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**(Original scientific paper)**

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**INFLUENCE OF CLIMATE CHANGES ON INDUSTRY AND  
POPULATION IN THE OHRID-PRESPA REGION**

**Abstract**

This research paper is based on the study for the Ohrid-Prespa region which aims to determine the socio-economic situation of the region given in consideration the climate change specifications. For the purpose of this paper, the emphasis of the research is given on the impact of climate change on the population and industry in the Ohrid-Prespa region. The analysis shows the probable forecast on the industry capacity for the region and GDP growth rate according to two different climate scenarios the RCP2.6 and RCP8.6 for future greenhouse gas concentrations for the period until 2100, as well as the dynamic of the total population in the region for the same period.

**Key words:** Socio-economic conditions, Industry, Climate change, population, Ohrid-Prespa region

**JEL classification:** Q50, Q510

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## **Introduction**

This research paper as mentioned in the abstract is a derivative of a larger case study, a large scope of data of many international organization, as UN agency (The Intergovernmental Panel on Climate Change /IPCC , UNESKO, others), NASA, World Bank, WTO, OECD Key EU laws and policies, as domestic and many others institution was consulted. Furthermore the importance of climate change and its effects on socio-economic wellbeing of the population are highlighted by Abdallah, S. and Stoll, L. (2012); Adam Szirmai (2015); Jonathan Haughton and Shahidur R. Khandker (2009); Roy, J.; Tschakert, P.; Waisman, H.; Abdul Halim, S.; et al. (2018). They refer to the major changes that negatively affect the environment, such as air, water and land pollution, degradation of other ecosystems and consumption of large amounts of natural resources.

Recent information has shown a reduction in annual rainfall and increase in average temperatures. The analysis of the different climate change scenarios for the country shows that the average annual temperature will increase by 1.0 ° C by 2025 and 1.9 ° C by 2050, while the average rainfall is projected to decrease by 3% and 5%. In the same periods, which means a significant increase in dryness. This poses a significant risk for the country particularly in terms of agricultural productivity and as a threat to the two lakes in these municipalities that are of key environmental and socio-economic importance. All this forms an implied subject of this research paper, i.e. the impact of climate change on the industry and population in Ohrid Prespa region. The actuality of the subject is that much important, particularly because Ohrid and Lake Ohrid have been declared a protected region by UNESCO and the guidelines for the protection of the region must be implemented.

Furthermore, for the purpose of the analysis, it should be considered, that apart from the two lakes, this region is characterized with its relative mountainous specifics. Then, apart from the larger urban centres, the remaining area is agricultural, with scattered rural settlements, mountains and pastures. In terms of infrastructure, the most significant form of transport in North Macedonia is land/road transport. All the municipalities in the region accessible via public roads and there is no motorway/highway to any of the municipalities. One of

the other interesting aspects of transport is that Lake Ohrid has regulated water transport.

This research paper was conducted given in consideration two hypothesis. First one states that the climate change scenarios RCP 2.6 and RCP 8.6<sup>1</sup> have impact on the industry in the Ohrid Prespa region. The second hypothesis concerns the population of the region taken in consideration the same climate change scenarios.

The methodology is quantitative and it's based on the forecast model developed according to the historical data and according to these selected presumptions:

- GDP growth rate logarithmic trend line from the period 2010-2021
- Number of enterprises trend logarithmic line from the period 2010-2021
- Projections of number of population in the region according to the UN population data till 2100
- Changes in basic climate variables: daily temperature and daily precipitation according to the RCP2.6 and RCP8.6 scenarios for future greenhouse gas concentrations defined by the Fifth Intergovernmental Panel on Climate Change (IPCC) for the period until 2100.

This forecast does not take into consideration any other variables, and gives the presumption that no other factors will change in the given period, i.e. *ceteris paribus*. Also another forecast is made taking into consideration the SSP scenarios that respond to the RCP scenarios taken into consideration.

The forecast results show declining trends of the forecasted indicators. This can be expected because of several factors. The fall in population due to changes in the birth rate of the region, migrations, and climate change induced migrations also influence the fall of the two separate indicators. Fall in populations means fewer possible employees and therefore fewer enterprises in the years to come. This also influences the region's GDP growth rate, which

