



Ecology in the Context of Sustainability

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Abstract

Sustainable development and sustainability itself is a very complex concept that combines and intertwines environmental, economic and social areas. The first mentioned environmental area is very important and dominant in this context, as the other two areas can be compensated in a certain way compared to the factors and resulting consequences that have a negative effect on the environment, which are often irreversible. Current trends in environmental care and ecology itself are characterized by the principles of complexity, integration, interdisciplinarity and transregionality. Within ecology, in connection with sustainability, there is also the so-called environmental management, which represents a set of technical tools and methods of environmental management, based on the identification of environmental aspects of products, activities and services of any type of organization, with the aim of adopting and implementing effective proactive measures to reduce their negative impact on the environment as such. The benefit of solving these topics is not only in the area of enlightenment and naming starting points, but also in bringing closer and establishing contexts for possible future research activities. The aim of this article is to define the basic principles and connections within the solved issue of ecology and sustainability as a prerequisite for meeting the needs of the present without jeopardizing the demands of future generations within the framework of sustainable development.

Keywords: Ecology; Environment; Management; Sustainability

1. Introduction

Sustainability is about meeting the needs of the present without compromising the ability of future generations to meet their own needs. It involves balancing the three interconnected pillars of environmental protection, social development, and economic growth [1]. Some key aspects of sustainability [2] include:

- Assuming that natural resources are finite and should be used conservatively and wisely with a view to long-term priorities,
- Promoting social development, seeking cohesion among communities, and ensuring quality of life, healthcare and education for all,
- Generating equitable economic growth without harming the environment,
- Combating climate change, halting biodiversity loss, and promoting sustainable consumption and production patterns.

The concept of sustainability first gained prominence with the 1987 Brundtland Report, which warned of the negative environmental consequences of economic development and globalization. The UN's 2030 Agenda and Sustainable Development Goals provide a framework for achieving global sustainable development [3].

However, despite some progress, much more needs to be done to achieve sustainability. Europe still consumes more resources and contributes more to environmental degradation than other regions. Projections show that global consumption, population, resource use, water demand, and energy demand will continue to rise rapidly in the coming decades [4],[5]. Urgent action is needed to transition to sustainable production and consumption systems and live within the limits of the planet.

The aim of this article is to define the basic principles and connections within the solved issue of ecology and sustainability as a prerequisite for meeting the needs of the present without jeopardizing the demands of future generations within the framework of sustainable development.

2. Ecology as a Basic Pillar of Sustainability

Ecology is a fundamental pillar of sustainability [6], emphasizing the importance of our planet and the impact humans have on it. It involves recognizing our dependence on Earth's diverse ecosystems and taking tangible steps to minimize our impact [7]. This pillar prioritizes the protection of biodiversity, the balance and health of ecosystems, and ultimately, our own survival. Effective biodiversity management is crucial, as it highlights our interconnectedness with all life forms and the necessity to protect them [8].

In the context of sustainability, ecology plays a vital role in various aspects such as energy use, waste management, biodiversity conservation, and addressing emissions. Businesses are key players in protecting the environment by integrating environmentally-friendly practices into their operations, contributing to climate change mitigation and promoting a circular economy to minimize waste and harmful discharge into ecosystems [9].

Overall, ecology as a basic pillar of sustainability underscores the need to respect and preserve the natural world, recognizing that our well-being and survival are intricately linked to the health of our planet's ecosystems.

2.1 Ecological criteria of sustainability

The following section presents the basic ecological criteria of sustainability. These criteria are essential for assessing and ensuring environmental sustainability. Here are some key points extracted from the sources:

Ecological System Maintenance [10]: To ensure environmental sustainability, it is crucial to develop and maintain every

element of the ecological system equitably. Neglecting environmental problems on a global scale can burden future generations with severe challenges, emphasizing the need for proactive measures to preserve nature and create a sustainable environment.

The most frequently mentioned environmental problems on a global scale [11],[12] are problems such as atmospheric pollution with chemical and solid substances, thermal pollution affecting water cycles in nature and changes in the structure of organisms, which leads to reduced productivity and stability of the landscape. Emissions of pollutants have a significant impact on morbidity, mortality, wear and tear of basic resources and agricultural production. Another important problem is the pollution of water by waste water from industry, human settlements and agriculture, which has a negative impact on the hydrosphere [13]. These problems have global consequences and require complex solutions and international cooperation to mitigate them and protect the environment for future generations.

