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SUSTAINABLE DEVELOPMENT INDICATORS AND MANAGEMENT OF NATURAL RESOURCES OF THE CITY OF NIS

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Abstract: *Natural resource management as a narrow scientific field investigates and studies the technical and economic distinctions of industries engaged in the exploitation and processing of raw materials from natural resources and studies the overall economy in the context of sustainable development. This provides it wider significance than its name and classifies it in a multidisciplinary field of technological importance for further industrial and social and economic development of each region individually and the country as a whole. A prominent place was given to the management of natural resources in Nis and its surroundings, that is, the Nis Administrative District.*

Keywords: *management, natural resources, sources, natural potentials, indicators, sustainable development.*

1. INTRODUCTION

Natural resources and their exploitation is a broad topic, especially when considering a scientific approach to it. There is a wealth of literature on natural resources and how they are used. However, their definition at the theoretical level is not, at least in our opinion, determined yet, since, in addition to this term, the following ones are used: natural conditions, natural resources, natural potentials and natural wealth. Certainly, one may think that there is no fundamental difference between the two concepts, but to determine their content accurately and in a unique way leads to inevitable discussions of a smaller or larger scope.

According to a definition, natural resources are the raw materials used in the production of all products, both the manufactured ones and the ones yet to be manufactured (Coburn, 2012). According to another definition, they are all things from nature that are available to man as its gifts (Common, 1998).

Natural resources certainly fall into the category of common goods and common resources. Their use, economic implementation and economic evaluation should be planned and purposefully controlled. They have their limitations conditioned by the capacity of the Earth, which renews them to certain extent.

Regardless of the type, structure and individual quantities, natural resources are the basis for the forthcoming economic development of each state, city, etc. However, economic development based on their irresponsible and irrational use is unsustainable. This is also the case with the Republic of Serbia and its territorial and local units.

The city of Nis, as an important territorial and economic center of southeast Serbia, possesses a considerable range of natural resources whose exploitation raises numerous questions. In order to try to answer at least some of them, it is necessary to adopt certain theoretical assumptions regarding natural resources in general, to observe the characteristics of the natural conditions of the city of Nis and, through certain indicators, to consider their use.

Only the sustainable use and management of natural resources can ensure their long-term availability and enable the adequate development of economic activities, both locally and nationally.

2. NATURAL RESOURCES AND SUSTAINABLE DEVELOPMENT - THEORETICAL DEFINITIONS

The term "natural resources" refers to everything that comes from nature. It is simply all that is common wealth or the common good as stated in the introduction. They are mineral resources, water, forests, soil, as well as climate and terrain, which are the conditions for the development of some other economic activities (Milanovic, 2016). Natural resources are conditioned by natural factors, such as elements of the geographical environment (climate, terrain, soil, solar heat, atmospheric precipitation, proximity to irrigation water), which cannot be directly used, but without which, some types of production are not possible.

Natural conditions are necessary for the survival of man, society and economics. The survival of every human community is conditioned by its existence. They exert their influence independently of the will of man. The question in each case is how and to what extent one will take advantage of it in creating new values.

There is no clear limit to what natural conditions and natural resources are, as some elements of nature may be conditions, and in certain situations they may also be resources. According to various attempts to define them, researchers are almost unanimous in the view that resources represent a dynamic category subject to change. In other words, they change in space and time, representing certain components that are the source of more or less useful substances and energy.

People transform natural resources, adapt them to their needs and change them. Natural resources and natural conditions represent natural wealth. It is a descriptive unit of value for natural potential. Natural potential represents natural resources with reserves of natural goods and natural conditions that may be or are already useful to man. These are minerals, soil with vegetation, water and other natural conditions.

Basically, natural resources are material resources contained in the natural environment. These resources may or may not be exploited at some point with the help of future technological means and under certain social and economic conditions. As conditions of exploitation are variable categories, so is the volume of resources variable.

A substantial part of natural resources remains and must remain outside economic and environmental flows, that is, it cannot be used for economic purposes. That part must be preserved from exploitation for the benefit of generations yet to come. This is especially true for those types of resources that are difficult to renew or that are non-renewable. So, natural resources are goods that are used economically.