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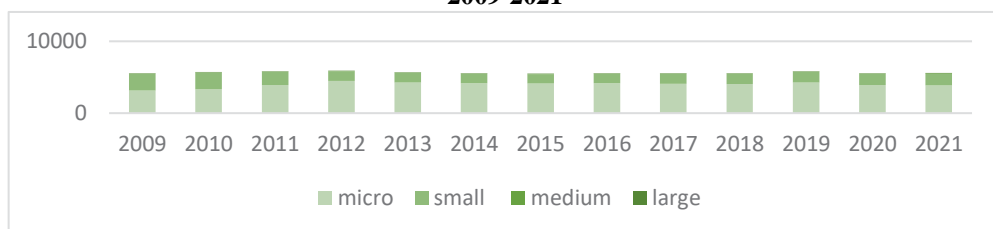
<sup>1</sup> [https://sedac.ciesin.columbia.edu/ddc/ar5\\_scenario\\_process/RCPs.html](https://sedac.ciesin.columbia.edu/ddc/ar5_scenario_process/RCPs.html) (Accessed on 9.10.2023)

will also fall due to the stated reasons. Third and the last reason for the decline of the indicators stated in this forecast is climate change.

## 1. INDUSTRIAL OVERVIEW OF THE REGION

The industry analysis of the Ohrid- Prespa industry region is firstly presented with the number of enterprises according to their size. As its show on the Figure below, it can easily be deducted that the majority of them are micro enterprises, which account for fewer than 10 employees. Expectedly so, next in number come small enterprises, followed by medium and large ones. In order to see more clearly the situation of the industry trend according to the size of the enterprises, the growth rates of the same are presented in the Figure 2.

**Figure 1 Number of enterprises according to their size in Ohrid-Prespa region 2009-2021**



*Source: State statistical Office of Republic of North Macedonia*

Micro enterprises are the most common enterprise group in Ohrid-Prespa region, when size of the enterprises is taken into consideration. The analysis of the growth rate of the enterprises shows us that even though the average growth rate of micro enterprises is positive (1% g.r. over the observed period), their logarithmic trend is negative. This means that taken into consideration the changes of the number of micro enterprises through the years and the perceived climate change, the overall number of the same will start to decrease over the period. This concerns mostly business in the industries such as trade, agriculture, tourism, artisanship, crafts, etc. The largest rise in micro enterprises can be seen in 2011, and the largest fall is seen in 2020 due to the fact of the economic shocks caused by the pandemic. Small enterprises, which according to the statistics are the second largest amount of enterprises

according to size have different prospects. Even though their average growth rate is -4%, their overall logarithmic trend is positive. This means that their number is slowly but steadily, rising with the prospect of increasing their number in the future. The negative growth rate over the period derives from the immense fall in their number over the two-year period of 2011-2012, their fall can be explained through the ripple effects of the financial crisis of 2008 as well as economic policy of increased focus on attracting foreign investments. Small enterprises employ between 10 and 49 people.

Medium enterprises have the greatest average growth rate among all the different types of enterprises according to their size (4% average growth rate). They also have a positive logarithmic trend that inclines to growth in the years to come. Medium enterprises which employ from 50 to 249 people, witness the biggest decline in absolute numbers is recorded in 2011 due to mainly the same reasons as stated above. Their greatest rise is recorded in 2019 the year before pandemic.

