ECONOMIC, SOCIAL AND ENVIRONMENTAL ANALYSIS OF THE DEVELOPMENT POTENTIAL OF NORTHWEST AND NORTH CENTRAL REGION IN BULGARIA

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Abstract: The establishment of trends and intensity of ongoing processes is important for revealing the causes and differences in the development of regions, the disproportions that have arisen and the need to apply adequate measures for their reduction and limitation. In today's economy, undergoing increasing transformations towards sustainability in each of the developing sectors in Bulgaria and especially in the sensitive regions, sustainability in the context of sustainable development is becoming even more important. Two of the poorest regions in EU are located in Bulgaria – the Northwest and the North Central Region (NWR and NCR), and this is the main reason to analyse the indicators characterizing their economic, social, demographic and environmental condition in this article. **The main objective of the study** is to analyse important indicators for two of the statistical regions in Bulgaria (NWR and NCR) related to the current vision for their economic, socio-demographic and environmental condition. The study found that, unfortunately, the negative trend of the NWR and the NCR being

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the least populated regions in the Republic of Bulgaria is still growing, where the population in the NWR manages to stay within the upper limit, while the NCR is emerging as the region with the fastest depopulation. Enterprises with high risk potential have a larger relative share in the NCR, and those in the NWR have lower values. The higher relative share of enterprises with low risk potential in the NWR indicates the possibility of increasing sustainable territorial development and connectivity between different territories, between urban and rural areas. A sustainable trend is observed towards reducing the carbon dioxide values in the sectors of construction, energy, industry and waste. The same trend is noted for methane in the sectors of agriculture, construction, transport and waste, and for the nitrous oxide component in the agriculture, construction and energy sectors. Alarming is the trend in both studied regions for increasing values of CO_2 in the agriculture and transport sectors, and of methane in the energy and industry sectors.

Introduction

The sustainability of the territory means that local regional policies should be increasingly focused on integrated and balanced development. Due to the dynamic development of regions, periodic and systematic studies should be performed in order to harmonize the regional development policy, and in particular – sustainable development of rural territories should be achieved by implementing policies aimed at protecting and maintaining the environment and biodiversity, reducing the environmental footprint, stimulating sustainable economic growth, social and demographic stability (Tireuov et al., 2019; Belgibayeva et al., 2024; Tireuov et al., 2020; Tireuov et al., 2018).

Regional studies of demographic and socio-economic development in Bulgaria and trends in this field have been the subject of research in a number of scientific works in recent years (Ilieva et al., 2023; Slaveva, 2023). Part of these researches are in the context of the European Union and outline the identified differences (Rangelova, et al., 2019), but besides that they analyse the horizons of the demographic processes not only in Bulgaria, but also in the world (Bardarov & Ilieva, 2022). The demographic processes affect all levels of socio-economic life, but the researches are focused on those rural areas experiencing the most severe effects of depopulation (Tesin, et al., 2024; Garcia-Madurga & Esteban-Navarro, 2024; Hu & Lin, 2023;

Doitchinova & Lazarova, 2023a; Doitchinova & Lazarova, 2023b; Wojewodzka-Wiewiorska, 2019; Fernandez, et al., 2013; Reichert-Schick, 2010). In this regard, the choice of a model for increasing sustainability in the specific territory should be aimed at optimal utilization of the regional resources, diversification in the functional use of the territory, optimal diversification of production and economic activities, environmentally friendly business practices and, above all, effective interaction between the institutions, local administration, the business and local communities (Nikolova & Pavlov, 2023). The opportunities for competitive advantages of agricultural farms and sustainable production models have been studied by various authors (Krasteva, 2017; Nikolova & Linkova, 2018; Nikolova, 2022; Doichinova, 2024; Stoyanova, 2024; Stanimirova & Kirechev, 2024; Nikolova, 2024), etc. The priorities for development are extracted in a synthesized form from the integrated territorial strategies of the two studied regions for the current period 2021-2027 (Integrated Territorial Development Strategy, Northwest Region, 2022), (Integrated Territorial Development Strategy, North Central Region, 2022) - fig. 1.
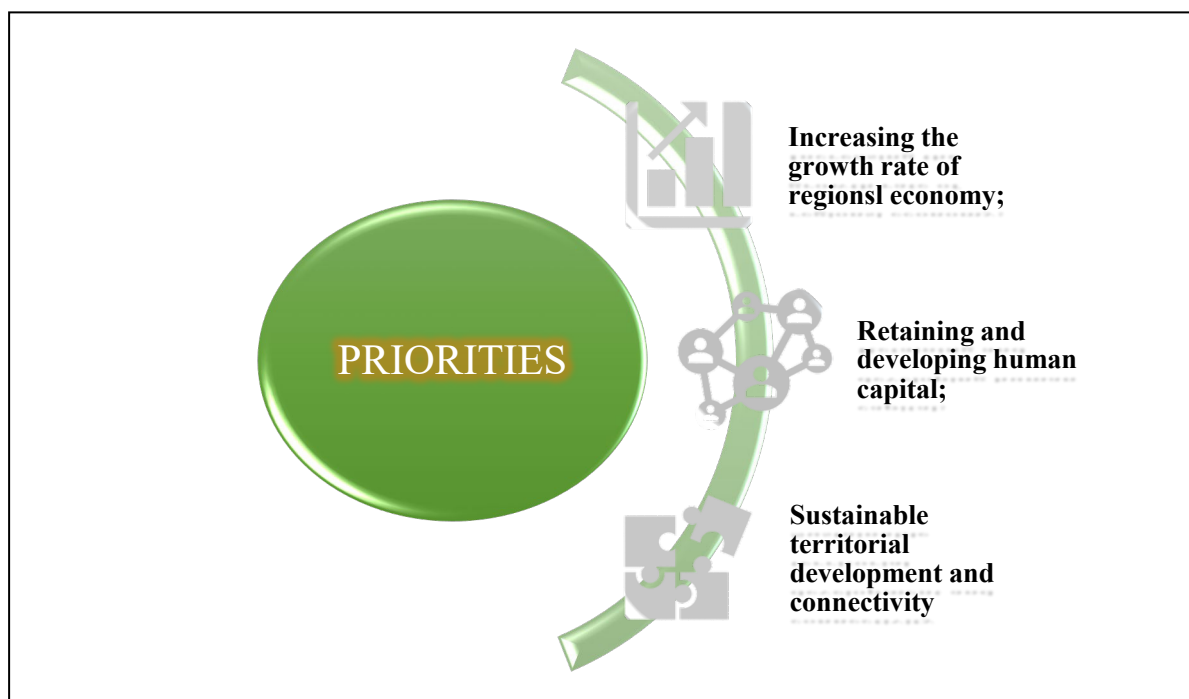
Figure 1. Main priorities in the Integrated Territorial Development Strategies (2021-2027), NWR and NCR

The comparison of priorities in the Northwest and North Central Regions shows that for both regions the strategic guidelines are in three main

directions, these are – **regional economy and upsurge, human capital, sustainable territorial development and connectivity**. The interaction and communication between all stakeholders in the process will undoubtedly play a very important role for the achievement of these priorities by the end of the period. The ultimate goal is to increase the sustainability of the individual territories. In this sense, the sustainability of the territory means that local regional policies must increasingly focus on integrated and balanced development. In order to achieve this, it is more than necessary to have a functioning and stable government, which can take long-term-oriented decisions and create conditions for sustainable economic growth. In recent years, we have witnessed short-lived parliaments in Bulgaria, which hampers the implementation of the European environmental law, and thus affects the potential for sustainable territorial development of individual regions. Nevertheless, due to the dynamic development of regions, periodic and systematic studies should be performed in order to harmonize the regional development policy, and in particular – sustainable development of rural territories should be achieved by implementing policies aimed at protecting and maintaining the environment and biodiversity, reducing the environmental footprint, harmful emissions, waste, etc.

