



THE OPEN DIALOGUE

THE OPEN DIALOGUE ■ ■ ■ ■ ■ ■ ■ ■ ■ ■

**THE FUTURE OF THE WORLD:
A NEW PLATFORM
FOR GLOBAL GROWTH**



INVESTMENTS IN ENVIRONMENT

Content

Abdelaal Gamal	6
Ayala Osuna Lennin Javier	14
Bosuandole Antoinette	18
Cabrera Cano Cesar Augusto	21
Chilon Rojas Cesar Erasmo	28
Chuprov Vladimir	33
Dorina Mariya	37
Fokin Dmitry	41
Gaitan Castro Jeanpierry Felipe, Lozano Reina Sofia de los Angeles, Vargas Soraca Nestor Ivan	46
Gharge Muskan	54
Goetz James	58
Gonzalez Guzman Joseph Charles	63
Guzoev Dalkhat	70
Hernandez Gladys Cecilia	73
Imoro Abdulai Azure	83
Iudaeva Victoria	87
Janashantha Apeksha Sandeepanie	89
Kasaudhan Harshit Kumar	95
Kataytseva Polina	105
Kayumova Anastasia	111
Kazymov Ramin	115
Khabalova Inolla	119
Khodochenko Anastasiia	122
Khushi Khushboo	127
Kirushanga Sivagnanam	133
Kumarasinghe Pubudu Priya Udayagee	138
Kurysheva Nina	142
Lashko Olga	148
Mamadou Sekou Diallo	153
Mendoza Rojas Diego Aimar	158
Monyem Matthew	164
Ndengwe Francois	167
Osorio Salamanca Victor Jair	173
Pacenza Pierpaolo Mariam	180
Ponomareva Natalia	188

Radaeva Galina	193
Rahymov Serdar	197
Reverte Arun	203
Rosalina Baez Martinez	208
Rudat Axel	213
Serafini Stefano	218
Serebryakov Kirill	223
Sharma Anusha	227
Steele Jason	233
Sun Jiachen	239
Vanyushkin Alexander	250
Zreda Marek	257

**Abdelaal Gamal**

Journalist

Al-Bawaba News



From the Delta to Upper Egypt, smart irrigation is changing the face of Egyptian agriculture...

The project is designed to help farmers and enhance the efficiency of the current system, which already reaches 85% efficiency

Smart irrigation projects have become one of the most important solutions to overcome water problems in different regions of the world. Many countries have started to apply these technologies to improve water efficiency in agriculture and increase productivity. Smart irrigation projects implemented in different regions have proven to be successful. In this regard, it is worth mentioning a smart irrigation project in the city of Masdar in the United Arab Emirates, where smart irrigation technologies are applied for agricultural needs using irrigation systems based on artificial intelligence. It uses sensors to monitor soil moisture and automatically determines the required amount of water according to the needs of plants. This project has successfully reduced agricultural water use by about 30%, helping preserve water resources in a region plagued by water scarcity.

In Australia, a smart irrigation project has also been implemented in Victoria: smart technology is used in urban agriculture with the Smart Watering system, which uses sensors to determine soil needs and weather conditions. Water is deliv-



Archive photo

ered with high precision based on data collected from the sensors. The system has proven to reduce water losses by 60% compared to traditional systems, while also helping improve the quality of water used for irrigation.

Egypt is making steady strides towards the New Republic, overcoming many important milestones on the way to realising Egypt's 2030 Vision, which is based on the digitalisation of all sectors of the state. This approach reflects the country's endeavour to simplify the delivery of services to citizens in a more efficient manner. As an important step towards ensuring water sustainability and increasing the productivity of the agricultural sector, Egypt has launched an ambitious project to modernise its water system and move towards smart irrigation in collaboration with the Government of Spain. This project aims to improve water use efficiency and water management in agriculture and is considered to be one of the strategic projects that will help significantly in coping with water scarcity and lack of water in some regions. The project aims to improve water efficiency in agriculture by introducing modern and smart irrigation technologies. Al Bawaba News has examined a project to modernise the water system and move towards smart irrigation in Egypt.

Advanced systems

The project is based on the application of advanced irrigation systems ensuring the efficient use of water, which helps reduce losses and achieve maximum benefit from available water resources. The transition to smart irrigation also contributes to improving agricultural productivity in the Delta and Upper Egypt areas, which are considered the most important agricultural regions in Egypt. Through this project, the Ministry of Water Resources and Irrigation aims to provide innovative solutions that will help farmers improve water efficiency and increase crop production. The project is designed to enhance agricultural production in a sus-



tainable manner that will contribute to Egypt's food security in the face of growing challenges caused by climate change.

Greater use of digitalisation to monitor and organise irrigation processes is one of the project's key features. With the help of modern technologies, such as smart devices and remote control systems, it will be possible to precisely control the flow of water in irrigation networks, which will permit more efficient decisions to be made at the right time. The project seeks to connect water management centres directly to farms, allowing farmers to track irrigation electronically and use water more accurately. These technologies also help simplify water management and boost its efficiency, which means reducing water wastage and achieving better utilisation of limited resources. Digitalisation also provides important data that helps improve irrigation management at all stages of agriculture.

Sharing experiences and utilising Spanish practices

On the other hand, sharing experience with the Spanish government is an integral part of the project as Spain is one of the leaders in smart irrigation and modern agricultural technologies. Cooperation with Spanish experts involves knowledge transfer on best practices in irrigation including the improvement of modern irrigation systems, training in the use of new technologies and ways to activate links between water users.



Spain also has a successful track record of improving water management in regions facing problems similar to those in Egypt. In addition, the project includes the adoption of integrated approaches to water management at the secondary canal level, where efforts will be made to improve coordination between farmers in certain regions to ensure optimal utilisation of available water. This initiative aims to promote the idea of cooperation and coordination between all water-related parties to avoid losses and achieve the best use of resources.

The project is part of a long-term plan to achieve sustainable water management in Egypt, where strategies have been developed on how to improve water planning and management in the long term. The project focuses on measures to reduce water losses and promote its use in agriculture in a way that reflects sustainable environmental practices. It includes improving the efficiency of irrigation water and agricultural wastewater use, which helps relieve pressure on natural water resources. Emphasis is also placed on applying the principles of integrated water resources management, which seeks to achieve a balance between agricultural water use and other vital needs for these resources. The aim is to provide sustainable and innovative solutions to water availability problems in different regions of Egypt.

The project's managers attach great importance to research support, working on the involvement of research centres and Egyptian universities in the different phases of the project. A number of Master's and PhD theses related to smart irrigation and improved water management in agriculture have already been reviewed. For example, Sohag University reviewed a PhD thesis that investigated smart irrigation technologies and their application to improve agricultural production using water control technologies, and Assiut University reviewed a master's thesis that examined the impact of using smart systems on the efficiency of water consumption in agricultural land in the regions of Upper Egypt. These studies seek to develop data-driven scientific solutions to improve agricultural water management efficiency and resource sustainability.

The project implementation plan also includes a number of activities and milestones that will be carried out in accordance with the established timeframe. In the current phase, the focus is on introducing smart water distribution systems on agricultural land and providing training to farmers on the effective use of these technologies. The subsequent phases include the development of the necessary infrastructure to support a digital monitoring system for the irrigation system. The project is expected to contribute to a quantum leap in Egypt's irrigation and agricultural practices, helping improve water use efficiency, increase agricultural production and enhance food security in the future.

Project objectives

The project to modernise the water system and shift to smart irrigation seeks to improve the efficient use and management of water resources with a focus on

enhancing agricultural productivity and food security. The project includes several key elements such as digital transformation, development and modernisation of gateways and irrigation systems. It aims to improve the efficiency of utilisation and management of available water resources in agriculture and to boost the productivity of the agricultural sector in the Delta and Upper Egypt regions. It also looks to utilise irrigation technologies and smart agricultural practices to help farmers improve water use efficiency, increase crop yields and enhance food security through climate smart technologies.



The benefits of a modern and smart irrigation system include increased income and returns, which reduces the cost of production and streamlines the use of fertilisers to increase productivity, which benefits the farmer. Smart irrigation also helps with water distribution: water is delivered to each plant through a network of pipes. Smart irrigation systems improve crop quality by protecting crops from disease and reduce irrigation costs for the farmer. The system also tells the farmer how much water the land needs and what the current moisture level is. The farmer can control the irrigation machines automatically or manually based on the measured data.

Long-term plan

Dr Hani Sewilam, Minister of Water Resources and Irrigation, held a meeting to monitor the progress in implementing the project to modernise the water system and move towards smart irrigation, which is being carried out in collaboration with the Government of Spain.

Sewilam pointed out that the project aims to improve the efficiency of utilisation and management of available water resources for agricultural purposes and enhance the productivity of the agricultural sector in the Delta and Upper Egypt regions. The project also focuses on using irrigation technologies and smart agricultural practices to help farmers boost water use efficiency and crop yields, while also bolstering food security through climate smart technologies.

In addition, the project ensures the promotion of digitalisation in the con-



text of irrigation system monitoring to help farmers use resources efficiently, and also facilitates the continuous exchange of knowledge about Spanish irrigation systems.

Sewilam said the ministry has developed a long-term plan to ensure sustainable water management. The plan envisages exchange of experience and study of successful practices in water supply, in particular, Spanish experience of modern and smart irrigation. Another valuable asset is the Spanish experience of interaction between water users, which Egypt intends to utilise to address the fragmentation of agricultural holdings. This will strengthen the collective approach to water management at the secondary canal level, improve water planning and management, and follow the principles of integrated water resources management to enhance irrigation water efficiency, increase agricultural wastewater utilisation and preserve water quality.

Sewilam gave instructions to follow up on various activities and components of the project in accordance with the established work plan and the approved timeframes for the implementation of the project components.

Development of a smart control device

Earlier, the Ministry of Water Resources and Irrigation announced the development of a smart control device to organise the irrigation process and reduce water consumption to help increase crop production. This smart system can measure temperature and moisture in agricultural soil and is solar powered. It also



sends text messages to the farmer's mobile phone to inform him or her of the soil's moisture status, whether the soil is wet or dry.

If the soil is dry, the smart device sends a text message to the farmer so that he can take quick action. The system gives the farmer two control options: the first is "automatic" irrigation, where the device starts irrigating as soon as it detects dry soil and continues until the soil reaches saturation level, then the irrigation process automatically stops. The second option is manual irrigation, where the farmer controls whether the irrigation process is switched on or off.

The system also has a self-diagnostic function for the control unit, sending a warning message when the battery is low to ensure continuous operation without the need for human intervention. The device can also be programmed to send three text messages to three different users, either through the mobile programming unit or by sending a message directly from the device to the farmer.



Dr Diaa Al-Din Al-Qousi, Advisor to the Minister of Water Resources and Irrigation and former international water expert, said that the irrigation system in Egypt is an old system that has existed since the time of the ancient Egyptians and it needs to be modernised in line with modern mechanisms and tools.

Al-Qousi added in his statements to Al Bawaba News that the current situation is different both in general and in details. The old system has many shortcomings that become the cause of leakages, wastage and higher water losses due to filtration and aquatic plants. To reduce these losses, we need to move towards a modern irrigation system.

Al-Qousi said modern irrigation systems are divided into two types: spray irrigation and drip irrigation. The former, spray irrigation, is suitable for dense plants such as wheat, maize and beans, while drip irrigation is good for gardens, trees and vegetables.

Al-Qousi explained that the efficiency of surface irrigation is about 50%, whereas the efficiency of spray irrigation reaches 75%, and that of drip irrigation – 85%.

According to Al-Qousi, there is a big problem with the fragmentation of agricultural holdings. Egypt has 10 million agricultural feddans and 20 million owners, which includes both owners and tenants. The average land holding size in Egypt is about half a feddan, while modern irrigation systems require a greater agricultural area. It is impractical to open a canal for every quarter of a feddan. Hence, there's a new approach – agricultural pooling. The whole basin is planted with the same crop at the same time, and water quantities and costs are distributed among them. Associations of water users and consumers are now being established, with an association responsible for water supply management being created at the level of each basin. Water saved due to modern irrigation system will be used for desert land reclamation.

Dr Abbas Sharaki, Professor of Geology and Water Resources at Cairo University, spoke in an exclusive interview with Al Bawaba about the significance of the water system modernisation project in Egypt. He said the project is aimed at improving the efficiency of the country's water resources, which have been limited to 55.5 billion cubic metres of Nile water since the construction of the Aswan Dam in 1971. The project also aims to increase agricultural production to meet the needs of the growing population by applying the latest technological methods in agriculture and irrigation.

Sharaki pointed out that the project to modernise Egypt's water system faces a number of challenges under existing conditions. These include an annual population increase of 1.5 million people requiring an additional 1.5 billion cubic metres of water per year, climate change leading to higher temperatures and increased evaporation, and large-scale urbanisation with the creation of some 24 new cities. The situation is further complicated by the expansion of agricultural activities, including a project to sow 1.5 million feddans and the New Delta project to cultivate 2.2 million feddans, in addition to the previously launched national projects in Toshka, East Oweinat and the Es Salam Canal, covering approximately 1.5 million feddans. Pollution from agricultural, industrial and sanitary wastewater is increasing, requiring the construction of many treatment plants, such as the El-Mahsama, Bahr el-Baqar and, now, the New Delta station. The depreciation of the Egyptian pound is putting significant pressure on the implementation, development and maintenance of water projects. Additional challenges include fragmentation of agricultural land in the valley and delta, low incomes of Egyptian farmers and, finally, the rapid filling of the Grand Ethiopian Renaissance Dam over five years reaching a total of 60 billion cubic metres, excluding evaporation and leakage losses.

Sharaki explained that modern irrigation techniques and the use of artificial intelligence help improve water use efficiency, reduce water losses and increase productivity, thereby somewhat reducing water scarcity, which reaches about 50%. This is being overcome by repeated reuse of irrigation water and also by importing some agricultural products such as wheat and maize.



Lennin Javier Ayala Osuna

Student

National Autonomous
University of Mexico



Footprint of bitcoin mining

Since the introduction of bitcoin in 2009, a boom in cryptocurrencies was faced by the world partly due to the exponential growth in the value of bitcoin, as well as the emergence of new cryptocurrencies that, while the vast majority of them do not have the same impact as bitcoin, are still an indication relevant and standard use of this currency as investment and means of transaction.

Cryptocurrencies are becoming more popular and their turnover is growing as a large number of people have accumulated large sums of money through cryptocurrency mining. However, few people talk about the impact they have on the environment, so my aim in this paper will be to evaluate these effects and propose measures to address them.

Before I continue, it should be clarified that as I mentioned before, there are many cryptocurrencies in the world today besides Bitcoin, such as Ethereum, Binance Coin, Tether, Cardano, and many others, however, in this paper I will focus on Bitcoin because this cryptocurrency and Ethereum account for more than 60% of the market capitalization of crypto-assets. However, while Ethereum percentage of power consumption is 20 to 39% of the total consumption of crypto-assets, bitcoin percentage of consumption is 60 to 77 % (White House, 2022).

So, because of bitcoin's higher power consumption, I will only focus on this cryptocurrency. This does not mean that the others do not pollute or that they are more environmentally friendly (with some exceptions, I will address later). The fact is that bitcoin is the most popular cryptocurrency that at the same time pollutes the environment more than others.

First, I would like to consider the question of how this cryptocurrency is generated, which requires understanding what exactly bitcoin is and, more importantly, how “mining” bitcoin is performed, since it is this process that affects the environment, not the cryptocurrency itself.

Bitcoin operates through the blockchain system that consists of a decentralized database acting as a sort of public financial registry. The information generated in this database is stored on multiple computers connected to each other via the Internet and is updated online (Iberdrola, no date).

Blockchain works “by solving complex cryptographic problems to validate transactions or records” (Artiga and López, 2021). This confirmation process is based on consensus because all users of the network have access to the same information, hence everyone can confirm its validity. This system allows data to be recorded in unique blocks of information, making it easier to retrieve and confirm the same at any time (Iberdrola, no date).

The structure of the blockchain includes a bitcoin mining system called Proof of Work (POW) that works as follows: all computers mine bitcoins to see at the same time who will be the first to solve one of the possible cryptographic problems set by the Bitcoin program, and the first person who manages to record a transaction gets bitcoin as a reward, and the more people competing for bitcoin, the more difficult problems they should solve to get more bitcoins as a reward (Iberdrola, no date).

As cryptographic tasks to be solved become more complex, there comes a need for computers and special equipment that consume large amounts of power to operate competitively (Jones, Goodkind and Berrens, 2022). At the same time, only one out of thousands of possible nodes will mine bitcoin, meaning that one computer will get the reward, the rest will only waste a large amount of power (Artiga and López, 2021).

There is so much power being consumed that, for example, in 2020, approximately 75.4 TWh/year was consumed for bitcoin mining. This number does not tell us anything, but it is very impressive when you consider that the energy consumption of bitcoin mining was higher than that of entire countries such as Austria (69.9 TWh/year) or Portugal (48.4 TWh/year) over the same period (Jones, Goodkind and Berrens, 2022).

One might ask: what energy sources are used to generate so much power in bitcoin mining? While 39% of POW is produced using renewable sources, the remaining 61% is produced using non-renewable energy sources such as fossil fuels (Jones, Goodkind and Berrens, 2022).

Bitcoin is estimated to have produced 3 to 13 million cubic tons (MT) of carbon between 2016 and 2018 (Krause and Tolaymat, 2018), which is equivalent to the emissions of small countries like Uruguay (6.51 MT), Senegal (10.68 MT) or Slovenia (12.47 MT) in 2020 (World Bank, no date).

Even the use of renewable energy does not protect the environment from the harmful bitcoin, as hydroelectricity is the most used renewable energy source in

bitcoin mining, but it consumes a lot of water, so that due to the evaporation of liquid in power generation, it is estimated that 1.65 km³ of water was lost between 2020 and 2021, equivalent to 660,000 Olympic swimming pools (Chamanara, Ghaffarizadeh and Madani, 2023).

To end this essay positive, here are a number of possible measures by which cryptocurrency mining could be either prevented or, if this is not possible, the environmental impact of cryptocurrency mining could be reduced.

For example, governments of major bitcoin mining nations could take regulatory measures to discourage cryptocurrency mining, such as raising power prices for individuals or companies that are mining bitcoins, imposing taxes on cryptocurrency transactions, prohibiting mining for which non-renewable and polluting sources are used, etc. (Chamanara, Ghaffarizadeh and Madani, 2023).

Use of Proof of Stake system should also be encouraged. Broadly speaking, POS is a consensus-based system within a group of validators (who should prove that they own a certain amount of cryptocurrencies to be selected) chosen at random and responsible for validating blocks in the blockchain as well as transactions in exchange for a commission (Investopedia, 2023).

POS is a more environmentally-friendly system because blocks are validated by consensus rather than by solving a cryptographic problem as in the case of POW, eliminating the competition that causes so much useless energy to be generated. In addition, validators at POS do not need to have the large-scale energy-intensive equipment necessary to mine bitcoin, they only need to prove that they have the minimum amount of cryptocurrencies necessary to become validators (Investopedia, 2023).

So-called “green” cryptocurrencies based on the POS system already exist, so spreading this type of crypto-assets and government incentives to use them instead of POW-based cryptocurrencies could be another measure to mitigate the environmental impact of cryptocurrency mining. Examples of green cryptocurrencies include Cardano, Solarcoin, Nano, Algorand, and Bitgreen (Cryptomus, 2024).

In conclusion, utilizing existing and future information and communication technologies is not a bad thing. Nevertheless, as we can conclude from our essay, it is important that their use be regulated, since everything that happens in the digital world affects our real life in its own way and has different kinds of consequences, such as the environmental impact addressed in this article.

References:

1. Artiga, C., & López, M. (November, 2021). BITCOIN, ENERGY USE, AND CLIMATE CHANGE. Friedrich Ebert Foundation. Accessed on April 4, 2024 by <https://library.fes.de/pdf-files/bueros/fesamcentral/18740.pdf>
2. Chamanara, S., Ghaffarizadeh, S. A., & Madani, K. (September 5, 2023). The environmental

- footprint of bitcoin mining across the globe: Call for urgent action. *Earth's Future*, 11, e2023EF003871. <https://doi.org/10.1029/2023EF003871>
3. Cryptomus. (March 20, 2024) What are green cryptocurrencies: the greenest cryptocurrency of 2024. Cryptomus.com. <https://cryptomus.com/es/blog/what-are-green-cryptocurrencies-most-eco-friendly-crypto-2024>
 4. Iberdrola. (no date). What are green cryptocurrencies and why are they important? Iberdrola. <https://www.iberdrola.com/sostenibilidad/criptomonedas-ecologicas>
 5. Investopedia Team. (November 1, 2023). What Does Proof-of-Stake (PoS) Mean in Crypto? Investopedia. <https://www.investopedia.com/terms/p/proof-stake-pos.asp>
 6. Jones, B.A., Goodkind, A.L. & Berrens, R.P. (September 29, 2022) Economic estimation of Bitcoin mining's climate damages demonstrates closer resemblance to digital crude than digital gold. *Sci Rep* 12, 14512. <https://doi.org/10.1038/s41598-022-18686-8>
 7. Krause, M.J., Tolaymat, T. (November 5, 2018) Quantification of energy and carbon costs for mining cryptocurrencies. *Nat Sustain* 1, 711–718. <https://doi.org/10.1038/s41893-018-0152-7>
 8. White House. (September 8, 2022). FACT SHEET: Climate and Energy Implications of Crypto-Assets in the United States. The White House. https://www.whitehouse.gov/ostp/news-updates/2022/09/08/fact-sheet-climate-and-energy-implications-of-crypto-assets-in-the-united-states/?utm_source=link
 9. World Bank Open Data. (s. f.). World Bank Open Data. https://data.worldbank.org/indicator/EN.ATM.CO2E.KT?end=2020&name_desc=false&start=1990&view=map&year=2020



CONGO



Bosuandole Antoinette

Communication and awareness manager

Association for the Protection of the Environment and Sustainable Development (APEDD)



Investments in environment

Introduction

In the world facing increasing environmental challenges investments in environment became a priority. Global warming, depletion of natural resources, and loss of biodiversity affect all regions, but mostly the developing countries. These states, regardless of their socio-economic vulnerability, have priceless ecological wealth, namely unique tropical ecosystems that play a key role in global climate regulation.

According to the World Bank's report dated January, 2025, Sub-Saharan Africa is forecasted to grow by 4.1% in 2025 due to the milder financial conditions and reduced inflation. However, development of this region is still threatened by extreme weather conditions that increase poverty level and slow down its economic potential.

In this context, investments in environment ensure double benefit: protection of our planet and promotion of sustainable and inclusive growth. Thus, such developing countries as Sub-Saharan Africa countries may turn their local problems into global solutions.

Problematics

1. *How investments in environment may promote sustainable economic growth, especially in developing countries?*
2. *What may happen to the world economy, if environmental issues remain neglected?*

Supported hypotheses and arguments

1. Investments in environment for activation of local and global economies

- *Creation of job opportunities associated with ecology and poverty reduction*

Such areas associated with the environment as renewable energy sources, waste management, and ecosystem restoration offer vast amount of job opportunities. In the Democratic Republic of Congo (DRC) projects of sustainable tropical forest management are aimed at the protection of natural resources, improvement of food security, and reduction of carbon emissions. These initiatives create thousands of local jobs and transform ecological problems into the possibilities for social and economic development.

- *Attractiveness of international investments*

Due to ambitious environmental policy, developing countries may raise foreign capital to support innovative projects. For example, in June, 2024, DRC launched a project of sustainable forest management in Mayombe, Ubangi, and Mai-Ndombe, which demonstrates the ability of African countries to combine local development and environmental protection.

- *Use of renewable energy sources for economic stability*

Sub-Saharan Africa has exceptional potential in the area of solar, wind, and hydraulic energy. By supporting implementation of these projects, the region not only reduces its dependency on fossil fuels, but also improves resistance to global market volatility.

2. Economic and social consequences of ecological inaction

- *Connection to environment and impact of migration*

Lack of safety and environmental crises in DRC aggravated by the struggle for control over natural resources resulted in mass displacement of the population.

According to United Nations, in 2023, there were 6.8 million internally displaced persons in DRC, which is the largest amount of internally displaced persons in Africa. This forced migration often caused by natural disasters such as floods or droughts aggravates social and economic tensions in migrant reception areas.

Besides, illegal use of natural resources by armed groups in areas of high biodiversity, such as tropical forests, promotes deforestation and loss of biodiversity. This illustrates the link between environmental problems and migration crises and highlights the urgent nature of investments in sustainable solutions to stabilize society and protect ecosystems.

- *Increased frequency of natural disasters*

According to the World Bank, increased frequency of droughts and floods in Sub-Saharan Africa may result in increased poverty level and destabilize the infrastructure.

- *Social and migration instability*

Lack of water and food aggravated by ecological crises may cause mass migration and geopolitical conflicts.

- *Increased costs associated with depletion of natural resources*

Non-sustainable use of these resources will increase production costs and disrupt common supply channels.

Analysis of particular solutions for investments in environment

- *Afforestation and forest restoration*

DRC acknowledged as the main lungs of the entire world plays a key role in combating deforestation and climate change. Investments in afforestation not only protect biodiversity, but also promote global climate regulation.

- *Sustainable agriculture and waste management*

Promotion of implementation of sustainable agricultural techniques improves soil productivity and reduces environmental impact. For example, International Centre for Research in Agroforestry and Biodiversity International are working on creation of a common seed bank in Tshopo province, DRC, to guaranty sustainable access to various seeds for local farmers.

- *Proprietary technologies and the circular economy*

Such technological innovations as green buildings and electric cars offer solutions to reduce global exhausts. Besides, promotion of circular economy maximizes efficiency of resource usage and reduces waste of raw materials.

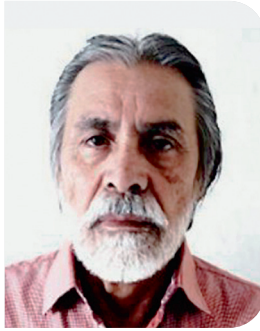
- *International cooperation and education*

Education and international cooperation are necessary to attract public attention and raise funding. In DRC, Association for Environmental Protection and Sustainable Development educates young people through literary competitions, such as LitEco. This program attracts attention of school children to afforestation and forest restoration, which are two efficient solutions for the deforestation problem.

Conclusion

Investments in environment are not a mere ecological imperative, but also an economic and social need. Developing countries that are rich in natural resources can become leaders in ecological transition, if they stick to a forward-looking policy and undertake long-term initiatives.

Otherwise, ignoring of these problems may result in deep crises that threaten food security, social stability, and global economies. Together, through coordinated efforts and significant contributions, it is possible for us to build a world, in which people and nature coexist in harmony, guaranteeing secure future for all future generations.



Cabrera Cano Cesar Augusto

Founding member

Institute of Economic, Political and Social Research for the Construction of Peace INEPS



Environment and socio-economic development in Guatemala

Introduction

The article presents the key elements for determination of the level of socio-economic development of Guatemala and how it is affected by the ecological crisis. It discusses the issues of land use, mining, and soil degradation; deforestation, water pollution, river sequestration; climate change; and vulnerability to natural phenomena. As well as possible comprehensive solutions to overcome the ecological crisis and strengthen socio-economic development of the country.

Guatemala

Guatemala, a state in Central America that is known for its ancient culture, the cradle of the Mayan civilization, is rich in natural resources and has exceptional biodiversity and ecosystems varying from tropical forests to coasts and volcanoes.

Geographical location, political and administrative division

The area of the country is 108,889 square kilometers. Political and administrative structure: 8 regions, 22 departments, and 340 municipalities.

Population

Four major peoples live in Guatemala: Mayans, Xincas, Garifunas and Mestizos, the total number of which exceeds 14,901,296 residents, of which 6,207,503 are Mayans, 19,529 – Garifunas, 264,167 – Xincas, and 8,346,120 – Mestizos, 27,647 – Creoles or people of African descent, and 36,320 foreigners. Gender composition of the population: 7,237,582 men and 7,663,314 women. The population growth rate is 2.5% (INE, 2018).

Expected survival at birth: 74.3%, average period of study is 6.6 years, per capita income is 8,494, and human capital development index is 0.663. Human capital development index is lower than in Latin American and Caribbean countries where it is 0.766.

61.6% of the population live in poverty or extreme poverty. They have no access to official jobs, public healthcare, social security, education, and housing.

Geomorphological formation of the territory

60% of surface of Guatemala is represented by mountainous relief; Sierra Madre crosses the country from the West to the East, runs parallel to Pacific Ocean, and extends to Honduras via Cerro Oscuro. Cuchumatanes mountain range extends to the North from the Chixoy, or Negro, river where it gets divided into two parts: Verapaz mountains in the East and Cuchumatanes in the West. It is one of the most volcanically active countries in the world: there are 38 volcanos here. Due to the multiple orographic folds it is subject to constant earthquakes, volcanic eruptions, and earthquakes (MARN, 2009).

Ministry of Environment and Natural Resources (MARN) divides the territory into seven regions: Pacific plains, volcanic highlands, metamorphic highlands, Northern limestone plateaus, Northern limestone lowlands, and Northern floodplains. They are divided into 14 land regions, each of which includes various land ecosystems in the country: wet, mountain, and dry forests; pine-oak forests, thorny bushes, and mangroves. This is a country with plenty of forests and well-developed forestry industry. Soils are heterogeneous due to the diversity of geological, orographic, and lithic conditions, as well as formation processes: Entisols, Mollisols, Inceptisols, Vertisols, Alfisols, Andisols, Ultisols (MARN, 2009).

Aquatic biodiversity of the country is divided into two fish habitats: Pacific and Caribbean. They consist of four ecoregions sharing 14 watershed ecological units that contain 204 riverine ecosystems and 19 stagnant or lake ecosystems (MARN, 2009).