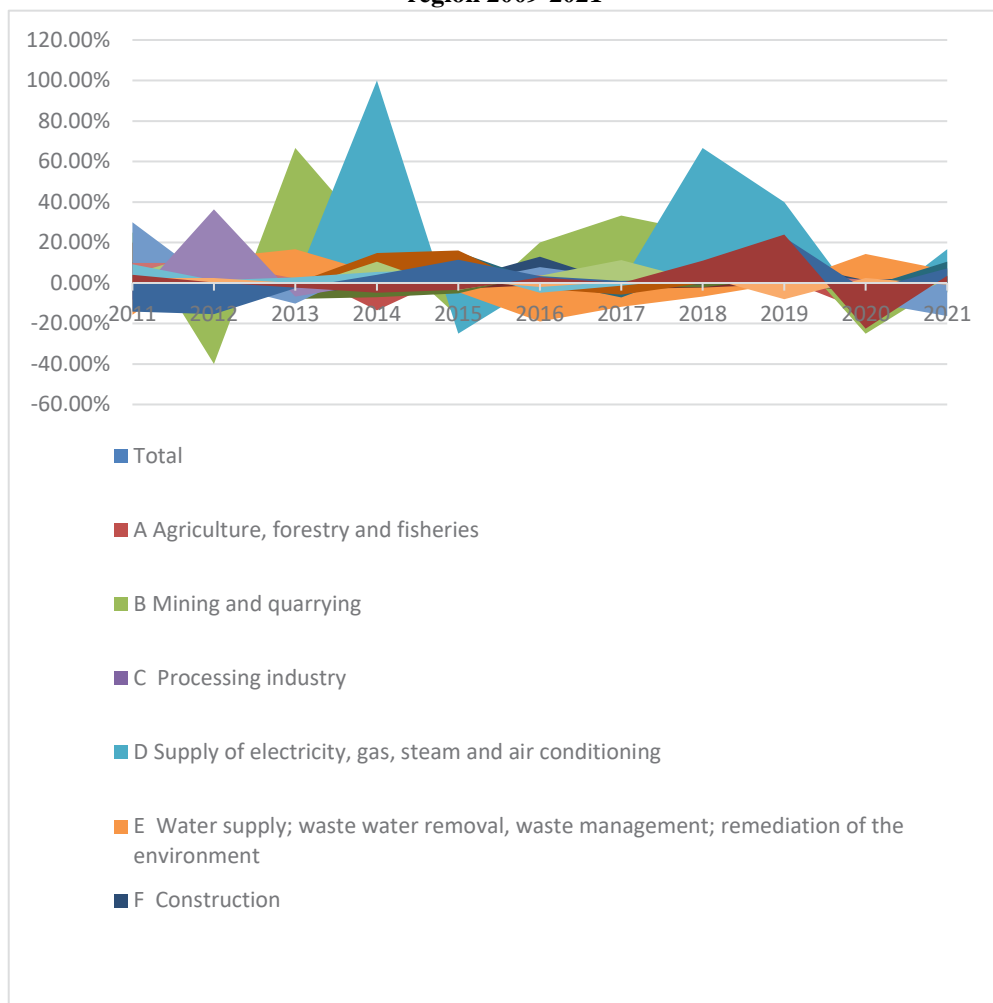
The last category of types of enterprises according to size belongs to large enterprises that employ above 250 people. Their absolute number has risen in the observed period accounting for 17 large enterprises in the Ohrid-Prespa region, and an average growth rate of 11%. However, they have declining logarithmic trend due to limited sources of resource use, low sustainable development policies, climate change effects and last but not least infrastructure factors. Poor connection within the country, poorly developed road infrastructure and lack of working railroads make the growth of large enterprises even more questionable for the future, or until the socio-economic and business climate is more favorable. Also lack of qualified labor, now and even more in the future with the number of population declining will present as a serious problem in front of the large enterprises in the Ohrid-Prespa region. They have seen the biggest rise in 2015 and the biggest fall was also recorded in 2011, supposedly according to the same reasons as other types of enterprises.

More in depth analysis of the industry or more so a general mapping analysis of the industry, has shown that different types of industries have different growth rates and are differently represented on the effects towards GDP of the Ohrid-Prespa region. Industry with the greatest number of enterprises in the period of 2010-2021 and as well as with the largest GDP contribution is wholesale and retail trade; repair of motor vehicles and

motorcycles. Second in the same parameters is tourism industry or in the official nomenclature of the industry stated as accommodation facilities and food service activities. Other industries which are among the most important considering the number of enterprises and their contribution towards the GDP of the region are processing industry, construction, professional, scientific and technical activities, health and social care activities transport and logistic, agriculture. Different sets of industries have different growth rates that influence the growth of the GDP of the region itself. Higher industry growth is a necessary determinant for a higher GDP growth, and the highest industry growth is recorded in the Supply of electricity, gas, steam and air-conditioning. However, this is an industry, which has very small impact on the GDP, considering the overall GDP generated from the region. The second largest growth rate is recorded in the mining and quarrying industry that also does not have sufficient impact on the regional GDP. Other three industries which combined have realized a significant growth are information and communication industry, professional scientific and technical activities and administrative services industry. These three industries can be called industries on the rise. Nevertheless their share in the GDP of the region is far less than the main industries referred above, and only one of them can be considered a reliable industry in the future of the region i.e. information and communication industry. Other two are relatively important but are considered satellite industries, i.e. industries that service other types of industries, and cannot exist by themselves. So further development of the information and communication industry in the region can bring additional sustainable development for the future, considering that the industries that were reliable in the past are slowly diminishing in the region.

Largest fall in the industry capacity for the observed period was noted in the largest industry in the region i.e. Wholesale and retail trade; repair of motor vehicles and motorcycles with an average annual fall of 2.41%. The second largest decline of the industry by type was registered in the agricultural industry with an annual average fall of 1.87%. Other important industries also realize negative growth rates in the observed period, such as: transport, logistics, and tourism industry. That is sufficient to create a total fall of the industry measured by number of enterprises and industry GDP related capacity of 0.22%.