If so, do natural reserves belong to the same category? According to unanimous opinions, the reserves are resources known and available for economic exploitation, with the help of available technology and at current prices. Reserves are potentials that can be used as resources at certain point, depending on the purpose of the use. As regards the assessment of the reserves, the available technology and the valid price are important, as it was already pointed out. The projected reserves are part of the resources that can also be economically justified in the long term. This period can last up to 50 years or more with the use of new technologies. Based on the extent of their geological exploration, reserves may be: proven, probable, observed, inferred, hypothetical and speculative. Considering the degree of their economy, the reserves may be divided into profitable, conditionally profitable, paramarginal, marginal and non-profitable ones.

The methods for classifying resources and the basis for them can be various. At the core of each possible classification is the rational management

of resources. In other words, the essence of any division of resources is rational and sustainable exploitation of natural resources. The criteria for the classification of natural resources are the following: qualification, durability, functionality, economy, renewability and position. All these criteria form the natural and economic criterion according to which natural resources can be classified into natural, economic and combined resources.

There are other divisions of resources, one of which is the criterion of assigning resources to one of the Earth's spheres. Thus, the resources can be divided into: natural resources of the atmosphere, natural resources of the lithosphere, natural resources of the hydrosphere and natural resources of the biosphere. If one uses the possibility of the exploitation as the criterion for the classification of resources, the economic classification of natural resources is obtained. Hence, they are classified as: material, tangible goods reserves used by man such as oil, coal, arable land, ores, etc., and intangible goods that exist in nature such as natural beauty, but which can be destroyed by various actions. (Pestic, 2000).

The composition and origin of resources can also be criteria for their classification and they can, therefore, be divided into organic and inorganic ones. The duration of resources indicates their most significant classification. Natural resources are divided into two groups according to their duration: non-renewable (mineral raw materials or mineral resources) and renewable (land, waterways, flora and fauna). Wind and sun energy are also a renewable resource that is increasingly being used.

In the European Union (EU), great attention is paid to the use of natural resources. Hence, they are classified as exhaustible and inexhaustible ones. The renewable and the non-renewable resources are found within both exhaustible and the inexhaustible resources (Harris, 2009). The inexhaustible renewable resources are: wind, sun, waves and precipitation, as well as air and oceans. Exhaustible renewable ones are forests, fish stocks and biomass, as well as freshwater reservoirs and soil. In the end, the division of resources into exhaustible and practically inexhaustible has been generally adopted both globally and nationally. Thus, natural resources could be divided into permanent ones (solar energy, wind, waves, water flows), non-renewable (metals, fossil fuels and non-metals) and potentially renewable (air, water, fertile soil, wildlife).

New trends in the EU and globally that involve greater development of an industrial sector that needs natural resources and the strong impact of natural

resource wealth on political and economic changes in the world today and in the future impose the need for many and varied analyses (Catalin, 2016). These analyses find their field of interest both at the local and the city level.

3. THE CITY OF NIS AND ITS NATURAL ENVIRONMENT

Nis is a city of about 260,000 inhabitants. The city has been an important regional, administrative, economic, business and university center of southeast Serbia for years. The city covers an area of about 600,000km². It is surrounded by mountain ranges: Suva Mountain, Svrljig Mountains and Stara Mountain, as well as Selicevica. It is also located on a significant European crossroads, which has made it an important place in many different events throughout history. Therefore, the protection of natural resources and their exploitation is one of the priorities for the life of its citizens, especially at a time when the inflow of population into the city has increased.

The nature of Nis and its surroundings is diverse. Its attractiveness can best be seen through geomorphological, climatic, hydrographic and biogeographical values. The terrain of the city of Nis is both plain and mountainous. The massive Carpathian and Balkan range ends to the south of Nis and collides with the Rhodope Mountains of the Balkans. Nis itself is located in the valley. Despite this fact, there are prominent geomorphological entities that are quite diverse.

