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QUALITY OF LIFE INDICATORS (NATURAL AND LIVING ENVIRONMENT) AND AIR POLLUTION AWARENESS - THE EXAMPLE OF SKOPJE, REPUBLIC OF NORTH MACEDONIA

Abstract: The state of the environment has a significant impact on the quality of life. Citizens are becoming more aware of the benefits of a high-quality environment, from basic rights like access to clean water to aspects like creating a noise-free living and working environment with access to nature and green areas.

Environmental quality indicators, environmentally responsible behaviour, and consumption of environmental services are used to evaluate quality of life. At the global level, various types of indicators that can be used to measure the quality of the environment that affects citizens' quality of life can be identified. These indicators are linked and provide an objective and precise criterion of the level of pollution and its impact on the quality of life of citizens.

Air pollution awareness is a critical component of incorporating environmental indicators and improving citizens' quality of life. Although no relevant data or studies on the link between the citizens' quality of life as measured by environmental indicators in the Republic of North Macedonia over the last two years exist, some research conducted during this period indicates a lack of awareness of the issue of air pollution in the capital Skopje.

Keywords: environmental indicators, quality of life, air pollution, public awareness

JEL Classification: O1, O13, O44

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Introduction

Environmental conditions have both direct and indirect effects on people's lives, health, and well-being, and they can have an impact on ecosystems and biodiversity by causing more serious consequences and environmental hazards. As a result, it is critical that all citizens recognize the significance of maintaining a healthy environment in which to live and work.

The Republic of North Macedonia must follow the positive example set by EU member states in raising public awareness of environmental issues that affect various aspects of quality of life. Skopje, the capital, is one of the most polluted cities in Europe and the world, but as one study findings indicate, there is lack of awareness of the extent and causes of air pollution in the capital, implying a poor quality of life for citizens who live and work there.⁴

Improving people's quality of life is a fundamental goal of sustainable development. Specifically, environmental quality is typically measured in terms of sustainability, which is also important for the overall quality of life of all citizens. The environmental dimensions related to quality of life are assessed using a variety of indicators classified according to a set of specific characteristics. The use of these indicators enables the collection of valuable information based on people's perceptions, awareness, and attitudes toward their environment.

1. Environmental indicators - concept and classification

There are various approaches to categorizing natural and environmental indicators used to assess quality of life. Quality of life, according to one approach, can be measured by environmental quality indicators, environmentally responsible behaviour, and consumption of environmental services.⁵ These indicators are interconnected and have a positive impact on environmental quality.

⁴ The study was conducted in period November 2020-March 2021 and used for the purposes of the project: *The quality of life of the population in the Republic of North Macedonia during the Covid-19 pandemic measured through quality of life indicators*, financed by the University of Ss. Cyril and Methodius-Skopje, Republic of North Macedonia

⁵ Dalia Streimikiene: *Environmental indicators for the assessment of quality of life Mykolas Romeris University, Faculty of Economics and Finance Management, Ateities St.20, LT-80303 Vilnius, Lithuania* Available online 19 October 2015, p. 67-79

Environmental quality indicators address a variety of environmental issues, including soil, water, air, and waste. Saving resources and energy, using renewable energy sources instead of fossil fuels, recycling waste, and properly managing and disposing of wastewater are all examples of environmentally responsible behaviour. The consumption of environmental services as a significant factor for life quality is measured by environmental indicators that have a negative impact on the environment, such as air, water, and land pollution from waste.⁶

Quality of life indicators according to Eurostat present statistical data on the quality of life in the countries of the European Union (EU).⁷ According to Eurostat reports, the measurement of quality of life is based on indicators that provide a detailed analysis of dimensions (8+1) that can be measured statistically to represent different complementary aspects of quality of life, supplementing the indicator that traditionally uses GDP as a measure of economic and social development. Eight of these dimensions refer to the functional abilities that citizens should possess in order to achieve their well-being effectively, based on their own values and priorities. The final dimension is the personal attainment of life satisfaction and well-being.⁸

Eurostat's reports sublimate and combine data obtained by applying environmental indicators on pollution, dirt, and noise exposure with data from the European Environment Agency (EEA) on fine particle exposure of the urban population. Because environmental factors can significantly influence an individual's choices (for example, deciding where to live), these aspects are also examined in terms of potential links between the risk of poverty and exposure to specific environmental conditions. Individuals are more likely to live in areas with environmental problems if they are more exposed to the risk of poverty.⁹