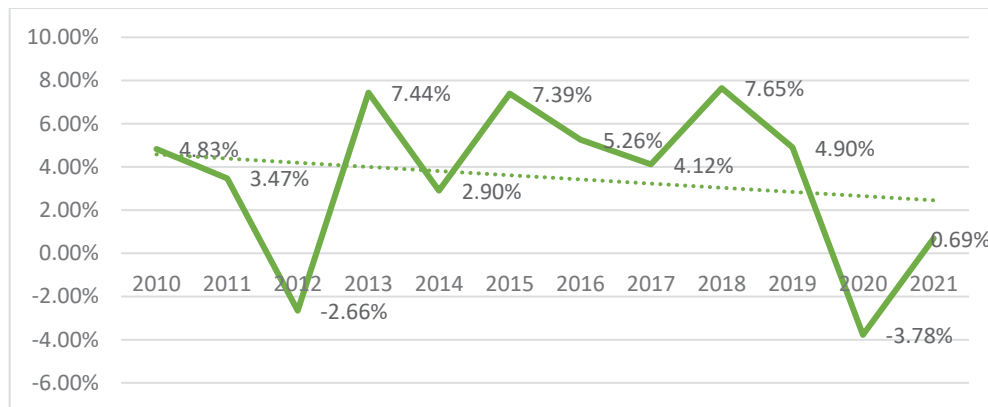
**Figure 2 Industry growth rate according to types of industries in Ohrid-Prespa region 2009-2021**



*Source: State statistical Office of Republic of North Macedonia*

The GDP growth rate of the region is positive with 3.2% on year to year basis. It is also similar to the GDP growth rate of the whole country. The biggest fall was realized in 2020 due to fall of the main industries to deliver the necessary output, related to start of the Covid-19 pandemic. Such sectors as wholesale, trade, agriculture and more so tourism were affected by the economic shock caused by the pandemic, therefore having impact on the fall of over GDP of the region. The greatest rise was recorded in 2018 with 7.65% rise of nominal overall GDP of the Ohrid-Prespa region.

**Figure 3 GDP growth rate of Ohrid-Prespa region 2009-2021**



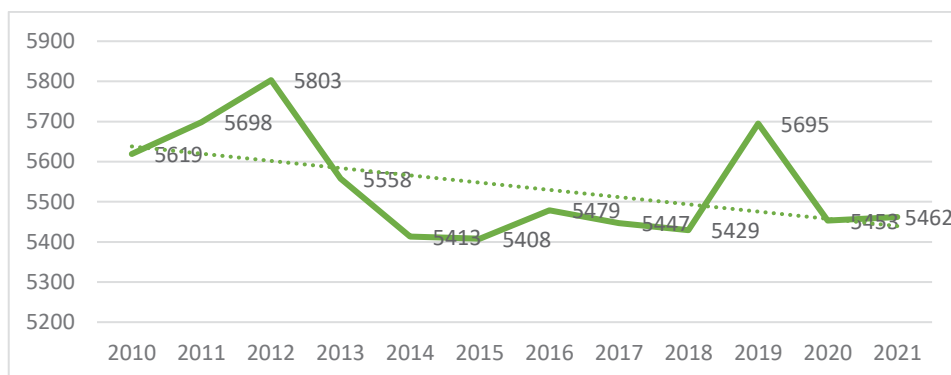
*Source: State statistical Office of Republic of North Macedonia*

Even though the average growth rate of the GDP of the region is positive, the logarithmic trend of the GDP is negative and shows downgrading tendencies. Although, as can be seen on the figure above the majority of years the industry of the region managed to create positive GDP growth, it still is not sufficient to generate positive trend for the future. This comes from the conclusion of the previous analysis i.e. the fall in output of the main industries in the region, trade, tourism, transport, and processing and agriculture industry. On the other, hand the rise of other industries such as IT industry is still not enough to create growth for the GDP of the region in the near future. The scope of each industrial sector in total industry of the region is presented in the figure below. As stated before the largest sectors belong to wholesale and retail trade, tourism, professional and technical activities, other activities and agriculture.

Total number of enterprises in the region is also in decline, this can be seen from the analysis presented in figure 4. The highest point of number of enterprises was realized in 2012 with the absolute number reaching 5803 entities. The lowest point was realized in 2015; however, the lowest growth or the biggest fall was realized in 2019 because of the pandemic and further uncertainties towards the future. The trend is incline with the industry trend, i.e. it has a downgrade perspective for the future. This only confirms the previously presented information from the industry analysis. Creating a more favourable business environment and further increasing the investment in infrastructure and sustainable energy resources could propel the industrial growth of the region.