1. Methodology

The analysis of the key indicators for economic development of the NWR and the NCR is based on official statistical data from the National Statistical Institute (NSI) available through the INFOSTAT information system, and on additional information provided by the NSI under research project No. КП-06-Н55/1 "Development of rural territories in the conditions of transformation towards a sustainable economy", funded by the Bulgarian National Science Fund. A variety of statistical and econometric methods is used in the analysis of the differences in the socio-economic development of the area, and the choice of the method is predetermined by the decomposable statistical data and the objectives of the study (Jackson, et al., 2020), (OECD, 2011). In the course of the study, statistical methods were used for analysis of time series, assessment of structural changes and testing of hypotheses. The structural changes and differences were assessed by using the integral coefficient of structural changes and differences (K_s) (Gatev, 1987; Yankova, 2007). The verification of an existing trend was based on the first-order autocorrelation coefficient at a significance level of

$\alpha = 0,05$. From the tested models – linear, parabola, cubic function, logarithmic, power and exponential function, the most appropriate trend model was selected by means of the correlation coefficient (r), the determination coefficient (R^2), the corrected determination coefficient (R^2_{adj}), the Fisher adequacy test (F) (Hamilton, 1994).

The analysis of the demographic and social situation in the NWR and the NCR was performed based on data from the National Statistical Institute (National Statistical Institute, 2024), as well as data from the population and housing census of 2011 and 2021 regarding the population at NUTS 2 level – total number and by rural areas. Subject to study were the dynamics of the natural growth rates in the country as a whole, in the cities and in the villages; per capita income and the correlation between per capita income and per capita expenditure in the NWR and the NCR for the period 2011-2023; as well as the population at risk of poverty or social exclusion in the age range of 18-64 years for the period 2019-2023.

When analysing the environmental condition of the studied regions, the Electronic Database (public register) of the Ministry of the Environment and Water (MoEW) was used to identify **enterprises with low and high risk potential**, which fall within the scope of Chapter Seven, Section One of the Environmental Protection Act (Environmental Protection Act, 2023) (EPA), (MoEW, 2024). The **greenhouse gas emissions** expressed in kton CO2eq were also studied using the Global Warming Potential (GWP-100) values of the IPCC AR5 (Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5).

2. Results and discussion

In most scientific publications in Bulgaria, the authors mainly examine the economic, demographic, and social processes in individual regions of our country. Regional differences or individual economic sectors are analyzed (Slaveva, 2020; Doitchinova & Miteva, 2022), etc. Other authors pay attention to the ecosystem approach when evaluating a specific area, in this case, agrarian sustainability (Bashev, et al., 2019). The essence of the ecosystem approach lies in understanding it as a tool for achieving three-dimensional sustainability (economic, social, and ecological). Therefore, this approach serves as a strategy for integrated management, aiming to achieve a higher degree of sustainability across various dimensions.

Strategic documents at the European, national, and regional level (integrated territorial development strategies by region) emphasize the possibilities for limiting economic, social, and demographic disparities in individual regions, as well as environmental problems. At the same time, discussions and studies about economic, social, demographic, and ecological processes on a regional scale are insufficiently developed. This has provoked the authors to conduct research on the relationship between economic development, on the one hand, demographic and social characteristics, on the other, and the ecological condition of the two studied regions, on the third. This approach unifies the three main components of sustainable development within a regional context (economic, social, and environmental). We believe that this provides a solid foundation for developing our own comprehensive system to enhance the sustainability of each region in Bulgaria. We are about to publish a collective monograph that delves deeper into the issue. The formation of a clear vision for the development of each region, when taking into account all the individual sides of the "sustainable ecosystem" assemblage, means not only taking into account the current state but also continuous collaboration between those, interested in the development of the process, participants. In this regard, we analyze the three important countries that predetermine the sustainability of each region and enable the construction of successful strategies for local development. Another upcoming publication will focus on the interaction between the various participants in the process.

2.1. Analysis of key indicators for the economic development of the NWR and the NCR

GDP is a major macroeconomic indicator for each country, and the analysis of its regional structure provides a possibility to establish the contribution of individual regions to its formation and to assess the differences in the economic development of the regions. In the period 2000-2022, the Southwest Region (SWR) played a dominant role in the regional structure of GDP, accounting for 35.3% of the GDP in 2000, and in the following years its share grew to reach its highest value of 50.6% in 2020, and 48.9% in 2022. The relative share of the Southwest Region in GDP formation is due to the fact that it includes Sofia Capital and Sofia District.

The contribution of other regions to GDP formation is much smaller, and the comparison to their relative shares at the beginning of the period shows a steady downward trend. The largest decrease is observed in the

relative share of the Northwest Region (NWR) – from 11.6% in 2000 to 6.43% in 2019 and 6.69% in 2022, and of the North Central Region (NCR) – from 10.4% in 2000 to 7.2% in 2022. The sustainable trend of increase in the relative share of the Southwest Region is accompanied by a decrease in the share of all other regions, where the most pronounced decrease in the contribution to the national economy is that of the NWR and the NCR.

The intensity of changes in the regional structure of GDP by statistical regions is measured by the integral coefficient of structural changes (K_s), the values of which are between 0 and 1, where the closer its value is to one, the greater the structural changes, and the closer it is to zero, the less pronounced the changes are. The integral coefficient of structural changes and differences was calculated at several bases, namely: the beginning of the analysed period (2000); the acceptance of Bulgaria as a member of the EU (2007); and against each previous year (chain basis). Analysing the intensity of structural changes against a different base enriches the analysis and allows an assessment of the structural changes that have occurred. Depending on the year, which is assumed as a basis in the GDP structure by regions, changes of varying intensity were established (Figure 2.):

•assuming 2000 as a base year, the results show significant changes in the regional structure of the Bulgarian economy, and their intensity increases with the deviation from the base year – for 2001 *Ks=0.0344*, for 2020 *Ks= 0.2381* and for 2022 *Ks=0.2133*;

•assuming 2007 as a base year, the changes are less pronounced – for 2008 they are minimal *Ks=0.0126*, but for each subsequent year the coefficient increases – for 2020 *Ks=0.0747* – and indicates smaller changes in the regional structure of GDP. The obtained results indicate that the country's membership in the EU, the funding it receives from European funds, and the implementation of cohesion policies have led to structural changes. However, the differences in the economic development of the country's regions have not decreased, but have instead deepened;

•assuming each previous year as a base year, the results show minimal changes, and even almost absence of changes in the GDP structure by region. As a result, it can be concluded that regional structure of GDP is sustainable, reinforcing the dominant role of the SWR and the much smaller contribution of the rest of the regions, where the most unfavourable trends are the declining contributions of the NWR and the NCR to the formation of the GDP. It is necessary to conclude that the current measures and approaches are not achieving the desired result of reducing the differences in economic development of the regions. This necessitates the

implementation of a targeted state policy based on real measures and incentives for the development of the less developed areas, particularly the NWR and NCR.

