of projects, intended for large-scale transactions. The latter alternative is dubbed wholesale CBDCs (w-CBDCs), set to improve the cross-border financial flows, also from the standpoint of costs (Gorjón, 2022).

Among the general motivations for the adoption of a CBDC are the following:

- Avoiding the risks of new forms of private money creation;
- Addressing the consequences of a decline in cash payments (meeting future payment needs in a digital economy);
- Improving the availability and usability of central bank money;
- Reduction of illicit use of money;
- Supporting the central bank's objectives of maintaining monetary and financial stability;
- Maintaining a resilient payments landscape;
- Promote financial inclusion (particularly for economically vulnerable households and communities);
- Reducing the cost of processing cash;
- Stimulating competition, efficiency and innovation in payments;
- Enabling better cross-border payments;
- Currency internationalization;
- The best solution adapted to geographical conditions, as demonstrated by the experience of Bahamas (Sand Dollar) and of the Eastern Caribbean Central Bank (DCash) (Oehler-Șincai, 2022b).

The inter-institutional cooperation meant to enhance cross-border payments started in 2015, at the initiative of the Financial Stability Board (FSB). Even if they are at the heart of international trade and economic activity at large, cross-border payments still face particular challenges, including: high costs, low speed, limited access and insufficient transparency. In October 2020, G20 joined the group made up of FSB, the Committee on Payments and Market Infrastructure (CPMI) of the Bank of International Settlements and other key international organizations in order to reach the objective of faster, cheaper, more transparent and inclusive cross-border payments (CPMI, 2022; BIS, 2022).

There are five evaluation criteria for analysing cross-border CBDC arrangements, namely: *do no harm, enhancing efficiency, increasing resilience, assuring coexistence and interoperability with non-CBDC systems, and enhancing financial inclusion* (BIS, 2022).

When designing their wCBDCs, central banks have three key alternatives as regards access:

- Closed, when only domestic payment service providers (PSPs) can access, hold and use the wCBDC (example of such projects: HSBC, Jasper-Ubin, Prosperus, MAS and Aber);

- Indirect, when foreign PSPs can access the wCBDC network via an intermediary (for instance Project Dunbar Phase I);
- Direct, meaning that foreign PSPs can directly hold and transact wCBDC, if they satisfy certain access criteria (e.g. Helvetia Phase II, mBridge and Jura) (BIS, 2022).

However, the drivers of CBDCs adoption include also bypassing restrictive financial measures imposed to sanctioned jurisdictions. Therefore, apart from their advantages in terms of efficiency and costs, CBDCs are currently considered "as geopolitical tools" (Reddy, 2022).

In 2018, the Asamblea Nacional Constituyente (National Constituent Assembly) in Venezuela approved the law regarding crypto actives, occasion for the Venezuelan authorities to declare that the law has an important role "to break the financial and commercial blockade" of the United States. The law regulates the use of El Petro as digital currency intended also to promote new international trade relationships of Venezuela with other countries (Gobierno Bolivariano de Venezuela, 2018).

In January 2022, the Central Bank of Iran (CBI) announced the intention to launch its own digital currency "in the near future"; subsequently, CBI provided financial institutions information about the rules regarding its crypto-rial, conceived to promote financial inclusion and to compete to other digital currencies (Iran Chamber of Commerce, Industries, Mines and Agriculture, 2022). According to a press report quoting Peyman-Pak, a senior government trade official in Iran, in early August 2022, Iran settled its first official import order (of $10 million) with crypto. The official added that by the end of September 2022, Iran will "widely" use cryptocurrencies in international trade deals with certain countries (Lindrea, 2022). The Iranian authorities have also encouraged the crypto mining industry. Regulations for cryptocurrency mining have been ratified in October 2020 (Financial Tribune, 2021a). Therefore, in June 2021, 30 crypto mining centres were authorized to operate (Financial Tribune, 2021b).

The Russia's central bank also recognises the potential of the digital ruble among the current geopolitical tensions. Even before the invasion of Ukraine, in October 2020, the central bank's press office declared to a Russian newspaper that digital ruble could help Russia to better mitigate the negative effects of foreign sanctions (Baydakova, 2020). A proof of greater resort to cryptocurrencies in response to the financial sanctions imposed against Russia at the beginning of the war in 2022 could be "their unusual appreciation" on February 28 (Rebucci, 2022). Moreover, some observers consider that increased use of cryptocurrencies in Russia began even earlier, in 2014, after the first sanctions have been imposed against this country (Cacioppoli, 2022).

The fragmentation risk of the cross-border payment landscape will increase if the new digital payments solutions, including cross-border CBDC projects fail to achieve interoperability (Reddy, 2022). In order to avoid fragmentation, global public digital platforms that connect different types of money should be developed (Gopinath, 2022). Regulatory action may promote achieving a common standard; to this end, the creation of the Single Euro Payments Area is a successful example of turning more than 30 different national payments market into a single one (Stefanovski, 2019). At the same time, the risk of fragmentation of the international payments system may be mitigated by market-driven solutions (Stefanovski, 2019). In addition, exchanges should strengthen regulatory framework for transactions denominated in cryptocurrencies in terms of AML (Anti Money Laundering) and CFT (Combating the Financing of Terrorism) requirements, and also know-your-customer ("KYC") procedures (Kirkpatrick, Savage, Johnston and Hanson, 2019).

5. Conclusions

Due to its peculiarities and evolving technologies, procedures, methods and specific instruments, the international payments system is both complex and dynamic. One can remark the high concentration within the international payments system, which is reflected by the market power of specific private actors, but also by the overwhelming share held by the most used currencies in global payments.

The changing landscape of international payments is reflected, among others, by the development of alternative payments system to the well-established SWIFT network. The complexity and dynamism of the international payment system has grown alongside with the digital currencies. The new blockchain technologies has created the premises for the improvement of cross-border payments. Among other implications, growing interest in cryptocurrencies and CBDCs, driven by changes in technology, benefits in terms of efficiency, cost and accessibility, but also possibility to circumvent SWIFT sanctions, poses the risk of growing fragmentation of international payments system.

In this context, increased international cooperation is required to mitigate the negative effects of fragmentation and enhance the opportunities that new alternatives can bring. However, despite the growing proliferation of alternative payment system, we align to others authors (such as Rebucci, 2022) considering that, at least, in short and medium terms the US dollar will maintain its prominent role in the international payments system.

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Intensification of the Prices Volatility for Oil and Natural Gas

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Abstract: Energy prices are generally more volatile than the prices of other commodities. This is because short-term energy demand responds more quickly to the impact of economic growth than to price changes. This paper aims to analyse this phenomenon. Therefore, when an energy shock occurs, an important price change may be necessary to influence the market. Currently such shock has been caused by the COVID-19 pandemic, which has produced the biggest sustained change in demand since World War II. In the medium to long term, energy prices will rise if investment will not be on an upward trend, which seems unlikely given the current environmental protection guidelines adopted by many countries around the world. In our paper we argue that supply and demand shocks and high price volatility are likely to continue to weigh on the energy market and the global economy.

Key-words: energy, volatility, prices, policies

JEL: Q41; Q43; Q48

1. Introduction

The term "price volatility" is used to describe the amplitude of fluctuations in the price of a commodity over the course of a day, week, month, quarter, but as a rule, the daily fluctuation interval is taken into account. Volatility is measured by the daily percentage difference in the price of the commodity. The degree of change, not the price level, defines a volatile market. Since price is a function of supply and demand, the volatility is a result of the basic characteristics of supply and market demand. Therefore, high levels of volatility reflect out-of-the-ordinary characteristics of supply and/or demand.

The prices of basic energy (crude oil, petroleum products, natural gas, electricity) are generally more volatile than the prices of other commodities. One reason why energy prices are so volatile is that many consumers are extremely constrained in their ability to replace other fuels when the price, for example, of natural gas, fluctuates strongly. Residential customers usually can't quickly replace their heating system — and in the long run, it may not be economical to do so. So while consumers can easily replace some food products with others when food prices change, most do not have this option to secure the heating of their homes, but even industrial consumers cannot easily replace one primary energy source with another. Volatility indicates the degree of price uncertainty in the markets. When volatility increases, firms may delay investment and other important production decisions or intensify their risk management activities. The costs associated with such activities tend to increase the costs of securing the supply and consumption of hydrocarbons.

2. Oil

Price volatility is something usual for stock market traders, but in oil the volatility has become excessive over the past three years, taking some players out of the market and making it harder for many companies that

normally use hedging operations for oil to benefit from some price stability, which is vital to their operations. A recent analysis by Reuters Agency (Reuters, 2022) shows that oil prices in 2022 have become extremely volatile through their large daily fluctuations that ordinary actors such as hedge funds have left the oil market, their activity falling to the lowest level in seven years (Slav, 2022). So one could appreciate that discouraging speculation would be a good thing up to a point when daily price range five times higher than usual. According to Reuters Agency analysis, between February 24 and August 15, 2022, the daily fluctuation range of the price of Brent crude oil was on average $5.64 per barrel compared to $1.99 per barrel last year.

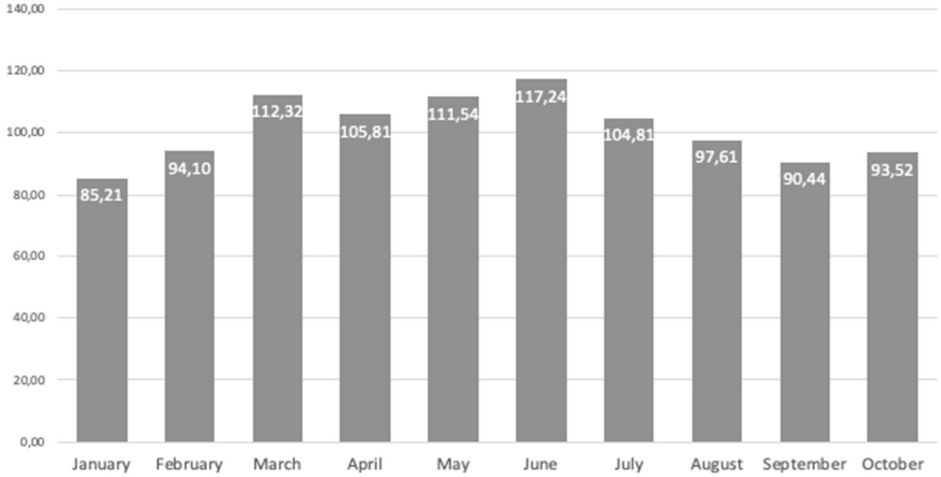
The withdrawal of speculators from the stock market is just one of the problems related to the high volatility of the oil price. But large and often unpredictable fluctuations also affect the affairs of the oil industry itself. An analyst quoted by Reuters Agency Arjun Murti explained that oil companies are still afraid to make large capital expenditures due to excessive volatility in oil markets. And because they are cautious, these companies are postponing projects that could help balance the oil market again.

Related to the oil industry, not only the current high price volatility negatively influences potential production growth, but also uncertainty about the dynamics of future demand as the energy transition increases in intensity. In a recent article for the Houston Chronicle, James Osborne said that the forecast of oil demand is becoming increasingly difficult amid developments such as the Inflation Reduction Act adopted by the US Congress in early August 2022 (Osborne, 2022). With the incentives given to the electrification of transports and the transition to the generation of electricity from renewable resources, the future of oil demand becomes uncertain, even in the view of the big international oil companies (Big Oil). It could be argued that most of them are heavily involved in the energy transition, which could cast a shadow over the credibility of their oil demand forecasts. However, the truth remains that many governments are determined to make a green transition, no matter how much it costs, and this has a depressive impact on oil demand. The latest momentum for the energy transition in both Europe and the US has already worsened the situation of high price volatility through the high uncertainty over the prospects for demand, while everyone can see that still the demand for oil, at the moment, is stronger than many observers expected, especially since some utilities in Europe are moving from natural gas to oil because of high gas prices. This proved too shocking not only for speculators, but also for industry players in the oil market, according to a Reuters Agency analysis. Open interest in trading in the oil futures market has declined by a fifth since Russia invaded Ukraine, traders seemingly tired of price fluctuations due to tight supply and fears of inflation.