Hydrography. Mountain systems define three hydrographic slopes: the Pacific Ocean and the Atlantic Ocean that is divided into the Caribbean Sea and the Gulf of Mexico. There are multiple rivers, lakes, and lagoons of volcanic and river origin within the territory.

Biodiversity of the country (0.07% of the planet's land area) according to the most common approaches. Terrestrial ecosystems of the country can be grouped into nine biomes (Villar, 1994), 14 Holdridge life zones, and 14 terrestrial ecoregions (Dinerstein, et al., 1995), (MARN, 2009).

Bioregionalization of the continental shelf and coast. Marine space of Guatemala is divided into two districts: the Eastern Pacific Ocean and the tropical north-western Atlantic Ocean that include marine ecoregions.

Physicochemical components correspond to the atmosphere, hydrosphere and lithosphere; biological components correspond to the biosphere, and social ones – to the sociosphere (Gallopín, 1980).

Land use

Land is the main means of production in Guatemala.

Land distribution is uneven: 98 % belong to large estates owning the most fertile lands. They belong to 2 % of the population, i. e. oligarchs and bourgeoisie. 2 % of lands are distributed between small landownerships owned by 98 % of the population: Maya, Garifuna, Xinca, and poor Ladino (Mestizos).

Large estates are concentrated in the departments of Escuintla, Retalhuleu, Suchitepéquez, Izabal, as well as in the Polochic river valley, Alta Verapaz department. These are fertile lands with high potential for usage; they can be cultivated without physical destruction of the soil¹.

Small estates are the small lots of barren land located on hills and slopes that are usually owned or possessed by middle-income and poor peasants. Their products are mainly meant for family consumption, as they are insufficient for large-scale commercial activities.

Monoculture, mining, land degradation, and biodiversity

In recent years, monoculture production has increased in large estates. Lands are intensively used for sowing, growing, and harvesting of sugar cane for production of sugar and its derivatives, as well as African palm – for production of oils and fats. Cultivation of original crops such as corn, black beans, and rice for domestic consumption, sale, and export to Central America has been destroyed in these areas, which forces import of these basic food items for majority of the country's population and weakens food security and economy of the country. Use of transgenic seeds has expanded.

1 US Department of Agriculture (USDA) and Ministry of Agriculture, Livestock, and Food.

Intensive exploitation of lands accompanied by excessive use of insecticides and pesticides and deforestation due to excessive logging operations cause degradation of soils and their biodiversity, including loss of soil fertility that cannot be recovered in less than 20 years. Deforestation of Guatemala reaches 1% a year, which is the highest rate in Latin America.

Open-pit mining

There is vast amount of minerals such as nickel, rare earths, jade, gold, tungsten, manganese, etc. within the territory of Guatemala.

The following mining companies are operating in the country: Goldcorp, a transnational company that operates via Montana gold exploration company and Marlin that mines gold in open-pit in San Marcos; Entre Mares, a mining project in Cerro Blanco, Jutiapa. Compañía Guatemalteca de Níquel, S.A – CGN, subsidiary of Solway Investment Group, is involved in mining and sale of nickel.

The Ministry of Energy and Mines approves licenses for exploration, extraction, production, and commercial use of oil, gold, nickel, jade, and other minerals. It is known that there are rare earth metals that are being mined. Contracts are very burdensome; companies retain 99% of the product, and the government retains 1% royalty.

At present, mining leads to incurable diseases, deterioration of living conditions, environmental pollution, deforestation, contamination, and drying up of rivers, lakes, and lagoons, destruction of biological diversity, as well as disappearance and loss of our natural resources, in other words, it leads to poverty and unhappiness for the majority of the country's population.

Hydrology

In Guatemala there are 38 rivers and their basins distributed between three hydrological basins: Pacific, Atlantic, and the Gulf of Mexico; 7 lakes, 49 coastal lagoons, 109 lagoons, 3 temporary lagoons, 7 water reservoirs. 14 out of 38 main rivers are severely polluted: Villalobos, Paz, Motagua, Suchiate, Naranjo, Salamá, Ican, Coyolate, María Linda rivers are contaminated with plastic, solid waste, wastewater, and industrial waste.

Hydroelectric power plants

There are several hydroelectric power plants in Guatemala: Chixoy, Renace, Jurun Marinalá, and other.

Construction and installation of the plants caused social tensions as the government failed to fulfill the condition on preliminary consultations and obtaining of preliminary free and informed consent of the population, which was also the

case for mining projects carried out on the lands of indigenous peoples and mestizos. Community lands are being expropriated. Besides, licenses are being issued without compliance with environmental and technical standards as a result of corruption activities of the ministries of environment, energy, and mining.

Electricity production with the use of river resources resulted in their embezzlement, due to which communities located downstream got deprived of vital moisture, and, in some cases, it caused severe floods. These communities are not getting electricity, as it is transferred to other regions and even abroad.

Solid waste management

Historically, there is no strategy of environmental protection in the country. There are no treatment facilities in large cities; wastewater and solid waste are dumped into rivers and turn into streams of sewage with time. Major rivers flow into lagoons, lakes, and the sea. Lakes Amatitlán and Atitlán, major tourist attractions, are contaminated with solid waste, plastic, etc. The country is lacking waste recycling culture, garbage monitoring system, garbage trucks, waste management and recycling, and landfill construction. The main dump of Guatemala “is among 50 largest dumps in the world and 13 largest dumps in Latin America, its area is 19.3 ha, and it receives 300,000 tons of domestic, commercial, industrial, and sanitary waste annually”.

It was only in early 2025 that the law on environmental protection came into force, and it was for the first time offered to separate organic, recyclable, and non-recyclable waste. There is no state policy to promote development of educational programs in the area of environmental protection, as well as the culture of solid waste recycling and utilization for the purpose of its processing and reuse.

Climate change

Poor communities, especially those residing in the inner regions of the country, are the most vulnerable to consequences of climate change. In recent years, the number of deaths and property destruction has increased due to more frequent natural disasters. Landslides, hill collapses, hurricanes, and tropical storms are on the rise; damage from the lack of rains increased, in particular, in the Dry Corridor, where the main crops got burned due to lack of water; malnutrition and hunger increased due to loss of crop. Extreme poverty that means, in particular, lack of decent housing, forces significant groups of the population to live in high-risk areas, such as river banks, hilltops, and volcano slopes, which exposes them to serious risks, including volcanic eruptions. There is no state policy in the country to prevent and mitigate consequences of such phenomena.

56.6% of the population in Guatemala live in poverty or extreme poverty; they have no access to legal jobs, public healthcare, and social security, education and housing. At the same time, approximately 15 families represent oligarchy and bourgeoisie that own major means of production.

The state is dependent on the imperial policy of North America, on oligarchy, bourgeoisie, and generals' junta using political structures in power and governments for their own interests.

Conclusion

Ecological crisis in Guatemala results from existence of the system that still combines pre-capitalist and neoliberal capitalist forms and gives preference to consumer goods production to meet business interests, which pertains both to the nascent and almost non-existent national industry and major transnational corporations continuously settling in the country without following a legal system that would provide for eco-friendly production and consumption.

The goal of such entrepreneurs is to gain enormous profits at any cost.

The society is historically divided into social classes; it is a deeply classist and racist society, in which suffering, exploitation, oppression, ethnic and cultural discrimination, and alienation become more acute day by day.

According to the worldview of the Mayan ancestors, man is in unity, in a vital union with Mother Nature. One should focus on this view and be guided by it in the management process.

However, there is no willingness to develop a state policy to promote socio-economic growth in order to meet vital human needs that would be based on development of the environment and technologies and support of national industry, energy conservation, environmental protection, clean energy, solid waste recycling, wastewater treatment, and water conservation. Goods production and consumption should be based on protection and priority of human life.

The way out of the crisis must be comprehensive, with participation of a strong state and with use of a strategy of sustainable state development. Socio-economic, ecological, and nature conservation crisis faced by the country can be overcome through implementation of the Peace Agreements – the only state program that exists in the country. Guatemala shall fit itself into the economic pole of the global South. It shall become a part of new platform for global growth based on the fundamental principles of BRICS: consensus, fairness, and openness for the sake of wellbeing of mankind.

Towards comprehensive solutions

1. To provide material conditions for life support, growth, and socio-economic development of the overwhelming majority of the population by way of estab-

lishment of an economic model that is alternative to neoliberalism in view of the local specifics.

2. To support improved ecological awareness at all levels through state educational policy.
3. To support creation of new laws on environmental protection and ecology; to strengthen and enforce existing laws.
4. Communities shall recover and ensure sustainable management of the forests, as they are the main element of terrestrial ecosystem that is the guarantee of human existence and development.
5. To support recycling and industrialization of solid waste in order to make it a source of income for the country.
6. To protect aquifers and ensure that water is suitable for human consumption.
7. International cooperation: establishment of allied and twinning liaisons between countries in order to ensure financing of programs, plans, and projects in the area of clean, renewable, and sustainable energy.



PERU



Chilon Rojas Cesar Erasmo

Coordinator of the social and human development management

Provincial Municipality of Cajamarca



Peru in the 21st century: crisis and opportunity. Case study of the Cajamarca region

This brief essay analyzes the reasons why 204 years after the Peruvian independence and 32 years after the implementation of the neoliberal policies of Western capitalism our country has still not achieved the expected development in economic, technological, academic, social, and cultural terms that was predicted for peripheral countries under the Western model based on liberal democracy after the Cold War.

Peru in figures

It is enough to consider some data on Peru as a whole, as well as macroeconomic level data, analyzed from the perspective of the present situation of a country suffering from poverty in order to better understand the failure of the neoliberal model and the economic policies of liberal capitalism. The Peruvian Ministry of Economy and Finance reports that by December 2024, Peru's economy has experienced accelerated growth over the past eight months, with a 3.9% growth rate in June of the same year – the highest rate in three years. However, this macroeconomic growth has not resulted in poverty reduction, increased access to a food

basket, increased official employment, and bridging the infrastructure gaps in water supply, which, in my point of view, constitute the foundation for social, economic, and human development. Let me further provide some figures demonstrating the failure of the economic system. In 2024, according to the National Institute of Statistics and Information (INEI), the population of Peru is 34,039,000 people, including 16,876,000 men (49.6%) and 17,163,000 women (50.4%). According to the Peruvian Institute of Economics, 9.8 million Peruvians are in poverty, which is a one-third of the entire population. According to the National Youth Secretariat of the Ministry of Education, the total number of young people aged 15 to 29 in 2023 was 7,875,000 (i.e. a quarter of the national population). However, only 30.9% of them have access to higher education, which is equivalent to 2,362,000 people. Meanwhile, 25% of university students are in poverty, which means that more than half a million future professionals, politicians, and civil servants live in poverty, studying in universities with outdated laboratories and without access to advanced technologies. **I believe this indicator is important because young people are the human capital, as well as the labor and political reserve of the country.** According to the Peruvian Research Institute, in 2023, 9,780,000 Peruvians were in monetary poverty, which means that 29% of the population had income insufficient to cover the minimum consumption basket. Meanwhile, 1,922,000 people earn less than 251 sols per month (less than 8 sols per day), which means they live in extreme poverty. Comparatively, the cost of a lunch in Peru is 7 sols. In 2022, according to the National Institute of Statistics and Information, 58.8% of employed Peruvians worked in the informal sector, without social protection, labor contract or stable employment. **Only 26% of the population had an official job, registered in accordance with labor law, social insurance, benefits, and labor rights.** In terms of gross value of production, the informal sector of the Peruvian economy accounts for 28% of national monetary value. According to Alexandra Ames Brachowicz, head of the Policy and Governance Observatory at the University of the Pacific School of Public Administration, in the article published in 2022 in "Evidencias" magazine, states as follows: *"...the informal agricultural sector provides 23.3% of employment at the national level; these jobs are, of course, also informal. In addition, it should be noted that the agricultural sector consumes the largest share of the labor force in the country's economy, i.e. 27.5% of the total quantity..."* In other words, only 4.2% of agricultural activity in Peru is official, which is a contradiction of the neoliberal economic system, since Peru is a predominantly agrarian country in a historical, cultural, and economic context. According to the INEI, the economically active population employed in the agricultural sector at the regional level is concentrated in Cajamarca, Puno, and Cuzco (26.6% of the total number), while Moquegua, Madre de Dios, and Tumbes represent the lowest proportion – 1.4% of the total number. It should also be taken into account that 54% of all agricultural units are concentrated in the highlands, 31% – in the forest area, and 14% of the country's total number – on the coast. According to data

published on the official website of the regional government of Cajamarca, 64% of the population lives in rural areas and is engaged in agriculture, which amounts to 900,000 residents of the region. According to the National Institute of Statistics and Information, the provinces with the highest percentage of rural population are San Miguel (90.4%), Santa Cruz (86.1%), and San Pablo (83.5%). Cajamarca covers an area of 32,000 km². Agriculture in the region is largely self-sustaining and does not use rain-fed irrigation technologies, i.e. rainwater dependent. In this regard, Cajamarca engineer Andrés Castro, in a recent 2024 publication for the Cajamarca Regional Information Network, notes, *“The deficit in water infrastructure is very significant, we do not have rainwater retention tanks. These are political decisions that require the involvement of the three levels of government, as well as the private sector and local communities. We will have more capacity to do a number of things if these things are done”*. In this sense, we note that the lack of water infrastructure does not enable the development of the agricultural sector, and thus the elimination of food security gaps.

Access to water: key factor in human development

- Poor access to high-quality water is a serious obstacle to the development of human capital. In Peru, this problem is still unresolved, despite the existence of government programs to reduce the gap in access to this basic and vital service that ensures the health of the national population. This is a public policy set out in article No. 7 of the Political Constitution: *“Everyone has the right to healthcare” (access to quality water guarantees health protection)*.
- Inadequate access to water adversely affects the development of the human abilities of the population and directly affects health, education, and the environment. The National Superintendency of Sanitation Services (SUNASS) reports that 10% of the Peruvian population does not have access to drinking water, which is more than 3 million 400 thousand people. Furthermore, 23% of the country’s population, which is more than 6 million Peruvians, do not have access to sewerage networks.
- According to the National Superintendency of Sanitation Services, diarrhea cases are reduced by 10% in homes connected to a water supply, and the rate is reduced by up to 20% when sanitation facilities are available.
- According to the Latin American Journal of Social Sciences and Humanities (LATAM) from the Latin American Researchers Network, issue No. 5 dated March 2024 titled “Social and Environmental Impact of Sanitary Sewerage Systems” confirms that access to potable water reduces chronic childhood malnutrition by 13% by preventing acute intestinal infections. Furthermore, a 10% increase in water supply coverage reduces the anemia rate in the community by 7.9%. The situation of water access remains unfavorable in the Cajamarca region. According to the data from the Peruvian Institute of Economics,

between 2022 and 2024, water and sanitation coverage increased from 27.8% to 45.5% among 1,468,000 citizens. This means that more than a half of the population of the Cajamarca region does not have access to water and sewerage, which makes the region the most disadvantaged in northern Peru in terms of the provision of this vital service. Analysis of the situation in rural areas of the Cajamarca region shows that, according to official data from the National Institute of Statistics and Information, only 22.5% of rural households have access to water supply. Taking into account that 60% of the region's population lives in rural areas, this means that approximately 352,320 (three hundred and fifty-two thousand three hundred and twenty) residents of the Cajamarca region have no access to either water or sewerage.

Conclusion. International arena. Opportunities for Peru

The twenty-first century increasingly brings us into a post-Western world where neoliberal hegemony and the increasingly obsolete Westphalian nation-state have already played their part in history, and the predatory interests of the Davos Forum techno-plutocracy and Anglo-Saxon capitalist hegemony are moving to the end. Meanwhile, after the dark night of savage capitalism, which considered South America and certainly Peru as its backyard, the light of a new century is now being predicted from the Cajamarca region in the new international relations of the BRICS countries, which at their last meeting in 2024 at the Kazan Forum denounced the illegal application of discriminatory economic sanctions, required to transform the international financial system, reorganize the World Trade Organization in order to better represent the interests of developing countries such as Peru. It is crucial for Peru to launch the opening of academic, political, and governance spaces where we will discuss commercial opportunities with (Eurasian) countries such as the Russian Federation and Asian countries such as the People's Republic of China, which are at the forefront of technological innovation and economic, scientific, and human development. In this regard, we highlight the words of the General Secretary of the United Nations at the Sixteenth BRICS Forum in Kazan, Russia, in October 2024. He called for the acceleration of the international financial architecture reform, emphasizing the same point reflected in the Kazan statement that the current financial system does not provide many vulnerable countries (such as Peru) with the necessary safety net and level of support we need, stressing the need for a transformation that reflects the economic realities for the most vulnerable in the 21st century. We also emphasize the opportunity provided by the BRICS area to strengthen development cooperation by seeking international cooperation to address the gaps highlighted in this paper. We are confident that the area, represented by me today (Cajamarca Province Municipality, the local government body of our country's government), is bringing my region, Cajamarca, closer to the new global economic dynamics of the 21st century, which, based on

the ideas of a multipolar world, reflect a collective vision of a fairer world within the framework of a new cultural paradigm. For us, people from the Cajamarca region, it is also important to seek technology transfer to our institution of higher education, the National University of Cajamarca, as well as student mobility with universities of this new paradigm of human development, which will strengthen the human capital of those 30 % of Peruvian young people who are the academic, intellectual, and labor reserve of our country. In terms of trade, Peru has a lot to offer this new world. Under the appropriate technological conditions, we could engage more than 500,000 hectares just in Cajamarca, which are currently not used for agriculture production due to the lack of water infrastructure and technology in the agricultural sector. This paper is just a sketch of the opportunities in the technological, academic, political, and administrative spheres that we are considering in line with the new paradigm of the BRICS countries. In this sense, our search for international co-operation for development is carried out from the positions I am currently engaged in. I am Coordinator of the Social and Human Development Department of the Cajamarca Province Municipality, Chairman of the International Cooperation and Foreign Trade Committee of the Cajamarca Chamber of Commerce, and Director of the Centre for Research for Development “Social Strategy” of the National University of Cajamarca. We are always eager to establish international relations with states in the new paradigm of a multipolar world and seek international co-operation for development.



Chuprov Vladimir

Executive Director

The Earth Concerns Everyone
project of the Nature
Protection Association



Introducing rooftop photovoltaic technology as a precondition for creating a comfortable environment under climate change conditions

Rooftop solar power plants are a technology that has proven its effectiveness in many countries all over the globe. Solar energy is an extremely promising avenue for achieving low-carbon strategy goals, and investments in rooftop photovoltaics help both energy systems and the urban environment in general to adapt to heat waves

Keywords: Rooftop solar power plants, energy system adaptation, heat waves

Climate change is a challenge for all of humanity, regardless of geographical location or level of infrastructure. Energy supply systems in large cities are no exception as they are becoming more and more vulnerable to heat waves. During such

heat waves, electricity consumption for air conditioning and ventilation increases dramatically¹.

But there are also other factors that put additional pressure on power systems. Thermal power plants play the leading role in electricity generation worldwide. Heat waves lead to a decrease in the efficiency factor and hence to a decrease in the specific power generation. In addition, high temperatures tend to increase electricity losses in grids due to higher resistance.

In this situation, technologies based on harnessing the increasing solar energy potential, namely rooftop and facade solar power plants, may be a possible solution to the problem of increasingly prolonged heat waves.

In addition to reducing the load on the energy system, the panels placed on roofs and facades of buildings protect the rooms under the roofs from overheating, which reduces energy costs for air conditioning. Solar panels contribute to cooling through the following factors²:

1. energy conversion: the panels absorb about 20 % of the solar energy reaching their surface, converting it into electricity;
2. reflection: solar panels reflect part of the incoming energy;
3. heat absorption: solar panels can heat up quite strongly and then dissipate the energy into space;
4. convection: the solar panels are mounted in such a way that a certain distance is left between them and the surface. This gap favours the creation of an air flow that dissipates the heat from the roof surface.

An instrumental study using thermal imaging cameras in the city of San Diego (in the United States) found that the air temperature under a roof covered with solar panels can be lower than the air temperature under a sunlit roof: the air conditioning demand of a building equipped with solar panels was 38 % lower compared to buildings with an 'open' roof³. Modelling of a solar panel installation in Paris has also shown that these panels, by shading roofs, reduce energy consumption for air conditioning by 12 %⁴.

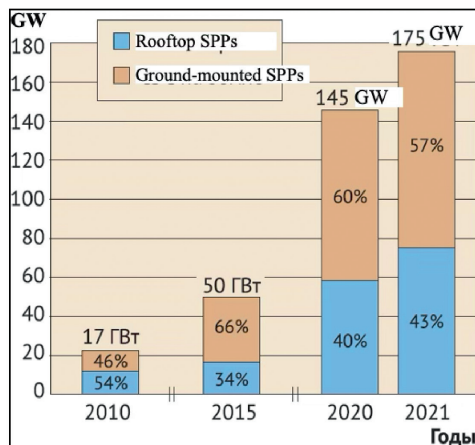
1 Power consumption in the UES of Russia breaks records due to hot weather [Electronic resource]. – 2021. – URL: <https://www.so-ups.ru/news/press-release/press-release-view/news/16336/> (accessed on 30 April 2023).

2 Do solar panels keep your roof and attic cooler? // The Solar Nerd: интернет-портал. URL: <https://www.thesolarnerd.com/blog/dosolar-panels-cool-your-roof/>. Дата публикации: 17.09.2021 (accessed on 3 May 2023).

3 Dominguez A., Kleissl J., Luvall J. C. Effects of solar photovoltaic panels on roof heat transfer / Solar Energy Journal. University of South Florida, USA, 2011. P. 2244–2255. URL: <https://www.sciencedirect.com/science/article/abs/pii/S0038092X11002131>. The publication date: 06.07.2011 (accessed on 3 May 2023).

4 Solar panels reduce both global warming and urban heat island / V. Masson, M. Bonhomme, J.-L. Salagnac [и др.] // Frontiers: online version. URL: <https://www.frontiersin.org/articles/10.3389/fenvs.2014.00014/full>. The publication date: 04.06.2014 (accessed on 3 May 2023).

Rooftop photovoltaics is a mature technology. According to the International Energy Agency, more than 60GW of solar rooftop power plants, or more than 40% of the total installed solar generation capacity, were commissioned globally in 2021 alone⁵. (See picture below.)



Newly commissioned installed solar generation capacity worldwide, by rooftop PV and conventional solar power plants.

At the country level, there are also examples showing the deployment of this technology. In Berlin, more than 160MW of rooftop SPPs were installed as of 2022. Legislative initiatives to make it mandatory for new homes to be equipped with rooftop SPPs have been taken in the European Union and Japan. A plan to equip 100% of municipal buildings with rooftop SPPs was adopted in Riga. Uzbekistan has adopted a Green House programme to encourage the installation of SPPs of up to 50kW in private households.

The installed capacity of rooftop solar power plants in China is about 150 GW, or one-third of the total installed capacity of solar power plants (as of 2022).

Plans to install rooftop SPPs en masse have also been considered in Russia. For example, in 2018, the Energy Ministry’s experts came up with an idea to launch the programme “One million solar rooftops” in Russia⁶. At that point, the potential for the total installed peak power of rooftop power plants was estimated at 3.5GW.

5 Evolution of annual solar PV installations and share by segmentation, 2000–2021 // URL: <https://www.iea.org/data-and-statistics/charts/evolution-of-annual-solar-pv-installations-and-share-by-segmentation-2000-2021> The publication date: 01.09.2022 (accessed on 15 February 2024).

6 The “One million solar rooftops” program is likely to be launched in Russia // RIA Novosti: online version. URL: <https://ria.ru/20180321/1516916168.html>. The publication date: 21.03.2018 (accessed on: 01.05.2023).

Conclusion

The use of rooftop and facade SPPs can be an effective complement to traditional solutions related to redundancy and manoeuvring of generating capacity during heat waves. The en masse introduction of small-scale solar energy technology will not only improve the reliability of electricity supply in summer, but also make a significant contribution to the creation of a comfortable environment in urbanised areas in the context of a changing climate.



Dorina Mariya

Student

Russian Presidential Academy
of National Economy and
Public Administration



Use of technologies to develop smart cities

Introduction

Recent decades have seen rapid development of technologies that are applied in various spheres of human activity. Urbanization is increasing rapidly: according to UN estimates, by 2050, more than 68% of the world's population will live in cities. It is necessary that cities are able to cope with the consequences of natural disasters, protect and preserve human lives, as well as limit the damage and destruction.¹ One of the interesting modern trends is creation and development of smart cities that use advanced technologies to improve quality of life of their residents. IBM defines smart city via three key qualities – equipped, connected, and intelligent. Smart cities are not a mere combination of high-tech infrastructure and digital solutions; it is entire ecosystem that strives to optimize resource usage and improve safety and environmental situation. In Russia, there is also growing interest in development of smart cities, vast experience was accumulated in Moscow, Saint Petersburg, Kazan, and Skolkovo that are the leaders in smart system development. Clear understanding of goals and expected results, including assessment of implementation efficiency, is an important aspect of the concept implementation.

1 Majority of the world's cities highly exposed to disasters, UN DESA warns on World Cities Day / [Electronic resource] // United Nations. Department of Economic and Social Affairs : [website].

Technological infrastructure as the basis of a smart city

The concept of smart city is based on powerful technological infrastructure. A system of sensors around the city collects data on various aspects of the city life: traffic, environment condition, energy consumption, and even crime rate. Smart CCTV systems help to reduce crime rate in Seoul. Internet of things (IoT) technology enables collection and analysis of data from various urban systems such as transport, energy, and waste management. This data is then processed with the use of analytical algorithms, which allows city authorities to make informed decisions. Many IoT devices use edge computing, which guarantees that only the most relevant and important data is delivered by communication network. Big Data analytics is used to analyze huge amounts of data collected by IoT sensors for work and subsequent optimization of urban systems. It is applicable to such services as preventive maintenance of urban infrastructure, energy consumption optimization, and emergency management. For example, traffic management systems can adapt to current conditions, thus, reducing congestion and improving overall quality of travel, as can be seen in Singapore.

Sustainable development and ecology

In addition to everyday life optimization, technologies play the key role in achievement of sustainable development goals. Smart cities are actively implementing solutions to reduce carbon footprint and improve energy efficiency. Wind and solar power plants integrated in the city grid enable usage of renewable energy sources while smart energy metering systems help residents and business to reduce consumption. AI is used to forecast and automate processes. In Amsterdam, AI helps manage energy grids, which promotes more efficient use of renewable energy sources.² Such integration of technologies makes the latter more accessible and archaic in the context of climate change combating. In Stockholm, smart heating and cooling networks help to reduce CO₂ emissions by 25%.

Social aspects of smart cities

However, one should not consider technologies as the sole focus of a smart city. Human factor is of great importance. Success of a smart city largely depends on the extent, to which residents participate in its development. Platforms for feedback and citizen participation in decision making become important tools. This could include surveys and special smartphone apps, using which citizens can report problems and suggest ideas.

2 Smart Energy Management: A Report on Amsterdam's Energy Efficiency Programs. / [Electronic resource] // Amsterdam Smart City : [website].

Besides, one should pay attention to availability of technologies for all segments of the population. A smart city shall be inclusive and allow each resident to use its benefits regardless of their age, social status, and income level. This requires thorough consideration of public space design and accessible transport solutions. Such an approach makes urban management more transparent and responsive. This promotes formation of active civil society, where residents become not only consumers, but also producers of services.

Challenges on the way towards smart cities

Regardless of comprehensive benefits, implementation of smart city projects also face significant challenges. In the era of digitalization, issues of data security, privacy, and cyber threats are becoming acute. The need to create reliable information protection systems and legislative norms regulating the use of data becomes a priority task for public and private entities. Development of smart cities requires significant investments in infrastructure and technologies. Also organizational barriers and lack of coordination largely hinder implementation of the smart city development concept.³

Thus, the use of technologies for smart city development is a multi-dimensional process that involves both innovative solutions and social changes. Smart cities shall become not only the place of technologies' integration, but also a living example of how technologies can improve quality of life, as well as create sustainable ecology and ensure active participation of citizens. However, it is important to remember that each technology requires careful implementation and consideration of local conditions. To ensure successful implementation of the smart city concept one shall take into account multiple challenges. Smart cities are not only an opportunity to improve municipal governance efficiency, but also a chance to create more comfortable, safe, and sustainable urban environment. In the end, successful development of smart cities will be based on a harmonious combination of technology, ecology, and human aspect, which will help to create better future.

Bibliography and resources

1. Majority of the world's cities highly exposed to disasters, UN DESA warns on World Cities Day / [Electronic resource] // United Nations. Department of Economic and Social Affairs: [website]. – URL: <https://www.un.org/development/desa/en/news/population/world-cities-day-2018.html> (date of access: 14.03.2025).
2. Smart Energy Management: A Report on Amsterdam's Energy Efficiency Programs. / [Electronic resource] // Amsterdam Smart City: [website]. – URL: <https://>

3 A. N. Khatskelevich, L. S. Ezhova. Prospects of "smart city" creation in Russia: systematization of problems and possible solutions / A. N. Khatskelevich, L. S. Ezhova – Series: Economics. – Perm: Bulletin of PSU, 2018 – P. 75-89

- amsterdamsmartcity.com/updates/project?page=2 (date of access: 14.03.2025).
3. Kumar, P., Choudhary, A., & Kaur, R. Smart Waste Management System: A Survey / Kumar, P., Choudhary, A., & Kaur, R. // International Journal of Computer Applications. – 2018. – № 14. – P. 29-32.
 4. A. O. Veselova, A. N. Khatskelevich, L. S. Ezhova. Prospects of “smart city” creation in Russia: systematization of problems and possible solution / A. O. Veselova, A. N. Khatskelevich, L. S. Ezhova – Series: Conomics. – Perm: Bulletin of PSU, 2018 – P. 75-89
 5. M. V. Argunova. “Smart” city model as manifestation of the new technological order/ M. V. Argunova // Science and school. - 2016. - No. 3. - P. 14-23



Fokin Dmitry

CEO

Midori
Network



Large-scale technological projects of a new generation: environmental care, green economy, blue economy, circular economy, terraforming ...