**Figure 4 Number enterprises in Ohrid-Prespa region 2009-2021**



*Source: State statistical Office of Republic of North Macedonia*

## 2. FORECASTS

This part of the paper shows the probable forecast on the number of enterprises (as an indicator for industry capacity for the region) and GDP growth rate (as an indicator for the industrial output of the region). The forecast is made according to these selected presumptions:

GDP growth rate logarithmic trend line from the period 2010-2021

Number of enterprises trend logarithmic line from the period 2010-2021

Projections of number of population in the region according to the UN population data till 2100

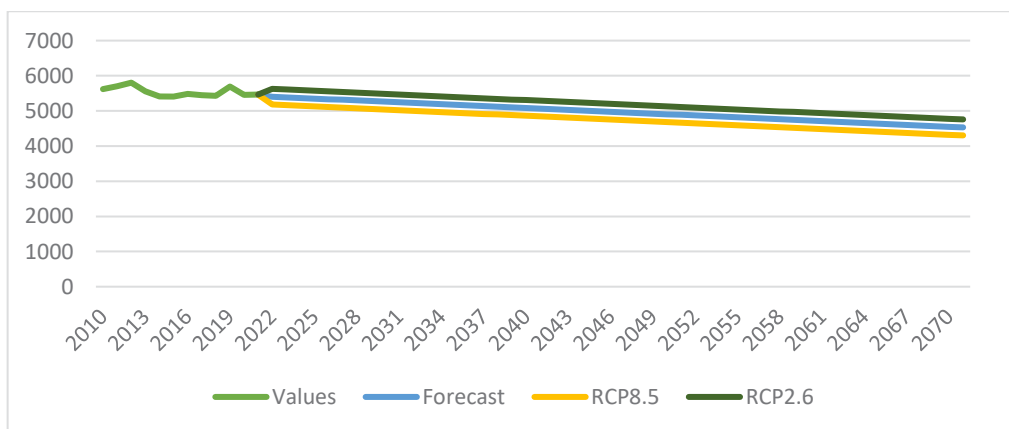
Changes in basic climate variables: daily temperature and daily precipitation according to the RCP2.6 and RCP8.6 scenarios for future greenhouse gas concentrations defined by the Fifth Intergovernmental Panel on Climate Change (IPCC) for the period until 2100.

This forecast does not take into consideration any other variables, and gives the presumption that no other factors will change in the given period, i.e. *ceteris paribus*. The two forecasts are shown in the figures below. The first depicts the probable trend of the number of enterprises in the region given the consideration the previously described presumptions until the year 2070. The

second shows the forecast of the GDP growth rate in the same period given in consideration the same assumptions. Both of the figures show declining trends of the forecasted indicators. This can be expected because of several factors. Firstly, the declining trends of both indicators. The indicators shown previously in the industry analysis had both shown declining trends; due to lack of development of certain aspects that the industry needs in order to develop further more. Secondly, the decline of the population in the region as well as in the country, shown previously in the demographic analysis.

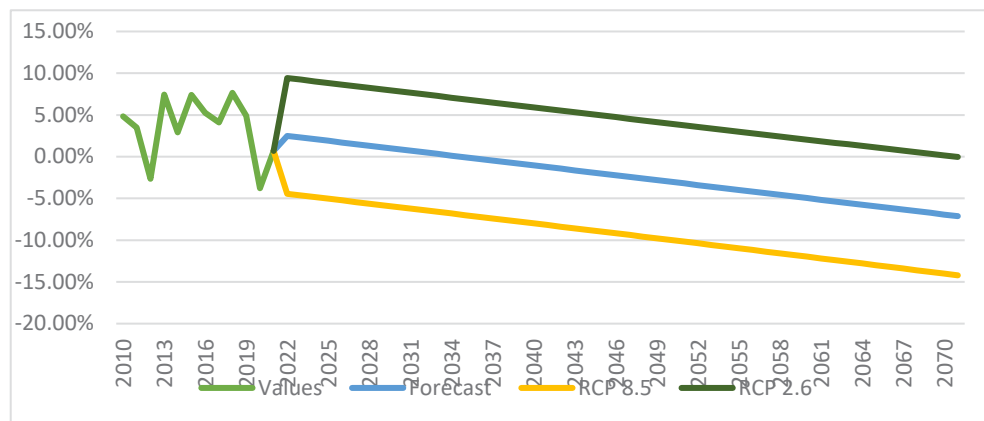
The fall in population due to changes in the birth rate of the region, migrations, and climate change induced migrations also influence the fall of the two separate indicators. Fall in populations means fewer possible employees and therefore fewer enterprises in the years to come. This also influences the region's GDP growth rate, which will also fall due to the stated reasons. Third and the last reason for the decline of the indicators stated in this forecast is climate change. Two different scenarios which were proposed and which show different temperature rises and two different precipitation forecasts, all generally incline towards the downgrade effect on both of the indicators. Rise in temperature and change in climate can really affect the region given that the biggest industry sectors are sensitive to climate changes.