What the future holds is – as always – impossible to predict, but it is quite unlikely that the price situation will change in the near future. This means that the negative effect that this price volatility has on companies in all industries will continue, fuelling the above-mentioned fluctuation in the price of oil. Businesses will continue to need energy that is affected by the restricted supply situation, but high prices for this energy will continue to threaten their growth prospects and the prospects for the development of their respective economies. Meanwhile, governments will continue to make legislation and invest money in the energy transition, further discouraging the oil industry from doing something important about the significantly increasing supply.

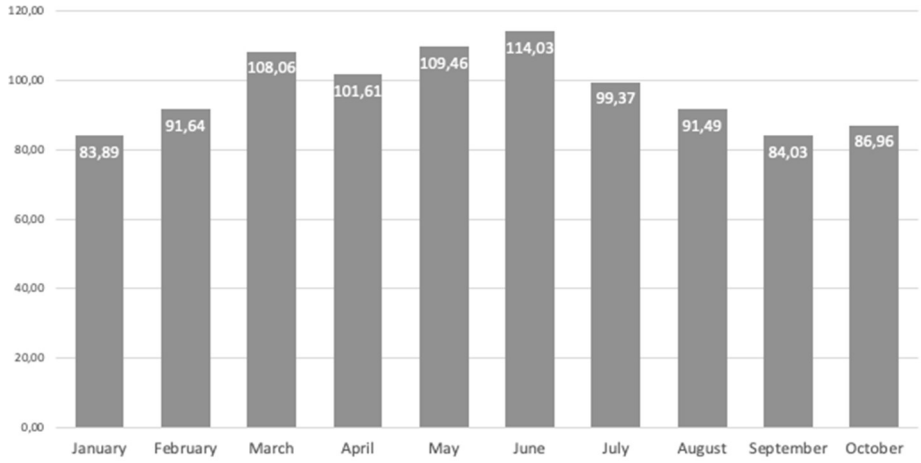
In the figures 1 and 2 we present the monthly volatility of the price of Brent and WTI oil in 2022 while in the figure 3 one can see daily volatility in crude oil prices in 2021 and 2022.

Figure 1: Monthly volatility of the price of Brent oil (ICE London) in 2022 (USD/Bbl)



Source: Authors according to IWE database, 2022

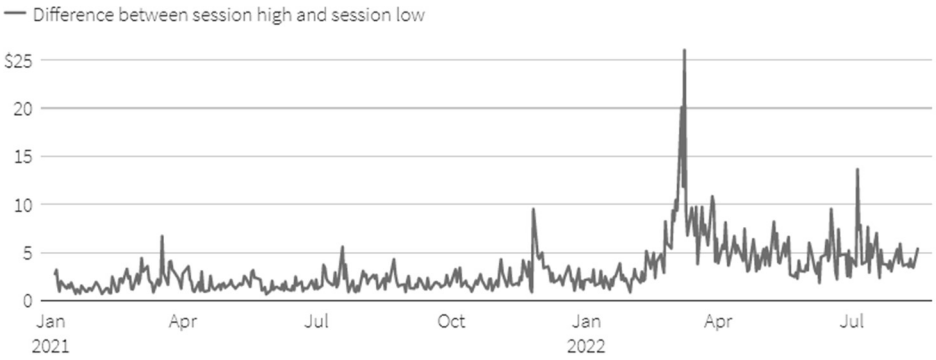
Figure 2: Monthly volatility of the price of WTI crude oil (NYMEX-New York) in 2022 (USD/Bbl)



Source: Authors according to IWE database, 2022

As shown by the Figure 3 oil prices have seen massive swings between session highs and session lows while this volatility has harmed companies that need energy market stability for their operations.

Figure 3: Daily volatility in crude oil prices (2021 - 2022)



Source: Reuters, 2022

While the oil price continues to be clouded by concerns of a potential recession-driven demand the OPEC further trimmed its global oil demand growth forecasts for 2023, due to the current economic challenges such as high inflation, rising interest rates, and supply chain disruptions.

3. Natural gas

U.S. natural gas price volatility reached its highest level in 20 years, while setting a record in the first quarter (January-March) of 2022. The historic 30-day volatility in U.S. natural gas prices averaged 179% in February, compared to 57% in the first quarter of 2021. Historical volatility is a measure of the daily changes in closing prices for a commodity at a certain point in the past. During July 2022, historical volatility was lower mainly due to the fact that natural gas prices were higher compared to the first quarter of the year.

The futures price at Henry Hub in July was 61.21% higher compared to the February price. Natural gas price volatility averaged 124% in the first quarter of 2022 and 75% in the second quarter. High uncertainty about market conditions affected the supply and demand for natural gas and also results in increased price volatility. Among the events that have contributed to the change in market conditions are:

- Stopping production;
- Storms;
- Unplanned maintenance activities of pipelines or various interruptions;
- Unusual weather for that time of year;
- Changes in stock levels;
- Availability of replacement fuels;
- Changes in the import/export activity;
- Other unexpected changes in demand.

U.S. natural gas prices are normally more volatile in the first quarter of the year due to fluctuating demand for natural gas used to heat homes, given the weather conditions at this time of year. Among the factors that contributed to the increase in volatility in the first three months of the year were the following:

- Fluctuations in natural gas demand caused by weather;
- The declining natural gas production in January and February;
- The sharp increase in LNG exports from the US to Europe in order to compensate for the low supply of Russian gas.

The historic Henry Hub price volatility fell to an average of 56% in April, but rose in the following months, averaging 109% in July. Temperatures higher than the average of the period and the increase in domestic supply have contributed to this increase in volatility. The temporary closure in June of the Freeport LNG terminal decreased the growth of gas for processing by 50 million cubic meters/day, generating a surplus of natural gas on the domestic market. Henry Hub futures prices fell by 39% from June 10 to June 30. In July, however, higher than normal temperatures led to increased demand for natural gas within the electricity sector, which absorbed a significant amount of the surplus Freeport LNG. As a result, the futures price of natural gas has increased by 52% in July compared to the previous month.

According to Natural Gas Intelligence (NGI), the U.S. natural gas market has become increasingly volatile in recent years as LNG exports have grown exponentially and as natural gas has occupied an increasing share in the U.S. electricity mix. At the moment, the export capacity is about 368 million cubic meters/day. The increase in demand has led to less market flexibility, making it more difficult to respond to difficult situations due to extreme weather conditions and other anomalies.

"As the U.S. exports a significant percentage of its domestic production in the form of LNG, U.S. natural gas prices are likely to become more volatile in the short and medium term, especially as the global natural gas market grows tighter," said Patrick Rau, director at NGI. He also noted that U.S. natural gas is currently one of the most volatile commodities on the CRB Index. Patrick Rau also pointed out that this high volatility is due to a lack of investment in infrastructure, but also noted that events outside the US have a significant impact.

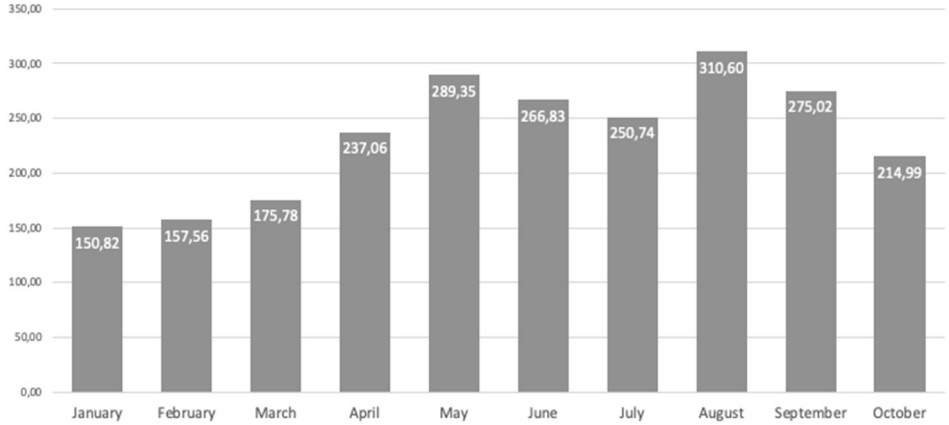
Exports, both to overseas countries and to Mexico, have continued to grow, creating the ground for additional volatility, especially as international markets become increasingly interconnected. By 2025, U.S. LNG exports will exceed 500 million cubic meters/day, should the Golden Pass and Plaquemines LNG projects come into operation.

According to Bloomberg, the annual volatility at Henry Hub is about 70%, compared to 80% at Title Transfer Facility, 83% at Japan-Korea Marker and 97% at National Balancing Point. "Natural gas prices in the U.S. are currently correlated with TTF, NBP and JKM prices, and any movement within them can cause Henry Hub to react accordingly," said Patrick Rau.

The volatility of natural gas prices at the Henry Hub (USA) and the CEGH Vienna Hub in the EU is shown in Figures 4 and 5.

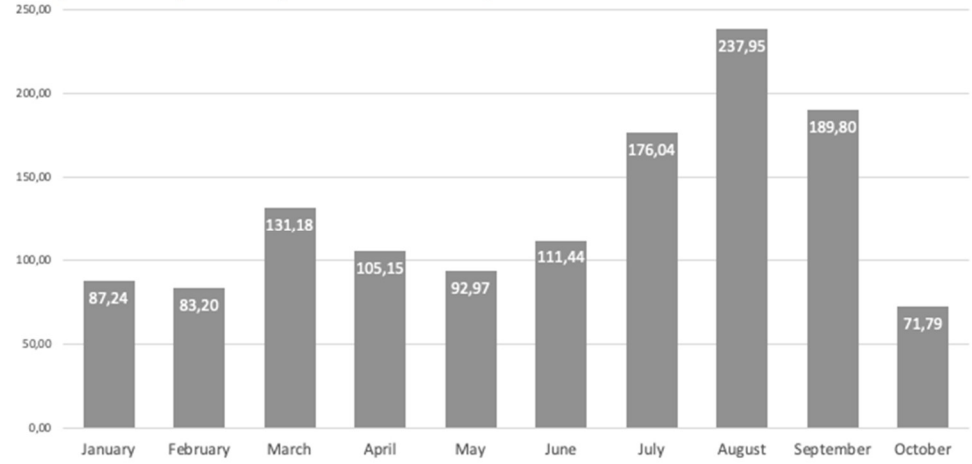
The quarterly reports of the European Commission (DG Energy) highlight the volatility of gas prices, both in the first quarter of 2022, but especially in the 3rd quarter, observing how spot prices have increased in the main hubs.

Figure 4: Monthly volatility in the price of natural gas at Henry Hub in 2022 (USD/1000 cubic meters)



Source: Authors according to IWE database, 2022

Figure 5: Monthly volatility in the price of natural gas at the Vienna Hub (CEGH) in 2022 (euro/MWH)



Source: Authors according to IWE database, 2022

Spot prices at European gas hubs remained high and volatile in the first months of the year, registering a five-fold increase from year to year, in the range of €95-100/MWh. EU gas consumption decreased by 8% (-11.6 billion cubic meters) compared to the previous year in the first quarter of 2022. For the Vienna Hub (CEGH), a significant price increase is observed in March and a particularly strong increase in July and August, after the rebound in the 2nd quarter.

The Central European Gas Hub – Virtual Trading Point (CEGH-VTP) is a market area located in Austria. It is a virtual trading hub that puts natural gas buyers and sellers in contact. Powernext offers CEGH-VTP derivative contracts for the next 5 months, the next 4 quarters, the next 4 seasons and the next 4 calendar years.

4. Difficult situation at the European energy markets

In 2022, the turmoil on energy markets intensified amid rising price volatility and the effects of geopolitical factors. On oil markets, long net speculative positions – the difference between growth-focused and falling bets – at Brent and WTI narrowed to a very low level in early August due to fears of recession and a slowdown in global economic growth, the SEB bank said in a note. The physical oil market is also losing momentum due to fears of an economic slowdown or recession, traders told Reuters in the second week of the month. "The market is very weak at the moment. No one is in a hurry to buy," a Singapore-based trader told Reuters (Paraskova, 2022).