The Balkan Mountain Range, part of which in Serbia is recognized as the Stara Mountain, while the name in Bulgaria and surrounding countries is the Balkan Mountains, is a mountain range in the eastern part of the Balkan Peninsula. It extends 560 km in length from Vrška Čuka on the border between Serbia and to the east through central Bulgaria to Cape Emine on the Black Sea. The highest peaks in Stara Mountain are in central Bulgaria. The highest peak is Botev (2,376 m), located in the Central Balkan National Park (founded in 1991). The Balkan Peninsula is named after the mountain.

Common name for a high elevated mountain area whose elevations sometimes exceed 1000 m, more often between 700 and 800m, but most frequently from 800 to 1000 m. To the north they reach the Svrljig Timok and its source branch of the Manojlica Mountain, in the south they are sharply bounded by Nisava, in the east they reach Trgoviste Timok and its original branch Stanjanci, then to the Cerovica River and Temska River to the confluence. In the west they are bounded by the Nis Basin, towards which, on the Gramada-Visegrad route, they end with steep sections. Within these boundaries, they cover approximately 430 km², and along this surface, the

Svrljig Mountains are among the most widespread in the vicinity of Nis. The highest peak on them is Zeleni (1334 m), approximately located in its central part.

Their geological composition is different. In fact, its core is of Upper Carboniferous sandstones and shales that have been discovered, mostly, on the northern rim. All other parts are covered by Mesozoic limestones. They are dominated by the Lower Cretaceous, i.e. Cretaceous, and a smaller part of this stratigraphic formation belongs to the Hauterivian deposits. At the eastern tip there are also Aptian sandstones, which, in two or three oases, are also present in the interior of the mountains. These zones also contain eruptions of predominantly Andesite rocks. According to their tectonic features, these mountains belong to the Eastern Zone of young fold mountain ranges. In addition, they are composed of multiple folds whose directrices are compatible with the orographic direction of the ridge. They are also clearly bounded by long and deep dislocations: in the north by the eponymous one, in the south by the Nisava River, in the east by the Pec and Svrljig and in the west by the Ozren and Sicevo.

Due to the predominantly calcium carbonate composition of the layers involved in the structure and due to the large part of the bare surface, the surfaces are subject to intense mechanical and chemical processes. Therefore, their sides, especially those facing north and south, are under many sections and flint at the base of which there are accumulated scree or they are ridged by *Neogondolella suhodolica*. The ridge and the highest parts, however, are anhydrous and swollen or eroded by karst forms, among which sinkholes, small bays and limestone pavement prevail. Almost all of the atmospheric sediment sinks through them, collecting in the interior of the limestone mass, or moving underground and dispersively toward the rim, where it often erupts in strong jets.

Suva Mountain is a part of the Carpathian-Balkan massif that stretches from the Danube in the north to the Zaplanje-Luzica basin of Ruj Mountain in the south. To the east, this massif extends from the Bulgarian border and to the west to the huge mountains of Pomoravlje. The diverse geological composition made these mountains rich in various ores and minerals. The highest peak of this mountain is Trem 1810 m high and located opposite the second highest peak of the Soko stone - 1361m. Both peaks represent remarkable natural beauty created in the distant past and still intact by human

hand. They are characterized by sharp stone edges in the north and sparse vegetation in the south accompanied by grassy areas and low juniper bush shrubs.

In addition to these massifs, an important natural resource is the Jelasnica Gorge as a part of the river valley of the Jelasnica River, created by intense vertical cutting of the watercourse into the limestone rock mass, on the west side of the Suva Mountain. This gorge belongs to the municipality of Niska Banja. The length of the gorge is about two kilometers and its width is only about 30 meters. It is a natural road that connects the Nis basin with the settlements and tourist destination Waters of Bojana on the northwestern slopes of Suva Mountain. Jelasnica Gorge has the status of a Nature Park, area of protection of category I and enjoys the protection as a natural asset of the Republic of Serbia of exceptional importance, with the aim of preserving the natural values of both flora and fauna there.