In the period 2007-2022, GDP per capita increased 3 times, where the average annual growth for the country is 7.9%, and for the NWR and the NCR the average annual growth rate is 7.6%. Despite the similar growth rates of GDP per capita for the country and for the individual regions, there are significant differences in the values of this indicator (Figure 3). In the noted period, GDP per capita for the NWR was between 33% and 39% lower than the indicator for the country, and for the NCR it was between 29% and 33% lower.
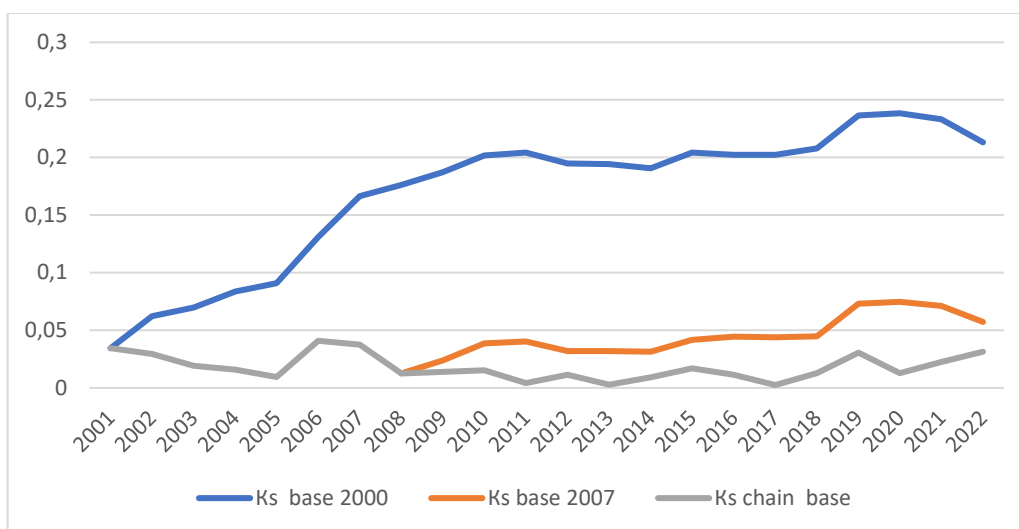

Source: Author's calculations.

Figure 2. Integral coefficient of structural changes and differences in the regional structure of GDP

At the same time, significant differences are noted in the indicator values by districts – in most years of the period, GDP per capita for the districts of Vidin, Montana, Pleven and Lovech is lower than the indicator for the NWR, and for the NCR lower values are noted for the districts of Silistra, Razgrad and Veliko Tarnovo. These facts reveal significant intra-regional differences within the statistical regions, which are most pronounced at the municipal level, especially in those municipalities that are considered rural territories.

The peculiarities of economic development in the separate regions are expressed in the sectoral structure represented by the main sectors – agricultural, industry, services. In Bulgaria, the relative share of the service

sector in the gross value added (GVA) was between 60.7% in 2001 and 71.2% in 2021, and it is dominant in the rest of the statistical regions. The share of the agricultural sector in the GVA in the studied period steadily decreased from 12.5% in 2000 to 4.3% in 2022, while the share of the industry sector showed significant dynamics and minimal growth over the years – between 25.9% and 31%. The GVA structure in the NWR and the NCR is very similar. In the studied period, the share of the service sector was between 50% and 60%, the agricultural sector – between 8% and 19%, and the industry sector – between 24% and 34%.
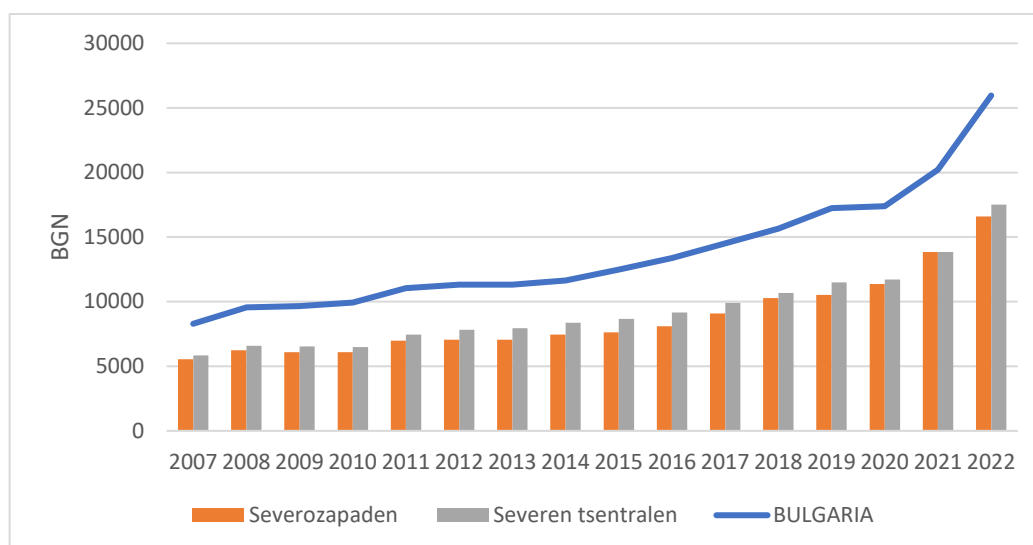

Source: NSI

Figure 3. GDP per capita for the period 2007-2022

The comparison between the sectoral structure of the NWR and that of the NCR shows some similarity, since the share of the agricultural sector is almost 2 times larger compared to its share in the structure of the national economy. The degree of difference in comparison to the sectoral structure of the national economy is assessed by means of the integral coefficient of structural changes and differences. The values of this coefficient show that the differences in comparison to the structure of the national economy are greater in the NWR – for 2000 *Ks=0.1231*, for 2007 *Ks=0.1132*, and for 2022 *Ks=0.1692*, while they are slightly less pronounced in the NCR – for 2000 *Ks=0.0719*, for 2007 *Ks=0.0783*, and for 2022 *Ks=0.0966*.

It was found that in the analysed period, in the GVA structure by economic sectors, as compared to the structure of the previous year, the changes in almost all years were greater for the NWR, and for the NCR they were much less pronounced (Figure 4).
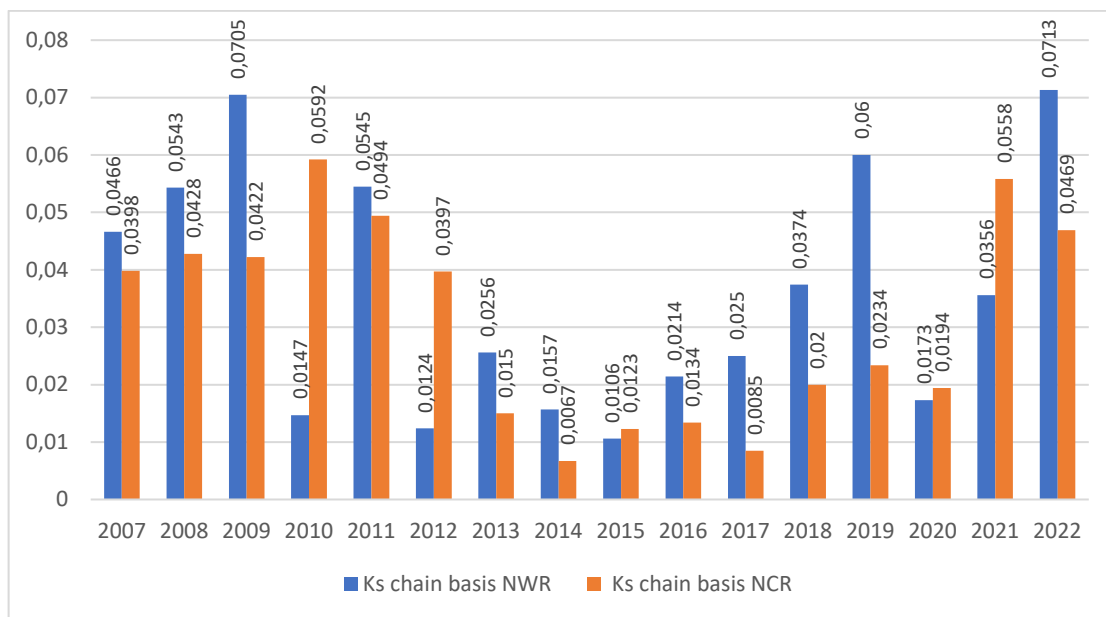
Source: Author's calculations.

Figure 4. Integral coefficient of structural changes and difference in the sectoral structure of the NWR and NCR

Another aspect in the study of the economic development of the NWR and the NCR is tracing of the dynamics of some key economic indicators for non-financial enterprises, namely: number of enterprises, employees, tangible fixed assets, expenses for acquisition of fixed assets, operating income.