According to Reuters, Europe's energy sector is facing a perfect storm, as a dysfunctional futures market can lead to a deepening crisis with rising prices due to a liquidity crisis. Sudden changes in gas and electricity prices in the market after Russia's invasion of Ukraine have left some oil and gas companies without the funds needed to cover their physical transactions because they could not meet margin calls, an exchange requirement for additional collateral to guarantee trading positions when prices rise." We have a dysfunctional futures market, which then creates problems for the physical market and leads to higher prices, to higher inflation," said a leading trader. In March, the lack of liquidity became apparent when trading firms, utility firms, oil companies and bankers sent a letter to governments and financial institutions, such as the European Central Bank, for emergency liquidity support to support energy markets as prices rose. Several traders who hedged their physical positions with short financial exposure in derivative markets were constrained by rising spot prices due to the Russian invasion and were forced to hedge as increased exchange requirements forced margin calls. Usually, players in the stock market borrow to build short positions in the futures market, with 85-90% of the funds coming from banks. Approximately 10-15% of the value of short positions (shorts), known as minimum margin, is covered from traders' own funds and deposited into a broker's account. But if the funds in the account fall below the minimum margin requirement, in this case 10-15%, a "margin call" is triggered. The difficult situation around winter is that increased margin requirements to secure transactions absorb capital from major natural gas companies, commercial firms and electricity utility firms (ZeroHedge, 2022). Some firms and trading desks have given up on this due to high margin requirements, which has led to a decrease in market participants, eventually causing liquidity to fall, creating even more volatility that could lead to higher prices.

Bankers and major traders stated that exchanges, clearing houses and brokers increased the initial margin requirements to 100%-150% of the contract value from 10-15%. For example, the ICE London stock exchange required margin rates of up to 79% for gas futures contracts at the Dutch hub TTF in Amsterdam. The letter sent by the European Federation of Energy Traders in March said that "the same company that normally expects to experience daily marginal cash flows related to price movements of around 50 million euros, now faces marginal variation requirements of up to 500 million euros in a business day."

Many companies find it increasingly difficult to handle margin calls. Norwegian state-owned firm Equinor, Europe's largest gas trader, recently warned that energy companies, with the exception of those from Great Britain, need at least 1.5 trillion euros to cover margin calls. A Governor of the European Central Bank challenged this figure and said that the losses are much lower in the worst-case scenario. Saad Rahim, chief economist at Trafigura, drew a warning signal due to illiquidity in commodity markets that can have a notable impact on the physical volumes that are traded because traders have to hedge margin calls. European officials have even discussed plans to suspend energy derivative markets as a form of intervention to prevent what some believe could trigger a collapse similar to Lehman Brothers." Helge Haugane, Equinor's vice president for gas and energy, said in an interview that "liquidity support will be needed." So far, countries like Germany have nationalized failed utilities such as Uniper SE. The question becomes how big the crisis is and whether the ECB will have to get involved this winter if prices rise due to the lack of liquid markets (ZeroHedge, 2022).

The link between the price of gas and the TTF (Title Transfer Facility) gas hub in Amsterdam, long considered the most representative European gas market, is proving to be the greatest catastrophe in the EU's regulatory systems, something recognised by the European Commission in September 2022, which through the EU Commissioner for Energy, Kadri Simson stated that the parameter used for the gas price, known as TTF, it is linked to a relatively small market based on pipelines, which does not reflect the current reality in the EU. Amsterdam's TTF is a virtual market, which mirrors at best the supply system in the north-east of the continent, created to manage the system of entry into the Netherlands through the gas pipeline originally managed by Gasunie Transport Services, 100% controlled by Gasunie, which is the energy body of the Dutch state. Large commodity traders, hedge funds and a small group of energy companies (including Gazprom) have increasingly adopted TTF as the benchmark for determining the price of gas at continental level, to the point of linking deliveries to the trend of the previous quarter of futures contracts (as was only noted in July 2022 by ARERA, Energy, Network and Environment Regulatory Authority).

Commission officials have admitted that the Dutch virtual market is small (born at best to be regional), with very high price volatility and that it is out of control. The non-official paper prepared by Commission officials shows that the TTF values were 30% higher than the average of the prices recorded in the virtual gas trading points in each country (British NBP, French Peg or Iberian PVB). It was proposed to freeze prices, cap them, make activities more transparent (quite opaque), index to the US Henry Hub index or LNG quotes, an analysis by ESMA of Dutch market conditions. Suspicions about outside influences of the market and prices were very high and targeted large exporters, Russia and Norway.

On October 18th 2022, the European Commission proposed to set up a price cap mechanism through the TTF gas exchange, to be triggered if necessary. The price correction mechanism would temporarily set a dynamic price limit for TTF transactions. Transactions at a price higher than the dynamic limit would not be allowed under TTF. This will help to avoid extreme volatility and excessive prices. In addition, in order to limit excessive price volatility and prevent extremely sudden price increases in energy derivatives markets, the Commission proposed to introduce a new temporary cap on sudden price increases over the course of a day, to be set by EU derivatives exchanges. This mechanism would protect energy operators against large fluctuations for prices during the course of a day.

The EC proposes a time-limited measure to manage excess volatility in gas and electricity derivatives markets, while preserving the price formation processes. The new temporary intra-day price spike cap mechanism will avoid excessive price volatility and prevent extreme price spikes in prices on energy derivative market (EC, 2022).

5. Conclusions

Oil and gas prices are volatile because short-term energy demand responds much faster to the impact of economic growth than to price changes and when there is an energy shock, it may take a big price change to strongly influence the market. And the pandemic has created a terrible shock, producing the biggest sustained change in demand since World War II (Rogoff, 2022). Before the Covid-19 pandemic, global oil demand stood

at around 100 million barrels per day, but lockdowns caused demand to drop to 75 million barrels a day, and suppliers could not collectively reduce supply quickly enough due to technical reasons. On April 20th, 2020, the price of oil briefly fell on the New York Stock Exchange to minus $37 per barrel as storage capacities were overwhelmed. Subsequently, starting with the second semester of 2020 and especially in 2021, the strong recovery of demand was hit by the inertia of the recovery of oil supply and the effect was not only a sharp increase in prices but also a sharp volatility of their commodity markets. Within EU the liberalization of energy prices and markets, adoption of European Green Deal and Russia invasion in Ukraine has aggravated the energy crisis in the field of natural gas and electricity. In the medium to long term, energy prices will be on an upward trend if investment does not rise sharply, which seems unlikely given the current environmental guidelines. Supply and demand shocks and high price volatility are likely to continue to weigh on the energy market and the global economy.

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Water Collection, Treatment and Supply as an Essential Service and Engine for Sustainable and Resilient Development in Post Pandemic Period. Economic Performance vs Social Responsibility

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Abstract: Communities are becoming active partners in economic development, and increasing the quality of life is the main expectation of locals. Water supply is essential for any activity, in the business environment or at the household level. In addition, the quality of the water supplied and the price can influence the health of the inhabitants. As an essential resource during the pandemic, water distribution was one of the facilitators for observing the restrictions and maintaining the conditions of hygiene and self-protection. Using quantitative and qualitative data on the availability and efficient use of local drinking water services, in our study we found that, as an essential service, the role of water distribution companies is to find a balance between supply and demand closing the gap of market deficit at the local level and to promote the increase of social profit but not only of monetary profitability. Based on the enterprise statistics, we highlighted the economic and financial performance of the Romanian companies compared to those from other EU-27 member countries, we identified the performance adjustment factors and we formulated some policy recommendations that would allow a sustainable and resilient development during post pandemic.

Keywords: water distribution services, social profit, economic profitability, digitalization, pandemic.

1. Introduction

The provision of drinking water to households and companies is a requirement of development and quality of life, it is incident with SDGs 6, 7, 11, 12, 13 and 15. The availability and access to water resources and the water quality are among the main challenges of modern society in which climate change and pollution require additional measures (technological, organizational and financial) to ensure safe water. According to The United States Geological Society safe water means "Water that will not harm you if you come in contact with it". In 2010 UN underlined that every person "has the right to sufficient, continuous, safe, acceptable, physically accessible, and affordable water for personal and domestic use" and states that a „better management of water resources, can boost countries' economic growth and can contribute greatly to poverty reduction". In this context, the responsibility of local communities is to support the provision of drinking water distribution services, quality water delivery for individual consumption and in the quantities necessary for the current consumption of households and for the business environment - companies, organizations, associations, actors of civil society etc.

This type of service is characterized by a specific profile of the business environment, because the social responsibility of the companies also targets the beneficiaries of the drinking water distribution services that serve them. Quality and affordability issues are connected with particular challenges of the industry development and performance, based on climate change and water pollution.

The purpose of this paper is to highlight the performance of companies operating in the water collection, treatment and supply (WCTS) sector in Romania, in the EU-27 spatial comparative analysis over the last decade, and to identify the positive and negative externalities of water management policy. Finally, we inventoried

possible directions for sustainable development and resilience of companies, taking into account the demographic challenges, economic performance and increasing demand for drinking water, and also the social responsibility of companies for water inclusion (network expansion and affordable prices). At the same time, we highlighted some aspects related to the digital transformation of the sector, as a factor to increase the company's performance, both from the perspective of business management and the improvement of communication with customers.

2. Literature review

The market for water distribution services is an emerging one, heavily dependent on demographic growth, increasing food needs and agriculture development and of the (higher) living standards of everyone. For economic agents, this means both capital and operating expenses for the capture, treatment and transportation of water by municipal, industrial, commercial, and residential users. In this context, the economic agents dealing with water distribution services will not only have a constantly growing market, but also the requirements for clean water, distribution in the requested quantities and with affordable prices will increase. The expansion of drinking water distribution networks in rural areas, in less developed countries, such as Romania, as well as the modernization of the distribution network will be the main challenges both for the public authorities and the business sector.

In our research, we started with a literature review based on the scientific papers published in the last decade in the Web of Science database using the VoxViewer program, focusing on market (supply and demand) and water efficiency.

A bibliometric analysis on the market of the water distribution sector, *Water supply - water demand*, indicates 1681 articles published in WoS, in the last decade, of which 16% in 2021. Therefore, the interest to ensure the needs of the market and reduce the gap between the demand and supply of water management services is a constant issue of the market operators, as well as identifying the push and pull factors for economic and financial efficiency.

In addition, water efficiency has been analysed in 877 papers of which 19% published just in the last year. Main correlated keywords and content topic analysed in those papers are presented in figure 1.

Regarding the sustainability of water distribution services, the analysis of the activity is not limited only to water management (model) - water sector efficiency - water sustainability, but also takes into account the resources in correlation with climate change and water scarcity, the entrepreneurial model associated with adaptive local governance, water quality and expansion of the water transport network.

Figure 1. The topic of water distribution market and business efficiency in the specialists' research works in the last decade, based on WoS database

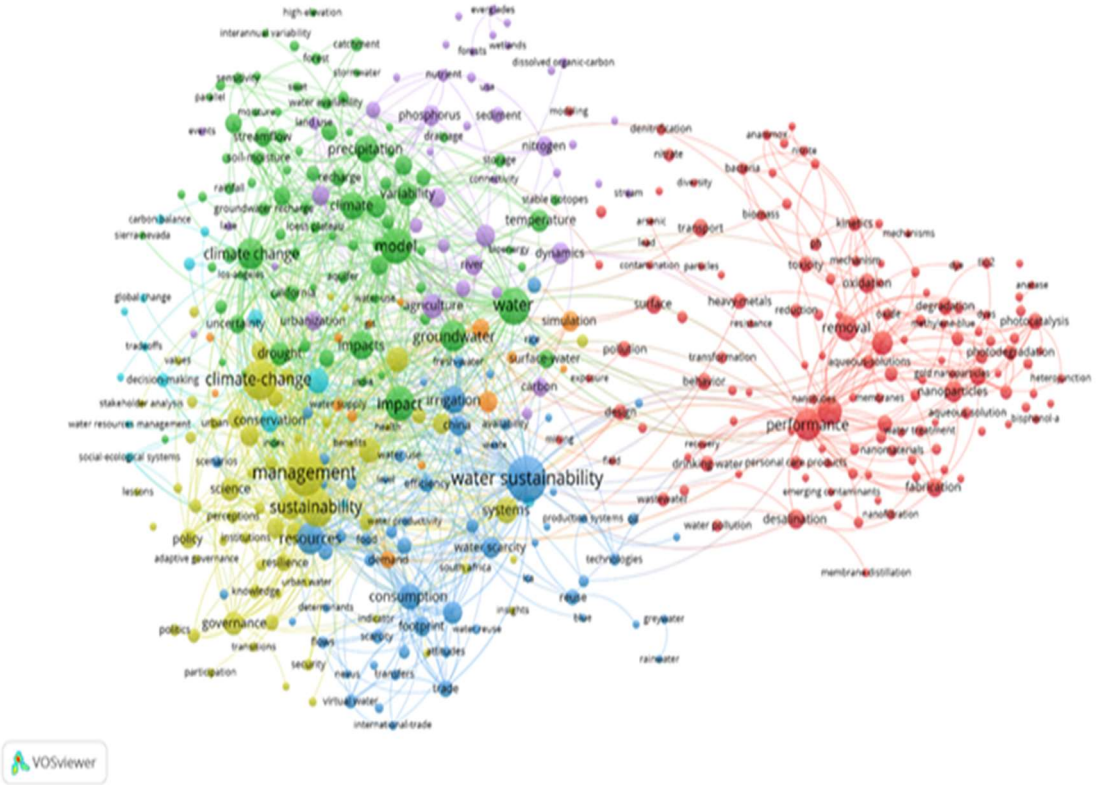
Topic: WCTS market: water supply and Watter demand (5)

Topic: WCTS industry efficiency : water efficiency (5)

Source: Authors' contribution based on bibliometric analysis of the papers published in Web of Science database in the last decade, using VOSviewer; The WoS database was accessed on March 18, 2022

The total number of published papers in WoS identified in the last decade was 1184, of which 15% in 2021- see figure 2.