**Figure 5 Forecast of the number of enterprises in Ohrid-Prespa region 2009-2100**



Source: Own calculations

**Figure 6 Forecast of the GDP growth rate in Ohrid-Prespa region 2009-2100**



Source: Own calculations

Furthermore, the region lacks basic infrastructure to support the existing industries, yet alone support new ones, or build resilience towards climate change perspectives. Lack of sufficient road infrastructure, lack of sustainable energy and touristic capacities are all reasons, which could see the slow but immanent downfall of the region. This will further add pressure to the socio-economic conditions that the resident population is facing currently, leading to more migration and more stagnation for the region in the future.

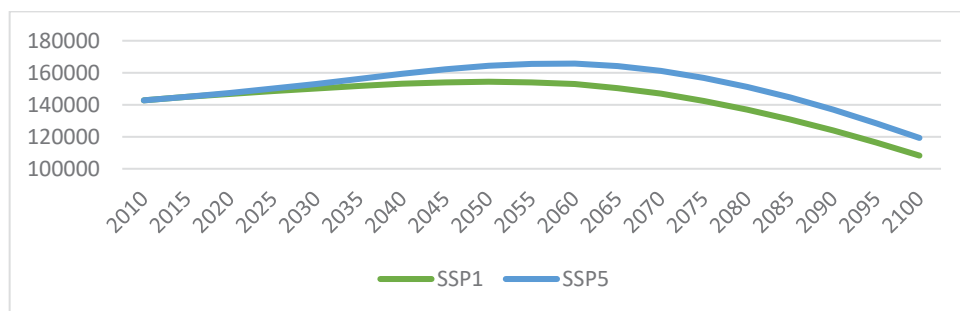
Another forecast of the population and economic activity of the Ohid-Prespa region is also presented in this research paper. The second forecast is based on the data from Shared Socioeconomic Pathways (SSPs)<sup>2</sup>. Shared Socioeconomic Pathways (SSPs) were developed over the last years as a joint community effort (by an international team of climate scientists, economists and energy systems modelers) to provide a toolkit for the climate change research community to carry out integrated, multi-disciplinary analysis. They describe plausible major global developments that together would lead in the future to different challenges for mitigation and adaptation to climate change. The SSPs are based on five narratives describing alternative socio-economic developments, including sustainable development, regional rivalry, inequality,

<sup>2</sup> <https://iiasa.ac.at/models-tools-data/ssp> (Accessed on 9.10.2023)

fossil-fuelled development, and middle-of-the-road development. In the context of the Pathways, the data from them was downsized in order to fit the purpose of the research and present the data for Ohid-Prespa region.

The forecast for the population according to the downsized data for SSP1 and SSP5 is presented in the figure below.

**Figure 7 Forecast of the population of the Ohid-Prespa region according to the SSP1 and SSP5 scenarios**



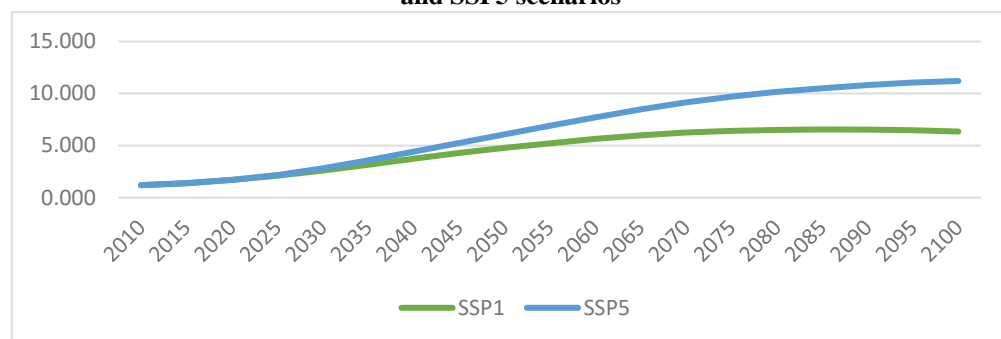
Source: © SSP Public Database (Version 2.0) <https://intcat.iiasa.ac.at/SspDb>

Sustainability (Taking the Green Road) or SSP1 stands for the paradigm that the world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. Management of the global commons slowly improves, educational and health investments accelerate the demographic transition, and the emphasis on economic growth shifts toward a broader emphasis on human well-being. Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Consumption is oriented toward low material growth and lower resource and energy intensity. As we can see from the figure the number of population in the Ohrid-Prespa region will reduce reaching almost 100.000 people in the region by the year 2100. That also happens in the SSP5 scenario, or Fossil-Fueled Development Scenario. This scenario concerns with the thesis that the world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and

development of human capital as the path to sustainable development. Global markets are increasingly integrated. There are also strong investments in health, education, and institutions to enhance human and social capital. At the same time, the push for economic and social development is coupled with the exploitation of abundant fossil fuel resources and the adoption of resource and energy intensive lifestyles around the world. All these factors lead to rapid growth of the global economy, while global population peaks and declines in the 21st century. Local environmental problems like air pollution are successfully managed.