In the period from 2008 to 2022, the number of enterprises from the non-financial sector in the NWR increased 1.12 times – from 28,287 to 31,612, with an average annual growth rate of 0.8%. In the NCR, there was also an increase in the number of enterprises – from 36,260 in 2008 to 40,136 in 2022, with an increase of 1.11 times and an average annual growth rate of 0.73%. The number of enterprises in the NWR in 2008 was 8.86% of the number of all enterprises in the country. Over the years their share has decreased and for 2022 it was 7.03%. In the NCR, there was also a distinct tendency for decreasing share of enterprises in the total number of enterprises in the country from 11.23% in 2008 to 8.93% in 2022. The dynamics of this indicator clearly shows declining entrepreneurial activity leading to negative trends in most of the indicators for the NWR and the NCR. The hypothesis that there is a trend was tested by means of the first-order autocorrelation coefficient (r_1) at a level of significance $\alpha = 0,05$ and theoretical values of the coefficient from -0.462 to +0.328. The results confirm a trend in the NCR indicator – the first-order autocorrelation coefficient is

0.5824, and the NWR indicator does not show a trend – the first-order autocorrelation coefficient is 0.1179.

In the period 2008-2022, the employed population in both regions decreased – in the NWR from 175,858 for 2008 to 144,411 for 2022, with an average annual decrease of 1.4%; and for the NCR it decreased from 229,631 for 2008 to 194,121 for 2022, with and average annual rate of decrease - 1.2%. The rate at which the employed population in the NWR is decreasing is higher compared to the rate of decrease in the employed population in the NCR. This negative trend is also manifested by a decrease in the share that the employed population in both regions has in the total number of employed people in the country. In 2008, the NWR accounted for 7.92% of the employed population in the country, and in 2022 this share was 6.6%. There is a significant drop in the relative share of the employed population in the NCR as compared to the employed population in the country – from 10.35% in 2008 to 8.87% in 2022. The verification of an existing trend confirmed a trend in the time series of the employed population in both regions – the first-order autocorrelation coefficients are 0.8967 for the NWR and 0.8193 for the NCR, where the most appropriate presentation models are based on the power function and are presented in Table 1.

The tangible fixed assets (TFA) of non-financial enterprises in the NWR and the NCR are increasing, and in the NWR the average annual growth rate is 0.7%, while in the NCR the average annual growth rate is 3.4%. The share of the NWR TFA in the total amount of TFA in the country is characterized by significant fluctuations, as in 2008 it was 5.7%, increasing to 6.71% in 2016, and decreasing to 4.68% for 2022. In the NCR, there is a stable tendency of increasing the relative share of TFA in the total amount of TFA in the country – from 5.96% in 2008 to 7.08% in 2022. The first-order autocorrelation coefficient is 0.6208 for the NWR and 0.8379 for the NCR, and the models describing the trend are presented in Table 1.

Investment is an important factor for economic development, restructuring the economy, increasing competitiveness, increasing employment and reducing unemployment. The analysis of the dynamics of TFA acquisition costs in the NWR and the NCR reveals that these costs are increasing, with the average annual growth rate for the NWR being 2.01%, and for the NCR being 1.47%. In both regions, there was an increase in the relative share of the TFA acquisition costs as compared to the country indicator – for the NWR from 4.29% in 2008 to 6.07% in 2022, and for the NCR from 6.3% in 2008 to 8.26% in 2022. The value of the autocorrelation

coefficient shows the presence of a trend in the time series of the NCR – 0.4446, while for the NWR it is 0.0846 and the series show no trend.

In the period 2008-2022, operating income in both areas increase, but the growth rate for the NCR is slightly higher – the average annual growth rate is 7.68%, while the same for the NWR is 7.13%. The share of the NWR and NCR operating income in the country indicator varies, but the overall trend is towards increasing – for the NWR from 4.76% in 2008 to 5.34% in 2022, and for the NCR from 6.88% in 2008 to 8.29% in 2022. The verification of an existing trend shows a trend in the time series – for the NWR r_1=0.9695, and for the NCR r_1=0.9428, where the most appropriate description models are presented in Table 1.

The trend models presented in Table 1 provide a basis to produce short- and medium-term forecasts for the estimated values of the analysed indicators in the NWR and the NCR, in order to determine the confidence intervals of the estimated values and on this basis to develop strategies and implement policies for reduction of the regional disparities.

Table 1.
Trend pattern characteristics

	Trend models	r	R^2	R^2_{adj}	F
Enterprises (number)					
NWR	No trend				
NCR*	$\hat{y} = 36264 - 499{,}74t + 43{,}821t^2$	0.8358	0.6985	0.6482	13.8986
Employed people (number)					
NWR*	$\hat{y} = 173456t^{0{,}072}$	0.9399	0.8834	0.8744	98.4958
NCR*	$\hat{y} = 220614t^{0{,}052}$	0.8450	0.7141	0.6921	32.4670
Tangible fixed assets (thsd BGN)					
NWR*	$\hat{y} = 3970664 + 855304{,}5t - 48805{,}2t^2$	0.7366	0.5426	0.4664	7.1171
NCR*	$\hat{y} = 5327766 + 211762{,}9t$	0.9287	0.8625	0.8520	81.5742
Costs for acquisition of tangible fixed assets (thsd BGN)					
NWR	No trend				
NCR	$\hat{y} = 1536996 - 94901{,}1t + 8515{,}6t^2$	0.6980	0.4872	0.4017	5.7010
Operating income (thsd BGN)					
NWR	$\hat{y} = 12822838 - 1211316t + 133965{,}1t^2$	0.9370	0.8780	0.8576	43.1700
NCR	$\hat{y} = 94299020 + 1554533t$	0.8551	0.7313	0.7106	35.3731

*Note: *Model parameters are statistically significant – P-value<0.05*
Source: Author's calculations.

The trend models indicate an increasing trend for the indicators of "number of enterprises," "fixed tangible assets," "expenses to acquire fixed tangible assets" and "income from the activity," while the trend for the indicator of "number of employed persons" shows a decreasing trend. If we

maintain the current development conditions, the dynamics of the indicators and established trends suggest that the number of enterprises will change at a slower pace, the number of employed persons will continue to decrease, and the costs of acquiring DMA will increase slowly. This implies that NWR and NCR will continue to lag behind the main economic indicators.

## 2.2. Study of the demographic and social characteristics of the NWR and the NCR

In the population and housing census in 2011 and 2021, the least populated regions in Bulgaria were the Northwest and North Central Regions (12% of the country's population lived there in 2011, and in 2021 it decreased to 11%), and this trend is not only persistent, but is also intensifying (see Figure 5).
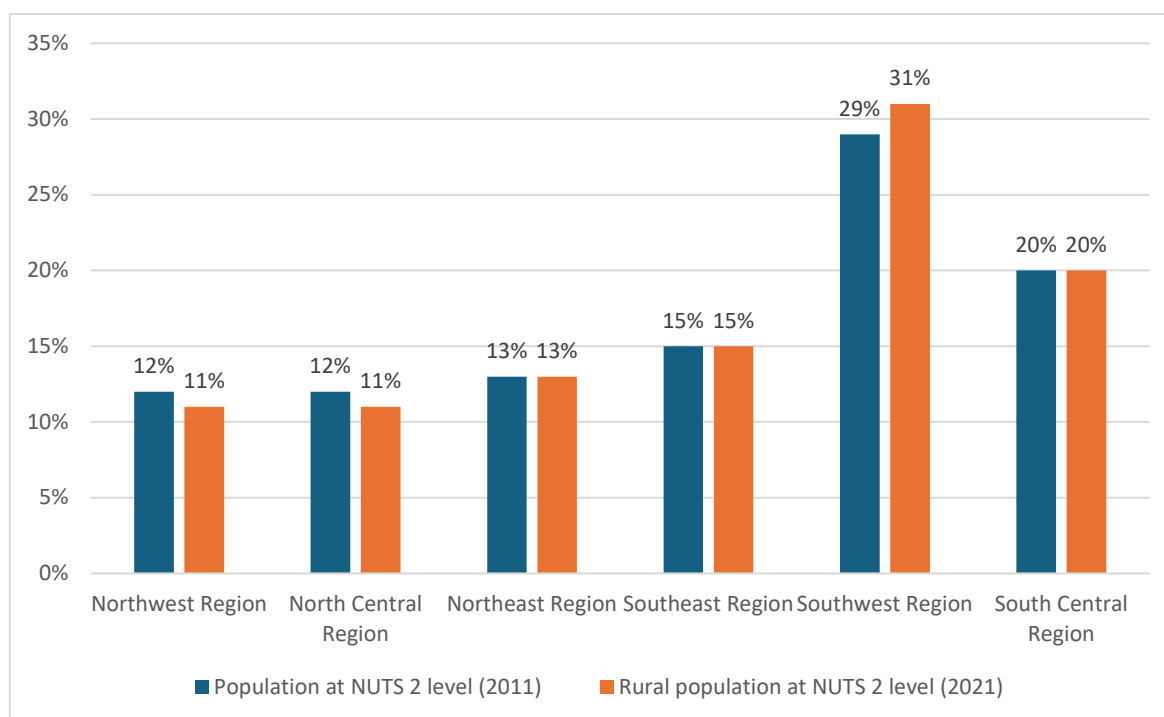
Source: (Author's calculations based on data from NSI)