Figure 2. The topic of water distribution market and business efficiency in the concerns of specialists' research works from the last decade (5)



Source: Authors' contribution based on bibliometric analysis of the papers published in Web of Science database in the last decade, using VOSviewer; The WoS database was accessed on March 18, 2022

The reform of the entrepreneurial water management model, in the conditions of the increase of the supply deficit, of the increase of the exploitation cost and of the challenges of the COVID-19 crisis focused on two important aspects, namely: digitizing the relationship with customers and ensuring the quality of services - quantitative and qualitative, in order to respond to measures to counteract the spread of the virus.

Moreover, there has been increasing interest in water poverty analysis, of the multidimensional aspects related to households' access to water quality (Sullivan 2002, Sullivan et al, 2006; Subbaraman, 2015), for geographical distribution of water poverty as main factors for local planning development of the localities (Kini 2017; Wilk, 2013) and of inclusion measures for increasing water security, in the last two years over 35 WoS indexed articles analyzing such aspects. Water stress and scarcity have also become an issue associated with water availability and accessibility analysis, but also with development capacity, all of which have a significant impact on human development (Ladi et al 2021, Koirala 2020), of water sector planning as an integrated part of the strategic development profile at local level.

From a company perspective, water supply in the desired quantities, flow and quality requires both a high-performance technological infrastructure - the network of pipelines and treatment plants -, adequate green water treatment technology, as well as an expenditure budget and a level of unit cost of production designed to ensure a comfortable return that would allow financing the development of the business from its own resources. On the one hand, there is the cost of material and human resources and, on the other hand, the expansion of the specific market, targeting all categories of consumers, in urban and rural areas.

Even if Romania had a low level of water stress - 6% in the year 2018 (Sustainable Development Goal (SDG) 6.4.2) - comparing to the Europe and Northern America (7%), the share of the population with access to safety managed drinking water services (SDG 6.1.1.) in 2020 was much lower, of 82% against 96% for comparative region. According to UN Water 2021 report, the performances are higher for: a) water quality, with 84% as against 76% of monitored water bodies that has good ambient water quality, SDG 6.3.2.; and b) the degree of integrated water resources management implementation was little higher, 77% as against 72%, SDG 6.5.1. By the contrary, a lower economic performance was registered by Romania in 2018 at the efficiency measured as the value added from the use of water by people and economic agents, reaching only half of the regional level of 56 USD/m^3, (SDG 6.4.1), (UN Water 2021).

The pandemic restrictions disrupted the technological value chain, „reducing face-to-face contact with customers, adjusting workflow to ensure social distancing" and „led to a sudden spatial and temporal shift in drinking water demand". A qualitative research conducted by Spearing (et al, 2021) on the managers of drinking water management companies in the USA, highlighted the need to increase the resilience of the water sector to future challenges by planning to urgently solve existing problems - infrastructure modernization, employee reskilling, operational issues, funding deficit for water quality distribution, risk assessment, equity in water distribution etc. The future efficient management of water distribution involves a fair and smart use of water resources by monitoring water footprint (personal & product) and changing the model in which the water is used for different purposes.

3. Methodology and database

We conducted a statistical analysis of the main indicators that define the size and performance of the drinking water distribution sector at the level of EU member states and the comparative position of Romania. Finally, based on a qualitative assessment of the partial information available for the pandemic, we identified post-pandemic recommendations. The main limitation of the analysis is the availability of statistical data for 2020 (partially) and 2021, from Eurostat enterprise statistics, as well as the lack of detailed comparative data at micro level, for companies in the drinking water distribution sector in Romania, for the period analysed.

4. Results and comments

4.1. Business sector performance

The economic performance of the WCTS sector highlights significant differences at regional level, from different perspectives: a) in terms of supply - respectively available resources, business model and availability of financial resources of economic agents but also b) in terms of the demand, respectively of the structure of the consumers, according to the average level of consumption and their purchasing power.

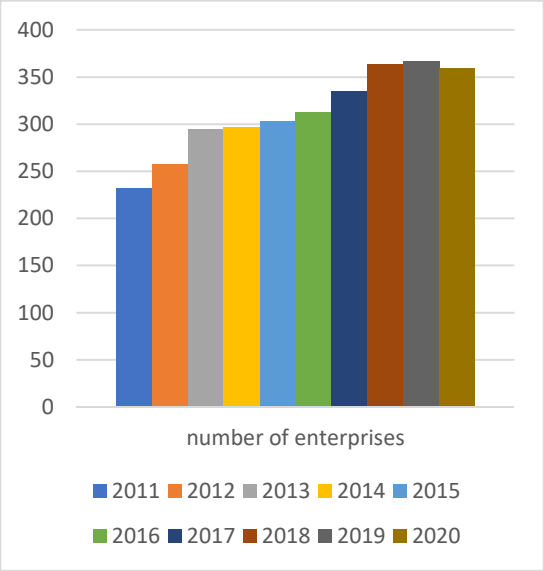
According to Eurostat database (2022), WCTS sector represents less than 1% of the total number of companies in the EU-27. In Romania, in 2020, 0.071% of total registered companies in the business sector were active in WCTS, respectively a number of 359 companies, increasing compared to 2011 by over 50%, but, against 2019 figures, their number decreased by 8.

The firms in the WCTS sector are mainly small and medium sized companies, with an average number of persons employed per enterprise in 2020, between 10 (Sweden) and 272 (Bulgaria). In Norway, Denmark, Austria and Finland the average persons employed by company in WCTS industry is even lower, with up to an average of 4 persons per enterprise. In Bulgaria, the Netherlands, Slovakia, Belgium and Hungary the average number of employees is much higher, over 100 persons, which indicates a higher number of medium and large companies.

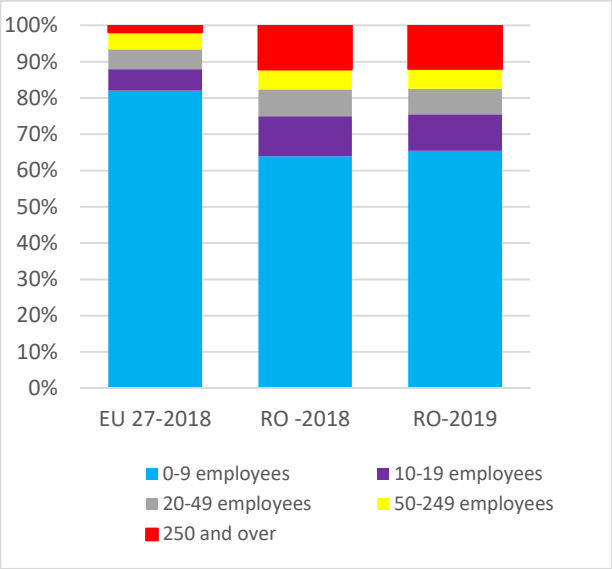
In Romania, the average number was around 150 people in 2011 and decreased below 100 in 2020, with a structure based more on medium and large enterprises, respectively with 17.5% of companies with over 50 employees (at the level of EU-27, their share is below 7%) - Figure 3.

Figure 3. WCTS sector, by firm number and structure

Dynamics of the number of companies in WCTS industry, in Romania, after 2011



WCTS sector, by companies' size, last available data, in Romania and at EU-27 level



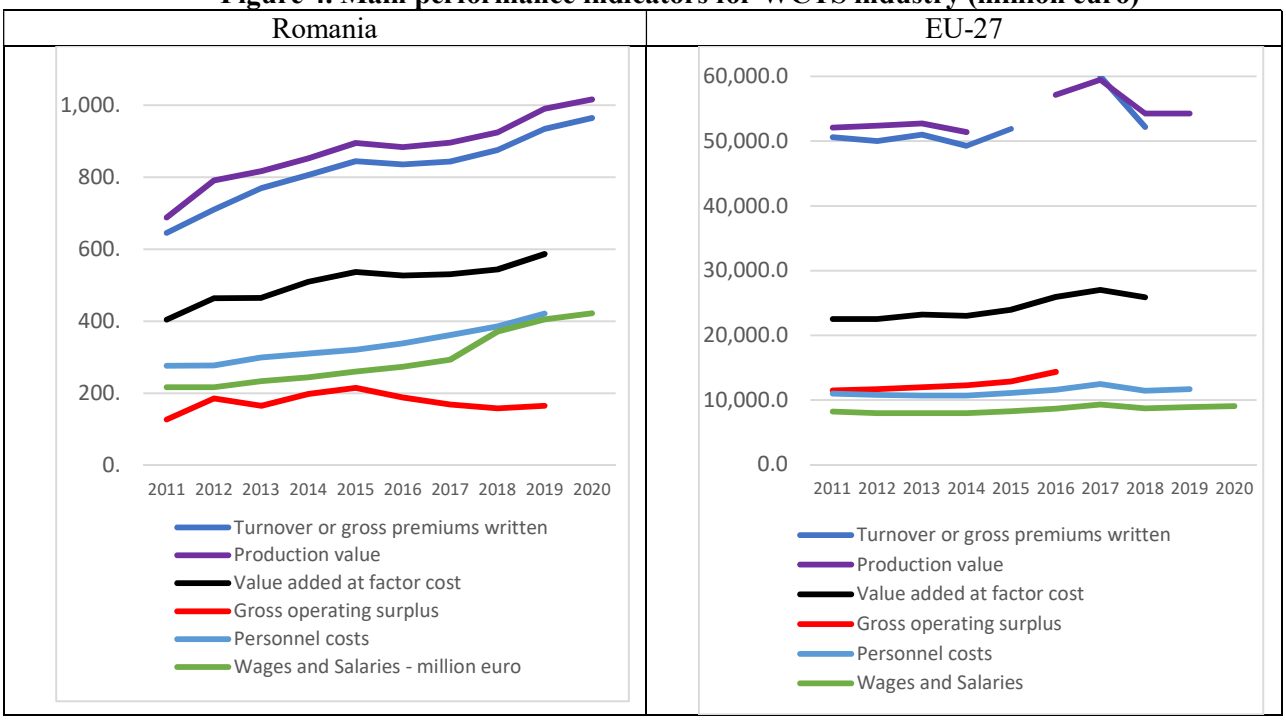
Source: Eurostat database, Annual enterprise statistics by size class for special aggregates of activities, accessed on March 19, 2022

The Eurostat database allows us a comparative analysis of the main performance indicators, of the activity results, of the main cost components and of some efficiency rates.

If we analyse the main result indicators, respectively turnover and production value, we find that their dynamics was more accentuated in Romania than on the EU-27 as a whole, evolution justified by the extension of the distribution network and the increase of consumption (figure 4).