The context and proposed concept

- Environmental problems such as ice melting, species extinction and a myriad of other problems are avalanching and catalysing one another.
- The world produces 400 million tonnes of plastic, of which only 10% is recyclable, and by 2050 plastic production will rise to one billion tonnes per year, aggravating environmental pollution.
- Europe has set a goal to reach a zero hydrocarbon balance by 2050.
- Biden allocates USD 2 trillion for new energy in 2020.
- In 2025, Trump cancels US participation in the Paris Agreement.
- China is actively moving towards alternative energy and environmental friendliness, recently amending its national constitution to include the concept of 'ecological civilisation'.
- Russia lags behind these trends and may suffer as an outdated hydrocarbon-dependent economy.

- Despite the ongoing debate on environmental issues, the general trend is that those countries that lag behind in this area will pay ever-increasing fines for their irresponsible attitude to the environment and will not be able to get away with declarative statements and demonstrative actions.
- Therefore, the only sensible way forward is to set up a long-term sustainable development strategy and see it not as a costly burden but as an opportunity for growth on a colossal scale.
- Naturally, this entails quite a few many political, economic, social, scientific and technical challenges.
- However, it is no secret that challenges are also an opportunity for innovation, outstanding solutions and technological breakthroughs.
- The environmental dimension offers great opportunities to improve the quality of life of citizens, initiate a new social agenda uniting all segments of the population, give impetus to science and innovation, create new jobs and even industries, tap into the country's dormant resources and strategic advantages, diversify the economy and boost export potential.

Russia can lead this agenda, which is extremely relevant for the global community, thanks to its unique competences

- Long-term thinking: the state has the ability to consider and implement projects over such long-term horizon that no businesses, no matter how big, can afford.
- Availability of the institute of national projects as such
- Huge production capacities and partnerships with different countries, industries and academia
- Ability to manage large-scale projects and integrate different manufacturers into a single chain to achieve common results
- Technology and innovation potential: high-skilled staff, established system, research base, supporting network of research institutes
- Higher reputation and growing influence in the world
- Financial, material and production resources of state-owned enterprises and banks

What is to be noted when you pick the most promising areas

- Understand global trends and estimate the outlook for environmental issues for a period of 50+ years
- Understand Russia's unique competitive advantages in this area
- Engage with the international community to identify unique Russian projects that have an impact on the global environment to be implemented with financial support from international partners

- Focus on projects that will gather broad support nationwide

Estimation of the economic effect

- Strategic long-term projects cannot always be accurately digitised because they can have a snowball effect, creating a plethora of additional opportunities along the way.
- Yet, even the rough estimate shows that implementing such an environmental programme will generate hundreds of billions of dollars, including external investment.
- Some examples are listed in the table below, which is by no means exhaustive and should be complemented through broad involvement of the public, scientific and business communities as well as international partners

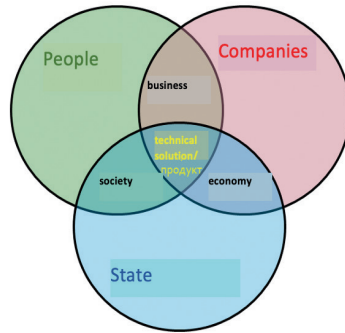
	Implementation time horizon	Budget	Global environmental impact	International interest	Scientific and technical component
Siberia's infrastructure	19-20 years	Very high (trillions of dollars)	Medium	Medium	High
Energy saving	10 years	High (tens of billions of dollars)	Low	Low	Medium
Coast: wind and water generation	5-15 years	High (tens of billions of dollars)	Medium	Medium	High
Hyperloop to China	10 years	Medium (billions of dollars)	Low	Medium	High
Forest planting	5-30 years	Medium (billions of dollars)	Very high	High	Low
Permafrost methane	5-10 years	Medium (billions of dollars)	Very high	Very high	Very high
Arctic sea ice in the lowlands of Siberia	5-20 years	Medium (billions of dollars)	Very high	High	Very high
Turnkey waste recycling plants	3-5 years	Medium (billions of dollars)	High	Medium	Medium

Coast: wind and water generation

Success factors

- Elements that are necessary to achieve the project's goal:
- Public demand for environmentally friendly products, lifestyle
- Local government problems related to environmental issues (water, rubbish, etc.)

- Emergence of new technologies
- The need for the Russian economy to be innovation-oriented
- Demand in Russia for export diversification
- Untapped potential of many businesses in Russia (excellent engineers, huge production capacities)



New projects and their impact: who, what and how

- Ordinary people: they need better quality of life, healthy environment, better health, positive image (mainstream) and more responsible lifestyle (self-fulfillment). Citizens support the projects and demand for new technological solutions and products.
- Business needs to ensure demand for its products and to leverage its production capacities. Business provides the production base for new technologies and products, and (partially) finances initiatives and projects.
- Local authorities: need public approval, regional and federal approval and funding, infrastructure and environmental improvements for their citizens, they provide a local regulatory framework, demand for (certain) products, ensure a functioning structure / framework for the success of projects and possibly some funding or other resources (land, buildings, etc.).
- Federal government: needs economic growth, international recognition, new sources of exports. It provides the legal framework, demand for (certain) technologies and products at the federal level, advertising (broad information campaign), possibly funding and other resources.

Conclusion

The world in general, and Russia in particular, is facing on the one hand a colossal and exponentially growing problem related to the collapse of ecological systems, and on the other hand an opportunity to create new industries, innovative products and sustainable solutions that will be in high demand. Russia, due to

many factors, including its size and geographical location, has a unique opportunity to become a global leader in the environmental agenda. This will lead to the development of innovation and technology, stimulate new industries, and harness the creative and intellectual potential of citizens. Such a programme will not only have a tremendous economic effect, but will promote Russia's position as a participant in international processes, while also sending a positive and inspirational message to the country's population in general and the youth in particular.



**Gaitan Castro
Jeanpierry Felipe**

Member

Common Force – Alternative
Democratic Pole



**Lozano Reina Sofia
de los Angeles**

Member

Common Force – Alternative
Democratic Pole



Vargas Soraca Nestor Ivan

Member

Common Force – Alternative
Democratic Pole



Sustainable energy communities as the cornerstone for social and economic development in regional livelihood systems in Colombia and Latin America

Topic:

Creating a comfortable environment subject to climate change

The 16th BRICS Summit, held in Kazan, Russia, in October 2024, emphasised the importance of environmental protection and promoting equitable and sustainable energy transitions. Through 12 key points, initiatives such as establishing the Contact Group on Climate Change and Sustainable Development, considering national circumstances in energy transitions (particularly for countries reliant on fossil fuels), and balancing energy security with commitments under the Paris Agreement were underscored. Additionally, support for the United Nations Framework Convention on Climate Change (UNFCCC) was reaffirmed, along with the importance of biodiversity conservation through the implementation of the Kunming-Montreal Global Biodiversity Framework (BRICS, 2024).

In this context, Multilateral Development Banks (MDBs) have supported initiatives such as the Just Energy Transition Partnerships (JETP), which focus on decarbonising economies in countries such as Indonesia, South Africa, and Vietnam. These platforms aim to mobilise substantial resources to foster low-carbon and resilient economies, emphasising equity and inclusion (MDB Climate Action Group, 2024). In light of global challenges, just energy transitions are increasingly seen as an urgent strategy for achieving sustainability goals. In this sense, projects such as energy communities in Colombia exemplify promising alternatives for planned territorial development, particularly in developing countries. These initiatives enhance community capacities and strengthen collective production chains, contributing to more comfortable, sustainable, and resilient living environments.

Furthermore, the Conference of the Parties to the United Nations Convention on Biological Diversity (CBD COP16), held in Cali, Colombia, under the theme “Peace with Nature,” marked a significant milestone in the global conservation agenda. The conference outlined a roadmap aimed at reducing biodiversity threats, enhancing ecosystem resilience, and promoting equitable access to

energy resources. Consequently, over 40 countries presented their revised and updated National Biodiversity Strategies and Action Plans (NBSAPs) (Convention on Biological Diversity, 2024). Colombia was notable for its Action Plan 2024-2030, which aligns with the National Development Plan 2022-2026: “Colombia: World Power of Life.” The plan focuses on land-use planning centred around water resources and prioritises three strategic axes: 1. Conservation and sustainable use of biodiversity; 2. Just energy transition; and 3. Carbon neutrality (Colombian Ministry of Environment and Sustainable Development, 2024).

These strategic axes aim to redefine production methods and territorial planning, ensuring active involvement from local communities. Within this framework, the implementation of Sustainable Energy Communities is proposed as an innovative model. The model fosters community ownership of territories through sustainable practices and technologies, promoting comfortable, safe, and sustainable living environments. This essay is organised into three chapters: 1) Conceptualisation and development of energy communities in Colombia; 2) Proposal for scaling up these communities across the country; and 3) Successful implementation experience. The conclusion emphasises that the widespread adoption of these communities will not only enhance local living conditions but also contribute to achieving global biodiversity conservation and energy transition objectives, setting a precedent for Latin America.

I. Energetic Communities in Colombia: the Axis of the Development of Regional Livelihood Systems

Energy communities, as defined by Decree 2236 of 2023, are associations of individuals or legal entities that cooperate in the generation, marketing, and efficient use of energy. Their primary objectives include decentralising the energy system, expanding access to energy in vulnerable regions, and fostering collective self-generation using renewable energy sources.

In the context of a just energy transition, these communities not only promote the use of clean energy but also ensure the inclusion of vulnerable populations, fostering equitable distribution of benefits. Additionally, they support Colombia’s commitment to reducing greenhouse gas emissions by 51% by 2030 and achieving carbon neutrality by 2050, aligning with global climate goals. As one of the world’s most climate-vulnerable countries, ranked sixth among upper-middle-income nations, Colombia faces significant challenges. The energy transition is vital for bridging social gaps and improving electricity access, particularly in rural and non-interconnected zones (ZNI). While the National Interconnected System (SIN) covers 47% of the territory and serves 96% of the population, ZNI regions account for 53% of the country and depend heavily on costly and polluting diesel plants. This underscores the urgent need for renewable energy solutions in these areas.

Currently, half of global greenhouse gas emissions originate from fossil fuel sources. In Colombia, the energy mix remains heavily reliant on hydrocarbons and coal, necessitating a gradual shift towards renewable energy sources. Diversifying the energy sector would not only decrease dependence on fossil fuels but also enhance the quality of life in ZNIs. This can be achieved by promoting region-specific technologies, such as solar systems along the Caribbean coast, bioenergy in agricultural regions, and small hydroelectric plants in the Pacific.

Therefore, a just energy transition is not merely an environmental imperative; it also presents an opportunity to bolster the country's economic and social resilience, ensuring sustainable and equitable development for future generations.

II. Methodology for Implementing Widespread Sustainable Energy Communities Across Latin America

Latin America faces significant challenges related to environmental sustainability and access to basic resources, particularly in rural areas. Despite their rich natural resources and cultural diversity, these regions often suffer from inadequate infrastructure and technology for efficient resource management. In this context, **Sustainable Energy Communities** emerge as an innovative solution. They integrate energy transition with circular economy practices, fostering local development and resilience in the face of the climate crisis.

The goal is to empower the farming community through a participatory approach, equipping them with tools that facilitate the adoption of knowledge and sustainable practices. Key objectives include optimising water usage, managing organic waste effectively, implementing renewable energy solutions, and promoting ecological restoration. These efforts are embedded in a continuous process of education and training.

The shared characteristics of rural territories in Latin America enable this project to serve as a replicable model for other communities with similar features. By integrating technology, education, and community participation, it is anticipated that the project will not only enhance the living conditions of residents but also contribute to mitigating climate change and preserving local ecosystems.

General Objective: To equip farming communities with tools that facilitate the acquisition of knowledge about energy transition practices and circular economy principles.

Specific Objectives:

1. Design and install a rainwater storage system in rural villages or communities to promote water recirculation in local agricultural production.
2. Design and install a system of four biodigester bales in community green areas to foster a culture of optimising and utilising organic waste in food production.

3. Install two solar photovoltaic lights in areas identified by the community as lacking adequate lighting.
4. Conduct three workshops focused on applying knowledge related to energy transition and circular economy.
5. Organise a one-day event for planting and ecological restoration in watershed environments.

The number of systems to be implemented will depend on the allocated budget and the specific needs of the territories and communities involved.

Methodology

The project will be implemented through five primary phases, each aligned with the specific objectives outlined. Each phase will include specific activities, community participation, and technical monitoring to ensure effectiveness.

Phase 1: Design and implementation of a rainwater storage system

1. **Participatory diagnosis:** Host a community workshop to identify needs and strategic locations for rainwater harvesting.
2. **Technical design:** Create a design tailored to the village's topographical and climatic conditions, utilising local and sustainable materials.
3. **Implementation:** Construct the storage system with active community involvement, ensuring its proper installation and operation.
4. **Training:** Provide a practical workshop on maintaining and efficiently using the system.

Phase 2: Implementation of biodigester bales for organic waste

1. Site selection: Identify four community green areas for installing biodigester bales, coordinating with the Junta de Acción Comunal or their equivalent.
2. Construction of biodigester bales: Train the community in constructing and managing biodigester bales using local organic waste.
3. Monitoring: Set up a monitoring system to assess the efficiency of the bales in producing compost.

Phase 3: Installation of solar photovoltaic lights

1. **Identification of critical areas:** Conduct a participatory mapping exercise to identify two areas with inadequate lighting.
2. **Installation:** Install the solar lights, ensuring they are properly functioning and connected.
3. **Training:** Offer a workshop on basic maintenance of the lights and the benefits of using solar energy.

Phase 4: Energy transition and circular economy workshops

1. **Content design:** Develop educational materials tailored to the local context,

emphasising energy transition and circular economy practices.

2. **Workshop implementation:** Conduct three practical and participatory workshops, covering topics such as efficient resource use, waste management, and renewable energy.
3. **Evaluation:** Use surveys and group dynamics to assess the impact of the workshops on the community.

Phase 5: Planting and ecological restoration day

1. **Planning:** Collaborate with the community and the Acueducto Veredal to identify priority areas for planting and restoration.
2. **Execution:** Organise a participatory planting day for native species, focusing on protecting water basins.
3. **Follow-up:** Develop a monitoring plan to assess the growth of the planted species and their impact on ecological restoration.

Cross-cutting approach: Community participation and sustainability

- **Inclusion:** Ensure active participation from all community sectors, including women, youth, and older adults.
- **Sustainability:** Foster community ownership of the project to ensure its long-term continuity.
- **Documentation:** Document each project phase to create a replicable model for other rural communities in Latin America.

III. First Sustainable Energy Community in Colombia: Vereda la Requilina, Localidad de Usme, Bogotá D.C., Colombia

Sustainable Energy Communities in rural areas represent an innovative model that combines energy reuse with the management of essential resources such as water, food, and energy. This approach fosters sustainable and resilient development by leveraging local capabilities and reinforcing community bonds. A notable example is the pilot project in Vereda La Requilina (Usme, Colombia), initiated by the Nodo Ambiental y Acción Climática de la Red Colombiana de Líderes Juveniles (RedKolumbien), in collaboration with the Junta de Acción Comunal and the Acueducto Veredal.

The project was grounded in the circular economy, focusing on waste management and resource utilisation, and consisted of two main components: educational and practical. It incorporated eight cross-cutting themes, including energy justice, social inclusion, poverty reduction, and local economic empowerment. This approach addressed not only the climate crisis but also broader social challenges.

Phases and Results of the Project:

1. **Approach phase:** The project began by identifying key leaders, assessing

territorial needs, and pinpointing potential collaborators. The community was then invited to participate in the project.

2. **Planning and mapping phase:** During this phase, a mapping of the territory was conducted to locate sustainable energy systems, and an implementation plan was outlined.
3. **Systems implementation phase:**
 - Rainwater storage: Eight rainwater storage systems were installed, benefiting 96 individuals by optimising water use in agricultural production.
 - Biodigester bales: Four biodigester bales were constructed to manage organic waste, benefiting 64 people.
 - Solar lights: Two solar lights were installed in areas plagued by insecurity issues, enhancing nighttime illumination.
 - Workshops and planting: Three workshops were conducted on energy transition and circular economy, and a planting day was organised where 102 endemic trees were planted in a water basin.
4. **Feedback and follow-up:** The project identified incorrect practices in using the systems, which allowed for adjustments to be made to improve their functionality.

In conclusion, Sustainable Energy Communities have emerged as a transformative model for social, economic, and environmental development in Colombia and Latin America. These initiatives align with global commitments such as the Sustainable Development Goals (SDGs), the Paris Agreement, and the Kunming-Montreal Global Biodiversity Framework, providing a comprehensive solution to challenges such as the climate crisis, social inequality, and reliance on fossil fuels. By leveraging clean technologies, circular economy practices, and community participation, they enhance living conditions in rural areas while contributing to biodiversity conservation and reducing greenhouse gas emissions.

The pilot project in Vereda La Requilina (Usme, Bogotá) demonstrated that integrating sustainable practices and fostering community ownership of knowledge can have a profound impact. Implementing rainwater storage systems, biodigester bales, solar lights, and ecological restoration optimised natural resource use, enhanced local capacities, and promoted social equity. Additionally, training workshops on energy transition and circular economy empowered the community to become an active force for change, building resilience against environmental and economic challenges.

This approach highlights Sustainable Energy Communities as a pivotal model for a just energy transition in rural Latin America. By adapting to diverse contexts, these communities promote local development, bridge gaps in access to essential services such as electricity, and reduce reliance on fossil fuels. The experience in La Requilina shows that decentralising the energy system and fostering collective self-generation can enhance energy sovereignty and economic stability. The success of this model is rooted in the integration of technology, education, and com-

munity participation – essential components for ensuring long-term sustainability. With supportive public policies, climate finance, and strategic partnerships, this model can help create a more equitable and resilient future in harmony with nature.

References:

1. BRICS. (2024). Kazan Declaration: Strengthening multilateralism for just global development and security. XVI BRICS Summit. Kazan, Russian Federation. URL: <https://brics-russia2024.ru/en/docs/>
2. Convention on Biological Diversity. (2024). Decision adopted by the Conference of the Parties to the Convention on Biological Diversity on 1 November 2024: Review of implementation: Progress in national target setting and updating of national biodiversity strategies and action plans (CBD/COP/DEC/16/1). Cali, Colombia. URL: <https://www.cbd.int/conferences/2024/cop-16/documents>
3. Instituto de Planificación y Promoción de Soluciones Energéticas para Zonas No Interconectadas (IPSE). (2023). Caracterización energética ZNI. URL: <https://ipse.gov.co/cnm/caracterizacion-de-las-zni/>
4. MDB Climate Action Group. (2024). Country platforms for climate action: MDB statement of common understanding and way forward. URL: <https://www.ndb.int/news/joint-multilateral-development-banks-mdbs-statement-for-cop29-mdbs-support-to-implementing-the-paris-agreement/>
5. Ministerio de Ambiente y Desarrollo Sostenible de Colombia. (2024). Plan de Acción de Biodiversidad de Colombia al 2030
6. Ministerio de Minas y Energía. (2023). Caracterización de viviendas sin servicio de energía eléctrica. URL: <https://www.integrare.gov.co/tablero/caracterizacion-de-usuarios-de-energia-electrica-por-zonas/>
7. Plan Nacional de Desarrollo 2022-2026' Colombia Potencia de la Vida'



INDIA



Gharge Muskan

Managing director

Young Sapiens
Network



Green Investments and Economic Growth in BRICS+ Nations: A Pathway to Sustainable Development

Preamble

In recent decades, the global economic landscape has undergone a dramatic transformation. Traditional centers of economic power are shifting towards the Global South and East, with the BRICS nations leading this change. This evolution not only redefines global market trends but also presents an opportunity to harness the strategic potential of sustainable and environmentally responsible investments.

The contemporary era demands a delicate balance between technological progress, economic growth imperatives, and urgent environmental stewardship. Sustainability is no longer a peripheral concern; it is central to ensuring long-term economic resilience and human well-being. Investments in green infrastructure, sustainable urban development, and resource management play a crucial role in mitigating climate change while simultaneously driving economic expansion.

This analysis recognizes that environmental investments offer a dual benefit: they bolster economic productivity and enhance quality of life. Within the framework of the Open Dialogue on “The Future of the World: New Platform for Global Growth,” this essay explores the impact of green investments in BRICS+

economies, drawing insights from data analysis, predictive models, and successful case studies. It aims to provide actionable policy recommendations and strategic insights to drive sustainable growth in an increasingly interconnected world.

Core Hypothesis and Analytical Framework

This essay posits that targeted green investments in environmental infrastructure and circular economy initiatives within BRICS+ countries can serve as catalysts for sustainable economic growth and social well-being. Integrating robust environmental policies with strategic financial and technological inputs not only mitigates climate risks but also generates multiplier effects across the economy.

A comparative study of BRICS+ nations highlights diverse trajectories in green investment. Russia is investing heavily in hydrogen and nuclear energy. China leads in green technology spending and operates the world's largest carbon trading system. India has significantly expanded its renewable energy sector and is pioneering hydrogen energy innovations. Brazil leverages biofuel production, while South Africa is transitioning from coal through initiatives such as the Just Energy Transition Partnership (JETP).

Predictive studies indicate that scaling up green investments can drive GDP growth by 1.5-2% annually over a decade and create 25% more jobs per unit investment compared to traditional industries. This section systematically compares conventional economic models with green investment approaches, assessing factors such as cost efficiency, risk management, and socio-economic benefits. While regulatory hurdles and market volatility pose challenges, the opportunities - ranging from job creation to international collaboration - offer significant long-term advantages.

Economic and Social Impact Assessment

Green investments stimulate economic growth by promoting new industries and employment opportunities. Studies indicate that clean energy investments generate more jobs per unit of energy produced than fossil fuel-based industries. Additionally, green technologies reduce operational costs, shielding BRICS+ economies from volatile energy prices and enhancing global competitiveness. Investments in environmental projects drive innovation in energy storage, smart grids, and sustainable construction materials, positioning BRICS+ nations as leaders in the global green market.

Several real-life case studies illustrate these impacts. In Russia, the Sakhalin Island project is pioneering hydrogen-based solutions to drive sustainable energy practices. China's Green Great Wall project, aimed at combating desertification, has restored millions of hectares of land while creating employment opportunities. In India, the Gujarat Solar Park exemplifies the country's renewable energy ambitions,

providing electricity to thousands of households and reducing dependency on fossil fuels. Brazil's ethanol program has significantly cut carbon emissions while strengthening its biofuel industry. South Africa's JETP facilitates a smoother transition from coal to renewables, ensuring economic sustainability for local communities.

Additional cases further validate the impact of green investments. Russia's Arctic LNG 2 project integrates renewable energy components to enhance sustainability in the energy sector. China's Shenzhen city has successfully transitioned its entire public bus fleet to electric vehicles, reducing urban air pollution significantly. India's wind energy expansion in Tamil Nadu showcases the potential of wind power in reducing energy costs and dependency on fossil fuels. Brazil's Amazon Fund, aimed at preventing deforestation, has provided sustainable livelihoods to thousands while preserving biodiversity. South Africa's expansion of solar farms in Northern Cape has reduced power shortages while creating green jobs.

Beyond economic gains, sustainability initiatives improve public health, promote social inclusion, and empower communities. Clean energy and sustainable infrastructure reduce pollution-related diseases and healthcare costs. Green projects push community-centered initiatives such as urban green spaces and accessible public transportation. Furthermore, integrating green technologies into urban planning enhances climate resilience and strengthens socio-economic stability.

Policy Recommendations and Strategic Initiatives

A well-defined policy framework is essential for accelerating green investments. Establishing regulations for green finance, including green bonds and tax incentives, will help mobilize private capital. Public-private partnerships (PPPs) should be leveraged to share risks and costs, alongside the development of innovation hubs to drive technological advancements.

Digital transformation will further enhance the effectiveness of green investments. AI-driven predictive maintenance can optimize renewable energy plants, while IoT integration can enhance real-time resource monitoring. Urban and rural development strategies should incorporate smart city infrastructure and sustainable agricultural policies to ensure a holistic approach to sustainability.

Institutional reforms and international cooperation are also pivotal. Independent oversight bodies should ensure transparency in green investments, while BRICS+ knowledge-sharing platforms can facilitate best practices and collaborative research.

Implementation Roadmap

The short-term phase (1-2 years) should focus on legislative reforms and pilot projects in renewable energy and smart cities.

Medium-term efforts (3-5 years) should scale up successful projects and deploy digital optimization systems nationwide.

In the long term (5+ years), green investment frameworks should be fully integrated into national development strategies, with continuous evaluation and adaptation to technological advancements.

Conclusion and Expected Outcomes

Targeted green investments serve as catalysts for economic growth, job creation, and improved social well-being in BRICS+ nations. Sustainable investments equip these economies with the tools to mitigate external shocks and enhances long-term resilience. Expected outcomes include enhanced GDP, improved quality of life through cleaner environments and better health outcomes, and broader community empowerment through inclusive economic participation. By prioritizing green investments, BRICS+ nations can not only ensure economic resilience but also lead the global transition toward a sustainable and equitable future.



Goetz James

Broadcast Output Editor

RT
(russian.rt.com)



Climate change drives the green agenda but the road is littered with bias and error

With the so-called man-made danger of melting ice caps, rising sea levels, a global revolution kicked off to curb CO2 emissions. While many nations spend on expensive renewable energy sources, developing countries still in their own industrial renaissance rely on fossil fuels. A pragmatic approach is needed to address the false premises of the green agenda and the challenges and opportunities we collectively face in the future.

The **climate has changed** for millennia.

(This is fact)

The **climate is changing** today.

(This is true)

The **climate will change** tomorrow.

(Nothing remains the same)

The climate **narrative should reflect reality.**

(Best to adapt to Mother Nature)

With the modern push to go green, it is often lost in the messaging that we share this world with over 8.2 billion people with individual vested interests. Each state has its own natural resource needs to keep its people alive, prosper and continue to develop industrial capacity. In survival mode, it is instinctive for individual

states to look after their own instead of collectively sacrificing opportunities for the sake of reducing man-made CO2 emissions that may, or may not, affect global temperatures. However, these priorities are often trumped by virtues that place an agenda ahead of the good of the people. With this in mind, it's time to take a pragmatic look at:

1. The impacts on developing economies pushed to adopt a green agenda
2. The pollution shell game that shifts emissions from point A to B
3. The recycling practices that are meant to help the environment
4. The effect of man-made CO2 emissions on the climate
5. The past, present and future of our planet, (it's Mother Nature's plan)
6. The opportunities and solutions to deal with the effects of earth's climate
7. The BRICS+ members and partners that stand to lead with a global solution

For centuries, step-by-step progress and rapid innovations have developed solutions that place heavy burdens of the past on the shoulders of modern machines and internal combustion engines as sprawling power plants light up our lives and provide the creature comforts many enjoy. The petroleum industry and its downstream plastic industry are part of the backbone of modern society, but not every nation in the world community has reaped the benefits as their industrial base lags decades behind and some have become the dumping grounds of the waste other countries look to ignore.

During this time, the 'go green to save the environment' campaign has pushed renewable energy projects like wind and solar to the forefront of the agenda with nations shuttering fossil fuel production and use. Aside from the fact these 'green' systems operate intermittently, their own financial and environmental costs remain high. From project lifespan, upkeep, recycling and geographic issues, the cost of this power is simply an unaffordable or unobtainable option for many states.

So with mandates in place like the Paris Agreement that are failing, and pledges made at yearly climate gatherings like COP 29 coming up short, developing economies are now still expected to skip, or somehow fast forward their own industrial revolution and plug gigawatts full of solar, wind and hydro power into their grids. While the cost of renewables has come down to about par with fossil fuels, the capacity is not there in terms of generation as wind, solar and hydro depend on specific geological and weather parameters. Nearly every nation in the world still relies on coal, oil, natural gas and nuclear power generation because the 24/7 output stands as the only reliable power for global society. Many countries are criticized for their total emissions output and told to make cuts. China and India for example are some that are singled out, but beneath the layers of numbers, you can see they are far from the worst offenders on a pollution per capita basis. The world needs to look at this data to see where the most serial polluters are and not drive a narrative and lay selective blame that leaves those on top blameless.

As part of the seemingly well-intentioned... and profit driven... green agenda, the electric everything generation was born. The EV revolution has made many

feel like they are doing their part in the fight against climate change. However, the smokestacks on the backend of power plants that produce the electricity are just out of sight. Data shows EVs cost up to 40% more to manufacture than their gas and diesel brethren in the next lane over with hopes this cost will come down within the next couple years.

While renewable energy systems are a great idea, their net effect on the environment is questionable. Recycling solar panels is a labor and energy intensive task, as dismantling the complex layers is considered hazardous work and a costly endeavor. With solar thermal power plants, 'streamers' has become a new word in the lexicon to describe scorched birds who can't escape the deadly heat rays. In the wind industry, millions of birds are killed yearly by the spinning blades. The incessant whooping soundtrack of megawatt-size windmills lumped into farms has been known to make humans sick and have an effect on whales in transit. All this while many projects do not end up making money or meeting the energy production models made that are promoted before ground was broken and government grants and investors sink money into deals.

In the case made to go green, the petroleum industry has been vilified. From 'Just Stop Oil' campaigns to others, the headline banners do not address the consequences of enacting the proposed solutions. The hope to transit to all electric renewable energy generation and propulsion systems would leave a fraction of drivers on the road, and the majority in a forever queue to charge from a grid that cannot now, nor in the near future handle that capacity. In turn, if it were 100% mandated and enacted today, society would seize, freeze and likely starve. In short, the human cost is not worth the virtuous dream today and more innovative strides are needed before this becomes possible.