Figure 5. Percentage distribution of population at NUTS 2 level in 2011 and 2021 by planning regions

At NUTS 2 level, the demographic problems in the rural areas of all regions worsened in 2021 (see Figure 6), but the region with the least rural population was the North Central (3.80%), maintaining its position since 2011.
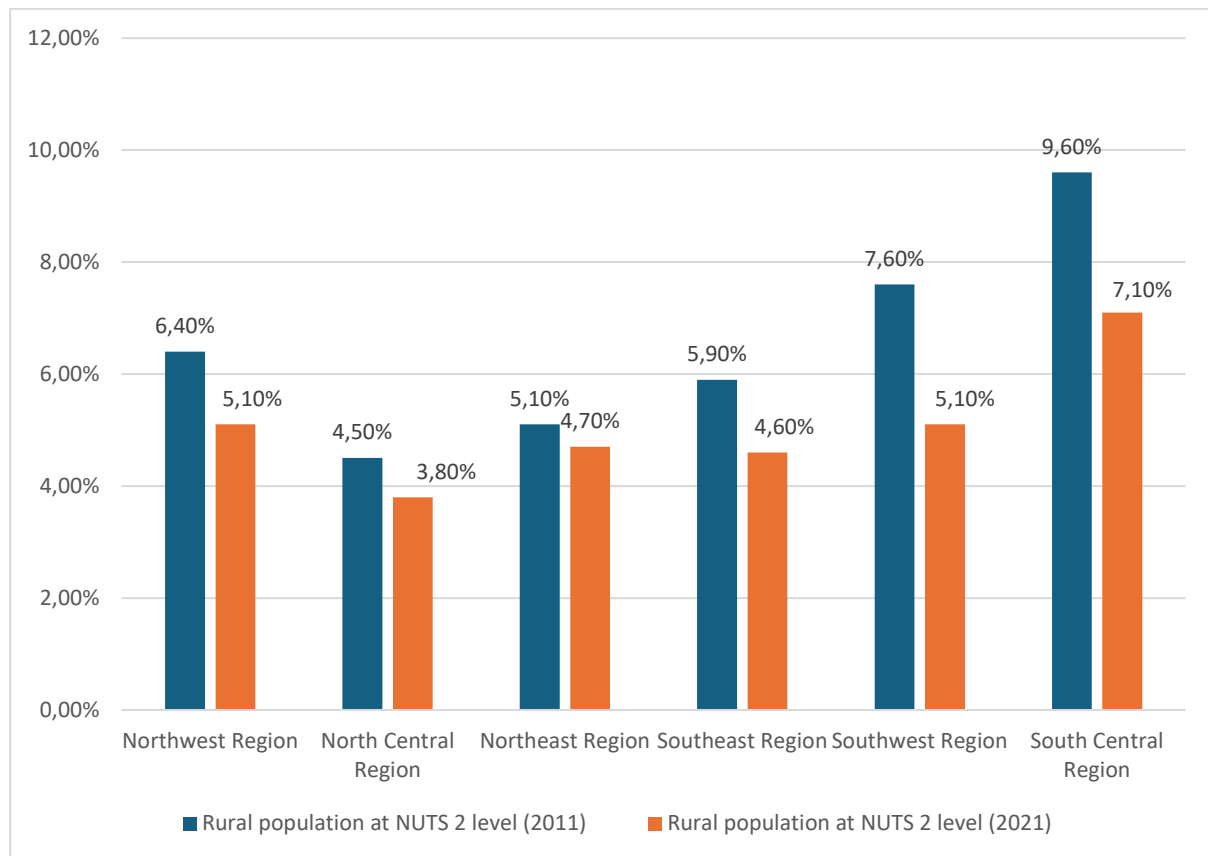
Source: (Author's calculations based on data from NSI)

Figure 6. Percentage distribution of rural population at NUTS 2 level in 2011 and 2021 by planning regions

Another important aspect is the decrease of rural population in the Northwest Region, where in 2011 it was 6.40% and in 2021 it ranks next to the Southwest region with 5.10% of rural population, while the South Central Region retains its leading position in terms of rural population (7.10% in 2021).

When examining the natural growth rate (NGR) in the NWR, the NCR and the country as a whole for the period 2011-2023 (see Table 2), it is noteworthy that this rate is constantly negative, but 2021 (the peak of the Covid 19 crisis) has witnessed worse numbers across all demographic levels.

2011 and 2013 show the lowest NGR values in the studied regions for the period 2011-2023. In 2011, NGR (country total) was -5.1‰ and NGR (cities) in both regions had the lowest values (about -5‰). In 2013, the NWR and the NCR recorded the lowest values of NGR (country total) for the studied period, with registered NGR (villages) -11.8 ‰ as country total and -13.2‰ in the NCR. NGR (villages) in the NWR registered the lowest values in 2023 (-17.7 ‰).

Table 2.
Natural growth rate (NGR) – country total, in cities and in villages for the period 2011-2023 in the Northwest Region, the North Central Region and total for the country

|	NGR (country total) in ‰			NGR (cities) in ‰			NGR (villages) in ‰		
	Country total	NWR	NCR	Country total	NWR	NCR	Country total	NWR	NCR
2011	**-5.1[5]**	-10.8	-8.0	**-2.2**	**-5.0**	**-4.9**	-12.7	-20.9	-14.3
2012	-5.5	-11.5	-8.2	-2.8	-5.8	-5.2	-12.8	-21.4	-14.2
2013	-5.2	**-10.5**	**-7.7**	-2.8	-5.4	-5.1	**-11.8**	-19.7	**-13.2**
2014	-5.7	-11.5	-8.7	-3.1	-6.2	-5.7	-12.9	-20.8	-14.9
2015	-6.2	-11.8	-9.0	-3.5	-6.8	-6.0	-13.4	-20.4	-15.2
2016	-6.0	-11.6	-8.7	-3.6	-6.9	-5.9	-12.6	-19.9	-14.6
2017	-6.5	-12.4	-9.8	-4.0	-7.5	-6.9	-13.5	-20.8	-15.6
2018	-6.5	-12.3	-10.1	-4.1	-7.4	-7.3	-13.5	-20.9	-15.9
2019	-6.7	-12.6	-10.2	-4.4	-8.5	-7.7	-13.1	-20.0	-15.5
2020	-9.5	-15.5	-13.9	-7.1	-11.3	-11.3	-16.0	-22.9	-19.3
2021	**-13.2[6]**	**-20.7**	**-18.1**	**-10.5**	**-16.1**	**-15.0**	**-20.2**	**-28.7**	**-24.1**
2022	-9.6	-15.4	-14.5	-7.2	-11.1	-11.9	-16.4	-23.0	-20.0
2023	-6.8	-12.3	-11.0	-4.8	-9.0	-8.9	-12.3	**-17.7**	-15.1

Source: (Data from NSI.)