An important natural resource of the city of Nis is the Spa of Nis. It is one of the most developed spas in our country, which individually generates over 100,000 overnight stays a year. It has a developed healing function, a solid material base and a favorable geographical position in view of the proximity of urban settlements, communications and other factors. The spa has excellent natural healing factors such as: moderate continental climate, thermomineral waters, natural mineral mud and medicinal gases. The healing waters well at five springs and belong to the group of alkaline earth homeothermic ones, slightly mineralized, poorly radioactive with a capacity of 56 liters per second.

The Karst terrain of the Nis Basin, which we described above, is also present in the Spa of Nis. Sandstones encircle the limestone block Koritnjak, at the base of which the spa is located and isolated from the limestone massif of the Suva Mountain into a separate hydrological unit. Forest resources abounding in the surroundings of the city of Nis represent complex ecological systems with many plant and animal communities. However, it is noticeable that in the last few decades their degradation primarily by human action, but also by the influence of other natural resources. Their reduction is conditioned, first of all, by the need to provide a sufficient amount of firewood, but also by other activities. The natural resources that the city of Nis can commend itself for far exceed the scope and requirements of this work, so the information stated above is merely a humble reflection on the natural resources of Nis and its surroundings.

4. INDICATORS OF THE ECOSOCIAL SYSTEM OF THE CITY OF NIS

As we have already pointed out, natural resources are constrained by the capacity of Earth which restores them to certain extent. For this reason, economic development based on their irresponsible and irrational use is unsustainable and impossible. These facts make natural resources crucial for the survival and development of every human society and state. Let us reiterate that, assuming that exploitation does not exceed their ability to regenerate, surface and underground freshwater resources, soil, forests and the living world represent renewable resources. On the other hand, fossil fuels and minerals are non-renewable resources.

Economic development that causes land, water and air pollution as well as the overexploitation of natural resources through international trade makes the needs for natural resources and their balanced use a global issue. But as much as it is a global issue, it is raised at the local level as well. For resource exploitation to be balanced, the rate of their consumption must be maintained within the capacity to regenerate natural systems. Human activities, production and consumption lead to an increase in the exploitation of land reserves of renewable resources and the level of pressure on their regenerative capacity is in many cases above the allowed one. On the other hand, the degree of environmental pollution has caused changes of a global character, the most significant being the destruction of the stratospheric ozone layer, global climate change, endangering biodiversity, pollution of surface and groundwater and planetary destruction of forests. At the local level, this degree of pollution, especially in urban areas, is increasing year by year, despite the multitude of measures and actions taken on environmental issues and environmental protection.

Every individual is a part of two interconnected and dependent systems. One is the social system and the other is ecological one. The social system includes a family in which a person is born and raised, a cultural community whose language he speaks, an economy and a society that provide him with the material and social conditions for survival and a political system whose laws determine the framework and the way of their life. It is a system of ordered social interactions based on social norms and values of a common character. Each individual in the system has their own place and function.

An ecological system (ecosystem) is a set of closed and interactive processes and structures that form a person's physical and mental habitat, including the area where they get around, the air, water, plants, animals and

the surrounding areas. It encompasses soil, living beings and everything else that affects its health, safety and survival. Finally, this includes the freedom of man, their personal comfort and the corpus of different rights that belong to them.

Social and ecological systems exist together with a high degree of interaction and form subsystems of a complex system called the eco social system. Any change in one of the subsystems has significant and partially predictable effects on another subsystem or on the system as a whole. Such a structure of the eco social system contains two questions: How do environmental conditions affect human society and culture? And second, do social conditions change the ecosystem so as to diminish or increase its vitality?