The plastic industry is also in a precarious position, as we all need its products, but many hate to admit the reality. The industry's public relation solution has been to blitz the world with a recycling campaign. However, the truth of the matter is that most of our single use items never see a transformation according to Greenpeace which says:

"Mechanical and chemical recycling of plastic waste has largely failed and will always fail because plastic waste is: extremely difficult to collect, virtually impossible to sort for recycling, environmentally harmful to reprocess, often made of and contaminated by toxic materials, and not economical to recycle."

Just a fraction is actually economically viable to recycle and reuse. Take a look at the codes on the bottom, understand a bit more of the technological challenges and it becomes clear that a new policy is needed to move forward like gasification by turning the trash into gas with technology that currently exists.

The main driver of the climate change agenda is the claim we emit too much CO2 for the planet to cope with. However, we can also agree there are plenty of other factors associated with emission such as natural fires and volcanoes and others. So are we to blame for rising temperatures? The question can certainly be

asked but can also effectively be paired with a moment to ponder if it is realistic to change course from a modern society and would it be better to spend our time to deal with, and plan for the ramifications of a changing world. After all, as was mentioned above, the climate on earth has always changed, sea levels have risen and fallen dramatically, all long before there were millions and then billions of people on our planet. We can assume, with or without us, Mother Nature has a more powerful plan, and we are just along for the ride that has been going on forever.

A collective effort is needed to tackle the challenges and opportunities ahead, and the answer is not a deindustrialized world. There should be no hierarchy of interests for some nations and people to throttle down their effort that are looking to catch up with the most developed nations who export their waste and buy up carbon credits in a shell game to win green medals. While we share one planet, vast political and economic divides remain that keep us at polar opposites.

Today we live in a multipolar world, and this can and should be a rally cry for 8.2 billion people to join forces for the greater good. The largest Bloc that exists today is the BRICS+ group of nations along with its member partners, and within this Bloc is an opportunity to create a roadmap for overcoming the global challenges ahead. BRICS is not bound by a military ideology, BRICS is an economic centric powerhouse that has become a leading unified voice in the world, representing nations that are currently affected by extreme weather events and eroding coastal areas amid a changing climate. These pages in this essay are too short to dissect the cause of each extreme case, if they are new to the world, if they are 1 in a 1,000-year events and how many more are likely to be on the way. The point stands that we must prepare for what's ahead and learn from, and deal with the consequences. BRICS has an opportunity to carry out a mission and plan that could unite the world.

The essence lies in developing a plan of action. Member and partner states of BRICS can and should fund solutions based on remediation, reconstruction and prevention. These efforts should not be based on charitable donations. Profits do drive the world and are a singular point that everyone can get behind. Consider the idea of a 'GLOBAL SHARE' (presented here) to represent both national and individual interests that can be purchased and managed via a transparent blockchain accounting system. Applicants in need of assistance may submit proposals to attract the capital to remediate, reconstruct or prevent a certain outcome. Global shareholders may vote via a unique blockchain backed system and funds would be provided. This creates the establishment of a global fund to deal with the consequences, and more importantly, identifies real problems that can be tackled versus speaking about generalities that the sky is falling and rallying the world to drive electric cars that shift their pollution to the power plants elsewhere or recycle plastic that will never be recycled.

The green agenda is written upon a false basis of cause and effect. The authors and lobbyists look at historical events (the effect) and insert a narrative that

de-facto human actions are responsible (the cause) of future hypothesized events (the effect again). This is an unproven premise, but it has shaped actions from the Paris Agreement to recycling campaigns that could have for years been dealing with solutions today that could make the world a better cleaner place. Technology and practices exist today that could clean up the dirtiest areas of the planet and turn trash to energy (gasification) on an industrial scale. Technology and practices exist today that could transform fossil fuel energy to a cleaner burning industry (scrubbing). Technology and practices exist today that can remediate and rebuild past damage and protect us in the future.

It is time we take a step back and look at climate change and the green agenda with a new set of optics, not from a standpoint of fear and blame, but from a collective view that whatever is ahead of us, we can overcome together, because each instance can be solved, one by one.



Gonzalez Guzman Joseph Charles

Professor and PhD student
in Economics

National Autonomous
University of Mexico



The importance of ecosystem services as an alternative approach to understanding the environment

Keywords: ecosystem services, technology, innovation, business, capitalism

The impact of human activity on the environment is by no means a recent phenomenon. The effects of climate change first began to be felt at least hundreds of years ago, as far back as the early industrial revolutions. But it is only recently that we have begun to raise concerns, conduct research and develop strategies to combat these effects. While we often rely on technology to solve problems we have created, the reality is – and deep down, we understand it – that the only way to mitigate climate change, environmental disasters and ecosystem death is to change our consumption patterns and lifestyles. However, campaigns to raise awareness of environmental issues do not yield the desired results, as the interests of business, governments and local consumers are often at odds with each other.

Therefore, the purpose of this paper is to conceptualise the importance of ecosystem services as an alternative approach to understanding the environment that can be of interest to all economic actors (business, family, government). In

addition, the valuation of ecosystem services provides an opportunity to bring together experts from different fields of science and develop joint proposals to address environmental issues.

One of the first scientists to address the problems of global ecology and the environmental damage caused by industrial activity was Vladimir Vernadsky¹ Despite the fact that he lived and wrote in the late 19th and early 20th centuries, they remain relevant today. Vernadsky developed the doctrine of the biosphere, which he described as “the union of all ecosystems into a single whole [...]”²His warnings of environmental harm were even published in the press of tsarist Russia. However, Europe’s urgent problems at the time, coupled with subsequent international conflicts such as the two world wars, diverted the world’s attention away from these crucial issues.

Later, in the 1960s, there were other scholars, such as Rachel L. Carson, author of *Silent Spring* (1962), and analytical and research organisations such as the Club of Rome, which was founded in 1968 and published *The Limits to Growth* in 1972. During this period, environmental issues that began to manifest themselves simultaneously with the emergence of numerous global social movements for peace, equality, sexual diversity, etc., came to the fore. These ideas were taken up by the United Nations in 1972 at the first World Climate Conference, which was the first global call for governments to address urgent environmental problems. In the following decades, efforts have been made to conclude binding treaties aimed at encouraging countries to resolve environmental issues. Examples include the 1992 Earth Summit, the 1997 Kyoto Protocol, the 2009 Copenhagen Accord, and the 2015 Paris Agreement.

Certainly, there are numerous actions and a wide range of councils and aid funds working successfully to help the most disadvantaged countries in the world. However, what these diplomatic efforts have in common is their failure to achieve their primary goal of solving environmental problems. For example, global warming and air pollution trends have been steadily increasing from 1972 to 2025.³ Air pollution levels rose from 320 parts per million in 1970 to 380 parts per million by 2008, and exceeded 400 parts per million by 2020⁴ The average temperature increase was about 0.26°C in each decade. In this regard, the World Meteorological Organization (WMO) confirmed that 2024 was the

1 He is considered by many to be the first Russian ecologist.

2 Valtuille Carlos M. (2022). Vladimir Ivánovich Vernadsky (1863-1945): Enciclopedista soviético del siglo XXI, 13 de junio de 2022, en: <https://www.ecologiapolitica.info/vladimir-ivanovich-vernadsky-1863-1945-enciclopedista-sovietico-del-siglo-xxi/> (accessed in March 2025).

3 Turin Rodrigo (2023). Antropoceno e futuros presentes: entre regime climático e regimes de historicidade potenciais. *Topoi* (Rio J.), Rio de Janeiro, v. 24, n. 54, p. 703-724, set./dez. 2023. En: <https://www.scielo.br/j/topoi/a/trWLRgpLgFhfBHMPHkcYFtD/?format=pdf&lang=pt> (accessed in March 2025).

4 Ídem.

warmest year on record, with temperatures exceeding pre-industrial levels by about 1.55°C.⁵

On the other hand, despite continuing technological progress, there is no real transformation of the economy. Environmental problems have been overshadowed by international issues such as the war between Russia and Ukraine, the conflict between Israel and Hamas, and tariff wars initiated by the United States. Germany, the UK and other European states are buying significant amounts of oil and gas and have even returned to using coal to generate electricity.

John Bellamy Foster identifies two main ways in which technological advances can help reduce environmental impact: firstly, by minimising the amount of materials and energy required for production, and secondly, by replacing existing technologies with less harmful alternatives.⁶ He calls for a stronger focus on solar energy development as part of the energy transition, drawing attention to the virtually inexhaustible supply of solar energy for thousands of years to come and its environmental friendliness. However, he emphasises that this must be accompanied by more widespread technological advances. In this regard, ideas such as solar reflectors and panels designed to absorb solar radiation have been discussed for several decades now.

Yet the use of solar panels and other innovative technologies comes with certain limitations in terms of energy storage and processing. Wind farms cannot be deployed in all countries and are expensive to maintain. In addition, electric vehicle batteries are often charged using electricity derived mainly from fossil fuels. Therefore, we cannot rely solely on current technological advances. As technological innovations evolve, it is necessary to consider awareness-raising strategies, for example, with a focus on ecosystem services. These innovations should aim at maximising benefits while minimising harm from the materials produced or generated.

Ecosystem services are the benefits that people derive from natural ecosystems serving as the foundation and support for life and the economy within our modern economic system. These benefits include essential resources such as water, timber, food, sunlight and oxygen. The conservation of ecosystems directly affects human well-being and economic activity. In a world where sustainability is increasingly important, understanding and valuing these services can provide companies with a competitive advantage. Ecosystem services are an integral part of both the production and consumption stages of the economic cycle, influencing the creation of goods and services. Human well-being directly depends on their conservation.

5 The World Meteorological Organization (WMO) (2025), 'WMO confirms that 2024 will be the warmest year on record, about 1.55 °C above pre-industrial levels', 10 January 2025, <https://wmo.int/ru/media/news/vmo-podtverzhdaet-cto-2024-god-stanet-samym-teplym-godom-v-istorii-nablyudeniy-primerno-na-155-degc> (accessed in March 2025).

6 For more information, see: Foster, John Bellamy (2000). "Capitalism's Environmental Crisis Is Technology the Answer?" *Ecology Against Capitalism*, Monthly Review, 1 December 2000.

Ecosystem research and valuation play a critical role in developing professional strategies that are ethical, economically viable and innovative. For example, investments in waste recycling and alternative energy are examples of practical applications of ecosystem valuation. This approach, which has been advocated by Robert Costanza since 1997, is consistent with the broader Sustainable Development Goals. Educating stakeholders on these issues and disseminating information can help improve cooperation between business, governments and communities. However, in Mexico and globally, the integration of ecosystem services into production cycle strategies remains limited. This gap highlights the need to explore and recognise the importance of ecosystem services in both economic systems and general livelihood practices.

The first step in adopting these concepts involves studying and scientifically applying them in the production sphere. Environmentalists, geologists, political scientists, economists and others should develop strategies and solutions based on their professional experience. They should also consider various ideas for their ethics, economic viability and innovativeness, taking into account the challenge of ensuring the well-being not only of human beings but also of the environment. For example, when a company invests in setting up facilities to recycle waste, purify resources, reuse materials and produce energy from alternative sources, it should conduct an ecosystem services assessment. Marketing can be a powerful tool in this regard, used for campaigns that encourage businesses to adopt environmentally friendly practices and shift their focus towards sustainability.⁷

It is only recently that ecosystem services have come under the spotlight. They were not included in the first wave of research on environmental issues in the late 1960s, nor were they among the priority activities of the UN in the early 1990s, such as the 1992 Earth Summit or the launch of the Conferences of the Parties in 1995. This approach was brought to the forefront by Robert Costanza in 1997 in his article “The value of the world’s ecosystem services and natural capital”⁸ co-authored with other researchers ⁹ was further developed in the 2000 article “Social goals and the valuation of ecosystem service.”¹⁰

Therefore, incorporating this approach into academic disciplines is in line with broader efforts to promote sustainable development and corporate social

7 For more information see: Arroyo López Pilar, Carrete Lucero Lorena, Trujillo León Andrea (coord). (2015). *La mercadotecnia verde en un contexto de conciencia ambiental en formación*. 1era edición, Editorial Plaza y Valdés Editores. P. 257.

8 Costanza, Robert., d’Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O’Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P., y van den Belt, M. (1997) “The value of the world’s ecosystem services and natural capital.” *Nature* 387(6630): 253-260.

9 D’Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O’Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P., y van den Belt, M.

10 Costanza, Robert (2000). “Social Goals and the Valuation of Ecosystem Service”. *Ecosystems* 3: 4-10.

responsibility. Addressing environmental challenges requires innovative thinking. It is essential that future professionals propose ethical and economically viable sustainability strategies when creating new industries and planning marketing campaigns and production processes.

Companies seek to expand their market presence, build customer loyalty and increase profits. However, they can achieve these goals by adopting the approach under consideration, thereby recognising their dependence on ecosystem services and considering the environmental costs of their activities. For example, companies should consider how much it would cost them to produce a product if certain ecosystem services were unavailable, or how much they would lose due to ecosystem degradation during production. These losses often exceed the benefits that companies can reap. Governments, in turn, should set strict rules and penalties and implement effective monitoring systems to create incentives for businesses to adopt this approach.

In conclusion, ecosystem services provide an opportunity for companies to differentiate themselves from competitors and contribute to environmental sustainability goals. However, this requires the cooperation of two other key economic actors: the state and the private sector. The state must provide legal certainty and stability, while the private sector must consume responsibly and demand changes from companies that are consistent with the objective of ensuring the well-being of society. Education and training play a crucial role in this process, as future professionals and entrepreneurs will be confronted with environmental challenges requiring the implementation of sustainable practices.

Sources:

1. Costanza Robert., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P., y van den Belt, M. (1997) "The value of the world's ecosystem services and natural capital." *Nature* 387(6630): 253-260.
2. Costanza Robert (2000). "Social Goals and the Valuation of Ecosystem Service". *Ecosystems* 3: 4-10.
3. Constanza Robert (2024). Misconceptions about the valuation of ecosystem services. *Ecosystem Services* 70 (2024) 101667, Institute for Global Prosperity, University College London, UK. Pp. 1-5.
4. Semarnat (2021). Servicios ambientales o ecosistémicos, esenciales para la vida. 11 de marzo de 2021. En: <https://www.gob.mx/semarnat/articulos/servicios-ambientales-o-ecosistemicos-esenciales-para-la-vida?idiom=es>
5. Sedema CDMX (S/A). Tipo deservicios ecosistémicos. En: <http://data.sedema.cdmx.gob.mx:8081/biodiversidadcdmx/index.php/beneficios/tipos-de-servicios>
6. Ivar Jorge; Montaña Elma; Larsimont Robin. (2023). Utilidad y limitaciones del concepto de servicios ecosistémicos para los análisis críticos de dinámicas socio-ecológicas. *Revista Scripta Nova*, Vol. 27Núm. 1(2023), p. 257-28331 de marzo de 2023, ISSN: 1138-97 En: <https://revistes.ub.edu/index.php/ScriptaNova/article/view/39952/39354>
7. GRINEVALD, J. (1991), «Vernadsky y Lotka como fuentes de la bioeconomía de Georgescu-Roegen», *Ecología Política*, n. 1. Pp. 99-112.

8. Nava-López Mariana; Jujnovsky Julieta, Salinas-Galicia Rubén, Álvarez-Sánchez Javier y Almeida- Leñero Lucia. Servicios ecosistémicos. En: http://www.repsa.unam.mx/documentos/Nava- Lopez_et_al_2009_Servicios_ecosistemicos.pdf
9. Cáceres Daniel; Tapella Esteban; Quétier Fabián y Díaz, Sandra. (2015). "The social value of biodiversity and ecosystem services from the perspectives of different social actors". *Ecology and Society* 20.
10. Farber Stephen; Costanza, Robert y Wilson, Matthew. 2002. Economic and ecological concepts for valuing ecosystem services. *Ecological Economics* 41(3): 375-392. [https://doi.org/10.1016/S0921-8009\(02\)00088-5](https://doi.org/10.1016/S0921-8009(02)00088-5) (accessed in February 2025).
11. Alonso J. y Grande E. (2013). *Comportamiento del consumidor: decisiones y estrategias del marketing* (7ª edición). España: ESIC.
12. Forbes México. (2023). Las nuevas tendencias de consumo en México impulsadas por el nearshoring. Recuperado de <https://www.forbes.com.mx/las-nuevas-tendencias-de-consumo-en-mexico-impulsadas-por-el-nearshoring/> (accessed in February 2025).
13. Banco de México. (2023). Informe sobre la economía regional: Octubre-Diciembre 2022. Banco de México. <https://www.banxico.org.mx/publicaciones-y-prensa/informes-sobre-la-economia-regional/%7B0FA41AB9-D2A1-5E51-36D5-02800467A623%7D.pdf> (accessed in February 2025).
14. Arroyo López Pilar, Carrete Lucero Lorena, Trujillo León Andrea (coord). (2015). *La mercadotecnia verde en un contexto de conciencia ambiental en formación*. 1era edición, Editorial Plaza y Valdés Editores. P. 257.
15. Martínez Martínez María Romualda (2019). *Planeación estratégica aplicada al marketing verde para las pequeñas y medianas empresas en México*. Programa de Posgrado en Ciencias de la Administración, Facultad de Contaduría y Administración, UNAM, Tesis para obtener el grado de maestra, UNAM. P. 98.
16. Aguilar A. (2016). Marketing verde, una oportunidad para el cambio organizacional. Realidad y reflexión (16), 44, pp. 92-106. Recuperado de: https://www.researchgate.net/publication/317045835_Marketing_verde_una_oportunidad_para_el_cambio_organizacional (accessed in February 2025).
17. Arrollo P., Carrete, I., y Trujillo, A. Coordinadoras (2015). *La mercadotecnia verde en un contexto de conciencia ambiental en formación*. México: Plaza y Valdés Editores.
18. Gracia A. (2005). Breve historia de la educación ambiental: del conservacionismo al desarrollo sostenible. Futuros (en línea), N° 12. Recuperado de: <http://www.gloobal.net/iepala/gloobal/fichas/ficha.php?id=1842&entidad=Textos&html=1> (accessed in February 2025).
19. Gallardo D. (2018). *Green marketing en México: realidad, oportunidades y desafíos*. Centro de Recursos para el Aprendizaje y la investigación. Recuperado de: <https://repository.usta.edu.co/handle/11634/14083> (accessed in March 2025).
20. Valtuille Carlos M. (2022). Vladimir Ivánovich Vernadsky (1863-1945): Enciclopedista soviético del siglo XXI, 13 de junio de 2022, en: <https://www.ecologiapolitica.info/vladimir-ivanovich-vernadsky-1863-1945-enciclopedista-sovietico-del-siglo-xxi/> (accessed in March 2025).
21. Gutiérrez Gutiérrez, M. M. (2022). El impacto de las tendencias ecosistémicas en la construcción de Brand Equity. Hacia un modelo de medición del valor de marca con perspectiva de Responsabilidad Social Corporativa.
22. Foster John Bellamy (2000). "Capitalism's Environmental Crisis Is Technology the Answer? "Ecology Against Capitalism", *Monthly Review*, 1 December 2000.
23. Foster, John B., Brett Clark & Richard York. 2010. "A Rift in Earth and Time", *The Ecological Rift. Capitalism's War on the Earth*, New York, Monthly Review Press. Pp 7-49.
24. Turin Rodrigo (2023). Antropoceno e futuros presentes: entre regime climático e regimes de historicidade potenciais. *Topoi* (Rio J.), Rio de Janeiro, v. 24, n. 54, p. 703-724, set./dez. 2023.

En: <https://www.scielo.br/j/topoi/a/trWLrgpLgFhfBHMPHkcYFtD/?format=pdf&lang=pt> (accessed in March 2025).

25. Bartra Armando. "El hombre de hierro. Límites sociales y naturales del capital en la perspectiva de la gran crisis", UACM, ITACA, UAM. 2014. P. 320.
26. Ribeiro Silvia. "Geoengineering in the Global South". Interview with Silvia Ribeiro, ETC Group #6, 2020, en: <https://www.etcgroup.org/content/6-geoengineering-global-south> (accessed in February 2025).
27. Leff Enrique. "El ecomarxismo y la cuestión ambiental", *Ecología y capital*, siglo XXI, 2003. Pp. 333-364.
28. Hinkelammert Franz y Mora Jiménez Henry. "Hacia una economía para la vida". Preludio a una segunda crítica de la economía política. Vicepresidencia del Estado Plurinacional de Bolivia. Bolivia quinta edición. 2013. P. 484.
29. Hardin Garret. "The tragedy of the commons". 1968 *En Science*, traducción Horacio Bonfil Sánchez, México 1995, *Gaceta Ecológica*, núm. 37, Instituto Nacional de Ecología 1243-1248.
30. Shand Hope y Wetter John. "Shrinking Science: An Introduction to Nanotechnology". State of the World, Worldwatch Institute, Washington D. C. 2006. Pp. 78-95.
31. O'Connor James. "¿Es posible un capitalismo sustentable?", *Causas naturales. Ensayos de marxismo ecológico*, Siglo XXI, México, 2001. Pp. 9-35.
32. The World Meteorological Organization (WMO) (2025), "WMO confirms that 2024 will be the warmest year on record, about 1.55 °C above pre-industrial levels," 10 January 2025. <https://wmo.int/ru/media/news/vmo-podtverzhdaet-chto-2024-god-stanet-samym-teplym-godom-v-istorii-nablyudeniy-primerno-na-155-degc> (accessed in March 2025).



Guzoev Dalkhat

Graduate student

The Presidential Academy
of National Economy
and Public Administration



Green infrastructure: creating sustainable and environmentally friendly urban spaces

At present, there is a large number of cities in the world that are actively developing in areas that are important for the country, such as industry, technology development, as well as tourism and recreational activities. Most of investments, innovations, and infrastructure are concentrated in cities. At the same time, urban development processes have been quite active recently, which causes overpopulation, increased levels of built-up density, and social tensions.

This topic is relevant due to the fact that dynamic development of economic and urbanistic processes in cities causes the issues of environmental safety of urban spaces. At the same time, the said negative phenomenon entails a number of social challenges that negatively affect the quality of life of the population, as well as the socio-economic development of a country in general. Besides, it is important to mention that almost in all BRICS countries there are cities where the amount of waste release to the atmosphere by industrial enterprises reaches critical levels, which does not create proper conditions for comfortable living of the residents. In addition, built-up density is reducing access to natural resources and urban microclimate is changing.

At present, to minimize the said risks, such concepts as “green” infrastructure and “sustainable” urban development are becoming more relevant and popular. As a rule, sustainable development is a model of rational use of resources that allows fulfillment of vital needs of the population along with maintenance of public health and transfer of this trend to the next generation. In 2015, the UN General Assembly defined 17 goals of sustainable development, several of which are dedicated to sustainable development of urban spaces. These include: goal No. 11 “Sustainable Cities and Communities” and goal No. 15 “Life on Land”. Besides, at present, the notion of ESG – environmental, social, governance – is of high relevance, which provides for a set of rules aimed at regulation of issues in the area of ecology, society, and corporate governance. At present, federal government bodies are actively working on ESG transformation of the economy of the Russian Federation. In addition, ESG ranking of the regions is provisioned to motivate constituent entities of the Russian Federation to observe the principles of sustainable development.

Green infrastructure in urban spaces, in its turn, not only ensures attractive appearance of the territory but also protects against negative climatic impacts. For example, most surfaces in the cities are made of concrete and asphalt, which gives them the property of absorbing all the heat and, thus, heating of the rest of the urban infrastructures. At the same time, the ecosystem acts as a natural air conditioner by absorbing heat, which reduces temperature and improves microclimate of urban spaces. Besides, it ensures partial water drainage, as plants absorb certain amount of rainwater. These effects, in their turn, positively affect public health, psychological condition, and overall quality of life of the population.

To improve sustainability and environmental friendliness of urban spaces, it is necessary, first of all, to revise approaches in the area of urban development policy of the city. In particular, a major boost to sustainable urban development could come from the spread of green roofing practices in multi-apartment buildings on 40 % of the total area of their roofs and walls, as well as on urban infrastructure, such as bus stops. It could significantly improve the energy efficiency of residential premises, as well as urban infrastructure.

Besides, in my opinion, the spread of bio-drainage canals (artificial lowlands covered with greenery) along sidewalks and roadways in urban spaces would help to collect, purify, and filter rainwater. This mechanism would enable water provision to plants, as well as reduced load on urban sewerage networks. To optimize sewerage network operations, it is also possible to apply permeable road surfaces, through which rainwater would seep into the ground and get captured in the lower sub-layers for reuse or drainage into the network.

It is also important to develop abandoned territories by way of popularization of green infrastructure and to transform industrial areas into recreational spaces. In particular, to improve environmental friendliness and sustainability of cities, it is necessary to build highly environmentally friendly areas (eco-districts) in such areas that will include vast amount of park zones, residential buildings built from

environmentally friendly and energy-efficient materials with tropical greenery on the floors, as well as other ecosystems that help to ensure safety and high level of satisfaction among residents.

Thus, active development of green infrastructure is likely to lead to sustainable development of urban spaces and general increase in the level of socio-economic development of cities. At the same time, it is important to take into account the specifics of each territory in order to ensure harmonious and efficient interaction between green and common infrastructure of urban areas. Inclusion of the ecosystem in urban environment will create an incentive for development of residents in various fields of activity.



CUBA



Hernandez Gladys Cecilia

Head of the Department of
International Finance

World Economy
Research Centre



Further economic development as a result of advancing progress beyond Gross Domestic Product

Introduction

In the 2030 Agenda for Sustainable Development and Our Common Agenda, it is recognized that a harmful anachronism exists at the heart of global policymaking, which is that our economic models and measurements overlook many aspects that sustain life and contribute to human well-being, while perversely placing disproportionate value on activities that deplete the planet. The intention of the proposals presented in the present policy brief is not to replace gross domestic product but to outline a path to develop complementary metrics in which what matters to people, the planet and the future is more fully recognized.

Today, the world is facing catastrophic and interconnected crises – including climate change, deteriorating ecosystems and biodiversity loss, devastating conflicts and violence, increasing poverty, hunger, inequalities, unsustainable debt burdens and heightened costs of living – which show no sign of abating. The Sustainable Development Goals are badly off-track. Gross domestic product (GDP) has become a proxy for how we determine value, how we measure wealth creation and development progress and how we allocate resources on that basis.

As mentioned in paragraphs 38 and 39 of my report entitled “Our Common Agenda” (A/75/982), GDP does not account for human well-being, environmental sustainability, unpaid household services, such as care work, and the biased distributional dimensions of economic activity. Moreover, it fails to capture the human and environmental destruction of some economic activities. Harmful practices, such as deforestation, overfishing and the burning of fossil fuels, often contribute to increases in GDP. To achieve the targets that we have set to address the triple planetary crisis and other crises, a fundamental shift in how we measure progress is urgently needed.

Discussions on moving beyond GDP have been under way for decades.¹ These efforts have laid the foundation for establishing a shared language and community of practice to go beyond GDP. Examples of recent initiatives include:

- a) The 2030 Agenda for Sustainable Development and the Sustainable Development Goals, with their economic, social and environmental dimensions;
- b) The United Nations Development Programme human development index, which supplements GDP with measures of well-being and agency, inequality and multidimensional poverty and takes into account the interconnectedness of socioeconomic and planetary systems;
- c) Gender-specific indicators across thematic areas that go beyond the Goals and adequately measure and compare the situation of women and men in all areas of life, including measures of time spent on unpaid care and domestic work and its distribution and economic value, along with other measures, such as the social and economic cost of violence against women;
- d) Work focused on inclusive growth and efforts to go beyond GDP undertaken by the Organization for Economic Cooperation and Development, the European Commission, the World Bank and the International Monetary Fund;
- e) Measures of environmental degradation and depletion, environmental and economic accounting and measures of inclusive or comprehensive wealth by the United Nations Environment Programme and the World Bank.

Of these initiatives, the Sustainable Development Goals and their indicators, universally adopted by Member States, were consciously crafted to address the shortcomings of GDP. Indeed, the Goals and their indicators are the most comprehensive “Beyond GDP” framework agreed to and measured today.

Moreover, in target 17.19 of the Goals, Member States are specifically called upon to build on existing initiatives to develop measurements of progress on sustainable development that complement GDP and support statistical capacity-building in developing countries by 2030. This call was taken up in Our Common Agenda and in the report of the High-level Committee on Programmes entitled Valuing What Counts: United Nations System-wide Contribution on Progress Beyond Gross Domestic Product,³ which serves as the technical foundation for the present policy brief. The brief is also aimed at building on ongoing processes, including the multi-year update of the 2008 United Nations System of National

Accounts⁴ by 2025 and the implementation of the System of Environmental-Economic Accounting and the System of Environmental-Economic Accounting – Ecosystem Accounting.

Nevertheless, GDP continues to play a key role as a yardstick for providing international support, including in criteria for countries classified as least developed⁷ or eligible for support by the International Development Association,⁸ leaving some countries with high vulnerabilities without access to concessional financing. It oversimplifies and obscures the complex needs of countries in special circumstances, including middle-income countries, small island developing States and landlocked developing countries.