Based on the above, it can be concluded that these regions are in a phase of more intensive deurbanization – shrinking cities and villages with perforated structure, due to the almost double decline in natural growth compared to the NGR (country total). Despite the global nature of these processes, no single solution exists to address the issues associated with deurbanization. Some authors argue that empowering the local community through the transition from national to local self-government is imperative (Kim, 2021), while others argue that an intensive national policy is necessary to ensure the necessary infrastructure for economic activity in the region (San-Martin Gonzalez & Soler-Vaya, 2024), despite the associated heavy investment and low efficiency in the short term. There are also authors who propose extensive solutions, such as the development of policies to actively attract immigrants, alongside the provision of appropriate social benefits (Garcia-Madurga & Esteban-Navarro, 2024). There are also balanced approaches to the problem that focus on socio-economic improvements, infrastructure investments, and policies that directly affect rural communities (Papadopoulos & Baltas, 2024). At the beginning of 2000, in support of this balanced approach, the concept of "smart shrinkage" appeared, for which the

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[5]The lowest NGR values for the period 2011-2023 are marked in light grey.
[6]The highest NGR values for the period 2011-2023 are marked in dark grey.

focus is not only on increasing the population in the affected areas but on providing favourable conditions for the current population, based on the high quality of life. For this purpose, it is necessary to develop local policies that aim to deconstruct or re-evaluate the current infrastructure, reorganize the functions of the public administration and the services provided, and create a distinctive image of the place using a cooperative approach, initiatives improving the quality of life of the local population, and effective immigration policies (Makkonen & Inkinen, 2023). In the current study, the analysis of the social conditions of the region takes into account factors such as the average total income per person, the ratio between total income and total expenditure per person, and the population at risk of poverty or social exclusion. Other factors can be added to these, such as educational structure, economic activity coefficients, employment and unemployment, distribution of the housing stock, health status, etc., but they remain outside the scope of the present study and will be analysed in subsequent publications on the subject.
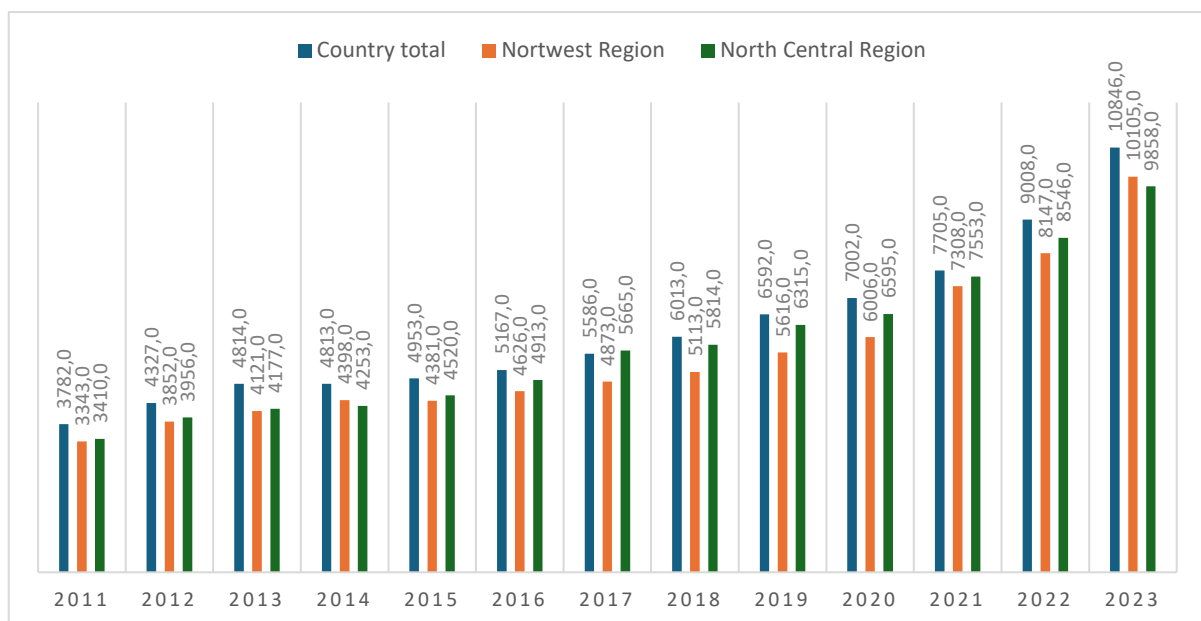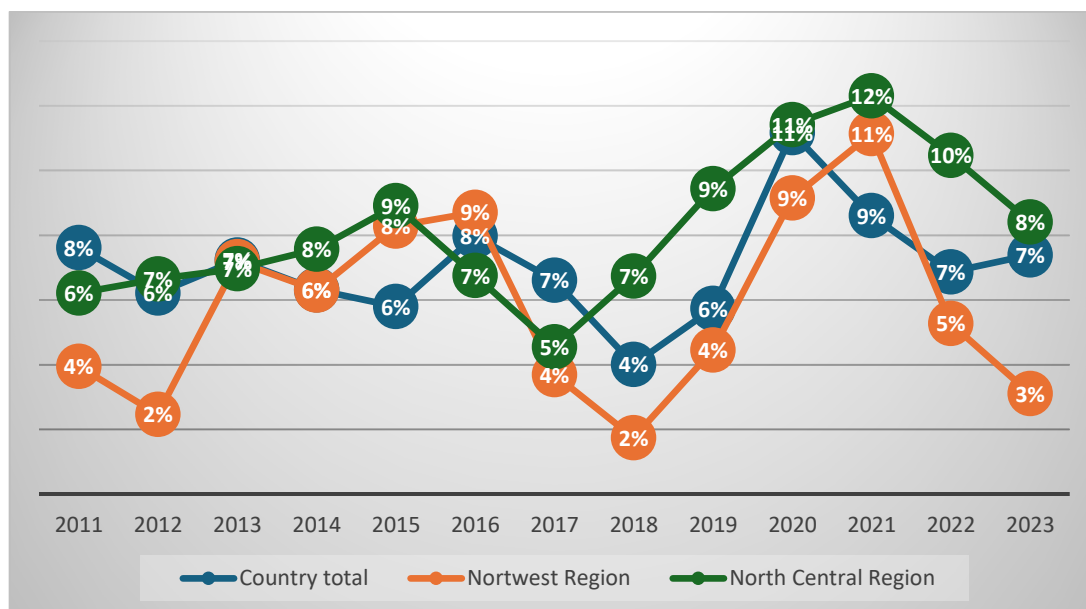

Source: (*NSI*)

Figure 7. Per capita income in the NWR, the NCR and country total (in BGN) for the period 2011-2023

When examining the per capita income in the NWR, the NCR and the country total (in BGN) for the period 2011-2023, there is a trend of a constant increase of this indicator in Bulgaria, since in recent years it has increased almost three times compared to 2011 (from BGN 3,782.0 in 2011 to BGN 10,846.0 in 2023) (see Figure 7).

In the studied period, the NCR shows a steady tendency to overtake the NWR in this indicator, but in 2023 the per capita income in the NWR reached BGN 10,105.0, while in the NCR it was BGN 9,858.0. This indicator is not a sufficient basis to draw a conclusion about the social significance of this trend.


Source: (Author's calculations based on data from NSI)

Figure 8. Ratio between per capita income and per capita expenditure in the NWR, the NCR and country total (in BGN) for the period 2011-2023

Therefore, the ratio between per capita income and expenditure was examined in the NWR, the NCR and the country total (in %) for the period 2011- 2023 (see Fig. 8).