The first question relates to the direct impacts the ecosystem has on human society, and the second refers to the direct and indirect impacts of the social system on the ecological system. These changes are realized through different influences and effects on the balance in nature, as well as the incentives of economic and social institutions and individual behavior with the positive or negative effects on the ecosystem. One of the consequences of the information technology revolution is the rapid increase in the amount and availability of data available to us as indicators of interaction in the eco social system. At the different levels of data that comprise the "information pyramid" at the bottom there are "data" that, if unprocessed, have little use value. However, when data are processed into statistical surveys or tables, they can be used in reports or as a basis for making certain estimates. Yet they are of such a level of statistical processing that they are complex to understand or useful in political decisions. That is why in the creation of social, economic and environmental policies, even at the city level, it is necessary to comprehend these data in order to enable the best possible decisions to be made.

A common way to avoid a lot of data is to use indices and indicators as a tool to get information. Indices and indicators are the means intended to reduce a large amount of data to their simplest form, while retaining the essential importance of the issues that characterize the data given, being very compact and having easily understood objectives. Classical indicators in socioeconomic theory and practice are dimensions that denote the whole of the economic and social categories, such as gross domestic product and national income or adult literacy rate (Human Security Indicators in Serbia).

In this way, indicators are statistically oriented indicators specific to political or technical issues and denote results and conclusions regarding a given policy or phenomenon. Indices, on the other hand, give relations that show the relative variations of one or more time or dynamic series. Thus, in

marginalist theory, indices emerge as indicators that express the utility of a commodity for an individual.”

With regard to etymology it can be said that indices connect different indicators into one number that is useful for comparison in time and space. In other words, an indicator is something that helps us understand where we are, what path we are following and how far we are from where we want to get. Information about changing the value of an indicator alerts us to a problem before it becomes too large and helps us determine what needs to be done to solve the problem. Traditional economic, social and environmental indicators - indicators of the eco social system such as: annual rate of growth / decline of a gross national product, annual rate of growth or decline of investment; annual employment rate, drinking water quality, ambient air pollution concentrations, or annual respiratory infections growth / decline rate; measures of change in one part of the subsystem as if it were completely independent of the parts or the whole of the Eco social system. Thus, these indicators do not reflect the reality of close interconnections within the Eco social system.

As demonstrated by the interconnectedness within the Eco social system, the exploitation of natural resources provides the raw materials for production which not only final products depend on, but also company profits and employee earnings. Jobs and profits affect employment and poverty rates, and poverty rates are linked to crime rates. Air quality, water quality and the properties of raw materials used in the production of food and general use items have an impact on the health of both the population and employees in the production process. Health problems caused by general problems with air pollution or poor working conditions and exposure to toxic substances due to inadequate occupational safety measures have an impact on productivity and contribute to the increased health insurance costs. In the decision-making process, it is necessary to translate numerous diverse and complex phenomena, processes and relationships, as well as the dynamics of their changes in space and time, into a limited number of objective indicators according to which, by applying the appropriate criteria, a certain position is taken and interpreted for the purposes of directing planned actions. and making and implementing appropriate decisions. Generally, indicators in all categories are a powerful means of expressing the original variable value in the past and present (Veljković, 2006).

5. RESEARCH

What are these indicators like in the territory of the city of Nis? In order to answer this question, we conducted a survey on a sample of 100 citizens of Nis, regardless of their gender, age and education, and asked them to answer the following questions:

- What is the exploitation of natural resources like in the territory of the city of Nis?
- What is the air quality like in Nis?
- What is the quality of water like in the territory of the city of Nis?
- Does the use of natural resources at the current level affect the health of people in Nis?
- Is the exploitation of natural resources in the city such as to affect the employment of citizens?
- Is the exploitation of natural resources in the city such as to affect the profits of the firms operating on its territory?
- In your opinion, does the level of education of people influence the way natural resources are used?
- Does the degree of natural resource exploitation affect the degree of poverty in the city?
- Is the use of natural resources related to environmental crime and to what extent?
- Does the use of natural resources provide sufficient raw materials for production in the city of Nis?

The results obtained on these issues have shown to a great extent the interdependence of the economy, society, healthy environment and the exploitation of natural resources in the territory of the City of Nis.