It is found that Romania has a model of cost structure different from other EU-27 countries. On average, the ratio between added value and production value is higher for Romania which means less material consumption, that could be explained by different technologies for water treatment and / or different maintenance cost for tangible assets. Another difference is related to the ratio between gross operating surplus and labour force cost, in Romania wages and total personnel cost are higher than at EU-27 average. This could be explained by a higher number of people employed in this sector in Romania than at EU-27 level, which demonstrated that the technology is less efficient and / or that for the maintenance of equipment (capture, water treatment and transport) more employees are needed, the repair and maintenance activities being carried out mainly on their own (without or with a lower degree of outsourcing of these services).

Figure 4. Main performance indicators for WCTS industry (million euro)



Source: Eurostat database, Annual enterprise statistics by size class for special aggregates of activities, accessed on March 19, 2022

The following aspects also support these assessments:

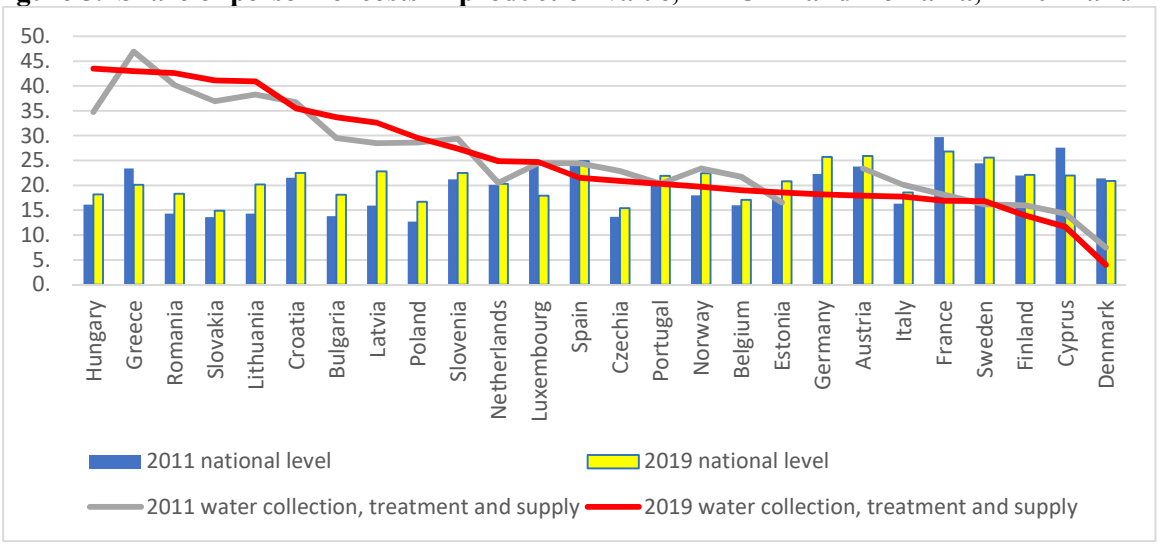
- The average number of persons employed per company at EU-27 was in the period analysed on average of 24 persons but in Romania the registered number was substantially higher - about 6 times higher in 2011, it was reduced in the analysed period to a rate from 1 to 4. Therefore, the average number decreased from about 153 people in 2011 to 98 in 2020 but is not associated proportionally with investments in technology, as we will see later.

- Apparent labour productivity calculated as gross value added per person employed is significantly lower in Romania WCTS industry than at EU-27 level, even if, in the analysed period, it increased by 60%. At the level of 2019 the apparent labour productivity in Romania was less than 40% of the EU-27 level, i.e. the value was 20.2 thousand euro per person employed in Romania and, respectively of 52.1 in EU-27

- Turnover per person employed was more than 6 times lower in Romania for the entire analysed period, but with a slight closing gap, from 1: 6.85 in 2011 to 1: 6.11 in 2018. It should be noticed that the production factor remuneration policy is different at EU-27 country levels.

If we analyse the share of personnel costs in production in 2019, we find that it was between 4.0 percent in Denmark and 43.5 percent in Hungary. The evolutions in 2019 compared to 2011 are different by country, with dynamics in both directions, determined by factors such as the level of economic development and the social model, transposed into policy measures. The differences between the national level, respectively "total business economy; repair of computers, personal and household goods; except financial and insurance activities" (Eurostat database) and WCTS industry is explained not only by the technological level and the specific model of combining the factors of production, but also by the salary policy on trades and professions promoted in each country, and / or depending the level of the minimum wage negotiated at the level of the activity sector.

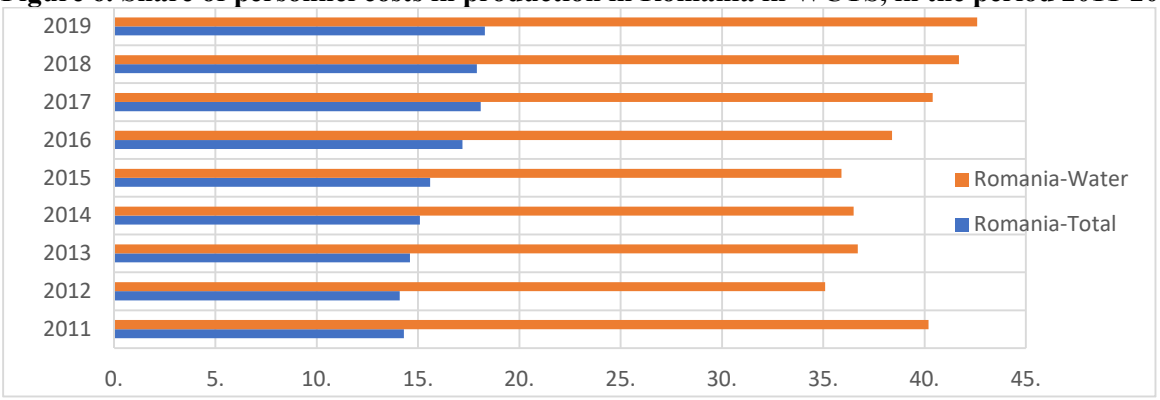
Figure 5. Share of personnel costs in production value, in EU-27 and Romania, in 2011 and 2019 (%)



Source: Eurostat database, Annual enterprise statistics by size class for special aggregates of activities, accessed on March 19, 2022

In Romania, the share of personnel costs in WCTS is almost double the national average (figure 6), a situation similar to most of the less developed countries in the EU (figure 5). The positive dynamics of personnel costs in the period 2012-2019 was mainly due to the increase in the national minimum wage, on the background of a relatively sustained economic growth, based on consumption. The local monopoly position of WCTS companies and the relatively high costs for investments in facilities that provide individual sources of water capture and treatment have allowed companies to negotiate quite differentiated salaries. It is one of the reasons why the tariffs for these services differ quite a lot by companies and geographical areas. For example, at present, according to ANRSC (National Romanian Regulator for Public Services), the tariff for water distribution services differs from a maximum of RON 6.88 / m^3 - around 1.4 euro / m^3 (SC AQUAVAS SA Vaslui) to a minimum of 3.75 RON / m^3 (around 0.75 Euro / m^3) (COMPANIA DE APĂ SOMEŞ SA Cluj Napoca)

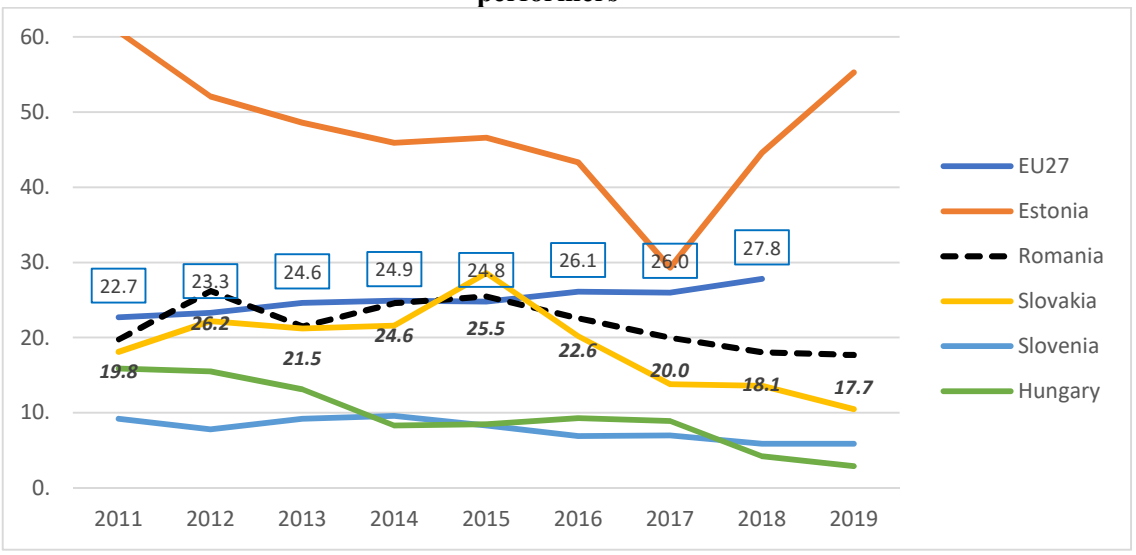
Figure 6. Share of personnel costs in production in Romania in WCTS, in the period 2011-2019 (%)



Source: Eurostat database, Annual enterprise statistics by size class for special aggregates of activities, accessed on March 19, 2022

In the last decade, gross operating rate measured as ratio between gross operating surplus and turnover at EU-27 level increased with around 5 p.p., reaching 27.8% in 2018. By countries, the rate fluctuated in both directions, respectively increased by more than 10 p.p. in Italy, Belgium and France, and decreased with 13 p.p. in Hungary, which in 2019 registered the lowest gross operating rate, of 2.9 percentage. Romania, with 17.7 percent is among the poorest performing countries (along with Slovakia, Slovenia and Hungary), and in the analysed period the situation has deteriorated, registering a reduction of 2 pp in 2019 compared to 2011 (Figure 7).

Figure 7. Gross operating rate of WCTS sector in Romania and EU-27, the first and the last 3 performers



Source: Eurostat database, Annual enterprise statistics for special aggregates of activities (NACE Rev. 2), accessed on March 19, 2022

All these results show the strong dependence of the development of the WCTS sector on the local conditions and the national policy for the development of services of public interest, but also on the power of the local authority to promote a model of services of local interest based on large providers or, on the contrary, on the encouragement of small businesses and local competition.

4.2. Digital transformation impact on business model

The economic performance of the business environment in today's society is based on two technical-organizational pillars, on the one hand, on the modernization of specific technologies to ensure the comparative advantages between the partners on the specific market and, on the other hand, on the promotion of a competitive business model, with as low managerial costs as possible. In both cases, the digital transformation can provide cost savings at the company level and facilitate the application of modern business management methods by refining the principles of total quality management and adapting successful management models in this field of water management, such as the Lean 6 Sigma method or using artificial intelligence techniques. (Tsironis et al, 2016; Miguel et al, 2014; AlDairi, 2021; Xiang 2021, Naeemah, 2021). According to the MKPR 2021 study, about 1/3 of Romanian companies had benefits from digitizing some activities „the turnover increased by 10-19%", i.e. financial performance in cost reduction and increased in turnover or profit. The availability of financial resources for digital infrastructure and reskilled human resources were the main challenges, but the pandemic accelerated the reshaping of the digital side of the business model.

The first results showed that the investment efforts can be amortized in the medium term, and the post-pandemic benefits can be maintained, including with the consolidation of the market segments gained during the pandemic. If the pandemic forced digitalization, according to the same study, the capitalization of digital reform at the company level can be achieved by continuing investments in digital technology and the gradual development of a "digital ecosystem based on specific functionalities of digitalization solutions, communication platforms and internally develop digitalization solutions tailored to specific business needs". According to McKinsey analysis (Novak et al 2018) automatization potential in utilities, process monitoring, e-commerce for services and advanced analytics for decision making could be drivers for increasing financial performance and also competitiveness at firm's level (Valoria Study, 2020), including for business sector in water management.

The Covid crisis has accelerated digitalisation and the pace of change in the business model and also in labour market jobs structure. Generally, the digital transformation makes life easier, increases the security of service quality, eliminates time-consuming repetitive activities and saves resources, facilitates the increase of time for personal life, increases the quality of life as a whole.