GDP emerged as a tool to address the crises of the twentieth century but fails to sufficiently address the environmental and social concerns of the world today. A number of examples are provided below:

- GDP does not account for air pollution, natural resource depletion, environmental degradation and biodiversity loss. Rather, these negative externalities often drive increases in GDP without consideration of the broader, longer-term socioeconomic and environmental damage involved. Global GDP has doubled since 1970, while the depletion of resources has more than tripled, with disastrous consequences for the natural environment. GDP contributes to the perception that permanent economic growth, without reference to environmental and social considerations, can reasonably continue indefinitely within planetary boundaries.
- GDP does not capture the full extent of the informal economy, such as unpaid care work in households, nor does it capture the social value of activities, such as health care, or the value of security.⁹ For example, unpaid care work, carried out largely by women, is often invisible and undervalued. This was particularly pronounced during the coronavirus disease (COVID-19) pandemic, when women spent an estimated 512 billion hours globally doing additional unpaid childcare work that sustained our economies.¹⁰
- GDP does not offer a lens on distributions to identify and address inequalities, including inequalities between women and men and those faced by refugees, migrants and minorities, nor does it account for the targeted interventions needed to address the needs of people facing intersectional forms of inequality. The social and environmental exclusion inherent in GDP perpetuates the misallocation of resources in ways that further exacerbate inequalities.
- As a result of serious compilation and measurement challenges, GDP still often insufficiently captures new economic phenomena, for example, digitalization and the use of free digital services, the use of crypto assets and the development of data. These particular issues are being addressed in the current discussions on the 2025 revision of the System of National Accounts.

Over time, it has become clear that there are intrinsic limitations to what GDP can measure. It does not fully capture the complexities of the urgent challenges we face today. Despite these evident shortcomings, GDP continues to be used – or misused – as the benchmark for important national and international policy settings, in particular in respect of development financing. This notably includes criteria of eligibility for official development assistance and decisions on debt relief and concessional financing, as well as such matters as graduation from the status of least developed country. This excessive dependence on GDP has created damaging bottlenecks and grave inequities in the functioning of the international financial architecture, with serious consequences for the sustainable development of all countries, in particular middle-income countries and small island developing States.

For that purpose, the document proposes

First, that Member States make an explicit commitment to go beyond GDP by agreeing on a conceptual framework, firmly anchored in the 2030 Agenda, by the time that the Summit of the Future is held in 2024. The report of the High-level Committee on Programmes provides a basis for the framework, as it draws on research carried out across the United Nations system and beyond, including discussions on GDP – its strengths, limitations and uses – and the identification of issues at stake to formulate a framework for the development of policies and metrics.

The framework should be designed to achieve three main outcomes:¹¹

- a) Well-being and agency. Putting the focus on people and promoting meaningful participation to ensure that decisions reflect people's needs and enable everyone to contribute to transformational change;
- b) Respect for life and the planet. Safeguarding the planet and ensuring possibilities for life and well-being in the future;
- c) Reduced inequalities and greater solidarity. Making efforts towards a more equal distribution of well-being.

The framework should also be based on three additional elements to pave the way for transformation:

- a) Participatory governance and stronger institutions. Steering us towards equitable, inclusive and safe societal conditions in which everyone is empowered to participate and contribute and from which everyone can benefit safely and effectively (the social dimension);
- b) Innovative and ethical economies. Serving people and the planet through innovative approaches as a way to find collective solutions to our challenges, involving responsible and ethical actions to deliver positive outcomes that uphold people's rights (the economic dimension);
- c) From vulnerability to resilience. Focusing on our interaction with the natural and built environment to strengthen preparedness and ensure well-being in a context of multiple risks and uncertainties (the environmental dimension).

Second, the political commitment to develop a conceptual framework to value what counts must go hand in hand with a technical and scientific process to develop the metrics that inform the framework.

In this regard, the document proposes the establishment of a high-level expert group of independent experts with a mandate to produce by March 2024 an initial value dashboard of a limited number of key indicators (ideally not more than 10–20 indicators) that go beyond GDP. This should be presented for consideration by Member States in preparation for the Summit of the Future.

The aim should not be to establish a single composite indicator that goes beyond GDP. An indicator of everything would summarize too much and reveal too little to be able to adequately inform policy. Instead, It proposes the selection of a set of core metrics that would be assessed, developed and selected through a scientific, multidisciplinary process and that would need to be:

- Comparable across time and countries, well-established and trusted
- Country owned
- Universally applicable
- Able to convey strong and clear messages that are actionable and intuitive
- Scientifically robust and statistically sound
- Iterative and dynamic, based on what exists, while allowing for the addition of new indicators, as relevant

The methodology and process to develop these indicators should build on current capacities and ongoing work and incorporate appropriately the results of the High-level Panel on the Development of a Multidimensional Vulnerability Index, as well as existing indices and indicators, including the Sustainable Development Goal indicators, the human development index and other relevant indicators that account for human rights and gender equality

What is the beyond GDP approach?

The Beyond GDP approach is about developing indicators that are as clear and appealing as GDP, but more inclusive of environmental and social aspects of progress.

GDP is a useful indicator of a nation’s economic performance, and it is the most commonly used measure of well-being. However, it has some important limitations, including: The exclusion of non-market transactions. The failure to account for or represent the degree of income inequality in society.

GDP includes what is spent on environmental protection, healthcare, and education, but it does not include actual levels of environmental cleanliness, health, and learning. GDP includes the cost of buying pollution-control equipment, but it does not address whether the air and water are actually cleaner or dirtier. GDP includes spending on medical care, but it does not address whether life expectancy or infant mortality have risen or fallen. Similarly, GDP counts spending on educa-

tion, but it does not address directly how much of the population can read, write, or do basic mathematics.

Beyond GDP indicators refers to alternative economic indicators that do not place economic growth as the most important variable in assessing a country's progress. Beyond GDP indicators are inclusive of other aspects of development, such as, environmental and social

Precisely because of this, GDP is not, on its own, an adequate gauge of a country's development. Development is a multi-dimensional concept, which includes not only an economic dimension, but also involves social, environmental, and emotional dimensions.

Some examples of general index that had been developed recently

HDI – Human Development Index.

HPI – Human Poverty Index.

Multidimensional Poverty Index.

Produced by the UN Development Programme in 1990, **the first Human Development Report outlined a new approach to development**, focused on people and their opportunities rather than economic growth alone. The Human Development Index (HDI) was introduced as a way to quantify this approach. Nearly 30 years later, the Sustainable Development Goals have rekindled discussions on how we measure progress. Does the Index offer a way forward?

The HDI framework comprises three indices:

- Life Expectancy Index, based on life expectancy at birth. The index is 1 when it is 85 years and 0 when it is 20 years.
- Education Index, based on mean years of schooling (15 is the projected maximum for 2025) and expected years of schooling (18 is the projected maximum – this is the equivalent of achieving a postgraduate degree in most countries).
- Income Index, based on Gross National Income (GNI) per capita by Purchasing Power Parity (PPP), which considers exchange rates and inflation adjustments when determining individual wealth. The index is 1 when GNI per capita is US\$75,000 or above, and 0 when it is US\$100.

Together, these three indices provide an indication of a person's capabilities and wellbeing. They provide a richer picture of progress than gross domestic product (GDP), which relates to a country's wealth, or even GDP per capita, which tells us something about an individual's means but nothing about their life outcomes.

Of course, the HDI has its limitations. It omits several factors that can have a significant influence on quality of life, such as environmental degradation. Industrial pollution and deforestation, for example, can lead to complex health problems

(e.g. lymphatic filariasis) or mental health conditions that do not necessarily have an impact on mortality rates but which can severely impair one's mobility or quality of living.

The HDI could serve as a reference point for new indices as we move towards understanding human development in a more comprehensive and capabilities-focused way.

Why should we encourage a Process Beyond Gross Domestic Product?

With their emphasis on leaving no one behind, it is clear that the SDGs will require a deeper understanding of development outcomes on the ground. However, as the framework swells in complexity – with 17 goals, 169 targets and even more indicators – there is also a need for a simple way to measure progress.

Over a 15-year timeframe, the HDI did a better job than GDP of capturing what progress is being achieved. It reflects a more nuanced understanding of human development while being simple enough to remain inclusive: unlike other more complex indices, the HDI is based on data that is likely to have been collected in many countries for a number of years.

Despite this, most countries still use GDP to assess standard of living and 'development', and it is easy to understand why. GDP is a measurement developed in the 1930s to measure the size of a state's economy by giving consideration to the value of goods and services produced within the country. The data used in determining GDP is relatively easy to access, and measurements are straightforward. Moreover, this very narrow definition of wealth is easy to apply universally, hence its popular use as an indicator of quality of life. It remains the preferred indicator of politicians.

However, even as a measurement of wealth, GDP leaves a lot to be desired. It does not consider levels of inequality within a country – whether it be the gap between the rich and poor or any instances of social or political discrimination. It also does not consider the methods of the creation or accumulation of wealth, such as the detrimental effects of the exploitation of natural resources. In this regard, GDP does not measure a standard of living at all – it should instead be seen as a measure of economic activity.

Human development, on the other hand, concentrates on qualitative outcomes. The HDI's consideration of life expectancy and education – alongside per capita income – allow us to flesh out this picture a little. These relatively simple forms of data are very important indicators of social welfare and freedom.

Nevertheless there have been other elements that also shadow the HDI performance. When looking for the factors determining quality of life outside of GDP, some specific instances can shed light on just how differently data is perceived when compared to the HDI. Qatar, Kuwait and the UAE – all top 10 countries by GDP (PPP) per capita, drop quite significantly in ranking in the HDI. Clearly, as the Gulf states demonstrate, high GDP is no guarantee of high HDI. Taking a capability approach to development may explain these successes and failures.

The Human Poverty Index (HPI)

The Human Poverty Index **complements the HDI** as it is an indication of the standard of living in an economy. It considers the level of poverty and deprivation of a community in a country. The HPI uses two indices:

1. The HPI-1 is used to measure developing countries.
2. The HPI-2 is used for developed countries that are part of the Organization for Economic Co-operation and Development (OECD).

The HPI has limited utility as it combines the average deprivation levels of each dimension and it can't be linked to any particular group of people.

The Multidimensional Poverty Index

The MPI replaced the HPI in 2010. It differs from the HPI as it **assesses poverty** at the **individual level**.

If one person is deprived of a third or more of ten (weighted) indicators, the global index identifies them as 'MPI poor'. The extent of poverty is measured by the percentage of deprivation a person is experiencing.

Economic happiness and economic growth

Can be happiness linked to economic growth? In economics, measuring happiness is very subjective. This would involve the evaluation of a wide range of factors that affect wellbeing, quality of life, and self-reported levels of happiness.

- Some of these factors are:
- Income
- Quality of consumption
- Quality of work
- The welfare of family members
- Leisure
- Environment, politics, and other non-economic factors that can affect happiness, such as religious freedom.

The Gross Domestic Happiness Index

Despite the number of factors that impact happiness and how subjective it is, there is an index that economists use to measure happiness: the **Gross Domestic Happiness (GDH) index**.

From the **neoclassical economic perspective**, higher income levels correlate with higher levels of utility and economic welfare, as a person is more able to purchase the goods and services (food, shelter, healthcare, and education) that would improve their quality of life.

'Happiness' is a complicated concept to quantify for measuring purposes, but many economists claim 'psychological surveys' can give a reliable measure of the level of happiness or satisfaction people are experiencing in their lives.

Other reasons why a rising GDP may not lead to increased happiness include the fact that the allocation of resources for the purpose of economic growth may bring about negative costs to society, which will impact its happiness levels.

A country could achieve economic growth thanks to mining, but if they're mining in their natural parks, this will be detrimental to society in the future: people will have fewer natural places to visit and pollution will increase. This, in turn, will affect their health in the long run.

Conclusions

This paper reviews debates and practice around the conventional and alternative measures of economic well-being. Evaluating the major contending "Beyond GDP" measures, as Human Development Index, HPI - Human Poverty Index, HPI, Multidimensional Poverty Index, Happiness/life evaluation index, Happy Planet Index, the OECD's Better Life Initiative dashboard

The proposals to develop a set of more integrated index to incorporate inequality, care for human beings and care for the environment in a single framework. Could be crucial to guide policy in responding to the major challenges of our time - rising inequality, climate change, environmental destruction.

It is important to develop indicators that make it suitable to gauge economic performance that contributes to well-being outcomes and examine proposed policies. Meanwhile, its dashboard-like features allow changes in contributing variables to be tracked in physical and monetary terms.

There are true limitations to this process that have to be presented. The indicators that should be provided could generate additional data demands, which would make difficult to estimate all the possible indicators, especially in low-income countries, and there will be a strong need to develop the logical methodology and financial support to really reach the purpose.. Taking into account the present global multidemands, the main obstacles to adopt the framework could be social and institutional, including lack of financial and institutional support.

Bibliography

1. For example, the Brundtland report (A/42/427) of 1987, the Stiglitz, Sen and Fitoussi report of 2009 and the Organisation for Economic Co-operation and Development listing of 500 initiatives to go beyond GDP (2019).
2. See World Health Organization, "Violence against women", 9 March 2021. Available at www.who.int/news-room/fact-sheets/detail/violence-against-women.
3. See <https://unsceb.org/topics/beyond-gdp>.
4. See <https://unstats.un.org/unsd/nationalaccount/sna2008.asp>.

5. See https://seea.un.org/sites/seea.un.org/files/seea_cf_final_en.pdf and <https://seea.un.org/ecosystem-accounting>.
6. United Nations Development Programme, Human Development Report 1990 (Oxford, Oxford University Press, 1990).
7. See www.un.org/development/desa/dpad/least-developed-country-category/lcd-criteria.html.
8. See <https://ida.worldbank.org/en/about/borrowing-countries>.
9. See Jayati Ghosh, "Let's count what really matters", Project Syndicate, 16 June 2022.
10. United Nations Entity for Gender Equality and the Empowerment of Women (UN-Women) and United Nations, Department of Economic and Social Affairs, Statistics Division, Progress on the Sustainable Development Goals: The Gender Snapshot 2022.
11. The outcomes should be based on the principles outlined in the report of the High-level Committee on Programmes and draw from the human development approach, the Brundtland report, the aspirations set out at the Rio and Rio+20 conferences and the 2030 Agenda.



GHANA



Imoro Abdulai Azure

Communication specialist

Abanga farms and food systems



Investments in environment: creating a comfortable environment subject to climate change, using Ghana as a case study

**Thematic Vector: Economic and Social Imperatives
of Environmental Investments in a Changing Climate**

Preamble

Climate change presents both a challenge and an opportunity for nations worldwide. For Ghana, a developing country with an economy reliant on agriculture, mining, and energy, the impact of climate change is becoming increasingly evident. Rising temperatures, erratic rainfall, and coastal erosion threaten food security, infrastructure, and public health. With strategic investments, Ghana can harness the benefits of green energy, sustainable agriculture, and climate adaptation to create a more resilient economy.

According to **Pierre Laporte, World Bank Country Director for Ghana, Liberia, and Sierra Leone**. *“Ghana’s contribution to global greenhouse gases emissions is small, with emissions on a per capita basis at 24% of the global average. The country can take a more resilient development pathway, avoiding costly lock-ins,*

leapfrogging to cutting-edge technologies, and starting to mobilize climate finance. “This essay explores how targeted environmental investments can enhance economic and social stability, ensuring a comfortable and sustainable environment for future generations.

Core Hypothesis: Investing in Environmentally Sustainable Practices to Mitigate Climate Change Effects and Enhance Economic Growth

Environmental investments have the potential to drive economic transformation in Ghana. By prioritising renewable energy, climate-smart agriculture, afforestation, and waste management, Ghana can not only mitigate climate change effects but also create jobs, boost GDP, and improve the quality of life for its citizens.

Analytical Insights and Statistical Data

Ghana stands at a critical juncture where climate change, environmental degradation, and resource management directly influence economic stability and national development. With climate-related disasters such as floods and drought already costing the nation an estimated 1.7% of its GDP annually, a figure projected to increase by 23% by 2050 without intervention, this could rise to 4% by 2050 (EPA, 2022). Ghana’s Renewable Energy Master Plan aims to achieve a 10% renewable energy contribution to the national energy mix by 2030. Solar and wind energy investments could generate thousands of jobs while reducing reliance on fossil fuels (Energy Commission of Ghana, 2021).

Again, Ghana loses about 135,000 hectares of forest annually due to logging and farming. Agroforestry initiatives can reverse this trend, increasing carbon sequestration and improving soil fertility for better yields (Forestry Commission, 2023). Accra, the capital of Ghana alone generates over 3,000 metric tons of waste daily, with only 40% properly managed. Investments in recycling and waste-to-energy projects can reduce pollution and generate new economic opportunities (Zoomlion Ghana Limited, 2022). The Climate Change Vulnerability Index places Ghana in a high-risk category, predicting that erratic rainfall patterns will continue to affect cocoa and maize production, key contributors to the country’s economy (World Bank, 2023).

The Role of Illegal Mining (Galamsey) in Climate Change

One of the most pressing human-induced environmental challenges in Ghana is illegal small-scale mining, known as *galamsey*. While mining contributes significantly to Ghana’s GDP, illegal mining activities have led to massive environmental degradation. Deforestation and Land Degradation, large swathes of forests are

cleared to make way for illegal mining activities, leading to a loss of biodiversity and disruption of ecosystems. The use of mercury and other harmful chemicals in illegal mining contaminates rivers and water bodies, affecting aquatic life and making drinking water unsafe for communities (Amoah, 2022)

The Future of ESG and Its Role in Ghana's Environmental Investments

Environmental, Social, and Governance (ESG) principles are becoming essential in global investment decisions. As Ghana moves towards sustainable development, the integration of ESG frameworks will play a crucial role in shaping its environmental policies and business practices. Companies operating in Ghana will need to adhere to strict environmental compliance standards, reduce carbon emissions, protect biodiversity, and invest in circular economies.

ESG frameworks should emphasize community engagement, fair labour practices, and public health. Investment in sustainable agriculture, clean water, and education will enhance social equity and economic empowerment. Ghana has an opportunity to attract foreign direct investment (FDI) by aligning its economic policies with sustainability goals. The government must establish clear ESG policies and encourage businesses to adopt sustainable practices for long-term economic resilience.

Economic and Social Effects of Environmental Investments

Environmental investments, from renewable energy projects to sustainable agriculture and waste management play a crucial role in fostering long-term economic and social development. These investments drive economic growth by creating jobs, improving resource efficiency, and enhancing productivity while mitigating environmental risks. They also yield significant social benefits, such as improved public health, increased resilience to climate change, and enhanced quality of life.

Economic Effects

Investment in the environment has significant economic effects, including job creation, increased agricultural productivity, foreign direct investment (FDI), and energy security. In Ghana, several initiatives illustrate these impacts: Investments in reforestation and afforestation projects, such as the **Ghana Forest Plantation Strategy**, have created thousands of jobs for local communities. Ghana's push for eco-friendly industries has attracted FDI, such as the **Norwegian-backed Green Ghana Initiative**, which supports reforestation and sustainable timber production, drawing international partnerships.

Social Effects

Investing in the environment has significant social benefits. Reduced air and water pollution lowers cases of respiratory diseases and waterborne illnesses, improving public health and reducing healthcare costs. Sustainable land and water management ensures that local communities have access to clean resources while preserving biodiversity, which supports ecosystems and agriculture. Greener cities with more trees, parks, and clean energy enhance residents' quality of life, providing better air quality, recreational spaces, and mental well-being.

General Conclusions and Expected Results

Investing in Ghana's environmental sector is no longer an option but a necessity. Ghana can mitigate the adverse effects of climate change while fostering economic growth. The expected results include a diversified economy, enhanced food security, improved public health, and a more resilient society. Illegal mining (galamsey) remains a significant threat to Ghana's climate resilience.

The future of ESG in Ghana presents a new frontier for responsible economic development. By integrating ESG principles into national policies and business operations, Ghana can secure international investments, ensure environmental sustainability, and promote social equity.

References

1. Amoah, S. (2022). The Impact of Illegal Mining on Ghana's Water Bodies. *Ghana Journal of Environmental Studies*.
2. Energy Commission of Ghana. (2021). *Renewable Energy Master Plan*.
3. Environmental Protection Agency (EPA). (2022). *Climate Change and Economic Resilience in Ghana*.
4. Forestry Commission of Ghana. (2023). *Annual Report on Deforestation and Land Use*.
5. Ghana Health Service. (2023). *The Health Implications of Illegal Mining in Ghana*.
6. World Bank. (2023). *Climate Change Vulnerability Index for Ghana*.



Iudaeva Victoria

Student

Volgograd State Technical
University



Investments in Environment

The future of humanity and the world is a matter of global significance. Every person, directly or indirectly, influences both history and the future.

Today, the question arises: how can we contribute to a better future for humanity? What determines this future: politics, economics, culture or the social sphere? Or, perhaps, all of them are equally important?

Undoubtedly, every area of human activity is shaped by people and continues to evolve through their efforts, including the global economy.

The global economy is a mechanism created by humans, a system that operates thanks to human labor. But how can we improve it? My answer is: through investments in environment.

Of course, it is important for economic development to invest in human resources, to create and integrate new technologies, and to improve logistical chains. It should be noted that all these aspects are human “inventions”: humans invented the economy, developed the concept of moving goods and services efficiently, and identified what must be created to optimize all processes. But there is one sphere that existed long before humans and continues to exist without their intervention. That is the natural environment. It is simple: if the environment is no longer suitable for sustaining living organisms, the extinction of the human species becomes a real possibility.

Since ancient times, humans have depended on nature. That connection still exists today. If humanity wants a better future not only for the global economy but also for its own survival and the well-being of future generations, then it

must acknowledge a critical fact: we are now on the verge of exhausting the natural world around us. This applies to ecology, natural resources, outer space, wildlife, the Earth's ozone layer, and many other components of the environment. But if the conditions necessary for human life disappear, there will be no economy, no politics, and nothing else.

Therefore, the question of priority does not even arise. The answer is obvious. Humanity has already begun taking steps to change the current situation. This offers hope and faith for the future. People should rethink the basic principles of their lives: how they relate to nature, how they use water resources, land, soil, and minerals, and more. Solving such problems will, in turn, foster the development of technologies, human potential, and much more. This is a top priority for the future, not only of the global economy but of humanity as a whole.



Janashantha Apeksha Sandeepanie

Research Assistant

University of Sri Jaywardenepura



Investments in Environment

The environment is the space we live in. Currently, the world is at a crossroads in its approach to environmental sustainability. As global challenges such as climate change, resource depletion, and biodiversity loss continue to intensify, the need for meaningful investments in environmental protection and sustainable development has never been more urgent. These investments are crucial not only for preserving the ecosystems but also integral to fostering long-term economic growth, improving social welfare, and building resilient communities. This essay explores the critical areas where environmental investments are essential, highlighting the need for human-centric territorial development, green infrastructure, climate adaptation, circular economy models, corporate social responsibility (CSR), and sustainable tourism. By examining relevant examples from around the world, it can better understand how these investments can create a better future for all. The need for commitment to environmental investments and long-term benefits for economies, societies, and ecosystems. This would create the pathway to better global growth.

Human-centric development is rooted in the idea that urban spaces should

prioritize the well-being of individuals while fostering ecological balance. It acts as a principle in territorial development. Investments in green infrastructure, such as parks, green roofs, and urban forests, are key to achieving this ecological balance. Singapore's green urban planning is a leading example of how cities can integrate nature into urban life. The iconic Gardens by the Bay in Singapore showcases the potential of green infrastructure to promote biodiversity and improve urban air quality. The incorporation of lush greenery into its urban fabric not only enhances the quality of life of the residents but also mitigates the urban heat island effect, demonstrating the long-term benefits of environmental investments.

Urban spaces have become central to addressing the environmental challenges of the modern world. Sustainable cities are those that reduce their ecological footprint while ensuring the well-being of their inhabitants. Copenhagen, Denmark, is often cited as a model for creating environmentally friendly urban spaces, especially the green rooftops and climate-resilient designs of Copenhagen. Their focus on green building standards, renewable energy, and extensive cycling infrastructure has resulted in one of the world's most sustainable urban environments. Copenhagen's ambitious goal of becoming carbon-neutral by 2025 highlights the vital role that local governments can play in driving environmental investments to create green, sustainable, and environmentally friendly urban cities.

Increased investment in sustainable and inclusive transport systems is essential to create cities that are accessible to all. As urban populations grow, transportation networks must be environmentally friendly as well as accessible to everyone, including people with disabilities. The Netherlands provides an exemplary model of how a transport system can be both green and inclusive. The bike-friendly urban planning of the Netherlands and its cycling infrastructure are world-renowned, with cities like Amsterdam and Utrecht offering safe and convenient cycling routes for all residents. In addition to reducing carbon emissions, these investments make transportation more inclusive and equitable, providing low-cost, healthy mobility options to people of all ages and abilities.

As the effects of climate change intensify, cities around the globe must adapt to the changing environment. Investments in climate-resilient infrastructure, such as flood management systems, cooling technologies, and energy-efficient buildings, are of high value to ensuring that urban spaces remain livable. Rotterdam, the Netherlands, is a leader in climate adaptation. The city has implemented innovative flood management systems, including floating structures and water squares that absorb excess rainwater. These investments not only protect residents from the impacts of rising sea levels but also create spaces that are pleasant and comfortable, even in the face of extreme weather events.

The concept of the circular economy is centered on reducing waste, reusing resources, and creating sustainable production and consumption cycles. It is the basic pathway to creation. The circular economy aims to minimize waste and make the most of resources by promoting recycling, reuse, and sustainable production. In the energy sector, this involves using renewable energy sources, improving energy efficiency, and implementing waste-to-energy systems. By shifting from a linear take-make-dispose model to a circular system, we can reduce environmental impacts, lower carbon emissions, and ensure long-term energy sustainability. This approach is crucial for achieving energy security and mitigating climate change.

This circular economy model offers a transformative approach to environmental investment, shifting away from the traditional take-make-dispose economy. Sweden's waste-to-energy system is a prime example of circular economy principles in action. The country has developed one of the most efficient waste management systems in the world, converting household waste into energy to power homes and businesses. This model not only reduces landfill waste but also generates renewable energy, proving that circular economy investments can create economic value while protecting the environment.

Corporate Social Responsibility (CSR) plays a pivotal role in advancing global sustainability goals. Companies that invest in sustainable practices not only help address environmental challenges but also set an example for others to follow. It is a global norm that aligns with sustainability. Patagonia, the outdoor clothing company, is a leader in environmental activism and sustainable business practices. The company has made significant investments in eco-friendly materials, fair labor practices, and environmental advocacy. Patagonia's commitment to CSR has set a new standard for the business world, demonstrating that companies can succeed while contributing positively to society and the environment.

Investments in disaster preparedness and natural hazard management are essential for building resilient communities. Countries that are prone to natural disasters might be better off investing in infrastructure and policies that minimize damage and protect lives. Japan is a prime example of how investments in resilient infrastructure can reduce the impact of natural hazards. The country has implemented advanced earthquake-resistant building designs, early warning systems, and disaster response strategies. These investments have saved countless lives during earthquakes and tsunamis, showing that proactive environmental investments are crucial for disaster risk reduction.

Creating accessible and inclusive environments is not just a luxury but a necessity for fostering social equity. Investments in barrier-free infrastructure, such as wheelchair-accessible public spaces, transport systems, and buildings, are

essential for ensuring that people with disabilities can fully participate in society. Curitiba, Brazil, is an example of a city that has prioritized accessibility in its urban planning. The city has an integrated public transport system, which includes low-floor buses and accessible stations, ensuring that all residents, regardless of physical ability, can access public services and opportunities.

Consumer behavior plays a significant role in driving sustainable supply chains. Conscious consumption is the basis for conscious or sustainable supply chains. Investments in conscious consumption, where consumers make informed choices about the environmental impact of their purchases, can push industries toward more sustainable practices. The Fair Trade initiatives in the coffee production movement provide an excellent example of how sustainable consumption can drive positive change. By purchasing Fair Trade-certified products, consumers support farmers and workers in developing countries who are committed to environmentally sustainable and socially equitable practices. This model shows how investments in ethical consumption can create demand for sustainable products, leading to more responsible supply chains.

Tourism is a leading global industry in the present world, and when managed sustainably, it can significantly enhance the quality of urban environments. Ecotourism, which focuses on conservation and sustainability, is a growing sector that promotes environmental stewardship while providing economic opportunities. Costa Rica has developed a successful model for sustainable tourism, emphasizing conservation efforts, local culture, and environmental education. By investing in ecotourism, Costa Rica has enhanced its natural environment while generating income for local communities, demonstrating that sustainable tourism can be a powerful tool for both environmental protection and economic development.

Hence, investments in the environment are critical to achieving sustainable global growth. By focusing on human-centric territorial development, green infrastructure, climate adaptation, circular economy models, and corporate social responsibility, it can create cities and societies that are economically prosperous, socially equitable, and environmentally resilient. As the world faces unprecedented environmental challenges, it is clear that the path to a sustainable future lies in the commitment to long-term investments in the environment. These investments will protect our planet while ensuring a better quality of life for future generations.

References

1. Akhator, E. P., Obanor, A. I., & Ezemonye, L. I. (2016). Electricity generation in Nigeria from municipal solid waste using the Swedish Wasteto-Energy Model. *Journal of applied sciences and environmental management*, 20(3), 635-643.