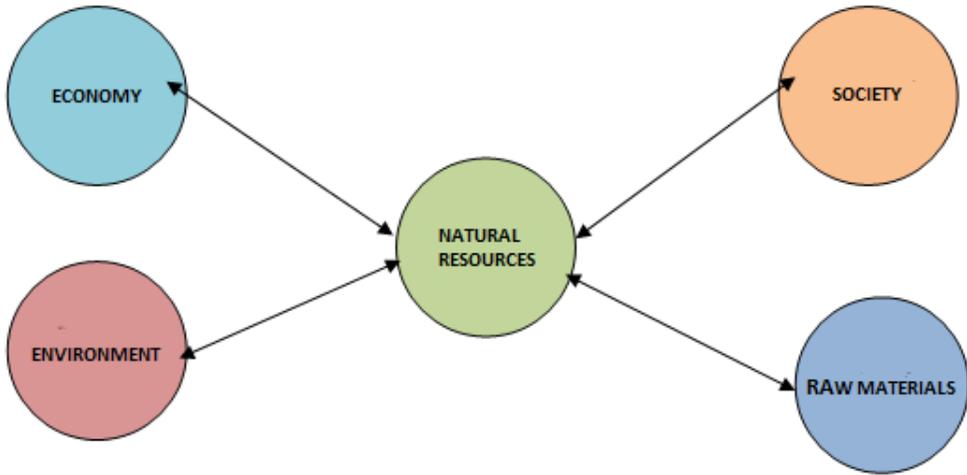
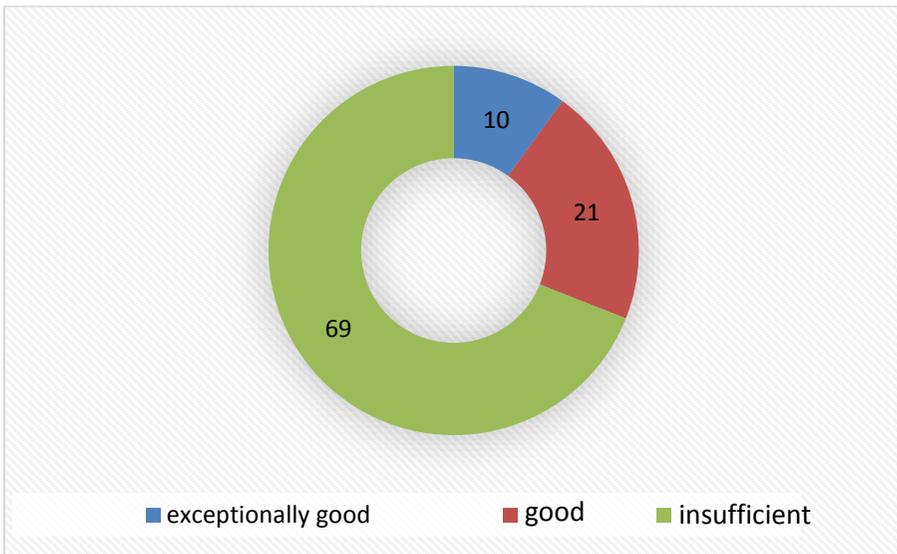


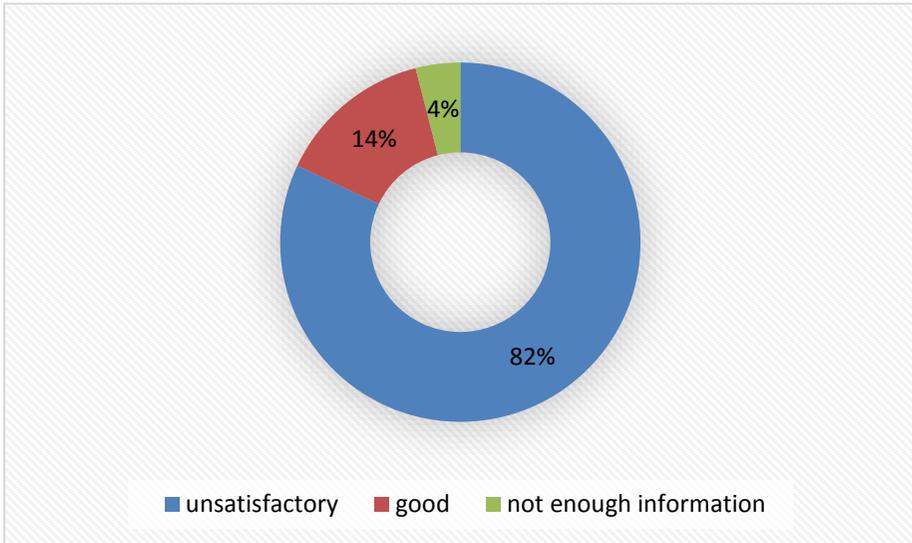
Fig. 1. Natural resource sustainability indicators