Even in some industries the transformation is limited, this fundamentally changes the company's cost structure and job categories. New jobs will emerge, routine jobs are at risk and reskilling / upskilling the soft skills will be necessary for all categories of labour force (FEPS, 2022). Is a good opportunity to change, adapt /

reshape also the business model. From the perspective of water distribution services, the digital transition means at least three levels of intervention: a) digital monitoring of technological processes of water treatment, but also of the operation of the distribution network, with permanent quality control of the transport network functionality, to limit the effects on costs of the malfunctions in operation; b) reorganization and optimization of jobs, by promoting hybrid work, where possible, and reducing the total cost of company staff - digitization of administrative services - accounting, staff, etc.; c) reshaping the relationship with the clients, by gradually switching to digital communication, for the entire flow of relationships - from the selection of the service contract to the payment and the monitoring of the quality of the services.

The cost management and the increase of profitability in terms of ensuring access to affordable water services from a financial point of view, for all categories of consumers, are dependent on both internal and external factors. Internal factors take into account:

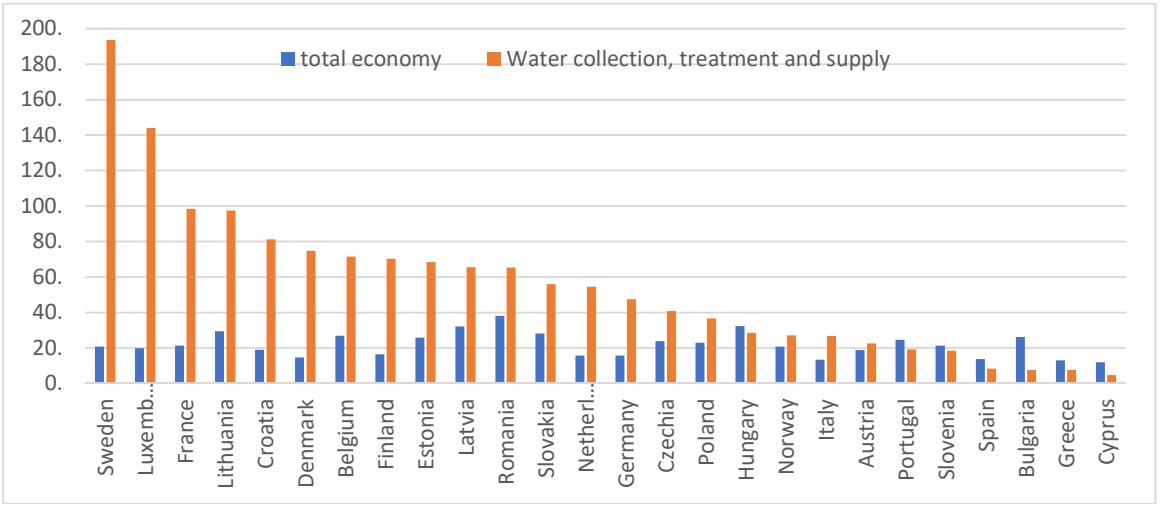
- Technological modernization of the systems for monitoring the processes of capture, treatment, distribution, purification and verification of water quality, including through digital monitoring
- Reducing the costs of technical interventions in case of network failures through digital surveillance - minimizing water losses in case of technological failures by reducing response time
- Diminishing the costs of managing the relationship with customers, industrial or domestic, by differentiating contract management services by customer categories - from the application of classic methods of collaboration in the case of elderly and / or poor customers, without access to digital services, up to complete digitization of contractual relations, in the case of industrial and domestic consumers with full access to digital services.
- Digitization of customer relationship management at company level and operational monitoring of payments for services, with the promotion of billing discounts or other facilities for payment of services and reducing the physical circulation of documents - digital invoices, online payment, etc. that should involve consistent alternative clients centred business model which involves transparency, accountability, different choices, open-source software and better standards for users.
- Expanding the network of service beneficiaries by increasing competitiveness based on digital platform development for customers.

Such transformations at company level are also dependent on a series of external factors, among which: a) financial inclusion; b) the level of economic and social development of the localities served; the existence of water resources and accessibility to other sources of drinking water - individual deep wells, financial capacity for local / individual water capture and treatment plants, water transport networks etc.; c) the policy of the local authority to support the distribution of drinking water through common networks, managed by specialized companies; d) the real-life, day-to-day implementation of the EU Declaration on digital principles (EC, 2022), i.e. accessible and human-centric digital services and of the 2030 European Digital Compass (EC, 2021), based on digital business enforcing.

If we position ourselves at the level of companies, it is important to ensure the sustainability of the business and the resilience of companies by financing the modernization of infrastructure, as the main component that determines water quality and decent tariffs, facilitating the reduction of water footprint and water inclusion, in the conditions of supporting the digital transition.

As future development programs for sustainable business we can consider the investment rate, calculated as share of the investments in value added at factor cost. According to available data for 2019, the investment effort of the analysed activity is much higher than the average at national level in Sweden and Luxembourg, and less than half of national level in Bulgaria and Cyprus with just 2/3 in Greece and Spain. In Romania, the investments are 1.7 times higher than average economy level, but even so, the water infrastructure is old and the water quality is affected in many cases (Figure 8.).

Figure 8. Investment rate in EU countries, in 2019 (%)



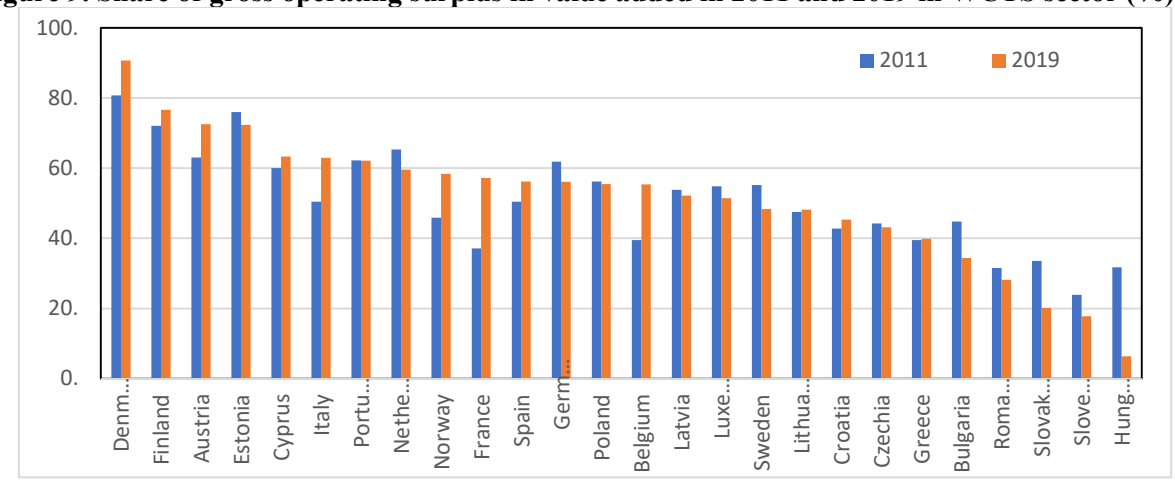
Source: Eurostat database, Annual enterprise statistics for special aggregates of activities (NACE Rev. 2), accessed on March 19, 2022

Under these conditions, it will be difficult to ensure the modernization of the water transport and treatment network, but also to expand the network, according to the future demand for services.

External sources of financing (loans) are generally expensive and therefore two can be sources of financing, namely the addition of capital by attracting external investors (FDI) or from own sources, respectively from profit. Another possible source is non-reimbursable financing, through structural funds or other lines of financing that support social objectives such as social and societal inclusion for all i.e. Green Deal or Horizon Europe Program

The share of gross operating surplus in total value added we have to mention that for all countries in water sector registered higher share than the national average level for all activities, in 2019 against 2011, except several new member state Czech Republic, Bulgaria, Slovakia, Slovenia, Hungary and Romania. It is worth mentioning the big differences between the countries, which can be explained by the technological level, the degree of automatization and the managerial model, but also depending on the level of personnel expenses (salaries and contributions) and the purchasing power of the beneficiaries. An increase of 10-20 p.p. have been registered in developed EU countries - France, Belgium, Italy, Norway, Denmark and Austria- figure 9.

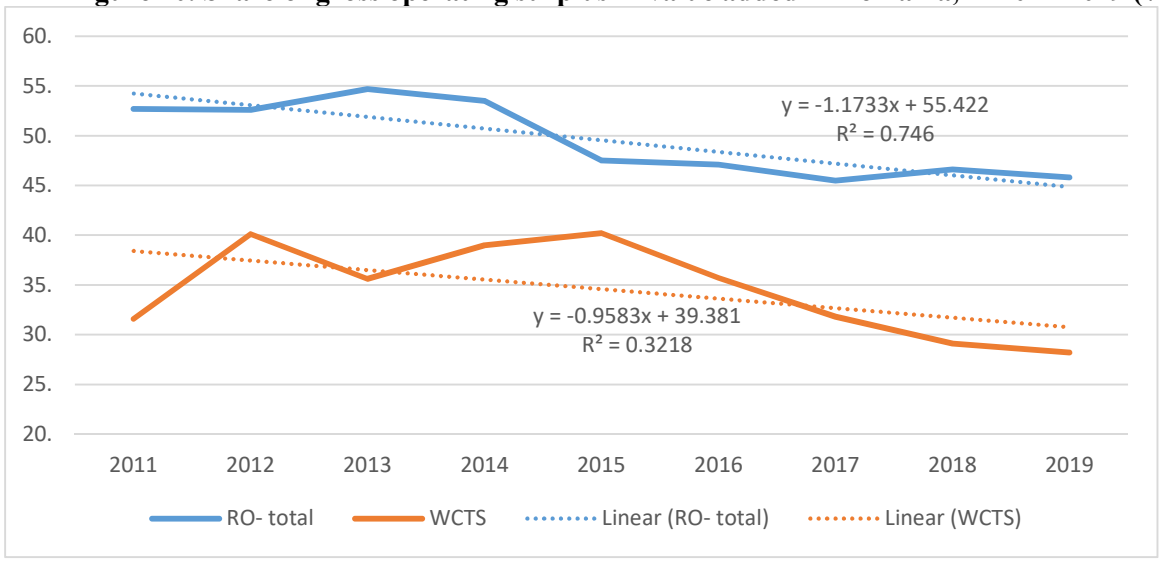
Figure 9. Share of gross operating surplus in value added in 2011 and 2019 in WCTS sector (%)



Source: Authors selection based on Eurostat database, Annual enterprise statistics for special aggregates of activities (NACE Rev. 2), accessed on March 19, 2022

If we analyse the level and evolution of capital remuneration, measured as share of gross operating surplus in value added for Romania, we find that in the period 2011-2019, in WCTS industry there are 2 distinct and opposite stages as dynamics, with a general downward trend- figure 10.

Figure 10. Share of gross operating surplus in value added in Romania, in 2011-2019 (%)



Source: Authors contribution based on Eurostat database, Annual enterprise statistics for special aggregates of activities (NACE Rev. 2), accessed on March 19, 2022

Until 2015, there is an oscillating evolution with an increasing trend that means a volatility of performance and prices, and after 2015, a reduction of the general profitability, mainly due to the increase of the minimum wage and of the other operational costs.

4.3. The effects of the pandemic on essential services. Peculiarities for the WCTS sector

The pandemic had disproportionate effects on economic activities, affecting individuals, households and businesses. If some activities were able to be reduced, temporarily closed or closed during the lockdown period, the essential services continued their activity, some of which also had an increase in demand. This is also the case for drinking water distribution services. Pandemic restrictions have imposed strict sanitary rules that have generated increased water consumption for repeated disinfection, cleaning services, etc. Also, the structure of water consumption by categories of consumers has changed significantly, there have been reductions in the case of economic activities and a general increase in the case of households (Kalbusch et al, 2020; Brauer et al, 2020; Cahill et al, 2022; Campos et al, 2021).

The period of the already two years of pandemic reiterated the importance of water supply inclusion as a driven factor for economic development and quality of life improvement. The pandemic has shown the higher importance of water supply management but also companies and households ability to cope with pressure for affordability prices for these services. It is mainly about ensuring cost-benefit efficiency in drinking water distribution services on the one hand, and the ability of consumers to pay, on the other hand.