The figure illustrates that despite the constant tendency of increasing income, the difference that remains after deducting total expenditure varies over the years between 5-12% in the country as a whole, with the NCR having more favourable range (between 4-11%) than the NWR, which for the same period varies between 2-11%. At the same time, it should be noted that in 2013 the values for the studied regions were almost identical with the country total values, as well as that the ratio between per capita income and per capita expenditure in the NCR was predominantly higher than the country total, while this value for NWR is traditionally lower than the national average. In 2023, this trend remained stable and the NWR, which showed the highest growth in per capita income, had only a 3% difference between per capita income and per capita expenditure. Moreover, the NCR, which was lagging behind in the growth of per capita income in 2023, approached and even slightly exceeded the national average of 7% difference between per capita income and per capita expenditure.
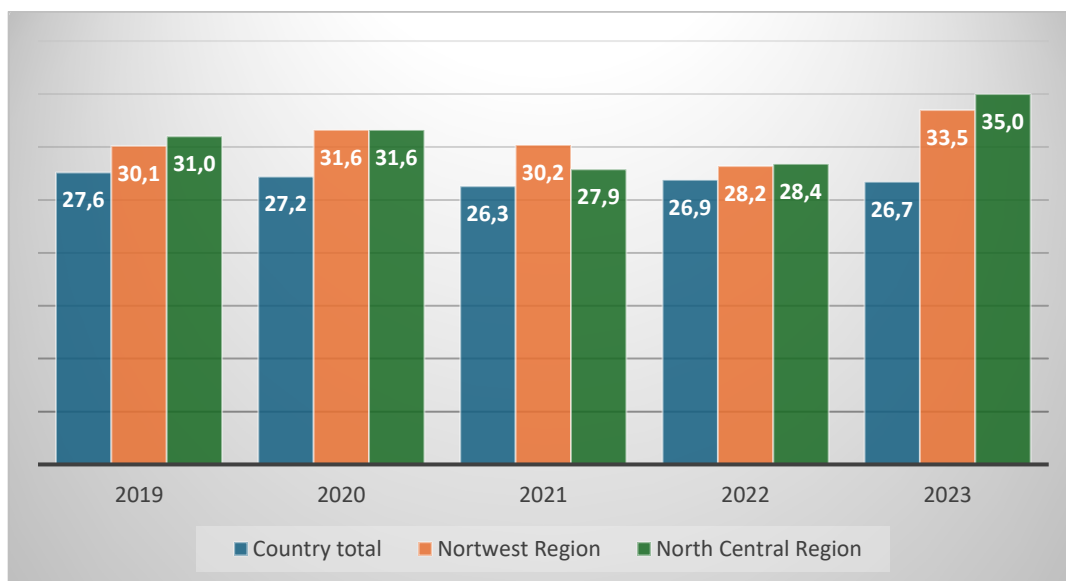
Source: (*NSI*)

Figure 9. Population at risk of poverty or social exclusion in the age range of 18-64 years, % of the population in the NWR, the NCR and country total (2019-2023)

The next studied aspect was the population at risk of poverty or social exclusion in the age range of 18-64 years, expressed in % of the population in the NWR, the NCR and the country in the period 2019-2023 (see Figure 9). This indicator has a new definition and includes persons living at risk of poverty, materially and socially deprived and living in households with unemployed people or with low intensity of economic activity. Particularly worrying is the fact that about 27% of the working population in the Republic of Bulgaria falls into this group, with the NCR overtaking the NWR for this five-year period and marking a significant increase from 31% in 2019 to 35% in 2023.

2.3. Analysis of the environmental condition of the NWR and the NCR

Today, researchers from all over the world, including in Bulgaria, pay more and more attention to the ecological aspects of public life. The greening of scientific knowledge and socio-economic development in recent years is inevitably associated with the "sustainable development" paradigm and its evolution. The protection of the natural environment unites modern society as a primary criterion for assessing opportunities and rates of economic development and social progress.

The issues of limited natural resources, environmental pollution, the greening of business, and the introduction of nature-saving practices have emerged as significant challenges in life, the economy, and any human activity. They are the subject of attention in various scientific publications by Bulgarian authors (Petrova, et al., 2023; Nikolova, et al., 2022; Pavlov, 2022; Krasteva, 2021), etc. Foreign authors have also conducted numerous studies on these problematic issues (Zhironkin, et al., 2018; Kovalevsky, et al., 2019; Islamgaleyev, et al., 2020; Zhernov et al., 2020), etc. The essential characteristic of the concept of sustainable development reveals the potential and possible choices for the main countermeasures, that, if balanced, could preserve human life at a qualitatively acceptable level. For this reason, in this publication we focus on two important aspects regarding the ecological state of the studied regions, namely pollution from industrial sources and data analysis of the main gas components.

In connection with the prevention and limitation of industrial pollution in the Northwest and North Central Regions, we extracted from the Electronic Database of the Ministry of Environment and Water (MoEW) the enterprises with low and high risk potential at the regional level and the corresponding Regional Inspectorate of Environment and Water (RIEW) (Table 3).

Based on the public register and our own calculations, we have presented in tabular form the number of enterprises with low and high risk potential and their relative share, where those with low risk potential are 60.87% in the Northwest Region, and in the North Central Region they are significantly less – 48%. The opposite trend is observed for enterprises with high risk potential, i.e. a higher relative share of these enterprises in the North Central Region (52%) compared to those in the Northwest Region (39.13%).

Table 3.
Relative share of enterprises with low and high risk potential and total number by region

Enterprises with low and high risk potential				
Risk potential	**Northwest**	**Relative share**	**North Central**	**Relative share**
Low	14	60.87	12	48.00
High	9	39.13	13	52.00
Total:	23	100	25	100

Source: (Author's calculations based on data from MoEW)

Out of a total of 14 enterprises with low risk potential in the Northwest Region, 10 are on the territory of RIEW Pleven, 3 at RIEW Montana and 1 at

RIEW Vratsa. In the same region, the distribution of the 9 enterprises with high risk potential is as follows: RIEW Vratsa – 3, RIEW Montana – 5 and RIEW Pleven – 1. The enterprises with low risk potential in the North Central Region are 6 enterprises at RIEW Veliko Tarnovo and 6 enterprises at RIEW Ruse. The high risk potential in the same region is assigned to 6 enterprises at RIEW Veliko Tarnovo and 7 enterprises at RIEW Ruse.

For the purpose of this analysis of the environmental condition of the studied regions, we have also considered the **greenhouse gas emissions**. In this case, we have analysed data on the main gas components - Fossil, CO2, N2O, CH4, F-gases, AR5 (Table 4).

Table 4.
Rate and direction of change in greenhouse gas emissions with ranking by regions

| Components | Sectors | STATISTICAL REGIONS | | | | | | | | RANK | |
| | | NORTHWEST | | | | NORTH CENTRAL | | | | | |
		1990	2022	Rate of change	Direction of change	1990	2022	Rate of change	Direction of change	NWR	NCR
Fossil CO2	Agriculture	61.36	89.12	45.24	↑	26.88	35.27	31.24	↑	5	5
	Buildings	1138.74	194.37	-82.93	↓	1015.98	198.20	-80.49	↓	2	1
	Energy	1492.87	81.44	-94.54	↓	3020.28	1886.87	-37.53	↓	1	3
	Industry	3021.59	2069.31	-31.52	↓	738.06	734.00	-0.55	↓	4	4
	Transport	865.65	1386.60	60.18	↑	707.64	1131.77	59.94	↑	6	6
	Waste	0.75	0.49	-35.37	↓	1.41	0.70	-50.43	↓	3	2
CH4	Agriculture	837.03	289.10	-65.46	↓	1016.04	419.98	-58.67	↓	1	1
	Buildings	45.40	31.55	-30.50	↓	41.23	32.78	-20.50	↓	2	3
	Energy	0.40	1.30	226.67	↑	0.78	1.33	71.37	↑	6	5
	Industry	9.72	26.85	176.34	↑	1.86	6.67	258.01	↑	5	6
	Transport	7.96	6.94	-12.85	↓	6.33	5.52	-12.84	↓	4	4
	Waste	601.54	433.89	-27.87	↓	1075.85	608.39	-43.45	↓	3	2
N2O	Agriculture	794.64	662.14	-16.67	↓	738.61	610.94	-17.28	↓	3	3
	Buildings	29.45	9.43	-67.99	↓	26.06	9.35	-64.11	↓	1	1
	Energy	3.22	1.65	-48.77	↓	9.61	7.93	-17.51	↓	2	2
	Industry	4.99	4.95	-0.77	↓	5.12	5.76	12.56	↑	5	6
	Transport	11.19	12.15	8.65	↑	9.88	9.89	0.11	-	6	5
	Waste	3.17	3.10	-2.03	↓	3.95	3.82	-3.34	↓	4	4
F-gases	Industry	1.10	431.44	39276.1	↑	1.36	530.32	38849.63	↑	-	-