2. de Souza, I. M., dos Reis, J. G. M., de Queiroz, L. S., & Formigoni, A. (2024). CYCLOMOBILITY DEVELOPMENT IN SÃO PAULO CITY: A COMPARISON WITH THE TEN MOST BIKE-FRIENDLY CITIES WORLDWIDE. *South American Development Society Journal*, 10(28), 108-108.
3. Errigo, M. F. (2018). The Adapting city. Resilience through water design in Rotterdam. *TeMA- Journal of Land Use, Mobility and Environment*, 11(1), 51-64.
4. Firoozi, A. A., & Firoozi, A. A. Geotechnical Innovations for Seismic-Resistant Urban Infrastructure.
5. Goodland, R. (1995). The concept of environmental sustainability. *Annual review of ecology and systematics*, 1-24.
6. Han, S. (2011). Modeling and optimization of a regional waste-to-energy system: a case study in central Sweden. In *Proceedings Sardinia 2011, Thirteenth International Waste Management and Landfill Symposium*. S. Margherita di Pula, Cagliari, Italy; 3-7 October 2011.
7. Herrero Amo, M. D., & De Stefano, M. C. (2019). Public-private partnership as an innovative approach for sustainable tourism in Guanacaste, Costa Rica. *Worldwide hospitality and tourism themes*, 11(2), 130-139.
8. Ingenbleek, P. T., & Reinders, M. J. (2013). The development of a market for sustainable coffee in the Netherlands: Rethinking the contribution of fair trade. *Journal of business ethics*, 113, 461-474.
9. Jamali, D., & Karam, C. (2018). Corporate social responsibility in developing countries as an emerging field of study. *International journal of management reviews*, 20(1), 32-61.
10. Kabisch, N., & Haase, D. (2014). Green justice or just green? Provision of urban green spaces in Berlin, Germany. *Landscape and urban planning*, 122, 129-139.
11. Kiper, T. (2013). Role of ecotourism in sustainable development. *InTech*.
12. Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, conservation and recycling*, 127, 221-232.
13. Lee, A. C., & Maheswaran, R. (2011). The health benefits of urban green spaces: a review of the evidence. *Journal of public health*, 33(2), 212-222.
14. Löhmus, M., & Balbus, J. (2015). Making green infrastructure healthier infrastructure. *Infection ecology & epidemiology*, 5(1), 30082.
15. Morelli, J. (2011). Environmental sustainability: A definition for environmental professionals. *Journal of environmental sustainability*, 1(1), 2.
16. O'Rourke, D., & Strand, R. (2017). Patagonia: Driving sustainable innovation by embracing tensions. *California Management Review*, 60(1), 102-125.
17. Pan, S. Y., Gao, M., Kim, H., Shah, K. J., Pei, S. L., & Chiang, P. C. (2018). Advances and challenges in sustainable tourism toward a green economy. *Science of the total environment*, 635, 452-469.
18. Prestes, O. M., Ultramari, C., & Caetano, F. D. (2022). Public transport innovation and transfer of BRT ideas: Curitiba, Brazil as a reference model. *Case Studies on Transport Policy*, 10(1), 700-709.
19. Seng, L. T. (2012). From Botanic Gardens to Gardens by the Bay: Singapore's Experience in Becoming a Garden City.
20. Thomas, L., de Haan, E., Gerards, L., de Haan, G., & Brouwer, J. (2023, August). Designing Floating Urban Realities: On the Urban Design of Floating High-Density Environments in the Dutch Context. In *World Conference on Floating Solutions* (pp. 33-51). Singapore: Springer Nature Singapore.
21. Wolch, J. R., Byrne, J., & Newell, J. P. (2014). Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and urban planning*, 125, 234-244.
22. Xu, H., Liu, L., & Ding, P. (2021, November). Building Climate Resilient City through Multiple Scale Cooperative Planning: Experiences from Copenhagen. In *IOP Conference Series: Materials*

Science and Engineering (Vol. 1203, No. 3, p. 032063). IOP Publishing.

23. Yaroshenko, O. M., Anisimova, H. V., Koliesnik, T. V., Kaplina, H. A., & Babych, N. O. (2024). National strategy for a barrier-free environment: Problems, tolerance and implementation. *International social work*, 67(1), 226-241.

24. Zuo, J., & Zhao, Z. Y. (2014). Green building research—current status and future agenda: A review. *Renewable and sustainable energy revisews*, 30, 271-281.



INDIA



Kasaudhan Harshit Kumar

Researcher

Centre for Russian and Central Asian Studies,
Jawaharlal Nehru University



Topic: The Problem of Environmental Sustainability and Its Social and Economic Impacts in the Arctic Region of the Russian Federation

Introduction

Environmental sustainability and climate resilience are now central to the future trajectory of Arctic Russia, yet policy implementation remains inconsistent and often subordinated to economic and military imperatives. While Russia's Arctic Strategy to 2035 pledges to promote ecological preservation, the actual allocation of resources reflects a stark imbalance, with environmental protection efforts receiving significantly less investment compared to energy extraction and defense infrastructure. Projects such as Yamal LNG and the development of the NSR are emblematic of Moscow's prioritization of economic returns over environmental stewardship. Simultaneously, legacy issues—such as industrial pollution from Soviet-era infrastructure and the inadequate remediation of contaminated sites—continue to pose substantial threats to Arctic ecosystems. Although initiatives like the "Clean Country" program have sought to address these legacies, they remain limited in scale and underfunded relative to the magnitude of ecological degradation.

This essay critically examines the intersections of environmental degradation, infrastructure fragility, governance challenges, and the Social and Economic

impacts of Environmental sustainability in Arctic Russia, highlighting the need for a paradigmatic shift toward sustainability, climate resilience, and inclusive policy frameworks in shaping the region's future.

The Arctic: A unique region

The Arctic region faces complex challenges related to environmental sustainability, social well-being, and economic development. These issues are profoundly interconnected and influenced by climate change, resource extraction, geopolitical interests, and indigenous rights. The Arctic is undergoing rapid environmental changes due to climate change, resource extraction, and human activities. These challenges threaten the region's delicate ecosystems, indigenous communities, and global climate stability. Environmental sustainability challenges are climate change, ice melt, permafrost thawing, greenhouse gas emissions, ocean acidification, marine ecosystem disruption, pollution, contaminants, resource exploitation, deforestation, biodiversity loss, ecosystem disruption, increased shipping, and industrial activity.

Regarding climate change and ice melt, the Arctic is warming almost four times faster than the global average. Melting sea ice reduces the Earth's albedo effect, leading to further warming.

Rising sea levels from ice sheet melting in Greenland threaten coastal communities worldwide. Loss of habitat for ice-dependent species like polar bears, walruses, and seals. Due to permafrost thawing and greenhouse gas emissions, including methane and CO₂ release, permafrost stores vast amounts of carbon; its thawing releases methane, a potent greenhouse gas. Roads, pipelines, and buildings in Arctic communities collapse due to thawing ground. Ancient bacteria and viruses may emerge from thawing permafrost, posing public health risks.

The Arctic Ocean absorbs CO₂, increasing ocean acidification and threatening shellfish, plankton, and fish populations. Declining fish stocks affect global seafood supply and indigenous communities reliant on fishing. Warmer waters disrupt marine food chains, affecting Arctic species and commercial fisheries. Oil spills from drilling, transportation, and ship traffic pose catastrophic risks in fragile Arctic ecosystems. Heavy metals and microplastics accumulate in Arctic waters and enter the food chain. Air pollution from distant industrial regions deposits black carbon (soot), accelerating ice melt. Oil and gas extraction damages landscapes and increases greenhouse gas emissions. Mining for rare minerals and metals leads to habitat destruction and water contamination. Increased deforestation in the boreal zone reduces carbon sequestration capacity.

In terms of biodiversity loss and ecosystem disruption, Polar bears, Arctic foxes, and reindeer populations decline due to habitat changes. Migratory patterns of birds and marine species shift due to temperature and ice cover changes. Invasive species from warmer regions disrupt Arctic ecosystems. Melting ice opens

new shipping routes (e.g., the Northern Sea Route), increasing emissions and oil spill risks. Noise pollution from ships disrupts marine mammal communication and migration. Growing tourism increases waste, pollution, and ecological disturbance. Stronger climate policies to limit emissions and reduce Arctic warming. Renewable energy development to replace Arctic fossil fuel extraction. Marine-protected areas from safeguarding ecosystems and restricting harmful activities. International cooperation through agreements like the Arctic Council and the Paris Agreement. Sustainable indigenous-led conservation initiatives to balance development and environmental protection.

The Arctic is home to diverse indigenous communities and small populations that rely on the region's natural environment for survival. However, environmental changes caused by climate change, resource extraction, and industrial activities are disrupting traditional ways of life, health, and economic stability. Here are the key social impacts of environmental challenges in the Arctic: threats to Indigenous Communities, Cultural Loss, Food Insecurity, Water Insecurity, Rising Diseases, Economic Challenges, Infrastructure Risks, Social Inequality, and the Impact of Increased Industrial and Military Presence. The Arctic is home to indigenous groups such as the Inuit, Sámi, Nenets, Chukchi, and Yupik, who have lived in harmony with nature for thousands of years. Climate change disrupts their traditional hunting, fishing, and herding practices, leading to a loss of livelihoods. Rising temperatures force migration as coastal erosion and permafrost thaw make villages uninhabitable. Language and cultural traditions are at risk as younger generations move to urban areas for economic survival.

Environmental Sustainability problems

Thawing ice and changing temperatures reduce fish, seals, whales, and reindeer populations, impacting indigenous diets. Contaminated water sources from oil spills, mining, and thawing permafrost affect drinking water supplies. Increased food import costs make survival difficult as traditional subsistence practices decline. Rising temperatures lead to new disease risks as bacteria and viruses trapped in permafrost for thousands of years resurface. Increased exposure to pollutants and heavy metals from industrial activities affects Arctic populations' health. Food shortages and displacement lead to mental health crises, including anxiety and depression. More frequent natural disasters (flooding, coastal erosion, and wildfires) cause injuries and stress-related illnesses.

Many Arctic communities depend on fishing, hunting, and herding, but climate change disrupts these economic activities. As industrial activities (e.g., oil drilling and mining) expand, traditional jobs are replaced with temporary, low-wage labour opportunities. Increased living costs due to disrupted supply chains make Arctic survival more expensive. Some governments promote extractive industries for economic gain, but these often fail to benefit local communities directly.

Permafrost thawing leads to the collapse of homes, roads, and pipelines. Coastal communities face forced relocation due to rising sea levels and coastal erosion. The high cost of constructing climate-resilient housing makes adaptation difficult. Many indigenous communities are excluded from decision-making in Arctic development policies. Forced displacement leads to loss of identity and social cohesion as communities struggle to maintain their traditions. Non-indigenous workers and industries move in, creating economic disparity and sometimes marginalising indigenous populations.

Growing Arctic interest from nations such as Russia, the U.S., Canada, and China increases militarisation and geopolitical tensions. However, “Gorbachev’s strategic vision received a positive response from Western counterparts, leading to the establishment of the first multilateral environmental cooperation framework in the Arctic—the Arctic Environmental Protection Strategy (AEPS), which was signed by the eight Arctic states in 1991. Initiated by the Government of Finland, the AEPS laid the foundation for a series of collaborative efforts aimed at safeguarding the Arctic environment, marking a significant milestone in the evolution of regional environmental governance.” Indigenous lands are sometimes taken over for military or resource extraction purposes. Pollution from industrial projects (e.g., mining, oil drilling) worsens local living conditions. Strengthening Indigenous rights & governance to ensure self-determination in Arctic policies. Investing in climate-resilient infrastructure to protect Arctic housing, roads, and water systems. Sustainable economic development focused on renewable energy, ecotourism, and Arctic-friendly industries—international cooperation to reduce resource exploitation and support indigenous-led conservation.

Resource extraction, climate change, and global geopolitics shape the Arctic's economy. While economic activities such as oil drilling, fishing, and tourism bring revenue, they also pose risks to the environment and indigenous communities. Climate change further disrupts traditional livelihoods, making economic stability in the Arctic increasingly uncertain. The Arctic is rich in oil, gas, and minerals, making it a key focus for energy companies and governments. Melting ice makes accessing untapped resources easier, but extraction can damage fragile ecosystems. Mining operations bring jobs but also cause pollution, habitat destruction, and land conflicts with indigenous groups. Some Arctic nations rely on fossil fuel industries, making economic diversification difficult.

Opportunities in the Arctic Russia

Melting ice has opened up new shipping routes, such as the Northern Sea Route and the Northwest Passage. These routes shorten global trade distances, benefiting industries but increasing environmental risks—more shipping leads to oil spills, noise pollution, and disruptions to marine life. Arctic ports

and infrastructure require significant investments to handle increased trade. Fishing, hunting, and reindeer herding—vital for indigenous communities—are threatened by climate change and overfishing. Warmer temperatures reduce fish stocks and change animal migration patterns, affecting Arctic economies. Indigenous groups often struggle to compete with large corporations in resource industries.

Tourism in the Arctic is increasing, bringing economic opportunities to remote communities. However, large cruise ships and mass tourism contribute to pollution and environmental degradation. Some areas struggle to manage waste and water usage and preserve cultural heritage in the face of rapid tourism expansion. Due to supply chain challenges, Arctic cities face higher costs for goods and services—permafrost thawing damages roads, buildings, and pipelines, requiring expensive repairs. Governments must invest heavily in climate-resilient infrastructure, straining public budgets. Countries such as Russia, the U.S., Canada, and China compete for Arctic control, increasing military presence. Unclear regulations on Arctic resources create economic uncertainty for industries and governments. Indigenous groups often face legal battles over land rights and economic benefits.

The Arctic has excellent potential for renewable energy, such as wind, hydro, and geothermal power. Shifting to sustainable industries could reduce dependence on fossil fuels while creating jobs. Investment in green infrastructure and ecotourism could balance economic growth and environmental protection. Diversifying the Arctic economy by investing in renewables, technology, and sustainable tourism. Strengthening indigenous economic participation in industries like fishing, ecotourism, and conservation. Developing strict regulations on Arctic shipping and resource extraction to minimise environmental damage. International cooperation to ensure responsible economic development and protect Arctic ecosystems.

The Arctic faces significant environmental, social, and economic challenges due to climate change, resource extraction, and geopolitical tensions. Addressing these issues requires a balanced approach that promotes sustainability, protects indigenous rights, and supports economic stability. Below are key solutions and strategies to address these challenges: environmental sustainability solutions, social solutions for Indigenous communities and local populations and economic sustainability strategies Implement strict regulations to limit fossil fuel extraction and reduce greenhouse gas emissions. Expand renewable energy projects (wind, solar, and hydro) to reduce Arctic dependence on oil and gas. Strengthen international climate agreements (Paris Agreement, Arctic Council) to enforce climate policies. Establish marine protected areas (MPAs) to safeguard Arctic marine life from overfishing and industrial activities. Ban or strictly regulate oil drilling and mining in ecologically sensitive areas. Promote sustainable fishing practices to prevent overfishing and ecosystem collapse.

Challenges Ahead

Thawing permafrost is projected to endanger approximately 70% of Arctic infrastructure by 2050, posing significant risks to critical assets such as oil and gas pipelines, urban settlements, and fragile ecosystems. A prominent illustration of these vulnerabilities is the 2020 Norilsk diesel spill, which resulted from the structural failure of industrial infrastructure due to permafrost degradation, highlighting the severe environmental and economic repercussions of insufficient adaptive measures. Furthermore, the release of greenhouse gases such as methane and carbon dioxide from thawing permafrost may exacerbate global warming trends, thereby jeopardising the attainment of international climate targets.

Invest in research on permafrost monitoring and carbon capture technologies. Reduce black carbon emissions (from shipping, industry, and wildfires) to slow ice melt. Enforce strict regulations on industrial waste and oil spills to prevent Arctic pollution. Grant indigenous communities legal control over land and resources. Ensure Indigenous representation in policy-making and climate negotiations. Support community-led conservation programs that align with traditional knowledge and sustainable practices. Expand funding for Arctic healthcare facilities to address emerging health risks. Support local food production through hydroponic greenhouses and sustainable hunting and fishing initiatives. Reduce reliance on imported food by investing in Arctic agriculture adapted to extreme conditions. Develop climate-proof housing resistant to permafrost thaw and coastal erosion. Build sustainable transportation networks to connect remote Arctic communities. Use renewable energy microgrids to reduce dependence on expensive fossil fuel imports.

Shift investments from fossil fuels to renewable energy projects (wind, hydro, geothermal). Promote sustainable tourism (ecotourism, cultural tourism) instead of mass tourism. Develop technology and research hubs in Arctic cities to foster innovation and job creation. Implement stricter environmental standards for Arctic oil, gas, and mining industries. Establish fair revenue-sharing policies to ensure Indigenous communities benefit from economic activities. Expand fishing quotas and marine conservation laws to prevent overexploitation. Enforce strict regulations on Arctic shipping to minimize emissions and oil spill risks. Develop green shipping technologies (electric or hybrid icebreakers) to reduce pollution. Enhance the role of the Arctic Council in regulating economic and environmental policies. Create legally binding agreements between Arctic nations to protect fragile ecosystems. Establish joint research and climate monitoring programs across Arctic countries. Promote diplomatic solutions for Arctic disputes to prevent militarization and conflict. Encourage international trade agreements that prioritize sustainable development. Develop cross-border conservation initiatives to protect Arctic biodiversity.

The Arctic is experiencing rapid and unprecedented changes due to climate change, industrial activities, and geopolitical interests. These transformations

have profound environmental, social, and economic effects, raising concerns about the region's long-term sustainability. The growing frequency of floods, wildfires, and extreme temperature fluctuations is placing mounting pressure on Russia's disaster management and emergency response systems. The 2024 floods in the Orenburg region were a critical indicator of institutional vulnerability and systemic inadequacies, with observers emphasizing the recurring shortcomings in adapting to escalating climate-related hazards. Industrial pollution, deteriorating Soviet-era infrastructure, and the expansion of fossil fuel ventures—such as the Yamal LNG project—pose substantial threats to Arctic biodiversity. Although these environmental risks are recognized in Russia's official Arctic Strategy, the policy framework continues to prioritize economic development objectives over the implementation of robust environmental protection measures.

The Arctic is warming nearly four times faster than the global average, leading to accelerated glacier and sea ice loss. Permafrost thaw releases methane, a potent greenhouse gas, exacerbating climate change. Increased coastal erosion and rising sea levels are threatening Arctic ecosystems and communities. Arctic wildlife (e.g., polar bears, walrus, caribou, and Arctic foxes) struggles to adapt to habitat loss. Warmer temperatures are changing migration patterns and causing food shortages for many species. The ocean acidification caused by CO₂ absorption affects marine life, including fish stocks crucial for local economies. Oil and gas drilling, mining, and shipping increase pollution levels in fragile Arctic environments. Black carbon emissions from shipping and industry are darkening ice surfaces, speeding up melting. Plastic waste and chemical pollutants from distant regions accumulate in Arctic waters and food chains.

Traditional ways of life, such as subsistence hunting and fishing, are becoming harder due to melting ice and changing ecosystems. Indigenous groups are facing land encroachment from industries and geopolitical conflicts. Health issues, including increased respiratory diseases and food insecurity, are rising due to environmental changes. Arctic settlements built on permafrost risk collapsing due to thawing ground. Extreme weather events like storms and flooding make daily life more hazardous. Remote Arctic villages lack reliable energy sources, healthcare, and transportation infrastructure. Younger generations migrate to urban centres, leading to cultural loss and depopulation. Traditional knowledge systems are at risk as globalisation and climate change reshape Arctic societies. Increased contact with outsiders (tourists, industrial workers, scientists) alters local social structures.

The opening of Arctic sea routes (e.g., the Northern Sea Route) attracts global trade and shipping companies. Oil, gas, and mineral exploration are increasing due to melting ice exposing new resource-rich areas. Fishing industries are expanding, but unsustainable practices threaten long-term viability. Many Arctic communities rely heavily on government subsidies due to limited local industries. Foreign

corporations dominate resource extraction, with little revenue returning to local populations. The cost of living in the Arctic is rising as transportation and supply chains become more unstable. Growing investments in renewable energy (wind, hydro, geothermal) offer hope for a sustainable economy. Ecotourism and scientific research could create jobs that align with environmental conservation. Technological advancements in cold climate infrastructure and sustainable agriculture could improve living conditions.

Arctic nations (e.g., Russia, Canada, USA, Norway, Denmark) have competing claims over resources and shipping routes. Geopolitical tensions are increasing militarisation in the Arctic, raising security concerns. The Arctic Council lacks enforcement power, making regulating environmental and economic policies difficult. Existing environmental laws do not fully cover Arctic-specific challenges. The lack of binding international agreements allows corporations to exploit Arctic resources with little accountability. Indigenous representation in policymaking remains limited despite communities being most affected."Asian observer states—including India, China, Japan, Singapore, and South Korea—are increasingly exposed to the cascading vulnerabilities arising from climate change in the Arctic region. The current suspension of activities within the Arctic Council's Working Groups is likely to exert a substantial impact on both ongoing initiatives and prospective collaborative projects involving these nations, thereby affecting their strategic and scientific engagement in Arctic governance and environmental research."

"The Arctic region remains significantly underdeveloped regarding space-based infrastructure, which is essential for ensuring reliable telecommunications, connectivity, navigation services, search and rescue operations, climate modelling, environmental monitoring, surveillance, and other related technological and operational domains."Moscow's Arctic Strategy to 2035 outlines ambitious objectives to enhance hydrocarbon extraction and establish the Northern Sea Route as a key global maritime corridor while simultaneously committing to the preservation of Arctic ecosystems. However, in practice, allocations for environmental protection measures remain disproportionately low compared to the substantial investments directed toward military expansion and energy infrastructure development. The release of Soviet-dumped nuclear waste has a social and economic impact on Russia in the northern region. However, ice melting will lead to more grazing places in the southern region of Russia. Initiatives such as the "Clean Country" program seek to address the legacy of Soviet-era environmental degradation in the Arctic, including efforts to remove hazardous waste in areas like Franz Josef Land. Nevertheless, such interventions remain limited in scale and insufficiently funded, mainly when measured against the magnitude and complexity of the region's broader ecological challenges.

Although geographically distant, India and Russia are linked through the interconnected geophysical landscapes of the Himalayas—often referred to as the "Third

Pole"—and the Arctic region. Building upon their longstanding bilateral relationship and institutional frameworks for cooperation, the Arctic presents emerging avenues for collaboration. These include joint ventures in oil and gas exploration, enhanced connectivity through maritime shipping lanes and fibre optic infrastructure, and expanding cooperation in tourism, healthcare, and maritime navigation. While the ongoing impacts of climate change remain a pivotal concern in shaping future policies, the Arctic region simultaneously offers a platform for India and Russia to strengthen mutual interests and diversify their strategic engagement. India's invitation for Russia to join the 'Coalition for Disaster Resilient Infrastructure' and "International Solar Alliance" has the potential to safeguard Russia's interest in the Arctic region.

Way forward

It is imperative to establish a comprehensive policy and legal framework governing the disposal of radioactive waste in the Arctic region to mitigate long-term environmental and public health risks. Additionally, the priorities and rights of Indigenous communities must be central to governance strategies, given their role as primary stewards and first responders to environmental crises in the region. Ensuring effective coordination and collaboration among various stakeholders—including governments, local communities, industry actors, and international institutions—is essential for inclusive and sustainable Arctic governance. Furthermore, investment in sustainable and specialized technologies should be prioritized to facilitate the responsible exploration and extraction of the region's untapped energy and mineral resources, thereby balancing economic development with ecological preservation.

Conclusion

Environmental sustainability is poised to play a critical role in shaping the future trajectory of Arctic Russia. However, conflicting policy priorities and growing geopolitical isolation present formidable barriers to effective environmental governance. Although there has been a notable rise in climate adaptation discourse and strategic planning, implementing concrete measures remains inadequate, particularly amid intensifying ecological crises. In the absence of decisive progress toward emission reductions, strengthened environmental regulation, and enhanced international cooperation, the coming decade will be a pivotal test of Moscow's ability to reconcile its economic and strategic interests with the imperative of ecological sustainability.

References

1. <https://eng.rosstat.gov.ru/search?q=Arctic>
2. AMAP. (2017). Amap.no. <https://www.amap.no/videos>
3. Sharma, B., & Sinha, U. (2021). Prospects for India-Russia Cooperation in the Arctic PROSPECTS FOR INDIA-RUSSIA COOPERATION IN THE ARCTIC 1. <https://www.idsa.in/system/files/issuebrief/india-russia-in-arctic-bsharma-uksinha.pdf>
4. Arctic Council in the Midst of Ukraine Crisis - MP-IDSA. (2025, March 7). MP-IDSA. <https://www.idsa.in/publisher/comments/arctic-council-in-the-midst-of-ukraine-crisis/>
5. Farish, M. (2013). The Lab and the Land: Overcoming the Arctic in Cold War Alaska. *Isis*, 104(1), 1-29. <https://doi.org/10.1086/669881>
6. Conley, H. A., & Newlin, C. (2021). Climate Change Will Reshape Russia. *Csis.org*. <https://www.csis.org/analysis/climate-change-will-reshape-russia>
7. Kluge, J., & Paul, M. (2020). Russia's Arctic strategy through 2035: grand plans and pragmatic constraints. 4. <https://doi.org/10.18449/2020c5>
8. Wall, C., & Conley, H. A. (2021). U.S.-Russian Arctic Relations: A Change in Climate? *Csis.org*. <https://www.csis.org/analysis/us-russian-arctic-relations-change-climate>
9. Advancing conservation and protecting biodiversity in the Russian Arctic - WWF Arctic. (2022, April 25). WWF Arctic. <https://www.arcticwwf.org/the-circle/stories/advancing-conservation-and-protecting-biodiversity-in-the-russian-arctic/>
10. <https://www.thearcticinstitute.org/partnership-between-us-russia-field-sustainable-development-goals-arctic-region/>
11. Romasheva, N., & Dmitrieva, D. (2021). Energy Resources Exploitation in the Russian Arctic: Challenges and Prospects for the Sustainable Development of the Ecosystem. *Energies*, 14(24), 8300-8300. <https://doi.org/10.3390/en14248300>



Kataytseva Polina

Student

Ural Federal
University



Unconditional Transport Accessibility in Urban Agglomerations: Between Urbanist Utopia and Economic Reality

Preamble

Urbanization is a term that could be listed among the most important words of the 20th century. The rapid growth of urban populations in BRICS countries from the early 20th century to the present reflects global shifts in economy, social structure, and demography. Each of these countries has experienced a long and distinct path of urbanization, which has been both a cause and a consequence of deep societal transformations. At the beginning of the 20th century, the urban population share ranged from 5% in China to 18% in South Africa. Let us leave aside the historical prerequisites and political processes and focus solely on the entry point and current indicators for each group member.

In China, urbanization accelerated in the 1950s, and by 2022, over 60% of the population – more than 900 million people – lived in cities. According to a study by the World Bank, the peak of urbanization has passed, and future urban growth will

concentrate around major megacities and new urban clusters such as the Yangtze River Delta and the Beijing-Tianjin-Hebei region¹.

In modern India, more than 35 % of the population – about 500 million people – live in cities. Urban population density in India exceeds the global average, primarily due to Delhi and Mumbai. Urbanization is expected to continue, with demographic shifts and GDP growth concentrating more people around the key metropolitan areas like Mumbai, Delhi, and Bangalore².

In South Africa, approximately 40 million people, or more than 70 % of the population, reside in urban areas. South African cities have lower population density compared to megacities in countries like India and China. Population density in South African megacities ranges from 1,310 to 3,040 people per square kilometer, due to large urban footprints and significant suburban zones in Johannesburg, Cape Town, and Durban. These agglomerations are likely to grow further through internal migration³.

Brazil has the highest urbanization rate among BRICS countries: over 86 % of the population, i.e. about 180 million people, live in cities. Urbanization rates are expected to stabilize, reaching around 90 % by 2040. Major urban agglomerations such as São Paulo and Rio de Janeiro will remain the key centers, and the government is currently developing targeted programs to improve urban quality of life⁴.

In Russia, industrialization and subsequent urbanization began in the 1920s. By 2022, 75 % of Russians – approximately 110 million people – lived in cities. Nearly 70 % of Russian cities have populations under 100,000, and the future of a third of these cities remains uncertain, heavily dependent on anchor enterprises and state investment in social services. By 2040, large cities are expected to grow due to internal migration from smaller towns and labor migration⁵.

Urbanization will thus remain the key development factor for BRICS countries in the coming decades, creating both opportunities and challenges for governments and societies. Common and specific urbanization-related issues include: overpopulation and housing challenges, including rising costs and reduced affordability; inadequate urban infrastructure that lags behind population growth; environmental issues driven by increased consumption and waste; and management difficulties in urban planning, all of which exacerbate social

1 Wahba Tadros, Sameh Naguib; Wellenstein, Anna; Das, Maitreyi B; Palmarini, Nic; D'Aoust, Olivia Severine; Singh, Gayatri; Restrepo Cadavid, Paula; Goga, Soraya; Terraza, Horacio Cristian; Lakovits, Carina; Baeumler, Axel E. N.; Gapihan, Anne Treylane.

2 Ibid

3 Ibid

4 Ibid

5 Institute for Urban Economics. The Economy of Russian Cities and Urban Agglomerations. Issue 5: Major Urban Agglomerations in the Global Economy. Moscow: Institute for Urban Economics Foundation, 2020.

inequality. The concept of unconditional transport accessibility is a vital tool for addressing these urbanization challenges. It promotes the creation of cities with equal opportunities for all residents, reduced environmental impact, and improved quality of life.

Hypothesis

The principle of Unconditional Transport Accessibility (UTA) emerged within the broader concepts of “Transport Accessibility” and “Unconditional Transport Accessibility”⁶. It has become widespread in urban mobility research and practice, especially alongside the ideas of “sustainable transport” and “smart cities”. One of the pioneers in developing this concept was American scholar David Banister. While still relatively unknown in Russian historiography, the concept warrants deeper exploration.

Banister and his colleagues studied how urban structure and transport planning affect access to essential services such as employment, education, health-care, and recreation. The core idea is that transportation systems should guarantee access to key services and destinations for all citizens, regardless of location, income, or physical ability.

The UTA concept has since been further developed by researchers and urban planning professionals. Their findings highlight that transport accessibility is crucial for achieving social equity and urban sustainability.

The principle of Unconditional Transport Accessibility (UTA) means that every city resident is to be able to access essential services and destinations without barriers, no matter where they live. This principle aims to provide equal opportunities to all citizens, including the elderly, people with disabilities, children, and youth.