⁶ Ibid

⁷ European Union: Final report of the expert group on quality of life indicators, *Publications Of-
fice 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](https://ec.europa.eu/eurostat/documents/7870049/7960327/KS-FT-17-004-EN-N.pdf/f29171db-e1a9-4af6-9e96-730e7e11e02f), accessed: 08.09.2021

⁸ <https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Eurostat>, ac-
cessed: 11.09.2021

⁹ [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quality_of_life_indica-
tors_-_measuring_quality_of_life](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quality_of_life_indicators_-_measuring_quality_of_life), accessed: 10.09.2021

The indicators of the natural and living environment establish:¹⁰

- exposure to pollution, dirt and other environmental problems
- the exposure to pollution, dirt and other environmental problems according to the degree of urbanization
- exposure to air pollution of the urban population
- the exposure of the population to air pollution
- noise pollution from the neighbourhood or from the place of residence (the street)
- noise pollution from the neighbourhood or from the place of residence (street) according to the degree of urbanization.

Environmental indicators from the quality of life perspective provide important data and assessments of an individual's environmental awareness. In doing so, it combines pollution, dirt, and noise indicators with data from the European Environment Agency (EEA) on the exposure of the urban population to fine particles (a form of air pollution linked, among other sources, to diesel emissions engines). Because environmental factors can influence an individual's choices (for example, where to live), these aspects are also investigated from the standpoint of potential links between poverty risk and exposure to such environmental conditions, given that people at risk of poverty frequently live in areas characterized by environmental problems. These issues, in turn, can affect their quality of life (for example, by affecting their health or by reducing the value of the property they live in).

2. Quality of life and environmental indicators in EU countries

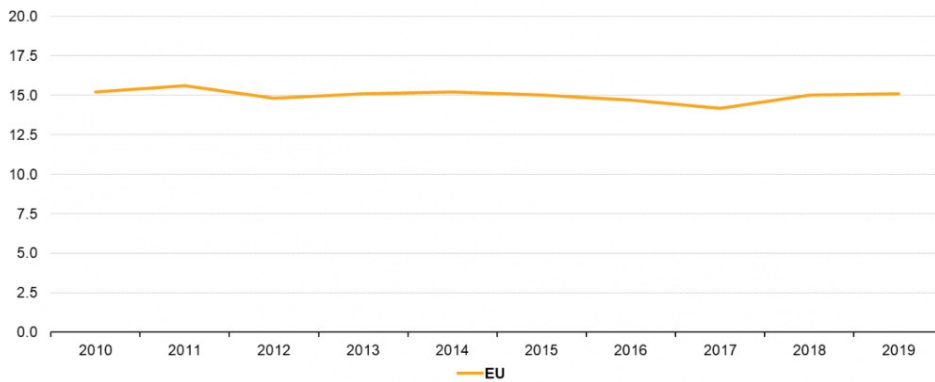
According to Eurostat reports, below is a brief overview of the quality of life in some EU countries, measured according to environmental indicators for 2019.¹¹

In 2019, 15.1% of the EU population is exposed to pollution, dirt, and other environmental problems, ranging from 33.9% in Malta to 5.9% in Croatia. (Figure 1).

¹⁰ European Union: Quality of life in Europe-facts and views, Publications Office of the European Union, 2015, <https://ec.europa.eu/eurostat/documents/3217494/6856423/KS-05-14-073-EN-N.pdf/742ace45-4085-4dac-9e2e-9ed7e9501f23?t=1433141890000>, accessed: 10.08.2021

¹¹ European Union: Eurostat regional yearbook, *Publications Office of the European Union*, 2021, <https://ec.europa.eu/eurostat/documents/3217494/13389103/KS-HA-21-001-EN-N.pdf/1358b0d3-a9fe-2869-53a0-37b59b413ddd?t=1631630029904>, accessed: 10.09.2021