There is faith in the ability to effectively manage social and ecological systems, including by geo-engineering if necessary. The next figure shows the GDP of the region in billion US dollars for the same period for both scenarios SSP1 and SSP5.

**Figure 8 Forecast of the GDP of the Ohrid-Prespa region according to SSP1 and SSP5 scenarios**



Source: © SSP Public Database (Version 2.0) <https://intcat.iiasa.ac.at/SspDb>

According to figure 8 there is expectations for the PPP growth in the region which will be more recognizable in the SSP5 scenario. In SSP1 the growth of GDP in the region will be less extensive and will spiral downwards in the end of the projecting period.

## **Conclusion**

Industry, agriculture and tourism are the most important for the economy in the region. Micro and small enterprises are the core of the region. The analysis of the growth rate of the enterprises shows us that even though the average growth rate of micro enterprises is positive (1% g.r. over the observed period), their logarithmic trend is negative. This means that taken into consideration the changes of the number of micro enterprises through the years and the perceived climate change, the overall number of the same will start to decrease over the period. This concerns mostly business in the industries such as trade, agriculture, tourism, artisanship, crafts, etc. Small enterprises, which according to the statistics are the second largest amount of enterprises according to size have different prospects. Even though their average growth rate is -4%, their overall logarithmic trend is positive. Medium enterprises have the greatest average growth rate among all the different types of enterprises according to their size (4% average growth rate). They also have a positive logarithmic trend that inclines to growth in the years to come. The absolute number of large enterprises has risen in the observed period accounting for 17 large enterprises in the Ohrid-Prespa region, and an average growth rate of 11%. However, they have declining logarithmic trend due to limited sources of resource use, low sustainable development policies, climate change effects and last but not least infrastructure factors.

A general mapping analysis of the industry, has shown that different types of industries have different growth rate and are differently represented on the affects towards GDP of the Ohrid-Prespa region. Industry with the greatest number of enterprises in the period of 2010-2021 and as well as with the largest GDP contribution is wholesale and retail trade; repair of motor vehicles and motorcycles. Second in the same parameters is tourism industry or in the official nomenclature of the industry stated as accommodation facilities and food service activities. Other industries witch are among the most important considering the number of enterprises and their contribution towards the GDP of the region are processing industry, construction, professional, scientific and technical activities, health and social care activities transport and logistic, agriculture.

Largest fall in the industry capacity for the observed period was noted in the largest industry in the region i.e. Wholesale and retail trade; repair of motor vehicles and motorcycles with an average annual fall of 2.41%. The second largest decline of the industry by type was registered in the agricultural industry with an annual average fall of 1.87%. Other important industries also realize negative growth rates in the observed period, such as: transport, logistics, and tourism industry. That is sufficient to create a total fall of the industry measured by number of enterprises and industry GDP related capacity of 0.22%.

The GDP growth rate of the region is positive with 3.2% on year to a year basis. It is also similar to the GDP growth rate of the whole country. The biggest fall was realized in 2020 due to fall of the main industries to deliver the necessary output, related to start of the Covid-19 pandemic. Even though the average growth rate of the GDP of the region is positive, the logarithmic trend of the GDP is negative and shows downgrading tendencies.

In the last part, based on the GDP growth trend, the growth of the number of enterprises, the predictions of the number of the population according to the UN for the year 2100 and the scaling of two SSP scenarios for the climate conditions until the year 2100, projections for the economic capacity of the region in 2100 were made. Both of the figures (the probable trend of the number of enterprises in the region until the year 2070 and the second, the forecast of the GDP growth rate in the same period) show declining trends of the forecasted indicators.

Two different scenarios which were proposed and which show different temperature rises and two different precipitation forecasts, all generally incline towards the downgrade effect on both of the indicators. Rise in temperature and change in climate can really affect the region given that the biggest industry sectors are sensitive to climate changes.