Key components of UTA include:

1. Access to public transport: public transport should be accessible for every citizen offering regular and convenient connections across all districts.
2. Comfort and safety of pedestrian areas: well-maintained sidewalks, lighting, and fencing.
3. Interactive maps and navigation tools to help residents plan routes and navigate cities easily.
4. Environmental sustainability: promotion of environmentally friendly transportation options (electric buses, trams, and personal mobility devices).

Some sources also emphasize cycling infrastructure, including dedicated bike lanes and parking.

⁶ Institute for Urban Economics. The Economy of Russian Cities and Urban Agglomerations. Issue 5: Major Urban Agglomerations in the Global Economy. Moscow: Institute for Urban Economics Foundation, 2020.

However, the ideal of Unconditional Transport Accessibility often clashes with the reality of urban agglomerations, which face serious resource constraints:

1. Financial: high costs of maintaining and upgrading roads, junctions, and public transport.
2. Spatial: difficult topography, existing and future urban development, and limited physical space to build or expand roads, bridges, junctions, parking lots, and other facilities.
3. Technical: outdated infrastructure, compatibility issues with modern systems (especially in tram and trolley networks), and integration challenges.
4. Political and administrative: barriers to transport between municipalities within one agglomeration, lack of subsidies to carriers or municipalities and regions to build road facilities or modernize public transport.
5. Social burden: ensuring access to social infrastructure, support for subsidized passengers, need for barrier-free, safe environments, public attitudes toward transit, and fare policy.
6. Environmental pressure: air and noise pollution (likely the least influential of the above).

Most Unconditional Transport Accessibility barriers stem from a fundamental question: Is public transport a business with social obligations or a municipal responsibility?

BRICS countries use hybrid models. In general terms: municipalities retain regulatory roles, municipal/government companies in China/ state corporations in India build and operate infrastructure. Metro and rail systems are state-managed; bus transport varies across public and private sectors. In many cases, public-private partnerships are used to develop large-scale projects like metro lines or fleet upgrades.

Public transport can function as a business, especially where operators pursue profitability through improved service and customer attraction. Yet public transit plays a crucial social role: granting access to jobs, schools, healthcare, and other essential services for all categories of citizens, especially for those without private vehicles. Profitability is often limited by the need to serve low-income areas and provide subsidies.

Therefore, municipalities consider transit as a core urban function providing access to essential services. Local governments regulate fares, plan routes, and integrate modes. Many routes are unprofitable, requiring subsidies to maintain service, modernize fleets, build infrastructure, and cover losses.

However, what we are witnessing is a classic case of nationalized losses and privatized profits: infrastructure – roads, interchanges, bus stops, and information systems – is maintained and funded by the municipality. A portion of public transport is also municipally operated (through municipal unitary enterprises of city transport), which includes metro systems, tram and trolleybus depots, and certain bus routes. Meanwhile, commercial companies reap the profits. Municipal

transportation companies consistently report financial losses every year (e.g., in Yekaterinburg⁷ and Moscow⁸), while competition for lucrative commercial routes is fierce, and, according to media reports, sometimes even criminalized.

The profitability of commercial routes is achieved through various means that often contradict not only the principles of Unconditional Transport Accessibility but also public road safety norms, service quality standards, and proper fare accountability. These include poorly maintained vehicles and inadequately trained drivers, extended service intervals during low-demand hours, and violations of passenger transport regulations.

Why, then, does not the municipality expand its regulatory authority or coverage in the public transportation sector? Such a decision would, in the long term, allow for more effective management of the resource limitations to implement the principles of Unconditional Transport Accessibility identified earlier:

1. financial: high costs of road, interchange, and public transport maintenance and modernization would remain but could be offset by revenue from commercially viable routes;
2. spatial limitations: the practice of expropriating land for road construction could be more actively pursued if municipalities had the economic incentive or a developer-partner focused on improving transport accessibility;
3. technical limitations: these are easier to address within unification and medium-term municipal planning framework than across several independent carriers;
4. political and administrative resources could be focused on a single objective based on shared principles, and centralization would simplify appeals to federal authorities for subsidies on road network and public transport development;
5. the city would gain flexibility in managing social obligations, including through comprehensive territorial development planning, attracting investors among developers for transport projects, allocating land for institutions and residents, and flexibly subsidizing fares for specific population categories (e.g., young municipal professionals);
6. environmental burdens could be significantly reduced through prioritizing electric transport, lowering carbon emissions, and minimizing the cost of vehicle disposal and maintenance for both public and private fleets.

Thus, implementing the principle of Unconditional Transport Accessibility requires a comprehensive approach and engagement from all the stakeholders: authorities, the business community, non-governmental organizations, and resi-

7 Report of the Head of Yekaterinburg on the Results of His Activities and the Activities of the City Administration, Including Responses to Questions Raised by the Yekaterinburg City Duma for 2023. Yekaterinburg, 2024.

8 Moscow Transport Complex: 2022 Performance Report. Moscow, 2023.

dents themselves. One way to realize the declared goals of Unconditional Transport Accessibility could be the transfer of transport operations to municipal management or the establishment of a system with stronger municipal oversight of public transportation.

Economic and Social Effects. When evaluating social outcomes, it is crucial to consider the cultural characteristics of specific societies. For instance, the expectations of residents in Russia, India, China, and Brazil do not align with the typical American approach to transport accessibility, due to distinct historical and cultural factors. What may work for atomized nuclear households in endless American suburbs does not meet the needs and expectations of those shaped by socially-oriented or even paternalistic states, or of the bearers of traditional cultural code representing the third or fourth generation of residents (given the pace of urbanization in BRICS countries).

The urban transportation systems in agglomerations may shift from being narrowly evaluated based on profit and loss to being recognized as a category of investment for the economic development of agglomerations.

General Conclusions and Expected Outcomes.

Urban transport accessibility in BRICS megacities faces shared challenges: road congestion, insufficient public transport, and environmental consequences. However, each country is developing its own strategy to address these issues, including expanding transport networks, integrating digital technologies, and promoting environmentally friendly transportation.

The concept of Unconditional Transport Accessibility directly addresses many of the urbanization challenges faced by BRICS countries. A robust public transport system aligned with UTA principles can reduce private car use, ease congestion, and improve environmental conditions. Ensuring access to transport for all residents, regardless of income, will make cities fairer and more inclusive. The use of green transport modes, such as electric buses and trams, will reduce carbon emissions and improve urban air quality.

The principles of Unconditional Transport Accessibility demand a comprehensive approach to urban infrastructure planning for more rational and socially equitable resource use. This is what makes expanding municipal authority over transport infrastructure such an attractive and promising direction.



RUSSIA



Kayumova Anastasia

Student

Novosibirsk State University
of Economics and Management



Path to Creation: Corporate Social Responsibility as a Norm

This essay has been prepared as part of the thematic block titled “Investments in the Environment: Which investment initiatives and solutions under New Platform for Global Growth will create a more comfortable, sustainable and safe living environment?”

Each year, the worsening environmental situation prompts society to increasingly scrutinise the environmental impact of corporate activities. On 6 February 2024, VCIOM (Russian Public Opinion Research Center) released findings from a monitoring survey on public perceptions of Russia’s environmental conditions, specifically for the RUIE (Russian Union of Industrialists and Entrepreneurs) Environmental Forum. According to the survey, 29% of respondents identified industrial companies as having a significant negative impact on the environment, while 30% pointed to the low level of environmental responsibility among businesses as a key obstacle to improving the situation [5].

Indeed, organisations that neglect to adhere to environmental laws and regulations and fail to fulfil their societal obligations and responsibilities pose a significant threat to sustainable and safe development in the future.

The social responsibility of businesses encompasses not only environmental protection but also includes social and economic dimensions, such as supporting local communities, providing employee training and professional development, offering benefits like voluntary health insurance for employees, creating safe and comfortable work environments, organising cultural and sports events, and more. Therefore, promoting the principles of corporate social responsibility and expanding its application areas presents a genuine opportunity to foster progressive societal development and create more comfortable and safe living conditions.

A survey conducted by VCIOM on 27 August 2024 revealed that the Russian public's awareness of corporate social responsibility remains moderate. Only approximately half of the citizens (47%) are familiar with or have heard about projects implemented by large enterprises in this area. Notably, residents living near large industrial facilities are 1.5 times more likely to be informed about these initiatives, as they often witness their impact firsthand [4]. For instance, in 2023, the Tatneft group and its subsidiary Tolyattikauchuk allocated over 100 million rubles to develop Tolyatti's infrastructure, resulting in 11 projects that enhanced culture, healthcare, education, and sports. These projects included renovating the Art Museum, equipping hospital operating rooms, refurbishing school classrooms, and building an inclusive sports playground, among multiple other transformations [2].

The survey also showed that projects focused on enhancing local community life, such as infrastructure development and urban environment improvement, are most noticeable and tangible to residents. However, this does not fully align with the preferences of the surveyed Russians, as every second respondent (51%) identified support for healthcare as the primary area of focus [4]. This is understandable, given that healthcare initiatives can significantly impact quality of life. It is important to note, though, that the lack of public awareness about ongoing healthcare projects does not imply that businesses are not investing in this area.

As previously mentioned, a significant number of citizens view the low environmental responsibility of businesses as a major obstacle to environmental improvement, which in turn affects the quality and standard of living. While such projects are currently underway, their scale and capacity are still insufficient to drive substantial changes in nature conservation. This is particularly concerning as global environmental challenges continue to escalate annually.

On 12 February 2025, as part of Russian Business Week, a Social Forum titled "Social Priorities in the Development of Responsible Business – Contribution to Achieving National Goals" took place. The event highlighted the state's current challenges, including enhancing infrastructure for families and children, expanding access to quality education and healthcare, promoting cultural leisure activities, and creating a comfortable living environment.

Alexander Shokhin, President of the Russian Union of Industrialists and Entrepreneurs, emphasised the significant role of businesses in addressing these challenges, while Tatyana Golikova, Deputy Prime Minister of the Russian Feder-

ation, highlighted the growing involvement of companies in implementing large-scale social projects. However, achieving success in these endeavours requires the combined efforts of the state, businesses, and society as a whole [3].

In 2025, new national projects will start, focusing on key objectives such as preserving the population, supporting families, enhancing public health and well-being, and improving living conditions. It is likely that these areas will become the primary priorities for businesses when implementing their social responsibility initiatives.

In terms of the interplay between social and economic impacts, companies that adhere to responsible business principles enhance their market position and business reputation. Consequently, they contribute to positive social changes while gaining a significant competitive edge. Although implementing socially impactful projects requires substantial resources and investments, it ultimately provides the company with clear economic benefits, such as government support, customer loyalty, human resource advantages, and more.

The advancement of modern technologies and the rise of artificial intelligence have profoundly influenced all aspects of life. Currently, many companies are leveraging these technologies to minimise their environmental footprint, and AI is enabling organisations to execute social projects that were once deemed unfeasible. Consequently, the integration of innovations can facilitate businesses in more effectively implementing social responsibility principles. The digitalisation of the economy allows for closer communication with consumers, thereby enabling companies to better understand and address their requests and needs.

Today, BRICS+ countries are actively integrating advanced technologies into their economies. Despite their cultural, economic, and social diversity, these nations share a common goal: improving the living conditions of their citizens.

In recent years, companies in BRICS+ countries have transitioned from exploring AI technologies to actively utilising them. However, there remain numerous opportunities for further AI applications, particularly in fostering socially responsible business practices [1].

It is, therefore, reasonable to propose leveraging AI to boost the interest of medium and small enterprises in high-quality sorting and recycling of recyclable materials. Additionally, AI can help expand the scope of social programmes, such as organising community events, increasing employment opportunities for socially vulnerable citizens within these companies, and more.

This can be accomplished by actively introducing grant support, which will be allocated based on a rating system established by AI using organised data on companies' activities in these areas. AI will also provide recommendations for adjusting current practices and suggest potential trends, helping companies to further develop and address existing issues.

As technologies advance, international collaboration and cooperation among BRICS+ countries are becoming increasingly significant. Only through their joint

efforts in improving waste sorting and recycling processes can these nations achieve substantial progress in addressing environmental challenges. AI plays a crucial role in this endeavour by optimising logistics and proposing effective solutions, taking into account shared borders, national capabilities, climate conditions, economic and social factors, human and energy resources, etc.

In summary, corporate social responsibility should be regarded as an absolute norm in today's world. The range of approaches and methods for its implementation will continue to expand each year, driving sustainable and prosperous development for both society and the economy, with outcomes directly shaped by companies' efforts in this area.

References

1. Yakov and Partners. Generative AI in the BRICS+ Countries: Trends and Outlook. URL: <https://yakovpartners.com/publications/gen-ai-brics/> (Accessed on 28 February 2025).
2. T. Gol'dina. Investing in Kindness: How Businesses Support Social Initiatives (in Russian language). URL: <https://sovainfo.ru/news/investitsii-v-dobrye-dela-kak-promyshlennost-vkladyvaetsya-v-sotsialnye-proekty/> (Accessed on 27 February 2025).
3. RUIE News. The Social Forum Explores Strategies and the Role of Responsible Business in Achieving National Goals (in Russian language). URL: <https://rspp.ru/events/news/na-sotsialnom-forume-obsudili-strategii-i-rol-otvetstvennogo-biznesa-v-dostizhenii-natsionalnykh-tseley-67af04c74d4e8/> (Accessed on 28 February 2025).
4. VCIOM News. Corporate Social Responsibility During Russia's Special Military Operation (in Russian language). URL: <https://wciom.ru/analytical-reviews/analiticheskii-obzor/socialnaja-otvetstvennost-biznesa-v-ehpokhu-svo> (Accessed on 27 February 2025).
5. VCIOM News. Environmental Situation in Russia: Monitoring (in Russian language). URL: <https://wciom.ru/analytical-reviews/analiticheskii-obzor/ehkologicheskaja-situacija-v-rossii-monitoring-2> (Accessed on 27 February 2025).



Kazymov Ramin

Deputy Director

JSC "Institute
of Economic Research"



Adapting to Climate Change in Kazakhstan

**Investing into the environment.
Natural disaster management**

Relevance

Climate change is one of the main global threats impacting sustainable development of both developing and developed countries. As the largest country in Central Asia, Kazakhstan faces major environmental challenges related to climate change.

The Climate Change Action report demonstrates that Kazakhstan's climate is getting warmer. In 1991-2020, average annual temperatures grew by 0.9°C compared to 1961-1990. Days with temperatures above 30-35° C are becoming increasingly frequent in the country's south, southwest, and west. Climate change makes heat waves stronger, and record temperatures seen in 2020 (1.92°C above average) exceeded the previous maximum recorded in 2013 (1.89°C).

In 2021, average annual air temperature in Kazakhstan was 1.58°C higher than the climate norm in 1961-1990, and this is the fifth-highest figure in the range of warmest years in 1941-2020. As average annual air temperatures grow, high summer temperatures recur with greater frequency, which negatively affects flora, fauna, and human population.

The issue of adapting to climate change in Kazakhstan becomes all the more pressing since climate change and natural disasters have major effect on the

country's economy and population. High temperatures, changing precipitation regime, extreme weathers such as droughts, floods, and dust storms cause damage to agriculture that is an important part of Kazakhstan's economy. Falling crop yields, cattle losses, water shortages cause economic damages and can result in higher food prices. Additionally, climate disasters often force population to migrate from the affected regions thereby creating further social and infrastructural problems. Extreme weathers also cause damage to urban and rural settlements, destroy buildings, roads, and communications, which translates into major repair costs and increases social instability.

In this context, the issues of adapting to climate change and having efficient disaster management become key factors in ensuring Kazakhstan's sustainable development amid global environmental change.

Argument

Successful adaptation to climate change in Kazakhstan requires a comprehensive approach that includes steps for preventing natural disasters and as well as strategies for minimizing their consequences. The outlook for Kazakhstan is further average temperature increases, which will cut water resources, change agricultural potential, and increase the frequency and severity of natural disasters.

Kazhydromet reports that the number of natural disasters in Kazakhstan has been climbing since 2019, mostly because of more frequent strong winds and dust storms in 2021. On the contrary, heavy rains in 2021 (10) were far fewer than in 2017 (32).

Extreme weathers	2017	2018	2019	2020	2021
Strong wind	49	50	32	48	96
Heavy rain	32	22	30	22	10
Blizzard	39	10	14	32	26
Heavy snowfall	10	11	8	2	11
Thick fog	4	1	6	3	3
Hail	1	0	0	3	4
Big dust storm	0	0	0	0	5
Sleet and ice	3	1	1	0	1
Total	138	95	91	110	156

Table 1. Extreme weather frequency in Kazakhstan (2017-2021)

Source: Kazhydromet

Kazakhstan's Ministry for Emergency Situations reports that in 2017-2021, 1,647 people died and 5,724 were injured in natural disasters. As for economic damage, Kazakhstan's Bureau of National Statistics reports that the costs of natural disaster recovery ballooned from KZT 1 bn. in 2010 to KZT 7.3 bn. in 2020, while the costs of anthropogenic disaster recovery shrank from over KZT 8 bn. in 2010 to KZT bn. in 2020.

Climate data analysis demonstrates that temperatures in Kazakhstan have already risen by 0.4–0.5° C over the last 30 years, which is higher than the world's average. Forecasts predict that by the late 21st century, Kazakhstan's temperatures may rise by 3–4° C, which will produce drastic changes in ecosystems and exacerbate current problems with water resources.

Changing precipitation regime is particularly dangerous for Kazakhstan's economy. For instance, Central Kazakhstan where the main agricultural districts are is predicted to experience a major precipitation shrinkage, which will make droughts more frequent and crop growing conditions will consequently deteriorate. The World Bank reports that Kazakhstan's agriculture has already lost billions of dollars because of droughts.

Equally important is the impact natural disasters have on the social sphere. More frequent droughts and other extreme weathers result in deteriorating quality of life, particularly in rural areas.

Economic and social effects

Climate change in Kazakhstan carries both direct and indirect economic risks. Direct losses stem from the damage caused by natural disasters such as floods, droughts, fires, destroyed infrastructure. Climate change particularly affects agriculture that still remains the key economic sector ensuring food security and jobs for millions of people. Falling crop yields and higher infrastructure rebuilding costs result in major economic losses.

Indirect losses stem from disrupting the environmental balance and from deteriorating health of the population. For instance, a greater number of dust storms and higher concentrations of airborne particles result in higher incidence of respiratory diseases, which in turn increases healthcare costs and reduces the population's working ability. Deteriorating water quality caused by pollution and shrinking water resources can result in potable water shortages, which also affects socioeconomic development.

From the point of view of the social sphere, climate change also is fraught with the threat of greater inequality. It is especially true for agriculture that is particularly vulnerable to climate disasters. The Economic Research Institute modeled several long-term outlooks for Kazakhstan predicting that frequent droughts would adversely affect economy. In dry years, the difference in real GDP increases to 2–2.5%. The drought scenario predicts that production will mostly drop in agriculture and in the energy sector; by 2050, the slump may amount to 7–12%. Other sectors, such as chemical manufacturing and manufacturing of food and drinks, may be indirectly affected as well.

Agriculture and retail are expected to experience the greatest slump; they are particularly labor-intensive and extremely vulnerable to droughts. In 2050, total employment will fall by 1.6% compared to the base scenario.

Modelling the effect extreme precipitation may have on Kazakhstan's economy also produced negative results. By 2050, the difference in real GDP will increase to 1.5%. It will mostly be affected by a drop in exports that fall by 2.3% in 2050 compared to the base 2022 scenario, while imports increase by 1.1% in the first years and then drops by 0.3% as economy slows in subsequent years.

In order to prevent such losses, Kazakhstan needs to take adaptive measures. Some anti-drought measures to be used in adapting to climate change could include water-saving technologies, breeding drought-resistant crops, building multi-purpose reservoirs etc. Modelling demonstrates that investing into irrigation will increase agricultural production by 1.9% (KZT 117.3 bn.) by 2050 compared to the scenario with droughts and without adaptive measures. This adaptive measure results in a GDP that is about 0.5% higher than in the scenario with droughts and without adaptive measures. Growth generally is driven by investments and increased household consumption.

Modelling the adaptive measure of building climate-resistant roads yields similar results. By 2050, investment in the first years and increased export potential later result in positive difference in real GDP increasing to 0.6% compared to the scenario without adaptation. Better roads cut travel time and costs, which results in exports growing on average by more than 1%.

Conclusions

Adapting to climate change is a vital task for Kazakhstan, which requires a comprehensive approach and an active interaction of all the parties concerned, including government bodies, the private sector, and local population. Natural disaster management should include both preventive steps, early alert systems, and effective emergency response systems.

Forecasts and current data demonstrate that unless Kazakhstan channels major effort into adaptation, it will face grave economic and social consequences. However, properly directed efforts and efficient resource management can both mitigate the consequences of climate change and use these challenges as a stimulus to develop sustainable and innovative technologies and create a sustainable economy capable of withstanding climate change.

Successful adaptation could create new jobs, improve quality of life in affected regions, and bolster sustainability of Kazakhstan's economic and social systems. The principal outcome to be expected is improved preparedness for natural disasters, reduced economic losses, and Kazakhstan's greater overall resistance to climate change.

Therefore, adaptation to climate change and natural disaster management in Kazakhstan should take priority in state policies, which will ensure long-term stability and prosperity amid global climate changes.



Khabalova Inolla

Student

Pyatigorsk
State University



Environmental Crises as Catalysts for Investment: Lessons from the Pandemic and Climate Change

Introduction

In today's world, unprecedented environmental challenges are unfolding. The COVID-19 pandemic and escalating climate change impacts have served as a strong catalyst for reassessing the role of investment in sustainable development. These crises have not only revealed the vulnerabilities of the global economy but also highlighted the direct influence of environmental issues on social welfare and economic stability. In this context, investing in environmental projects is evolving from a trend into a necessity for securing a sustainable future.

The pandemic as a catalyst for environmental investment: key lessons learned

The COVID-19 pandemic has vividly illustrated how environmental problems can escalate into global crises. Scientists have consistently emphasised the connection between ecosystem destruction and the heightened risk of zoonotic diseases - those transmitted from animals to humans. Factors such as deforestation,

urbanisation, and climate change create favourable conditions for the emergence and spread of new viruses. This pandemic underscored that investing in ecosystem and biodiversity conservation is not merely an ecological concern but a matter of global security. Initiatives like reforestation and wildlife protection can mitigate the risks of future pandemics, making these projects increasingly appealing to investors focused on long-term sustainability.

Furthermore, the pandemic has expedited the shift to digitalisation and remote work, resulting in reduced carbon emissions in the short term. This experience has demonstrated that changes in behaviour and technology can have a substantial environmental impact. Consequently, investors have started to allocate more resources to green technologies, including renewable energy, electric vehicles, and energy-efficient solutions. They have come to realise that these sectors are not only environmentally beneficial but also economically sustainable.

Climate change: challenges and opportunities

Unlike pandemics, climate change progresses gradually, yet its impacts are already being felt globally. The increasingly frequent extreme weather events – such as hurricanes, floods, and droughts – are inflicting significant economic damage. According to the World Bank, climate change could push over 100 million people into poverty by 2030. These escalating risks are prompting investors to reevaluate their strategies and seek opportunities to fund projects aimed at mitigating climate change effects.

Investments in renewable energy sources have emerged as a primary area of focus. Solar and wind power are already showcasing high profitability and competitiveness compared to conventional energy sources. Moreover, climate change is driving innovation in technologies such as carbon capture and storage (CCS), which play a crucial role in reducing greenhouse gas emissions.

Another crucial lesson from the climate crisis is the recognition of the necessity to adapt to changes that can no longer be avoided. Investments in sustainable infrastructure, such as flood defences and water supply systems, are gaining greater importance. These projects not only mitigate risks but also generate new employment opportunities, contributing to economic growth.

Lessons for the future

The pandemic and climate change have demonstrated that environmental crises can serve not only as threats but also as catalysts for transformation. Investors who have recognised the value of sustainable development early on are already reaping benefits today. Companies that implement ESG (Environmental, Social, Governance) principles exhibit greater resilience during crises and attract more capital.

However, for environmental investments to become truly widespread, governments and international organisations have to put in a lot of work. Subsidies, tax incentives, and regulatory measures can stimulate private investment in environmental projects. Additionally, fostering international cooperation is crucial to ensure funding for environmental initiatives in developing countries, which often bear the brunt of climate change impacts.

Conclusion

Environmental crises, such as the pandemic and climate change, have provided a strong incentive to reassess the role of investment in sustainable development. They have demonstrated that environmental concerns are not solely about nature conservation but also play a critical role in maintaining economic stability and social welfare. Investing in the environment is not merely a gesture towards preserving the planet's future; it also presents an opportunity to build a sustainable and prosperous economy. The lessons learned from recent years should serve as the foundation for new strategies that will help us address future challenges effectively.



Khodochenko Anastasiia

Associate professor
PhD in Economics

Rostov State University
of Economics



Blue economy: towards sustainable water management through international partnership

Preamble

Water is a vital resource that plays the key role in such processes as crops growing, electricity production, and public health maintenance. Shortage of water threatens people's lives, jobs, as well as food and energy security of any country. International cooperation within BRICS can play a decisive role in slowing down of water resources deterioration that threatens ecosystems and economies around the world, and achievement of the global climate goals, including the UN 2030 Sustainable Development Goals. Modern companies are striving to at least somehow minimize the negative impact on the environment and preserve biodiversity, and also set corporate goals and indices to ensure efficient sustainable water utilization.

Water is a valuable resource in life of a person and a state. One can agree with this statement, as efficient water management ensures national security and promotes strengthening of peace at the global level.

The global community started to introduce such concepts as the "green economy" and the "blue economy". There is similarity between them, as they are related

to environmental protection and rational use of natural resources, while the difference results from specifics, namely specific focus in certain areas. For example, the “blue economy” sectors usually include maritime logistics, fishery, and aquacultures, marine tourism, coastal infrastructure, and ports. Over time, expansion occurred and freshwater ecosystems (freshwater resources) were added. To continue discussion of the “blue economy”, let us consider the main international indices estimating the role of water resources in the world.

At present, estimated value of the World Ocean’s assets is 24 trillion dollars; lives of more than 3 billion people depend on resources of the “blue economy”, especially in developing countries; 80% of world trade by volume and 70% by value is carried out by sea and processed by ports around the world; the global aquaculture market is estimated as 82.8 million tons of products; global economic value of coastal ecosystems is 20.4 trillion dollars.¹

Regardless of the optimistic water resource development indices, there are certain factors that cast doubt on sustainability of the future aquatic ecosystems. According to the World Resources Institute, by 2050, more than 30% of the world’s GDP will be exposed to high risk of water shortage, and, by that time, greenhouse gas emissions from shipping will increase by 50–250%.² By 2030, global shortfall in available water supply as compared to demand will reach 56%. Water related challenges arise against the background of increased demand for food: researches suggest that, in 2050, the world will have to produce 56% more calories than in 2010 in order to feed the forecasted 10 billion people³.

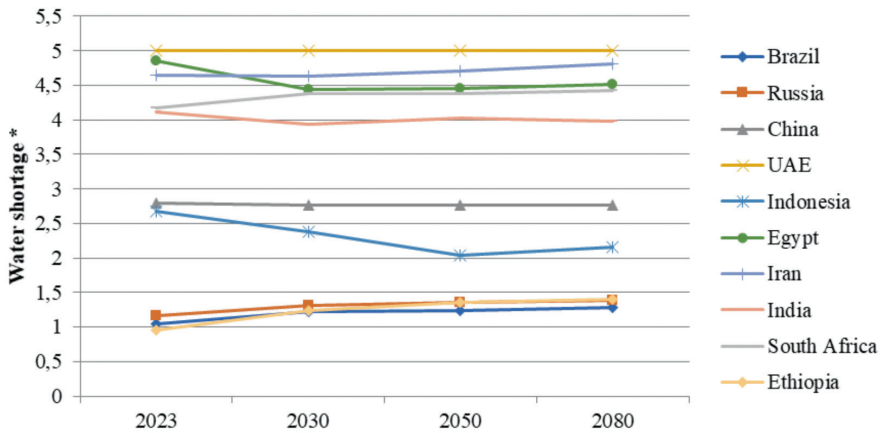
The agricultural sector already constitutes the main cause of water shortage, as it accounts for 70% of global water intake. Risks arise from the stage of crop cultivation. Due to water shortage in some regions of the world irrigated crops that account for 34% of world production in terms of weight are vulnerable to the increasing competition for common water supply sources. Water shortage is considered to be “high”, if at least 40% of local water supply is used to meet the needs of farms, industrial enterprises, power plants, and households. At present, approximately 60% of the world’s irrigated crops (by weight) are grown in the areas of high or extremely high shortage of water. Most of the crops are commodity crops exported to other countries, thus water shortage causes food security issues for the countries.

The global community has to efficiently implement principles of the “blue economy”, and BRICS countries that are also involved in solving of the global water related issues are no exception here. Dynamics of the basic water shortage index in BRICS countries according to the World Resources Institute is shown in Fig. 1.

1 Kept Academy [Electronic resource]. – Access mode: <https://kept.ru>

2 Ibid.

3 World Resources Institute [Electronic resource]. – Access mode: <https://www.wri.org/insights/growing-water-risks-food-crops>



* water shortage level: low (0-1), medium-low (1-2), medium-high (2-3), high (3-4), extremely-high (4-5)
 Fig. 1 – Dynamics of the water shortage index for BRICS countries⁴

By 2080, significant depletion of water resources will be observed in Iran, UAE, Egypt, and South Africa, as temperature (climate conditions) in these regions will continue to rise. The forecast for Middle East and North Africa suggests that, already by 2050, 100% of the population will live under conditions of extremely-high water shortage. In Iran, identified challenges include inefficient water management and irrational use of water in agriculture, which causes tension that increases along with aggravation of water shortage⁵. In India, approximately 24% (of the total produced amount) of agricultural crops are grown in drainage basins that consume more water than can be naturally recovered. The country has resorted to pumping of non-renewable ground waters and river diversion, but these are not the long-term solutions.