Environmental Monitoring [14],[15]: A fundamental aspect of ensuring environmental sustainability is the competent assessment of the environment's state. This involves systematic observations at global, national, and local levels to evaluate the health of living and non-living natural objects, identify sources of impact, and predict changes to prevent negative environmental consequences.

Environmental monitoring and assessment of the state of the environment are fundamental aspects of ensuring environmental sustainability. These processes include the monitoring and evaluation of various components of the environment, such as air quality, water, soil and biodiversity. Key competencies [16],[17] required to effectively manage an environmental management system (EMS) include:

- Knowledge of environmental regulations and laws,
- Knowledge of EMS principles and standards,
- Ability to identify, assess and manage environmental risks,
- Skill in environmental monitoring and measurement,
- Ability to analyze environmental data and performance indicators,
- Knowledge of emergency procedures and ability to coordinate responses to emergency situations,
- Ability to perform internal EMS audits and assessments.

Resource Use and Waste Management [18]: Achieving environmental stability requires improving resource use quality, adopting safe technologies, implementing structural transformations in the economy, and managing industrial waste effectively. Transitioning to waste-free production technologies and minimizing harmful substances' impact on land, water, and air are critical for environmental sustainability.

Preservation of Natural Environment [19],[20]: Countries are urged to preserve natural environments, landscapes, and biological diversity as part of the transition to environmental sustainability. This involves cleaning polluted territories, managing waste responsibly, preventing ecological emergencies, and implementing sustainable development programs to maintain the natural balance and protect habitats.

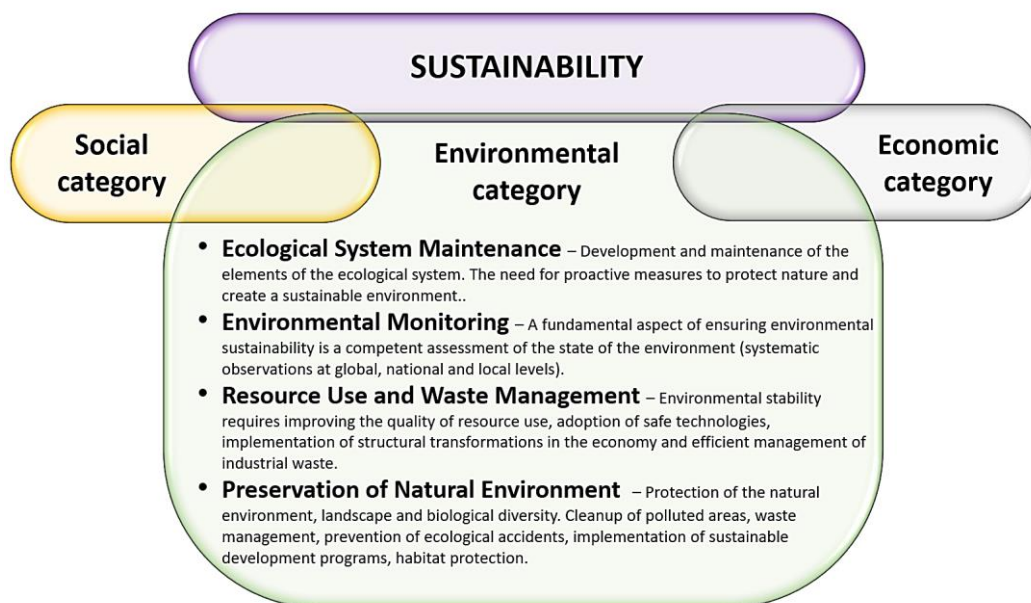


Fig. 1. Sustainability in connection with the criteria of the environmental field.

The ecological criteria for sustainability encompass maintaining ecological systems, monitoring environmental health, improving resource use, managing waste, and preserving natural environments. These criteria are essential for promoting a sustainable environment and ensuring the well-being of current and future generations.

2.2. Global Trends and Challenges Related to Sustainability

In connection with sustainability by the principles of ecology, the following global trends and challenges according to the EEA (European Environment Agency) [21] are presented in five clusters. The first cluster, called social, includes: different global population trends, the increasing rate of urbanization in the world, the changing burden of diseases and the risks of pandemics. The second technological cluster contains: accelerating technological progress. The third economic cluster includes: continued economic growth, multipolar world, more intense global competition for resources. In this context, the fourth and key cluster is environmental, containing: increasing pressure on ecosystems, increasing severity of problems and consequences of climate change, increasing environmental pollution. The fifth cluster contains: management and diversifying approaches to management.