According to the literature analysis, the pandemic has changed consumer behavior for drinking water use - laundry and higher consumption of cleaning materials, washing food with plenty of water, as a precaution against the risk of infection, reducing water consumption in households in the morning and the increase throughout the day, especially in the case of the workforce working remotely, the increase in consumption in residential areas during the week and the reduction during the weekend; the increase of consumption in the agglomerated residential areas and only a slight change in consumption in the more isolated inhabited areas, without important human interaction.

All of these changes have highlighted the volatility of the water consumption pattern and its strong dependence on unforeseen events, such as the pandemic. Its also highlighted the increasing trend of water dependence, such as the correlation with changes in ambient temperature - global warming, or depending on changed employment model (hybrid or remote) and / or related to household structure, which supports the model of water demand future increase for ordinary events and water consumption practices.

Regional differences and by categories of consumers will be maintained and will even increase if no measures are initiated to close the regional gaps regarding the access and price of water management services. The post-pandemic period may lead to a reduction in water consumption for the financially vulnerable, even if the general trend of water consumption remains on the rise.

5. Conclusions and policy recommendations

The need for drinking water is essential, and the pandemic highlighted the importance of the three factors analysed in the paper - quality and affordable services for all, digital & financial inclusion, business management innovation. Ensuring these components at the company level in the WCTS industry requires micro-level measures to reduce costs, financial performance to facilitate infrastructure investments and personal reskills for soft competences able to facilitate full digital communication with customers.

The digital transformation of drinking water distribution services will determine a positive outcome for firms and citizens i.e. access and affordable essential services, saving time with managing contractual relations, lower costs and quality of water consumed. From the perspective of WCTS industry in Romania and the analysis of the economic performance of the companies active in this sector, a series of recommendations are necessary, namely:

a) Proposals for the modernization of the digital management of water services through: artificial intelligence to monitor the technological process of supplying drinking water - surveillance of water processes and distribution; managing customer relations with facilitation provided by the use of database and cloud-computing capabilities; promoting affordable tariffs for services provided through consumer-centred contracts and discount for digital and advance payments

b) Stimulating FDI in water supply services based on the expected outcomes in distribution network investment for replacement / modernization and in the implementation of good practices in digitalized systems for monitoring the state of the network and water quality;

c) Cost benefit analysis at firm level and increasing companies 'social responsibility.

d) Providing public-private partnership in the local strategy for increasing the quality of living condition in the locality, based on access for all for WCTS services, in the benefit for the future generation and a greener environment for all.

In order to increase the efficiency and accessibility of water services, a change of approach is needed, a fundamental shift in how companies / providers understand, values and manage water resources.

Policy orientation for the post-pandemic better normal targeting closing water inclusion and demand and supply gap are oriented, among others, toward:

a) Extending the water distribution network to reduce the market gap between supply and demand

b) Identification of alternative water sources to meet the needs of industrial and domestic consumption in parallel with ensuring the quality of distributed water

c) Promoting affordable prices for consumers to increase access to quality water sources, including vulnerable groups, poor households or those located in hard-to-reach geographical areas

d) Increasing the internal efficiency of the companies that manage the water supply by adjusting the business model, with the promotion of digital transformation and / or hybrid system activities, development of water distribution monitoring services to reduce the risks of water transport or network failures;

e) Flexible working arrangements and hybrid employment; closing access gender gap to decent employment / jobs; digital inclusion and financial inclusion of all categories of customers; reduced informal employment and a wider cover by job retention schemes for the youth in local essential jobs employment such in WCTS sector;

f) Promoting the public-private partnership in the management of drinking water distribution services and attracting foreign direct investment for the modernization of the water transport network, the technological upgrade of the water capture and treatment plants.

The limits of the present research are given by the lack of microdata for the last years for the comparative analysis of the economic-financial performances of the companies operating in WCTS sector at regional level in Romania and for a detailed correlation analysis based on territorial gaps in network development, companies' efficiency and supply deficit, considering the geographical boundaries, operating cost restrictions and affordability prices for services. In future research we will focus on comparative analysis at the regional level, as well as on the analysis of externalities generated by the pandemic period on the digitalization of relations between water service providers and beneficiaries, including the analysis of the financial impact.

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Risk Management in Cultural Heritage. Methods of Analysis

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Abstract: Cultural heritage management is about striking a balance between developing the tourism industry, generate revenue while still conserving the physical integrity of sites, promoting and celebrating their educational, historic and cultural values. According to UNESCO, heritage is our legacy and cultural identity that we pass on to the next generation. Tangible features, such as monuments, groups of building, and both historic and natural sites, are considered as part of our heritage by UNESCO. Identifying and developing interdisciplinary methods that can capture the 'invisible' vulnerability, value, and capacity of cultural heritage is considered an urgent policy need. This need is greatest in developing countries where people often lack the resources and agency to develop or adopt frameworks for risk-informed management in which concerns the cultural patrimony. Tools and methods have been developed in order to support a risk management strategy, thus not all of them can be applied regardless of the natural context and the local social and political vulnerability.

Keywords: risk management, cultural heritage, tourism, sustainability.

1 Introduction

Cultural heritage has gained increasing recognition as a catalyst for social and economic development. This evolution is the consequence of the important changes that the global cultural landscape has faced in the last few decades. From the digital revolution, to the development of new technologies and political events that have caused a series of conflicts or multiple factors which have affected the ecosystem of cultural heritage. On the other hand, natural and material heritage are threatened by anthropogenic actions (e.g. vandalism, conflicts, etc.), geo-hazards and the effects of climate change (e.g. earthquakes, landslides, storms, etc.). Therefore, cultural heritage is currently challenged on two levels: first, to address these threats and strengthen its site protection measures, and secondly, to take advantage of new technologies to stimulate development and dissemination cultural heritage.

Intangible heritage refers to traditions or expressions inherited from ancestors and passed on to descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices regarding nature and the universe, or knowledge and skills for traditional crafts.

Tangible heritage refers to historical buildings and places, monuments, artefacts, etc., which are considered worthy of preservation for the future. These include objects significant to a particular culture's archaeology or architecture, science or technology.

Natural heritage refers to: natural features consisting of physical and biological formations or groups of such formations, which are of outstanding value; Geological and physiographic formations that constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of the vision of science or conservation; Natural sites or natural areas of universal value for science, conservation or natural beauty.

Cultural heritage tells the stories of many peoples of the world. Tangible but also intangible cultural heritage can be subject to certain threats that make it vulnerable.

What are the possible imminent risks to a cultural property? What are the most likely risks? Which of these are expected to cause more and extensive damage? Does the damage differ from one cultural property to another? How can these damages be well understood and assessed? What are the priorities, given the human

capital and available budgets? Which institutions are responsible for cultural sites and museums and how can they work together to prevent and treat risks?

All these questions can be managed through cultural heritage risk management and cultural heritage sustainability.

Risk management can help us answer these questions regarding the conservation and use of cultural heritage. It allows us to consider all risks to prioritize and plan resources better. We can also apply risk management to deal with any situation that requires a comparison between two or more specific risks, involving a dilemma between conservation and sustainability of the environment, cultural heritage elements, etc.

The element of risk can be defined as "the chance that something will happen that will have a negative impact on our goals." Whenever we think about risk, we need to consider both its chance and expected impact.

As far as cultural heritage is concerned, the same concept of risk applies to cultural heritage. Many things can happen that can have a negative impact on heritage collections, buildings, monuments, sites, and our goals for their use and conservation. The impact of the risks in this case is expressed in terms of the estimated loss of the values of the heritage assets.

The types of risks to cultural heritage range from catastrophic (such as major earthquakes, floods, fires and armed conflicts) to gradual and cumulative processes (such as chemical, physical or biological degradation). The result is the loss of values of the heritage asset. For example, if a historic house catches fire there is usually a large or total loss of value to the building and its contents. When the fragile objects of a museum collection are destroyed during an earthquake there is a loss of value in the same collection. Colour fading in traditional textiles exposed to daylight also causes a loss of value. Sometimes the risk does not only involve damage to the heritage asset, but rather the loss of information about it, or the inability to access heritage objects. For example, an archaeological collection or site will lose value if the existing documentation about it disappears.

Heritage managers need to understand these risks well in order to make good decisions about heritage protection (for future generations) while providing accessibility for the current generation.

Due to its importance as a management tool, international standards have been developed, one of which is ISO 31000:2009. As in any field, and with regard to cultural heritage, there are certain stages to consider in the analysis and management of risks that may affect cultural heritage.

2. Understanding the context

In this step, we try to understand all relevant aspects of the context in which the heritage asset is located. This includes physical, administrative, legal, political, socio-cultural and economic environments.

It is also important to identify all the actors, inside and outside the organization, who can help us in the process. Obviously, we need to clearly define our objectives, as well as the scope of the action. It must be clear to everyone what the "patrimonial asset" is. For example, the "heritage asset" could be all the archaeological sites in the country or a specific one or only a certain part of an archaeological site. It could be all the historic museum houses in the city, a particular museum, or just a certain part of a museum's collection.

3. Risk identification

In this step we try to identify all the risks that threaten the cultural heritage (collection, building, monument or site.) It is important not to miss any significant risk. If we are not aware of the various risks affecting our heritage, our decisions and use of resources will be based on an incomplete picture and therefore less effective. When identifying risks, the main question we need to ask ourselves is this: What can cause damage and loss of value to the heritage asset?

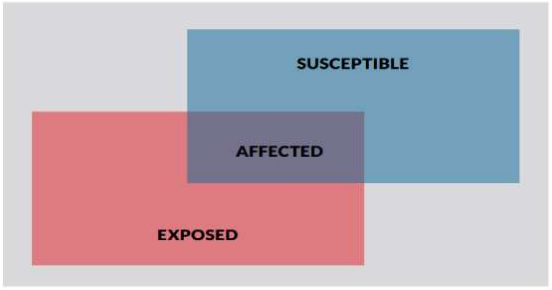
There are several agents that can cause damage and loss of heritage objects:

• physical forces: what types of physical forces can affect me (eg strong winds, earthquakes, improper handling, overcrowding, accidental collisions, visitor traffic, etc.).

human resources, lack of employee training, criminal acts (eg, opportunistic theft, armed robbery, vandalism, terrorist attack, etc.)

• the decay of cultural heritage over time (temperature, UV, pollutants, pests, etc.).

Figure 1. Susceptible heritage vs. affected property



Source: A Guide to Risk Management, Government of Canada, Canadian Conservation Institute, 2016.

In this diagram, the entire heritage asset is represented by the grey rectangle. Suppose that part of it, indicated by the blue rectangle, is susceptible to a certain damage agent. On the other hand, the part of the heritage asset that is exposed to that agent is indicated by the red rectangle. This means that only elements that are both sensitive and exposed to the agent will be affected, i.e. suffer damage and loss of value. For example, wooden objects and buildings are susceptible to termites. They will be affected if exposed to this agent. A metal sculpture displayed outdoors is exposed to direct sunlight. This sculpture will not be affected by light and UV because it is not susceptible to this agent.

4. Risk analysis

Identifying the risks that threaten cultural heritage is necessary but not sufficient if we want to manage these risks effectively. How big are these risks? Which are unacceptable? How can we prioritize them? We need to answer these questions to make effective decisions. The impact of risks on cultural heritage is expressed in terms of the estimated loss of value of the heritage asset.

When risks are of the "event" type, we try to estimate how often they occur. For example, "a major earthquake that damages the heritage asset is expected to occur approximately once every 300 years", "theft of heritage items is expected to occur approximately once every 30 years", " rainwater infiltration through the roof affecting the museum collection is expected to occur approximately once every 3 years' etc. When the risks are of the "cumulative process" type. we try to estimate how quickly the damage will accumulate. For example, 'the total loss of relief decoration on the walls of the archaeological site due to weathering is expected to occur in about 300 years, 'the magnetic tape recordings will have severely degraded and will no longer be accessible in about 30 years ", "colored textiles recently put on display will have a noticeable fading in their most light-sensitive colors in about 3 years, etc.

4.1. ABC scale for risk analysis

A tool has been created to calculate, compare and communicate the extent of risks to cultural heritage. It consists of numerical scales used to quantify the frequency or rate of occurrence and the estimated loss of value for the various risks.

The ABC scale has 3 components. The "A" component quantifies the frequency of the adverse event or rate of occurrence of a process. Components "B" and "C" together quantify the expected loss in value for the heritage asset. The combination of A, B and C defines the magnitude of risk.