The second forecast is based on the data from Shared Socioeconomic Pathways (SSPs). Shared. The SSPs are based on five narratives describing alternative socio-economic developments, including sustainable development, regional rivalry, inequality, fossil-fuelled development, and middle-of-the-road development. In the context of the Pathways, the data from them was downsized in order to fit the purpose of the research and present the data for

Ohrid-Prespa region. The forecast for the population according to the downsized data for SSP1 and SSP5 shows big a fall of population in the both scenarios. The number of population in the Ohrid-Prespa region will reduce reaching almost 100.000 people in the region by the year 2100.

Another indicator show that there is expectations for the GDP growth in the region which will be more recognizable in the SSP5 scenario. In SSP1 the growth of GDP in the region will be less extensive and will spiral downwards in the end of the projecting period.

According to the forecast analysis and the outputs of the research taken into consideration the two hypothesis presented in the paper are accepted. The forecast based on the RCP and SSP climate scenarios showed that in the future the effects of climate change in the Ohrid-Prespa region will have sufficient impact on the industry of the region as well as the number of population. In order to tackle this challenges a climate risk mitigation strategy for the region should be imposed, which will take into consideration the climate change of the region and the problems that may arise with the same. Preventing the inevitable will be possible only by abiding to sustainable development strategies in the region and focusing on the growth of industries that would be less affected by the changes in climate of the region that are anticipated.



## References

1. Abdallah, S. and Stoll, L. (2012), Review of individual-level drivers of subjective well-being, produced as part of the contract 'Analysis, implementation and dissemination of well-being indicators', Eurostat.
2. Adam Szirmai, "Socio-Economic Development", Cambridge University Press, Second edition 2015, pg. 1-33
3. European Commission, Atlas of Migration 2021, <https://publications.jrc.ec.europa.eu/repository/handle/JRC127608>, EU, 2021
4. European Union: Final report of the expert group on quality of life indicators, Publications Office of the European Union, 2017, <https://ec.europa.eu/eurostat/documents/7870049/7960327/KS-FT-17-004-EN-N.pdf/f29171db-e1a9-4af6-9e96-730e7e11e02f>
5. James Eric Foster, Suman Seth, Michael Lokshin, ZurabSajaia. 2013. A Unified Approach to Measuring Poverty and Inequality: Theory and Practice. World Bank Publications, pg. 158
6. Jonathan Haughton and Shahidur R. Khandker, "Handbook of poverty +inequality", The International Bank for Reconstruction and Development/The World Bank, 2009, pg. 101:119.
7. Liverman, Diana M. (2009). "Conventions of climate change: constructions of danger and the dispossession of the atmosphere". *Journal of Historical Geography*. 35 (2): 279–296.
8. Lozanoska A., Janeska V., Djambaska E., Challenges of the demographic ageing in the Republic of North Macedonia – current situation and prospects, *Economic Development – Journal of the Institute of Economics – Skopje*, Year 24, No. 2/2022
9. Riahi, Keywan; van Vuuren, Detlef P.; Kriegler, Elmar; Edmonds, Jae; O'Neill, Brian C.; Fujimori, Shinichiro; Bauer, Nico; Calvin, Katherine; Dellink, Rob; Fricko, Oliver; Lutz, Wolfgang (2017-01-01). "The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview". *Global Environmental Change*. 42: 153–168. doi:10.1016/j.gloenvcha.2016.05.009. ISSN 0959-3780.
10. Roy, J.; Tschakert, P.; Waisman, H.; Abdul Halim, S.; et al. (2018). "Chapter 5: Sustainable Development, Poverty Eradication and Reducing Inequalities" (PDF). IPCC SR15 2018.
11. State statistical office of the Republic of North Macedonia, Population, Households and Dwellings Censuses from 2002 and 2021, <https://makstat.stat.gov.mk/PXWeb/pxweb/mk/MakStat/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5ef>

12. State statistical office of the Republic of North Macedonia, Population, Vital events  
<https://makstat.stat.gov.mk/PXWeb/pxweb/mk/MakStat/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5ef>
13. State statistical office of the Republic of North Macedonia, Population Estimations (MakStat database),  
[https://www.stat.gov.mk/PoslednoObjavenoVoMakstat\\_mk.aspx](https://www.stat.gov.mk/PoslednoObjavenoVoMakstat_mk.aspx)
14. UNFCCC, "What is the United Nations Framework Convention on Climate Change?" US EPA (13 September 2019). "Global Greenhouse Gas Emissions Data". Archived from the original on 18 February 2020.
15. United Nations, Department of Economic and Social Affairs, Population Division (2022). Data Portal, custom data acquired via website. United Nations: New York. Available from <https://population.un.org/DataPortal/> (accessed 23 November 2022)