Most citizens, 69 of them, consider the exploitation of natural resources as insufficient in the territory of Nis. Only 21 participants rated it as good and only 10 rated it as exceptionally good.



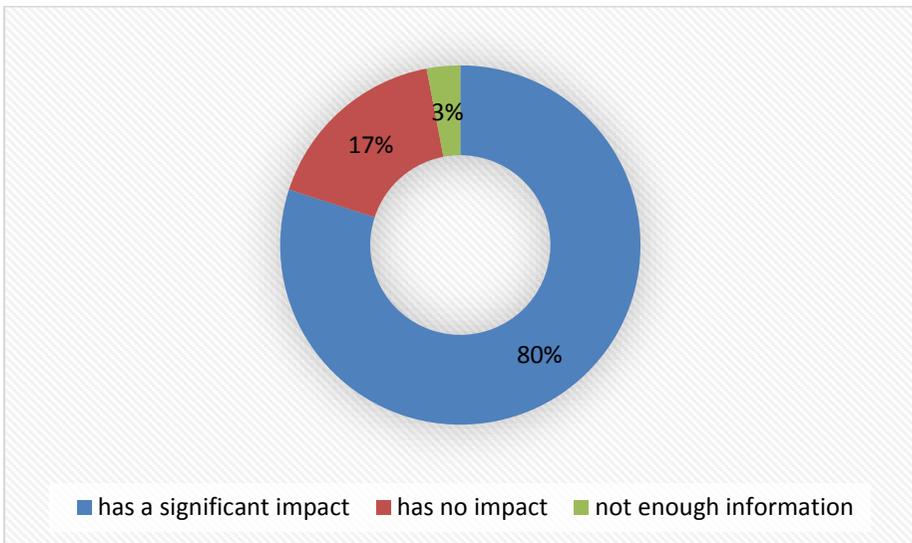
Graph 1. The exploitation of natural resources

As for the second and third question, almost equal percentage of citizens, that is 82%, opt for the answer that the quality of water and air is unsatisfactory, only 14% consider it good in both cases, and 4% think that they do not have enough information to give an appropriate response.



Graph 2. The quality of water and air in Nis

Most citizens, 80 of them, believe that inadequate use of natural resources has a significant impact on the health of the residents of Nis. Only 17 participants believe that this was not a factor affecting the health of the population to a significant extent, and three of them did not have enough information to answer this question.



Graph 3. The impact of inadequate use of natural resources on public health

In terms of the impact of the natural resource exploitation on the profits of firms operating in Nis, 47 citizens believe that this significantly increases the profits of firms. 31 of them believe that it has no significant impact on profit and 12 that it has some influence but not to a significant extent. The rest opted for a lack of information on the connection between the use of natural resources and the profits of firms.