Source: (Author's calculations based on data from EDGAR)

Carbon dioxide emissions on the territory of a country are an indicator of only one of all greenhouse gases. In order to provide a thorough assessment of the climate change impact in our country, gases such as methane and nitrous oxide should also be analysed. In general, carbon dioxide accounts for the largest share of greenhouse gases contributing to the global warming and climate change.

From the long-term data of the Emissions Database for Global Atmospheric Research – EDGAR

(https://edgar.jrc.ec.europa.eu/dataset_ghg80_nuts2, 2023) and (Crippa, M. et al., 2023), we selected data for 4 main components in the sectors of agriculture, construction, energy, industry, transport and waste for the Northwest and North Central Regions. Changes in values are tracked as a comparison between 1990, assumed as a base year, and 2022, for which statistical information is currently available.

The table shows that in both studied regions there is a change in the direction of increase or decrease, and a sustainable tendency for decrease of the *CO2 component* is noted in the sectors of construction, energy, industry and waste. There is a negative trend towards increasing values in the sectors of agriculture and transport. For the second component (*methane CH4*), there is a positive trend towards reduction in the sectors of agriculture, construction, transport and waste. There is a worrying trend for rising methane values in two of the sectors – energy and industry.

The third component *N2O* is characterised by a significant decrease in values compared to the base year 1990, especially in the agriculture, construction and energy sectors. Fluctuations in the industry, transport and waste sectors compared to 1990 are insignificant. The fourth component, *F-gases,* in 2022 is characterized by a high rate of change in the direction of growth compared to the base year. This trend in the industry sector applies not only to the Northwest but also to the North Central Region, with the rate of change in the North Central Region being more pronounced.

Based on the calculated value indicators for the rate of change in the studied regions, the sectors are ranked by three of the components – carbon dioxide, methane and nitrous oxide (CO2, CH4 and N2O). The sector with the largest reduction in harmful emissions is ranked first, and the sector with the largest increase is ranked 6th. In this sense, Table 2 shows that regarding the *carbon dioxide component* the largest reduction of greenhouse gases in the Northwest Region is in the energy sector (-94.54% – Rank 1), while in the North Central Region the percentage change towards reduction of gases is in the construction sector (-80.49% – Rank 1). The highest values for

greenhouse gas growth in both studied regions are in the transport sector (60.18 for the NWR and 59.94 for the NCR – Rank 6). Regarding the *methane and nitrous oxide components*, the agricultural sector (-65.46) and the construction sector (-58.67) rank first in both regions. Regarding the same components, the last place – with Rank 6 is taken by the sectors of energy (NWR – 226.67) and industry (NCR - 258.01) for the CO2 component; and the sectors of transport (8.65 for NWR) and industry (12.56 for NCR) for the N2O component.

Conclusions

As a result of the analysis of the key indicators of economic development, the demographic and social characteristics and the environmental condition of the NWR and the NCR, the following conclusions can be made:

• The regional structure of GDP clearly shows the dominance of the SWR and the decreasing contribution of the NWR and the NCR to the GDP formation, and over the years it has become a sustainable trend that indicates the presence of significant disproportions in regional economic development.

• The economic development of the regions is largely determined by their geographical location, natural resources, infrastructure, traditions in certain industries and entrepreneurial activity.

• Compared to the country values, the differences in the indicator for the NWR and the NCR are increasing, and compared to the highest value of the indicator for the country – that of the Southwest Region, the gap is even greater.

• The integral coefficient of structural changes and differences reveals minimal changes in the regional structure of the national economy. This suggests that NWR and NCR have maintained a low share of GDP creation throughout the period, and the rates of change have not significantly changed the regional GDP structure. Insufficient infrastructure and connectivity with the rest of the country significantly contribute to the uneven development of the regions, leading to a decrease in investment activity in the NWR and NCR and, consequently, a lower contribution to the overall GDP creation. To encourage the growth of NWR and NCR, we need to implement a purposeful regional development policy, clearly identify priority sector policies, and provide financial support for their execution. Improvements in transportation connectivity, the business environment, and living conditions in NWR and NCR, coupled with the

rapid development of information and communication technologies and the digitization of many services and activities, can stimulate their development, reduce inequality, and foster internal cohesion.

- After examining the main economic indicators for NWR and NCR, it was found that although the indicators for "number of enterprises," "fixed tangible assets," "expenses to acquire fixed tangible assets," and "income from the activity" have increased slightly, they are still small compared to the indicators for the whole country. This is why the number of jobs is constantly decreasing and the local economy is not improving much.

- The trend models presented allow for both short-term and medium-term forecasting, and the forecasts indicate that if the current policy and achieved results continue, the differences in the development of the country's regions will widen. In order to reduce the differences between the NWR and the NCR and the other regions in the country, it is necessary to implement an adequate and targeted policy to stimulate local entrepreneurial activity, attract foreign investments, create favourable conditions for investing in these regions, improve transport connectivity both between settlements and with neighbouring districts and regions, in order to improve the business climate, to increase the employment rates and living standards, etc.

- The negative trends for the NWR and the NCR being the least populated areas in the country are worsening against the background of the progressive decline of the population in the Republic of Bulgaria. Despite the continuing trend for declining population in the rural areas, the population in the NWR manages to stay within the upper limit, while the NCR takes the bottom position in the ranking as the region with the fastest depopulation rate.

- The analysis of NGR (country total, cities and villages) confirms that the NWR and the NCR are in a phase of more intensive deurbanization, with shrinking cities and villages and perforated structure, due to the almost double decline in their natural growth.

- Although there is a nominal increase in the income, and the NWR is ahead of the NCR in terms of per capita income, when examining the ratio between per capita income and per capita expenditure, it is evident that the real income in these regions is decreasing, despite the inversion in the positions of the studied regions.

- The population at risk of poverty or social exclusion of working age in the studied regions exceeds the national average, which is an indicator of the progressively deteriorating demographic and social conditions.

- Enterprises with high risk potential have a larger relative share (52%) in the NCR. Their share in the NWR is lower (39.13%). Particularly acute is

the growing need for an adequate regional policy addressing the issues of regional transformation or attracting enterprises with low risk potential. The higher relative share of enterprises with low risk potential in the NWR (60.87%) indicates the possibility of increasing sustainable territorial development and connectivity between different territories, between urban and rural areas.

- A sustainable trend is observed towards reducing CO_2 values in the sectors of construction, energy, industry and waste, CH_4 in the sectors of agriculture, construction, transport and waste, and the N_2O component in the sectors of agriculture, construction and energy. Alarming is the trend for increasing CO_2 values in the sectors of agriculture and transport, methane in two of the sectors – energy and industry, both in the NWR and the NCR.
- The ranking of the sectors according to the rate of change in the studied regions regarding the CO_2 component shows that the largest reduction of greenhouse gases in the Northwest Region is in the energy sector (-94.54%), while in the North Central Region the percentage change towards reduction of gases is in the construction sector (-80.49%). Regarding the CH_4 and N_2O components, the agricultural sector (-65.46) and the construction sector (-58.67) rank first in both regions.

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