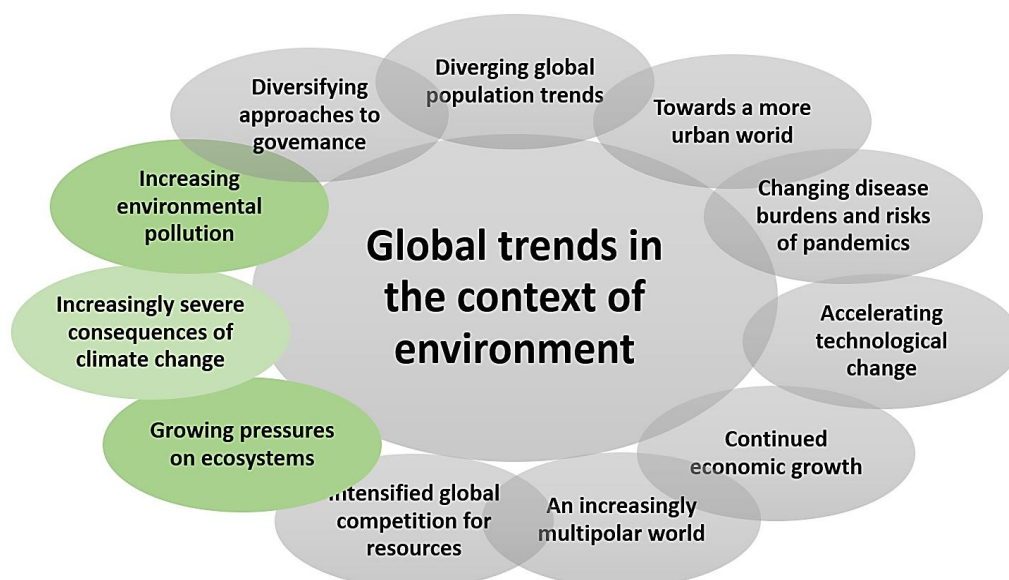


Fig. 2. Global trends and challenges in the context of the environment "modified according to [21]".

The growing pressure on ecosystems is a serious problem not only in connection with climate change, but also with increasing environmental pollution, which threatens the stability and functioning of natural systems. The main factors [22]-[27] exerting pressure on ecosystems and key variables include:

Changes in land use and changes in land types, such as the conversion of arable land to grassland, which significantly affects the potential of regulatory ecosystem services,

Increased emissions of pollutants into the air, which damage plants, slow down their growth and threaten entire ecosystems. An excessive amount of nitrogen leads to eutrophication of soil and water ecosystems,

Population growth, increasing pressure on natural resources, rising living standards by increasing consumption and carbon footprint, waste and invasive species.

Increasing the average temperature, while individual seasons are warmer and extreme weather fluctuations are more frequent and intense.

Changes in the water regime, such as prolonged periods of drought in the summer and autumn months associated with a lack of water, and at the same time an increased risk of floods.

Negative impacts on ecosystems, biodiversity and agriculture.

Economic consequences, such as disruption of business operations, property damage, disruption of supply chains and infrastructure, which may ultimately lead to increased costs and higher prices of essential commodities.

In this context, the factories mentioned above and their consequences affecting ecosystems, human health and biodiversity are often irreversible. Therefore, it is imperative that measures are taken to protect the environment and prevent further pollution in order to maintain a healthy and sustainable environment for current and future generations in the context of sustainability.

3. Conclusion

A comprehensive approach to global environmental problems is essential, as these problems are interconnected and require holistic solutions. Some key aspects of such an approach are as follows. Moving from the investigation of individual trends to their comprehensive evaluation and predictions using the concept of global trends that influence each other, operate on a large scale (globally) and also have large local impacts. In this context, these are interdependent social, economic, political, environmental or technological changes. A more ecologically oriented approach represented by biocentric attempts to maximize suitable living conditions for all living organisms, not just humans. Protection of the environment and biodiversity. International cooperation and coordination in solving global problems such as environmental pollution. Integrating environmental aspects into all areas of policies and decision-making processes, from spatial planning to agriculture and energy. Within the strict observance of these contexts, it is possible to keep the trend of sustainability in the full breadth of its meaning and mission.

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