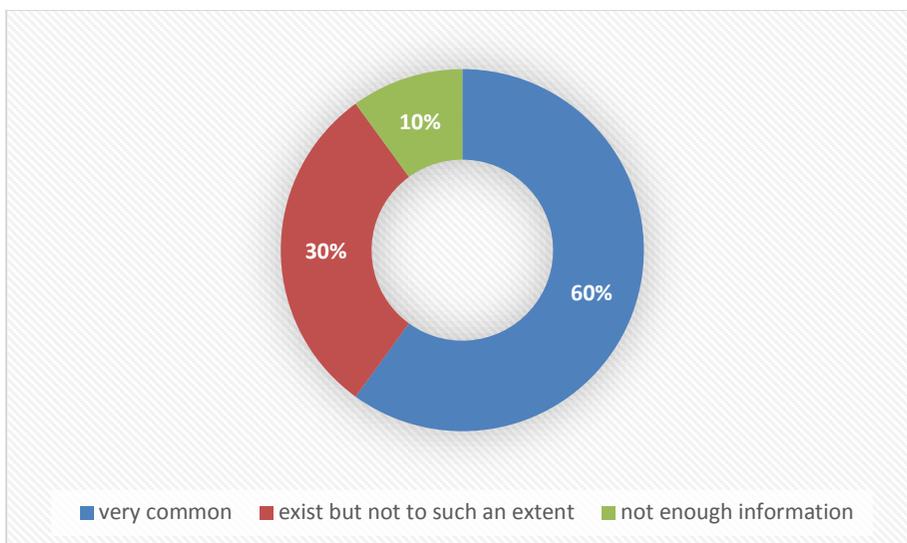
Table 1. The impact of natural resource exploitation on the profit of firms

Significantly increases the profit	No significant impact on profit	Some impact but not a significant one	Not enough information
47%	31%	12%	10%

Citizens were most unanimous when answering whether the degree of education affects the way natural resources are exploited, and thus, 92% consider education to be an important factor and 8% believe it to be a relative one.

About 50% of the survey respondents believe that the level of exploitation of natural resources greatly influences the poverty level in Nis, while 30% consider it a less important factor in affecting the poverty of citizens. However, 20% chose the option of not seeing a connection between the level of natural resource exploitation and poverty in the city.

When asked about the connection between the use of natural resources and criminal occurrences in the field of environmental crime, 60 citizens consider this connection very common, 30 that it exists but not to such an extent and 10 claim that there is not enough information about it. In addition, the illegal logging is considered to be the leading criminal phenomenon in the field of inadequate use of natural resources by 35 out of 60 respondents who consider it very common.



Graph 4. Relationship between exploitation of natural resources and criminal occurrences in the field of environmental crime

Half of the respondents believe that the exploitation of natural resources does not provide sufficient raw materials for production in the City of Nis, while 24% believe that it provides them at good extent, while the rest do not have enough information about the connection between the two terms.

6. CONCLUSION

Wealth in natural resources is one of the most important benefits any economy can have, both today and in the future. Natural resources, whether renewable or non-renewable, are essential for the survival of a social community. Their exploitation must be designed and implemented in such a way that it does not endanger the survival of man and at the same time ensures an adequate level of environmental protection. It must be economically and environmentally friendly.

The extent of the exploitation of natural resources is variable and is greatly influenced by the technological advancement of society and each environment individually. It must always be borne in mind that a part of natural resources must remain for future generations, and therefore it cannot be exploited.

Exploitation of natural resources is of importance to any community at global, regional or local level. This is also the case when it comes to the city of Nis and its surroundings.

Nis is not only an important center of the Republic of Serbia, but also a crossroads that greatly affects its strategic position. With more than a quarter of a million inhabitants and with constant migration, Nis is gaining in

importance each year. The countryside of Nis and its surroundings is full of natural resources, and therefore the care of their exploitation is one of the priorities when it comes to the quality of life of citizens. The wealth of the natural resources of Nis and its surroundings is best viewed through geomorphological, climatic, hydrographic and biogeographical values.

The exploitation of natural resources everywhere, even in Nis, can best be seen through a limited number of indicators. In general, indicators are a means of expressing certain values in the past and in the present. The indicators we used in this paper indicated a strong degree of interdependence between the economy, society, healthy environment and the use of natural resources.

The results of the survey indicate that a large number of citizens do not have enough information when it comes to linking some indicators with the exploitation of natural resources in the territory of Nis. This indicates the need for constant and accelerated education of the population on these issues, since only an informed citizen is a satisfied citizen. Naturally, in addition to local authorities, the whole society must be involved in such a process.

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