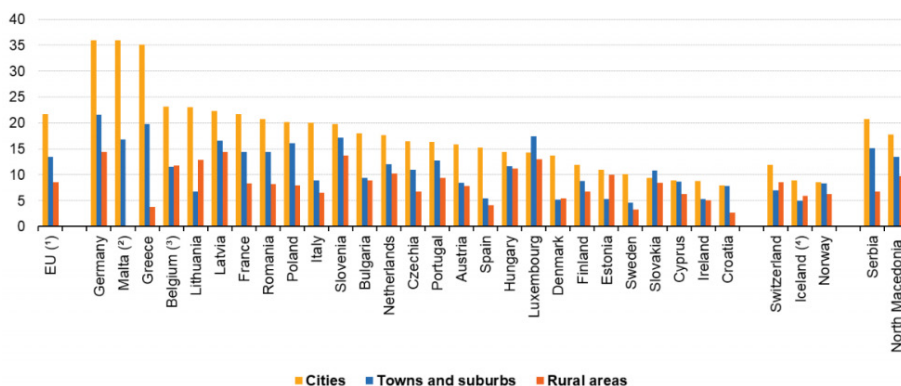
Figure 1. Population exposed to pollution, grime or other environmental problems, EU, 2010-2019



Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quality_of_life_indicators_-_natural_and_living_environment#Key_messages, accessed: 9.10.2021.

Environmental problems and pollution are associated with lower levels of citizen well-being, according to indicators used to determine exposure to pollution, dirt, and other environmental problems based on the degree of urbanization. According to these figures, the percentage of EU citizens exposed to pollution and other environmental issues dropped from 15.2% in 2010 to 14.2% in 2017, but then rose to 15.1% in 2019.

Figure 2. Pollution, grime or other environmental problems, by degree of urbanisation, 2019 (% share)

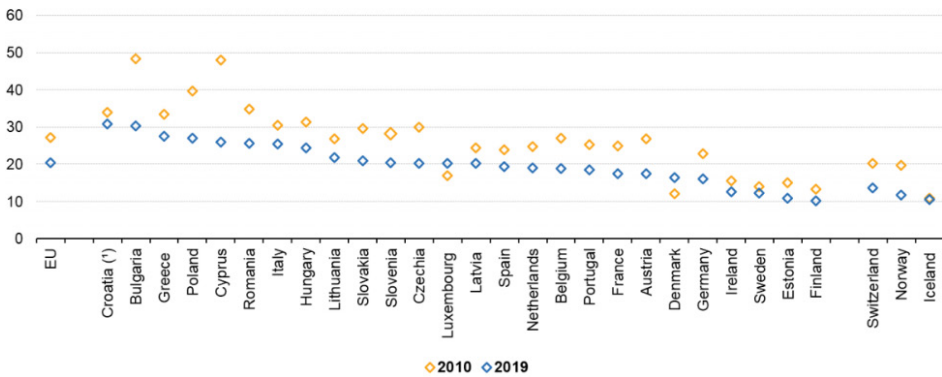


(*) Estimate.
 (†) Low reliability.
 (‡) Break in series.
 (*) 2018 instead of 2019.

Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quality_of_life_indicators_-_natural_and_living_environment#Key_messages, accessed: 9.10.2021.

In terms of urban air pollution exposure (exposure of the urban population to particulate matter), data show that urban residents are more likely to be affected than people living in rural areas. The disparity can be quite significant, with percentages exceeding 20% in Germany (21.6%) and even 30 percentage points in Greece (31.3%). In 2007, the EU urban population was potentially exposed to 29.3 g/m³ of PM₁₀, and by 2019, it was potentially exposed to 20.5 g/m³ of PM₁₀. A comparison between 2010 and 2019 (Figure 3) reveals a general decrease in the potential exposure of urban populations to PM₁₀ across EU Member States.

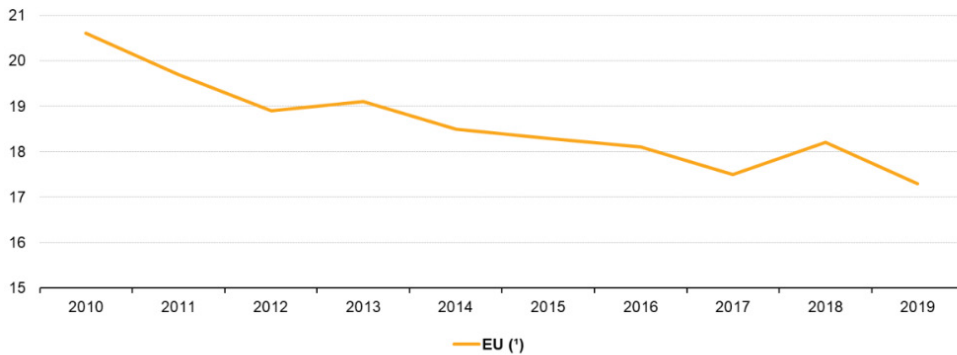
Figure 3. Exposure of the urban population to particulate matter, 2010 and 2019 (micrograms per cubic metre; µg/m³)



Note: the indicator shows the population-weighted concentration of PM₁₀ to which the urban population is potentially exposed, covering fine and coarse particulates (PM₁₀) whose diameter is less than 10 micrometres. Malta: not available.
 (*) 2013 instead of 2010.

Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quality_of_life_indicators_-_natural_and_living_environment#Key_messages, accessed: 9.10.2021.

In terms of noise pollution from the neighbourhood or the place of residence (street), data show that 17.3% of the EU population reported being exposed to noise from neighbours or the street in 2019, 3.3 percentage points lower than in 2010. Exposure to ambient sound levels above normal comfort levels is formally defined as this type of pollution. It can have serious direct and indirect health consequences, including hypertension, high stress levels, sleep disruptions, and, in severe cases, tinnitus or hearing loss. Eurostat’s data is based on self-reported noise disturbance from neighbours or the street, and it shows how noise can affect an individual’s quality of life.

Figure 4. Population reporting noise from neighbours or from the street, EU, 2010-2019

(¹) Estimate.

Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quality_of_life_indicators_-_natural_and_living_environment#Key_messages, accessed: 9.10.2021.

In 2010, around a fifth (20.6%) of the EU population reported exposure to noise pollution that was above their comfort level. This share decreased almost continuously between 2010 and 2017 and by the end of the considered period it was lower by 3.3 percentage points, to 17.3% (Figure 4).

3. Air pollution and quality of life in the city of Skopje

Environmental pollution, particularly air pollution, has been a problem in the Republic of North Macedonia for many years, and the country has taken and continues to take measures to address it. Globally, the country ranks among the worst affected by air pollution, with a premature death rate higher than in most EU countries. Every year, 2,574 people die as a result of air pollution. At the national level, the residential sector is the largest source of harmful PM 2.5 particles are emitted when solid fuels are burned in homes. Energy, industry, agriculture, and transportation are other sources of PM 2.5 particle emissions. Around 60,000 households heat with low-quality wood and coal. Residents even use textiles, plastics, and waste to heat their homes due to a lack of reliable gas supply and the high cost of electricity.¹²

The low average income (the minimum wage is €260) and energy poverty are just two of the issues that contribute to Skopje's severe pollution. An-

¹² <https://prizma.mk/zagaduvaneto-na-skopje-zlostorstvo-bez-zlostornitsi/>, accessed: 9.10.2021.

other reason is the city's natural location, which is in a valley surrounded by mountains, that traps fog in the city. A temperature inversion, a natural phenomenon that causes warm air to remain above cold air and contributes to the greenhouse effect, complicates matters even more.

Different indicators for the natural and living environment are used to assess the quality of life in the Republic of North Macedonia. As environmental indicators in 2019, the national State Statistical Office includes the quality of environmental media (e.g., water, air, soil, etc.), environmental problems (e.g., ozone depletion and climate change, environmental protection and biodiversity loss, waste generation and management), and the development of sectoral policies (integrated indicators related to agriculture, tourism and environmental protection policy instruments)¹³. These indicators are numerical values that can be used in the environmental reporting process.

According to the Macedonian Ministry of Environment and Physical Planning (MOEPP), the indicators collect and present data in a predefined manner. The establishment and development of environmental indicators is driven by the need to identify those that are relevant for monitoring the state of the environment and developing state policies, and are in accordance with the 37 indicators of the European Environment Agency Core set of indicators (CSI) approved and adopted in 2004. These indicators should provide answers to key questions for environmental policy development.¹⁴

Correctly chosen indicators, based on adequately chosen time series, reveal key trends and enable timely and appropriate action by all participants in the environmental protection process, relevant to the development of environmental protection policy. These should include socioeconomic change, air, climate change, water, soil and land use, nature, agriculture, forestry, waste, households, energy, transportation, health, noise, tourism, environmental economics and resource management, and environmental policy instruments. All indicators provide data on the state of the environment and serve as the foundation for policy development and major decisions.¹⁵ They should be available to all citizens of the Republic of North Macedonia, so that everyone can contribute to the process of improving the current state of the environment.