A - For "event" risks, this component indicates how often we expect the event to occur, i.e. the average time between 2 consecutive events. For 'cumulative processes', this component indicates how many years it will take for a given level of damage to accumulate.

A-score	How often does the event occur? How many years for accumulating a certain level of damage?
5	~1 year
4 ½	~3 years
4	~10 years
3 ½	~30 years
3	~100 years
2 ½	~300 years

2	~1000 years
1 ½	~3000 years
1	~10000 years
½	~30000 years

Source: Culture and Local Development, OECD 2018 Canadian Conservation Institute, A Guide to Risk Management, Government of Canada

For example, if we expect "a large earthquake to damage the heritage asset, these occur approximately once every 300 years, the A score for this risk would be A=2½.

B - This component indicates the size of the loss in value that we expect for each element of the heritage asset affected by the risk. By "item" we mean an object in a collection, an element of a historic building (eg a facade, the interior decoration of a particular room, a roof, a staircase), a part or a particular feature of a heritage site (eg. a fountain, a burial area, a gate, a set of murals), etc. To estimate the loss of value of the affected objects, one must first visualize the type and extent of damage they will suffer. It then estimates how much this damage represents in terms of loss of value for each item. The loss of value can vary from a total loss to a minimal one.

B-score	Lost value of the affected item (%)	Guidelines
5	100%	Total or near total loss
4 ½	30%	
4	10%	Large loss of value of affected items
3 ½	3%	
3	1%	Little loss of value
2 ½	0,3%	
2	0,1%	Very little loss of value of the items
1 ½	0,03%	
1	0,01%	Negligible loss
½	0,003%	

Source: Culture and Local Development, OECD 2018 Canadian Conservation Institute, A Guide to Risk Management, Government of Canada

C - This component indicates how much of the value of the heritage asset is affected by the risk. Does the risk affect the entire heritage asset, a large part, a small part, a part or only a small part of it? How important is the part of the heritage asset affected by the risk? To score C we estimate the percentage or fraction of the heritage asset, value that will be affected by the risk.

C-score	Percentage of the value of the heritage asset	Guidelines
5	100%	All or nearly all of the value of the asset is affected
4 ½	30%	
4	10%	Much of the property's value is affected
3 ½	3%	
3	1%	A small part of the value of the asset is affected
2 ½	0,3%	
2	0,1%	A very small part of the value of the asset is affected
1 ½	0,03%	
1	0,01%	The affected value of the asset is negligible
½	0,003%	

Source: Culture and Local Development, OECD 2018 Canadian Conservation Institute, A Guide to Risk Management, Government of Canada

For example, suppose that the heritage asset is a historic house museum that contains a collection of furniture, clothing and household artifacts, as well as a historical archive that belonged to the owners of the house. The main purpose of this museum is to preserve and showcase the lifestyle and history of this prominent wealthy family in the region who owned the house and lived there in the 19th century. The house is a unique example of a typical architectural style that cannot be found anywhere else. It is in a very good condition, and most of its construction materials and finishes are original. Most of the furniture, clothing and artefacts show the family's lifestyle at the time that are typical of other wealthy families and therefore similar items can be found elsewhere. In fact, some of the artifacts on display are modern copies of original items that can no longer be displayed due to their poor condition. The only real "treasure" among the objects of the museum collection is a unique set of five vases decorated with exceptional aesthetic quality made by a nationally famous craftsman of that time. In the archive we can find letters of correspondence with family members who lived abroad, a small collection of illuminated manuscripts and some rare business documents that bear witness to the history of trade in the region. After scoring the three components of each risk using the ABC scales, we can calculate the magnitude of the risk (MR), i.e. its potential to cause loss of value to the heritage asset. This calculation is done by adding the scores of the 3 risk components:

$$A + B + C = MR$$

4.2. Case study The fortified church of Biertan. Risk analysis.

Biertan is part of the first German settlements in Transylvania, being included in the two "Seats" Mediaș and Șeica - in the Andreeana Diploma from 1224. Biertan is mentioned in a document for the first time in 1283, together with other villages, inhabited at that time by Saxons in - a document regarding the taxes required by the Catholic Capital of Alba-Iulia from the Catholic priests in the Saxon communities. Like any Saxon settlement, it had an urban organization, the Franconian style of rows of houses around a central square, above which rises an imposing fortress church, stands out. Among the total of almost 3 fortified churches built between the 15th and 16th centuries, the church in Biertan has preserved its original appearance very well.

The door of the sacristy, with a complicated system of 19 locks, was made by local craftsmen in 1515 and was awarded at the World Exhibition of 1900 in Paris. It is a representative example of medieval Saxon manufacture, thanks to the inlays and the original closure system, which still works today. The surrounding fortifications are considered the strongest in Transylvania, from a peasant fortress. It has three rows of walls, 6 towers and 3 bastions built in different stages starting from the 14th century. At the top it has a defense corridor, the clock and the bells. The "mausoleum" tower is located to the northeast and has a mausoleum on the ground floor that houses, since 1913, the graves of the prelates of this church.

The slabs were made by Nikolaus Elias from Sibiu. The Catholic tower, located on the southern side, housed the chapel reserved for non-reformation Catholics. There is an organ in the church, the oldest information about it dates from 1523, when the organist Bartholomäus is mentioned. After several restorations, we arrived at the organ that exists today, with 1290 pipes, 2 keyboards, a pedal board and 25 registers, which dates from 1869 and was made by master Carl Hesse from Vienna.

The maker of the pulpit seems to be a Ulrich stonecutter, originally from Brasov, who arrived in 1523 in Biertan. The wood painting of the pulpit dates from 1754. The pulpit impresses with the representations of biblical scenes and the decoration with particularly neat architectural and plant motifs worked in the transitional style from the Gothic to the Renaissance. The same artist who made the pulpit of the church, Johannes Reichmuth from Sighisoara, is the author of the special gate of the sacristy.

In the risk analysis, we will consider one risk from each category mentioned above. There are several agents that can cause damage and loss of heritage objects:

• physical forces: what types of physical forces can affect me (eg. strong winds, earthquakes, improper handling, overcrowding, accidental collisions, visitor traffic, etc.).

• human forces lack of training of employees, criminal acts (for example, opportunistic theft, armed robbery, vandalism, terrorist attack, etc.)

• the decay of cultural heritage over time (temperature, UV, pollutants, pests, etc.)

Applying the ABC Scales in terms of risk management in the case of the Church of Biertan, we can reach the following conclusions:

A-For "event" risks, this component indicates how often we expect the event to occur, i.e. the average time between 2 consecutive events.

If we consider a major event such as an earthquake or a fire, the statistics show us that these events are quite rare.

A large fire is a "rare event" risk for a museum. National statistics from various countries show that the average interval between major fire events for museums with basic fire control measures is about 300 years. By basic control measures, we mean: local smoke alarms and portable fire extinguishers properly positioned, in sufficient number, inspected, tested and regularly tested; a telephone line and a fire station available full time. Also, the area of southern Transylvania is not currently affected by high-magnitude earthquakes, therefore, using the scalar table, we can identify an A score of 2 ½ for the rare risks of the church in Biertan. (see table) (This does not mean that it occurs exactly every 300 years. From the perspective of our decision, it may be more useful to express it as a 10% chance every 30 years.)

B- This component indicates the size of the loss in value that we expect for each element of the heritage asset affected by the risk. By "item" we mean an object in a collection, an element of a historic building (eg. a facade, the interior decoration of a particular room, a roof, a staircase), a part or a particular feature of a heritage site (eg. a fountain, a burial area, a gate, a set of murals), etc. To estimate the loss of value of the affected objects, one must first visualize the type and extent of damage they will suffer. It then estimates how much this damage represents in terms of loss of value for each item.

Considering that there are many wooden elements in the church (floors, ceilings, stairs, roof framing, doors, windows, picture altar), as well as the church tower which is made of wood, these are combustible materials that can be subject to a total loss or almost the total value of each element of this heritage asset affected by the fire (building and objects). The effects of fire refer to the partial or total collapse of the building, the burning of parts of the building and its contents. An earthquake would also have devastating effects on the stone construction of the church, foundation, walls, statues inside that could break, etc. The B score in this case would be B=5.

The C score indicates how much of the heritage asset's value is affected by the risk. Does the risk affect the entire heritage asset, a large part, a small part, a part or only a small part of it? How important is the part of the heritage asset affected by the risk?

To score C we estimate the percentage or fraction of the heritage asset, value that will be affected by the risk.

Given the characteristics of the building and its contents, we expect that most of this heritage asset and its value would be affected in the event of a major fire or earthquake. The C score in this case would be C=5.

Magnitude of Risk (MR)

The magnitude of the risk is MR=12½(2½+ 5 + 5).

To summarize: if a major event (fire or earthquake) will occur in the church, once every 300 years on average (A=2½), which means a 10% chance. every 30 years, fire or earthquake will affect all or most of the value of the heritage asset (C=5) causing total or near total loss of value of each affected item (B=5).

If we refer to the second category of risks (human forces, lack of employee training, criminal acts (for example, opportunistic theft, armed robbery, vandalism, terrorist attack) then the conclusions will be different.

Thefts or attacks originating from wars or other human actions are considered to have a higher probability of occurrence, especially in the current context, where we could witness important losses of Ukrainian cultural heritage in the context of the war.

Regarding human-caused actions such as theft or armed attack, the A score for the church in Biertan would be 4 and 3 ½ respectively.

The B score that we have seen shows us the size of the loss of value that we expect for each element of the heritage asset affected by the risk, we assume that the theft of a statue or painting would involve almost total or partial loss of the respective heritage elements, if we consider calculate a possible recovery. Also in case of war. Score B= 4 ½

The C score tells us how much of the heritage asset's value is affected by the risk. In this case, the score C= 4 ½, with an estimate of the percentage or fraction of the heritage asset, value that will be affected by the risk of 30%-40%.

Magnitude of Risk (MR)

The size of the theft risk is MR=10 ½(4½+ 3+3).

Size of war risk: MR= 13 ½(3½+ 5 + 5).

To summarize: we expect a theft event to occur once every 3 years for an average of 10 years (A=3½), which means a 30% chance. And the risk will partially or to a small extent affect the value of the heritage asset (C=3) causing the partial or no loss in some cases of the elements of the heritage asset (B=3), if it is recovered.

In the event of a terrorist attack or war, once every 30 years on average (A=3½), the Fire Risk will affect all or most of the value of the heritage asset (C=5) causing total or near total loss of value of each affected element (B=5).

5. Conclusions

Risk management, also, in the case of cultural heritage involves the identification and assessment of risks, the identification and establishment of the response to the risk in order to reduce the possibility of the defense of the risks, as well as the reduction of the consequences produced, as a result of the materialization of the risks. The risks affecting the built cultural heritage are different from the risks associated with the intangible cultural heritage which are more aimed at the loss over time of traditions and customs, of national identity or other elements related to the specificity of an area. Built heritage, once gone, cannot be brought back. As a good practice, the preservation of cultural and natural heritage should be part of the design of every project/program, and the benefits resulting from the use of cultural heritage should be reflected on as many members of the community as possible.

In the context of sustainable cultural tourism, the involvement of civil society is equally important for the maintenance, transmission and management of cultural heritage and for the sustainable management of the place for economic tourism activity.

The main interested parties for the development of sustainable cultural tourism at the national level are:

- Government (public sector);
- Local and heritage communities (community);
- Cultural heritage (religious heritage, organizations, institutions, sites, practices);
- Tourism associations (operators, developers, entrepreneurs);
- Tourists (consumers)

In order to develop sustainable cultural tourism, local and regional planners must consider the impact of climate change and the surrounding natural environment. It, also, means that other players such as local communities, politicians, organizations, cultural institutions and authorities must be integrated into the process. Entrepreneurs produce and offer cultural products, services and cultural experiences.

The ultimate aim of risk management is to help heritage professionals and organizations responsible for collections, buildings, monuments and sites to achieve their objectives in a more controlled and successful way. This means both optimizing the conservation of these heritage assets and optimizing their benefits to society over time. By assessing the risks affecting our collections, buildings, monuments and sites in their specific context, we can make more effective decisions about the sustainable use and safe keeping of heritage assets.

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