For a long time, the capital Skopje has been one of the most polluted cities in the country, ranking high on official lists of the most polluted cities in Europe and the world. As a result, the population and health of Skopje res-

¹³ [www.https://www.stat.gov.mk/PublikaciiPoOblasti.aspx](https://www.stat.gov.mk/PublikaciiPoOblasti.aspx), accessed: 15.9.2021

¹⁴ https://www.moepp.gov.mk/?page_id=746, accessed: 16.09.2021

¹⁵ *Ibid*, accessed: 09.10.2021

idents are the focus of several strategic documents at both the national and local levels. One of them is the Draft Report on the Strategic Assessment of the Environment, Local Environmental Action Plan for the City of Skopje for the Period 2020-2026.¹⁶ Several thematic areas are elaborated based on an assessment of the state of the environment in the city of Skopje, analysing the relationship between the pressures that the driving forces exert on the environment and the measures that should be taken to reduce the pressures: air, water, soil and land use, regional and biological diversity, climate change, stakeholders in the development of the city of Skopje and their impact on the environment (urbanism, greenery, transportation) (health, public awareness, information, institutional capacities, green policy). Long-term positive effects on population and human health are expected, according to Skopje's strategic plan for the period 2020-2022.

In the Republic of North Macedonia, there are no official data on the quality of life of Macedonian citizens as measured by environmental indicators and have not yet been published a sufficient number of relevant studies that would indicate a link between the quality of life of Macedonian citizens measured through environmental indicators. However, according to studies conducted by various ministries and international organizations (UNDP, UN), the habits of using public transportation, pollution from cars, construction work, and households that use solid fuels for heating are the most frequently identified sources of pollution in Skopje. Traffic is another pollutant that contributes to the increase in greenhouse gas emissions caused by the use of cars by one person, the lack of fast roads, the frequent stopping of vehicles due to traffic lights, and so on.

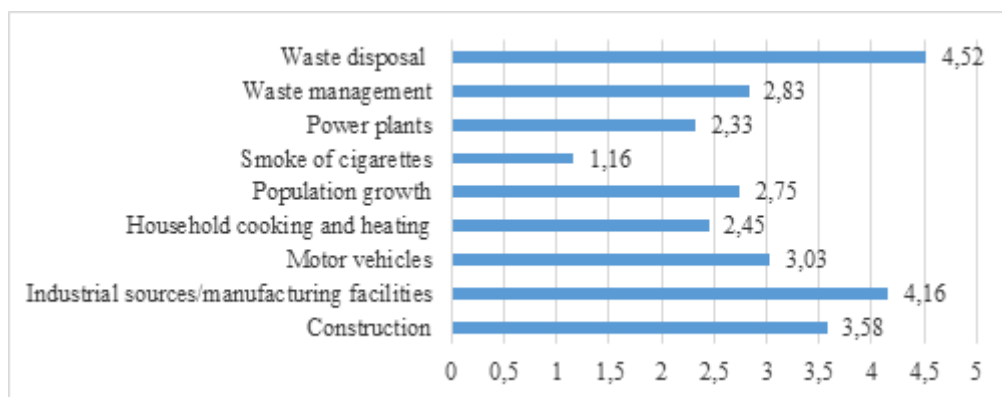
Findings from these studies suggest that air pollution sources can be significantly reduced if citizens' awareness of the basic causes and consequences of this problem is raised through targeted campaigns and social marketing activities. According to the larger literature on health and environmental awareness, communication about environmental risks must go beyond individual behaviour education in order to empower communities to mobilize to reduce environmental threats. To be effective, social campaigns must first conduct complementary research to determine public awareness and identify target groups of citizens on whom these campaigns and activities will have the greatest impact.

¹⁶ <https://skopje.gov.mk/mk/objavi/strategii/>, accessed: 09.09.2021

The level of awareness of citizens in the capital Skopje about the causes of pollution was determined by a survey conducted from November 2020 to March 2021.¹⁷ The research was conducted on a representative sample of respondents in the capital sorted by age, education, ethnicity, and gender. According to findings of this study, citizens do not blame themselves for the pollution problem. In contrary to previous surveys, which identified households and traffic as the major polluters, the citizens of Skopje believe that industry and construction are the primary sources of pollution. They believe that stricter legal regulation is required to encourage conscious and responsible behaviour in construction, industrial facilities, and traffic in order to reduce pollution.

What the research indicates is that citizens in Skopje are unaware of their own habits and behaviour as a source of pollution. As a result, social marketing activities are required to cause a change in each individual's habits and behaviour toward the environment, thereby contributing to their active participation in reducing pollution both locally and globally. According to the study's findings (Figure 5), the majority of respondents believe that, in addition to the construction industry, the main source of air pollution in Skopje is the problem of waste management and waste disposal.

Figure 5. Ranking of the main sources of air pollution in Skopje (Likert scale 1-5)



Source: Tatjana Petkovska Mircevska, Natasha Daniloska, Diana Boskovska, Vladimir Petkovski, Meri Karanfilovska: Raising Public Awareness of Pollution in Skopje as a Basis

¹⁷ Tatjana Petkovska Mircevska, Natasha Daniloska, Diana Boskovska, Vladimir Petkovski, Meri Karanfilovska: Raising Public Awareness of Pollution in Skopje as a Basis for Conducting Social Marketing Activities, *16th SDEWES Conference on Sustainable Development of Energy, Water and Environment Systems*, October 10-15, 2021 in Dubrovnik, Croatia.

for Conducting Social Marketing Activities, *16th SDEWES Conference on Sustainable Development of Energy, Water and Environment Systems*, October 10-15, 2021 in Dubrovnik, Croatia.

Home heating is ranked very low in the survey responses, as illustrated in Figure 5. Such a finding is highly contradictory, given that, according to official reports, it is one of the primary causes of air pollution and implies a lack of awareness about one's personal contribution to human-environment pollution.

It is widely assumed that air pollution in Skopje is a problem caused by the construction industry and the industrial use of fossil fuels. Although these are two of the most significant sources of air pollution, industry and local governments are collaborating to address some of the most serious issues by encouraging the use of clean fuels and supporting investment in new technology. It can be concluded that the majority of Skopje residents are unaware that household emissions increase personal exposure to air pollutants and contribute significantly to total air pollution emissions. This is a clear indication that there is an urgent need to launch targeted social marketing campaigns and raise awareness about air pollution among Macedonia's capital city's residents.

Pollution sources can be significantly reduced if citizens' awareness of the fundamental causes and consequences of the problem is raised through targeted campaigns and social marketing activities. For social campaigns to be effective, it is necessary to assess public awareness and identify the target groups of citizens on whom these campaigns and activities will have the greatest impact. Accurate, timely information can be a powerful tool for mitigating the harmful effects of air pollution. Although there are national environmental risk communication guidelines based on risk and crisis communication principles, little is known about how they are implemented or the effectiveness of existing communication efforts.

Conclusion

Citizens' quality of life and environmental quality are significantly associated, and this interaction can be accessed via various types of indicators. The application of these indicators enables the acquisition of substantial information that is based on people's perceptions of their environment. In this regard, awareness of the issue of air pollution can play a key role in the application of environmental indicators that relate to people's quality of life, as shown

by the example of Skopje, the capital of the Republic of North Macedonia, which is one of the most polluted cities both domestically and internationally.

In EU nations, the majority of people appreciates its (often intangible) rights to have access to environmental resources. The 7th Environment Action Program (7th EAP) of the EU offers direction for environmental policy up to 2020 and a longer-term outlook up to 2050. Protecting, preserving, and enhancing the EU's natural capital; transforming the EU economy into one that is resource-efficient (green and competitive); safeguarding EU citizens from environmental pressures that could endanger their health and well-being; and more are some of its main goals. The EU pledges to considerably reduce noise pollution as part of its action program, for instance by altering how cities are planned or lowering noise at its source. The principal EU policy tool for the assessment and regulation of environmental noise is the Environmental Noise Directive (Directive 0049/2002/EC); noise from home activities, noise from neighbors, noise from workplaces, and noise from inside cars are not covered by this directive.

From the findings obtained and presented, it is evident that each citizen's quality of life is significantly influenced by the natural and environmental surroundings in which he or she resides and works. People's health, wellbeing, and other aspects of their quality of life are impacted by the environment both directly and indirectly. The experiences of EU nations demonstrate that there is a growing need to raise environmental awareness among individuals about environmental issues that have an impact on a variety of areas of citizens' quality of life, both nationally and internationally.

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- 4 European Union: Quality of life in Europe-facts and views, Publications Office of the European Union, 2015, <https://ec.europa.eu/eurostat/documents/3217494/6856423/KS-05-14-073-EN-N.pdf/742aee45-4085-4dac-9e2e-9ed7e9501f23?t=1433141890000>.
- 5 <https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Eurostat>.
- 6 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Quality_of_life_indicators_-_measuring_quality_of_life
- 7 <https://skopje.gov.mk/mk/objavi/strategii/>.
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