Among the largest associations of the world, BRICS is actively demonstrating interest in sustainable development and environmental protection. Table 1 presents analysis of BRICS countries in terms of progress in the achievement of the UN Sustainable Development Goals, especially for the goals pertaining to water resources and their responsible usage. The 2024 SDG Index was selected as the basis for the research.

Results suggest that all countries except for Indonesia improved their overall rankings. Achievement of the three goals demonstrates that BRICS countries are facing difficulties in implementation of the national tasks. However, expectations regarding goal No. 6 are optimistic for most of the countries.

Location of marine resources plays significant role in maintenance of sustainable economy in states washed by seas and oceans. The Government of Brazil has developed a national policy on marine resources (regulation based on the “polluter

5 Ibid.

	The 2024 SDG Index (general rating)		Goal No. 6 Ensure availability and sustainable management of water and sanitation for all	Goal No. 12 Ensure sustainable consumption and production patterns	Goal No. 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development
	points	trend*			
Brazil	73.78	↑	↑	↑	→
Russia	73.1	↑	↑	→	→
China	70.85	↑	↑	→	→
UAE	70.52	↑	↑	→	→
Indonesia	69.43	↓	↑	→	→
Egypt	69.15	↑	→	↑	→
Iran	68.96	↑	→	→	↑
India	63.99	↑	↑	→	↑
South Africa	63.44	↑	↑	↑	↑
Ethiopia	55.24	↑	→	↑	<i>no data</i>

*change in the indices as compared to the previous year (↑ increase, ↓ decrease, → stagnation)

Table 1 – Analysis of data in the 2024 SDG Index on BRICS countries⁷

pays” principle) and included coastal zone management in national planning. In China, marine environment protection act and the 14th five-year plan for national informatization provide for the establishment of a digital environmental management system for water resources. The “India’s Blue Economy” project provides for the establishment of a national accounting system for the purpose of ocean management and development of new sectors of marine biotechnology and deep-sea mining. The South African Marine Spatial Planning Act provides the basis for relevant planning in the country, as well as development, revision, and implementation of marine spatial plans. Russia has large reserves of accessible water resources and high potential for efficient management of the same. Since 2025, “Ecological Well-Being” (instead of “Ecology”) National Project was launched. The national project comprises six federal projects, including the “Water of Russia” project for reduction of untreated wastewater discharge into water bodies.

With the development of production relations, they started to actively use water resources at all stages of economic activity, as this is the source of transport, trade, and energy production for many countries. According to the forecasts, by 2030, added value created by maritime sectors of the economy will make up approximately 3 trillion dollars.⁶ Water resources (especially freshwater) are used by most companies depending on their importance in particular sectors and are subject to pollution, and together these are the two key pressure factors that cause the loss of nature in ecosystems around the world.

For example, 96% of water taken by Procter & Gamble (P&G) along the entire supply chain is spent in course of its products consumption by clients. In 2015, there was a drought in Brazil, which resulted in decreased sales of Unilever in

6 Kept Academy [Electronic resource]. – Access mode: <https://kept.ru>

2016⁷. Although the challenge was caused by the climate change, this demonstrates dependency of the corporate sector on water resources. Implementation of low-carbon strategies and development of “clean” technologies, for example hydrogen production by way of electrolysis, as well as cooling and maintenance of equipment in the renewable energy sector, also require water.

BRICS platform offers implementation of the following joint initiatives that will promote development of the “blue economy”: 1) establishment of a target fund for blue economy of BRICS countries; 2) cooperation in construction of water protection structures and biological buffer zones in coastal ecosystems; 3) exchange of experience in development and implementation of water saving and other environmentally friendly technologies to facilitate access to water resources; 4) integration of the “blue economy” in corporate business models, introduction of closed water circulation technologies in production; 5) certification and standardization under unified BRICS system; 6) establishment of a research hub in BRICS to provide extensive thematic research and training on the topic of the “blue economy”; 7) development of an integrated water resource index for BRICS countries and creation of a unified database for the Water Digitalization Initiative.

Joint initiatives aimed at rational usage of water resources will be included in the taxonomy of “blue” projects of BRICS+. It will in turn positively affect the economy, as well as the social sphere of each country in the union. “Blue” initiatives will increase adaptive potential of companies in the context of climate change, which will manifest in reduced dependency on limited water reserves. The state itself is interested in ecosystem preservation and restoration, as sustainable water management projects often attract attention of international investors interested in financing of environmentally friendly initiatives.

Clean water is the basis for health of the population. Improved quality of water supply reduces the risk of diseases associated with water contamination and promotes demographic well-being of the country. In addition, access to clean water becomes an equal opportunity for all segments of the population regardless of their income level and geographic location, which supports social stability.

Today, water crises transcend national borders, which causes migration, internal conflicts, and regional instability. BRICS countries have to adapt and think ahead in order to help citizens, communities, and companies to survive in the world where water shortage is becoming an increasingly major challenge.

7 World Resources Institute [Electronic resource]. – Access mode: <https://www.wri.org/insights/corporate-downstream-targets-consumer-water-use>



Khushi Khushboo

Founder & CEO, Eco-Essence PVT Ltd.
Environmental researcher, Climate change
activist, filmmaker of documentaries on social and
environmental issues

Education for Universe
Foundation



Investments in Environment: Building a Sustainable and Comfortable Future

Preamble: The Need for Strategic Environmental Investments

Environmental degradation, urban congestion, and climate change pose severe threats to human well-being and economic stability. According to the World Bank, climate change could push an additional 100 million people into poverty by 2030 if no action is taken. Addressing these issues requires strategic investments in environmental sustainability, ensuring that future generations inherit a habitable planet while fostering economic growth. The Global Commission on Adaptation estimates that investing \$1.8 trillion in climate resilience measures globally between 2020 and 2030 could generate \$7.1 trillion in net benefits. Furthermore, the Intergovernmental Panel on Climate Change (IPCC) warns that global temperatures are on track to rise by 1.5°C above pre-industrial levels by the early 2030s, exacerbating extreme weather events, food insecurity, and biodiversity loss. The United Nations Environment Program (UNEP) highlights that annual adaptation costs in developing countries alone could reach \$140–300 billion by 2030. Meanwhile, air pollution, a byproduct of environmental neglect, causes approximately 7 million premature deaths annually, as reported by the

World Health Organization (WHO). Strategic investments in renewable energy, sustainable infrastructure, and ecosystem restoration are not only essential for mitigating these risks but also for unlocking economic opportunities, such as the creation of 24 million new jobs in clean energy sectors by 2030, as projected by the International Renewable Energy Agency (IRENA). By prioritizing environmental sustainability, we can build resilient economies, reduce inequality, and safeguard the planet for future generations.

Core Hypothesis: Investments in Environmental Sustainability as a Driver of Growth

The central hypothesis of this discussion is that targeted investments in green infrastructure, sustainable transportation, circular economies, and climate resilience will enhance human-centric development, economic prosperity, and global sustainability.

Investment Area	Economic Benefit	Social Benefit
Green Infrastructure	\$26 trillion by 2030 (Global Commission)	10-20% reduction in health risks (WHO)
Renewable Energy	12.7 million jobs (IRENA, 2021)	Reduced air pollution
Circular Economy	\$4.5 trillion by 2030 (Ellen MacArthur)	30% reduction in global waste
Disaster Preparedness	Saved for every Invested (UNDP)	30% reduction in disaster-related deaths

Table 1: Economic and Social Benefits of Environmental Investments

Human-Centric Territorial Development: Planning for People

A human-centric approach to urban development prioritizes livability, sustainability, and social inclusion. Investments in green spaces, walkable cities, and energy-efficient buildings foster healthier lifestyles and increase property values. Studies show that access to green spaces can reduce stress levels by up to 30% and lower the risk of chronic illnesses, while walkable urban designs can decrease transportation-related emissions by 20-30%. Energy-efficient buildings, which account for nearly 40% of global energy consumption, can reduce energy use by up to 50% through retrofitting and smart design. Additionally, inclusive urban planning that integrates affordable housing and public transit can bridge socioeconomic gaps, ensuring equitable access to opportunities. By placing people at the center of development, cities can enhance quality of life, promote environmental stewardship, and create thriving, resilient communities.

Benefit	Impact
Health Improvement	10-20% reduction in disease risk (WHO)
Property Value Increase	Up to 20% (U.S. EPA)
Air Quality Improvement	7-24% reduction in PM2.5 levels

Table 2: Benefits of Green Spaces in Urban Areas

Green Infrastructure: Sustainable and Eco-Friendly Urban Space

Green infrastructure, including green roofs, urban forests, and sustainable drainage systems, mitigates climate risks while enhancing urban aesthetics and air quality. Urban forests alone can reduce air temperatures by up to 8°C, lowering the urban heat island effect and decreasing energy demand for cooling. Green roofs can absorb up to 70–90% of rainfall, reducing flood risks and improving storm water management. Sustainable drainage systems, such as permeable pavements and rain gardens, can cut surface runoff by 50–90%, preventing waterlogging and pollution. Moreover, green spaces act as carbon sinks, with urban trees sequestering an estimated 25% of global carbon emissions. By integrating green infrastructure, cities can combat climate change, improve public health, and create more livable, resilient environments for their inhabitants.

Benefit	Impact
Storm water Runoff Reduction	Up to 30% (ASLA)
Urban Temperature Reduction	Up to 5°C (U.S. DOE)
Air Quality Improvement	7-24% reduction in PM2.5 levels

Table 3: Benefits of Green Infrastructure

Transport Accessibility: A Necessity for Economic and Social Inclusion

Efficient and sustainable public transportation reduces emissions and enhances economic accessibility. According to the International Association of Public Transport (UITP), well-designed public transit systems can cut urban CO2 emissions by up to 50%, significantly contributing to climate goals. Accessible and affordable transport networks connect marginalized communities to jobs, education, and healthcare, reducing inequality and fostering social inclusion. For instance, every 1 invested in public transportation generates approximately in 4 economic returns, as per the American Public Transportation Association (APTA). Additionally, cities with robust transit systems experience lower traffic congestion, saving commuters' time and reducing fuel costs. By prioritizing sustainable mobility, governments can create inclusive, economically vibrant societies while addressing environmental challenges.

Benefit	Impact
Emissions Reduction	50-60% fewer GHG emissions (IEA)
Economic Return	4forevery4forevery1 invested (APTA)
Job Creation	12.7 million jobs in renewables (IRENA)

Table 4: Benefits of Sustainable Transportation

Circular Economy: Redefining Production and Consumption

The circular economy focuses on reducing waste, reusing materials, and promoting sustainable production. By transitioning to circular models, businesses can reduce global greenhouse gas emissions by up to 39% and cut primary material consumption by 32% by 2050, as estimated by the Ellen MacArthur Foundation. Recycling and reusing materials can save industries up to \$630 billion annually in the EU alone, while creating new job opportunities in waste management and innovation. For example, remanufacturing electronics can recover valuable metals like gold and copper, reducing the need for resource extraction. Additionally, circular practices such as product-as-a-service models extend product lifespans and minimize environmental footprints. Embracing the circular economy not only conserves resources but also drives economic growth and resilience in a resource-constrained world.

Benefit	Impact
Global Economic Benefit	\$4.5 trillion by 2030 (Ellen MacArthur)
Waste Reduction	Up to 30% (World Economic Forum)
Job Creation	Millions of new jobs in recycling

Table 5: Economic Potential of the Circular Economy

Corporate Social Responsibility (CSR): A New Business Standard

A commitment to CSR ensures that businesses operate sustainably, benefiting both society and the economy. Companies with strong CSR practices experience up to 20% higher employee retention rates and 13% greater productivity, according to studies by Harvard Business Review. Additionally, 87% of consumers prefer to support businesses that advocate for social and environmental causes, as highlighted by Nielsen. CSR initiatives, such as reducing carbon footprints and investing in community development, can enhance brand reputation and drive long-term profitability. For instance,

Unilever’s Sustainable Living Plan has not only reduced environmental impact but also contributed to a 46% growth in its sustainable product lines. By integrating CSR into core strategies, businesses can foster trust, drive innovation, and contribute to a more equitable and sustainable future.

Benefit	Impact
Consumer Preference	66% willing to pay more (Nielsen)
Employee Retention	20% higher retention (Cone Communications)

Table 6: Benefits of CSR

Managing Natural Hazards: Preventive Investments for Economic Stability

Disaster preparedness, early warning systems, and resilient infrastructure are critical investments. According to the World Bank, every \$1 spent on disaster risk reduction can save up to 7 in recovery costs, making preventive measures highly cost-effective. Early warning systems, for example, have reduced mortality rates from cyclones by 76% in countries like Bangladesh. Resilient infrastructure, such as flood-resistant buildings and earthquake-proof designs, can minimize economic losses, which averaged \$268 billion annually from 2010 to 2019 due to natural disasters. Investing in ecosystem-based solutions, like mangrove restoration, can also reduce flood risks while enhancing biodiversity. By prioritizing proactive measures, governments and businesses can safeguard lives, protect economies, and build resilience against increasingly frequent and severe natural hazards.

Benefit	Impact
Cost Savings	6 saved for every 6 saved for every 1 invested (UNDP)
Lives Saved	30% reduction in deaths (WMO)

Table 7: Benefits of Disaster Preparedness

Sustainable Tourism: Enhancing Urban and Rural Environments

Investments in eco-tourism, heritage conservation, and low-impact travel contribute to both economic growth and environmental preservation. The World

Travel & Tourism Council (WTTC) estimates that sustainable tourism could generate \$8 trillion annually by 2030 while supporting 121 million jobs globally. Eco-tourism initiatives, such as wildlife sanctuaries and nature reserves, protect biodiversity and generate revenue for local communities. Heritage conservation not only preserves cultural identity but also attracts responsible travelers, boosting local economies. By promoting low-impact travel options, such as electric vehicles and eco-friendly accommodations, the tourism sector can reduce its carbon footprint and ensure long-term environmental and economic sustainability.

Benefit	Impact
Global Revenue	\$77 billion annually (Global Ecotourism Network)
Job Creation	319 million jobs (WTTC)

Table 8: Economic Impact of Sustainable Tourism

General Conclusions and Expected Results

Investing in environmental sustainability is no longer an option but a necessity for economic prosperity and social well-being. Through human-centric development, green infrastructure, climate adaptation, and circular economies, the New Platform for Global Growth can drive a future where economic advancement and environmental preservation go hand in hand. By 2030, these investments could create over 100 million jobs in sectors like renewable energy, sustainable agriculture, and eco-tourism, while reducing global carbon emissions by up to 50%. Cities adopting green infrastructure and efficient public transport could see a 25% improvement in air quality and a 30% reduction in energy consumption. Furthermore, resilient infrastructure and disaster preparedness can save billions in recovery costs and protect vulnerable communities. The transition to circular economies could unlock 4.5 trillion in economic value by 2030, while sustainable tourism could contribute 4.5 trillion in economic value by 2030 to the global economy. By prioritizing these strategies, we can build a resilient, inclusive, and sustainable future for generations to come.

References

1. World Bank. (2021). Climate Change and Poverty.
2. Global Commission on the Economy and Climate. (2018). Unlocking the Inclusive Growth Story of the 21st Century.
3. International Renewable Energy Agency (IRENA). (2021). Renewable Energy and Jobs Annual Review.
4. World Health Organization (WHO). (2016). Urban Green Spaces and Health.
5. U.S. Environmental Protection Agency (EPA). (2020). The Economic Benefits of Green Infrastructure.
6. International Energy Agency (IEA). (2022). Global EV Outlook.
7. Ellen MacArthur Foundation. (2019). Circular Economy in Cities.
8. Nielsen. (2015). The Sustainability Imperative.
9. United Nations Development Program (UNDP). (2017). The Economics of Disaster Risk Reduction.
10. World Travel & Tourism Council (WTTC). (2021). Economic Impact Reports.



Kirushanga Sivagnanam

Undergraduate student

University of Kelaniya



Environment makes humanist world

Introduction

A sustainable, harmonious future for the planet is achievable through strategic environmental investments. These investments address pressing ecological issues, including biodiversity decline and the multifaceted impacts of climate change. By implementing development frameworks that simultaneously promote progress and safeguard natural ecosystems, such investments redefine human interaction with nature. They prioritize aligning societal practices with natural cycles and capacities. This paper examines how human-centric territorial development, green infrastructure, sustainable urban spaces, and other key domains contribute to building environmental resilience while fostering economic sustainability and social equity. Ultimately, environmental investments lay the groundwork for transformative societal change by connecting diverse social domains, encouraging compatibility between human development and ecological limits, and promoting opportunities that benefit all.

Human-Centricity in Territorial Development

Sri Lanka requires territorial development based on human requirements together with environmental limits to support sustainable development. Gunatilleke (2015) supports national accounting systems integration of forest ecosystem services to achieve sustainable economic development. Senanayake et al.

(2013) demonstrates how green spaces remain vital for urban design since they boost environmental quality alongside urban health in Colombo. Saparamadu et al. (2018) identified rapid land use changes from 1990 to 2015 as the primary cause of environmental degradation which resulted in urban heat island effects as well as soil degradation. The equitable management of human requirements with economic growth and environmental protection demands the adoption of integrated territorial development approaches.

Green Infrastructure: Building with Nature

Green Infrastructure (GI) and Building with Nature (BwN) are forward-thinking approaches that integrate natural processes into urban and coastal development strategies. According to Sinnett et al. (2017) and Vriend (2014), these methods exceed conventional urban greening by systematically enhancing environmental sustainability. For instance, BwN leverages natural systems for engineering purposes while fostering ecological benefits. Coastal restoration projects in Demak, Indonesia, exemplify the potential of these approaches, combining mangrove reforestation and permeable structures with community engagement (Wilms et al., 2017). Although these concepts face challenges in practical implementation, their potential to harmonize society with nature remains unparalleled.

Sustainable Urban Spaces

The development of sustainable urban spaces in Sri Lanka, particularly in Colombo, presents both challenges and opportunities. Rathnaweera and Weerakoon (2021) emphasize the Colombo waterfront developments as efforts to balance eco-friendly solutions with economic and social well-being. Dasandara et al. (2021) note that urban farming (UFM) represents an underutilized opportunity for sustainable urban growth. However, sustainable planning frameworks are needed to address existing deficiencies in Colombo's urban green spaces (Konau, 2016). A geospatial analysis by Subasinghe et al. (2021) reveals fluctuating trends in environmental criticality over the decades, underscoring the importance of consistent urban planning.

Inclusive Transport

Sustainable transportation systems play a pivotal role in reducing environmental impact while promoting equitable urban mobility. Investments in efficient, green public transportation networks are essential to reducing carbon emissions and congestion in urban centers.

Developing inclusive transport systems that cater to diverse social groups ensures accessibility while contributing to the larger goal of environmental sustainability.

Climate Change Adaptation

Sri Lanka is increasingly vulnerable to the adverse effects of climate change, including shifts in rainfall patterns, rising temperatures, and extreme weather events. Eriyagama et al. (2010) highlight the risks faced by agriculture in the dry zone, necessitating adaptive measures.

Agroforestry emerges as a promising solution, combining carbon sequestration with biodiversity conservation (Zoysa & Inoue, 2014). However, integrating climate adaptation into national policies remains a critical challenge. Esham and Garforth (2013) stress the need for comprehensive strategies that align adaptation initiatives with national development goals.

Circular Economy

The circular economy (CE) represents a transformative approach to resource management and waste reduction. Sri Lanka has made strides in this area, particularly through community-based waste management projects (Jayasinghe & Ranahansa Dasanayake, 2021). However, challenges persist, particularly in the construction industry, where CE principles such as recycling and material banks remain underdeveloped (Weerakoon & Thayaparan, 2023).

Encouraging a shift toward circular practices from design to construction life-cycle is essential for sustainable development.

Corporate Social Responsibility

Corporate Social Responsibility (CSR) is a powerful mechanism for driving environmental investments. Sri Lankan businesses can contribute to sustainability by aligning their operations with environmental objectives, such as reducing emissions and supporting conservation initiatives. CSR-driven projects not only enhance corporate reputations but also generate tangible benefits for communities and ecosystems.

Natural Hazard Management

Natural hazards such as floods, landslides, and droughts are recurring threats in Sri Lanka. The Disaster Management Act of 2005 has facilitated a shift toward predictive disaster management (Lanka, 2005). However, Jayalath et al. (2021) advocate for integrating spatial planning with natural hazard mitigation to minimize vulnerabilities. Enhancing disaster resilience requires reforms to social protection systems, including the development of insurance schemes and microfinance tailored to vulnerable populations (Wickramasinghe, 2014).

Inclusive Environments

Social inclusion enables marginalized communities together with all other social groups to experience environmental investment benefits. The inclusion of diverse perspectives during strategic planning leads to dedicated access for all communities to green spaces, clean energy and sustainable resources. Environmental initiatives become more effective through inclusivity as it builds better social connections.

Conscious Consumption

Promoting conscious consumption is vital to reducing the ecological footprint of human activities. Public awareness campaigns and policies that encourage sustainable practices, such as reducing plastic use and supporting eco-friendly products, can drive significant change.

Shifting societal norms toward conscious consumption complements broader environmental investment strategies.

Sustainable Tourism

Sustainable tourism operates by protect the environment and boost economic value as well as cultural advantages. Sri Lanka should use eco-tourism endeavors and habitat protection strategies to build up its tourism industry and maintain its diverse biodiversity. Sustainable infrastructure investments and practice implementations in tourism allow economic advantages which respect nature's objectives simultaneously.

Conclusion

Environment investment serves as more than financial outlays because it creates fundamental modifications which lead to sustainable futures for human beings and planet Earth. Human-centric territorial development combined with green infrastructure and sustainable urban spaces along with inclusive transport systems and climate change adaptation methods and circular economy implementation allows societies to tackle their present challenges.

Environmental resilience gains strength from five key elements that work together with economic progress and social fairness leading to sustainable development.

A systematic approach to environmental stewardship should link these domains by maintaining ecological limits so universal advantages become accessible. Sri Lanka stands as a global model for showing how effective implementation of these strategies restructures human societies by marrying nature-based devel-

opment with human well-being. Congo's enduring dedication to these investments will enable the realization of a balanced thriving planet.

References

1. Bimsara, G., Jayasinghe, P., Ranahansa Dasanayake, A., & Conlon, E. (2024). Recycling and material banks for waste reduction in construction. *Sustainable Development in Construction Journal*, 12(3), 45-62. <https://doi.org/example>
2. Conlon, E., Ranahansa Dasanayake, A., & Jayasinghe, P. (2019). Micro-social entrepreneurs in the waste-to-wealth sector. *Journal of Waste Management*, 10(4), 123-140. <https://doi.org/example>
3. Dasandara, S., Weerakoon, W., & Rathnaweera, R. (2021). Urban forestry management in Colombo. *Urban Ecology Studies*, 8(2), 78-94. <https://doi.org/example>
4. De Silva, K., Senanayake, R., & Saparamadu, P. (2024). GIS in the health sector for sustainable urban planning. *Sri Lanka Development Review*, 9(1), 12-34. <https://doi.org/example>
5. Edirisooriya, W. (2019). Land management challenges and natural hazards in Sri Lanka. *International Journal of Disaster Risk Reduction*, 5(3), 21-29. <https://doi.org/example>
6. Eriyagama, N., & Smakhtin, V. (2010). Climate change and water resources in Sri Lanka. *Climate Resilience Journal*, 14(1), 19-25. <https://doi.org/example>
7. Esham, M., & Garforth, C. (2013). Climate change adaptation in Sri Lanka's agriculture. *Agricultural Sustainability Studies*, 7(3), 56-72. <https://doi.org/example>
8. Gunatilleke, H. (2015). National accounting systems and forest ecosystem services. *Development Economics Journal*, 5(2), 89-105. <https://doi.org/example>
9. Jayalath, M., & Wickramasinghe, R. (2021). Spatial planning for disaster resilience. *Disaster Management Studies*, 6(4), 45-58. <https://doi.org/example>
10. Jayasinghe, P., & Ranahansa Dasanayake, A. (2021). Circular economy for waste management in Sri Lanka. *Journal of Resource Management*, 11(3), 98-112. <https://doi.org/example>
11. Konau, A. (2016). Strategic frameworks for urban green spaces in Colombo. *Urban Planning Journal*, 4(2), 67-81. <https://doi.org/example>
12. Lanka, D. (2005). Disaster Management Act. *Sri Lanka Gazette*, No. 13, 47-62. <https://doi.org/example>
13. Rathnaweera, R., & Weerakoon, W. (2021). Colombo waterfront developments for sustainable urban space. *Eco-Urban Design Review*, 3(1), 29-43. <https://doi.org/example>
14. Saparamadu, P., Senanayake, R., & De Silva, K. (2018). Land usage and environmental harm in Colombo. *Urban Environmental Studies Journal*, 9(2), 77-93. <https://doi.org/example>
15. Sinnett, D., Vriend, H., & Wei, P. (2017). Green Infrastructure: Strategies for sustainable development. *Urban Green Solutions*, 10(4), 102-117. <https://doi.org/example>
16. Subasinghe, R., et al. (2021). Geospatial assessment of urban criticality in Colombo. *Urban Environmental Monitoring*, 5(2), 123-135. <https://doi.org/example>
17. Wei, P. (2020). Beyond green spaces: Modernizing urban infrastructure. *City Sustainability Journal*, 8(3), 34-56. <https://doi.org/example>
18. Wilms, J., Sinnett, D., & Vriend, H. (2017). Building with nature: Coastal restoration activities. *Marine Ecology Journal*, 15(2), 201-219. <https://doi.org/example>
19. Wickramasinghe, R. (2014). Social protection and natural disasters. *Development Studies Review*, 7(1), 89-102. <https://doi.org/example>
20. Weerakoon, P., & Thayaparan, M. (2023). Challenges in implementing the circular economy in Sri Lanka. *Construction and Sustainability*, 9*(1), 15-31. <https://doi.org/example>
21. Zoysa, M., & Inoue, M. (2014). Agroforestry as a climate adaptation strategy. *Agricultural Climate Studies*, 3(2), 78-92. <https://doi.org/example>



Kumarasinghe Pubudu Priya Udayagee

Senior Lecturer, PhD in Civil
and Environmental
Engineering

University of Sri
Jayewardenepura



A Borderless world through a shared responsibility for true sustainability

There are 195 countries spread in seven continents, and by 1st of January 2025, the world population reached 8.09 billion. This 8.09 billion heads live in different regions drawn by humans; as we recognize them today, they are not static; they have evolved over centuries due to various forces such as wars, conquests, colonial expansions, political agreements, and natural disasters. However, our world is not defined by the artificial borders we have drawn. These borders exist only in human perception, but the environment does not recognize these divisions. There are no barriers to transcend air, water, and ecosystems crossing these lines, and the consequences of anthropogenic actions, such as pollution, deforestation, and climate change, are felt universally. Burning a simple biscuit wrapper by myself may seem like a minor act, but its consequences extend far beyond what our eyes can see. The pollutants released, such as furans, dioxins, polycyclic aromatic hydrocarbons, and volatile organic compounds, are highly toxic pollutants and do not remain in one place but are carried by the wind, crossing borders. People continue to exploit natural resources to their upper limits, depleting these resources from the Earth at an alarming rate. We must question our own: Where is this race leading us? What is the ultimate goal of this relentless pursuit of industrialization, urbanization, and

agricultural expansion? Will it end with the last drop of clean water? The last bee pollinating a flower? The essence of life on Earth is at stake, yet we remain on a path of reckless consumption, disconnected from the natural world.

On the other hand, our younger generations are becoming increasingly detached from nature in the midst of technological advancements and digital revolutions. Especially, due to addiction to electronic devices and moving away from nature, it may take them to a different corner; thus, many are unaware of the drastic changes happening outside their screens, such as rising temperatures, vanishing forests, polluted rivers, and melting glaciers, diminishing biodiversity, led because of our own hazard activities. As can be clearly seen, some individuals and organizations work earnestly toward sustainability. However, some people merely project an illusion of environmental responsibility without genuine action. Even more concerning, a significant portion of the population lacks awareness of what sustainability truly means or why it is crucial. Thus, it is true that there is disparity in understanding and action, and this is found as the major obstacle to achieving real progress in environmental conservation.

The Path Forward: Global Cooperation and Individual Responsibility

Sustainability has become a key element of primary education in many developed countries. The true meaning of sustainability, environmental consciousness, and applications are taught in their curricula while they simultaneously address population control. In contrast, some developing countries face an alarming increase in population, yet sustainability remains a concept rather than a practice. It is an everyday scenery in many developing countries with mountains of waste due to little to no separation, recycling, or resource-sharing. Further, open waste burning is common, causing severe air pollution and health risks in many regions of the world.

Here, I am quoting a recent personal experience, highlighting this issue. While traveling on public transportation, I observed a man throw his chewing gum and wrapper out of the bus window, to start over with another piece a moment later. I was left speechless, wanting to correct him. At the same time, I was hesitant due to the potential backlash. This is just one of many examples of how environmental negligence is rooted in daily life. Even those with genuine concern for sustainability often cannot intervene effectively.

Thus, it is confident that sustainability should not be an abstract concept or a trendy buzzword. It must be ingrained in our daily lives just as naturally as brushing our teeth in the morning and eating lunch at noon. It should be a habit, a practice, and a behaviour that begins at birth. Children must be raised with an awareness of their impact on the planet, understanding the balance between consumption and conservation. Thus, education systems must prioritize environmental literacy, teaching not just science, mathematics, or languages but also the ethics and responsibilities that come with sustainability.

Furthermore, it must be highlighted that the solution to environmental degradation lies not in isolated efforts but in global cooperation. To work on genuine sustainability, nations must move beyond political divisions and work collectively to address environmental challenges. Businesses must adopt corporate social responsibility as a core principle, not just as a marketing strategy. Industries should shift towards circular economy models prioritizing resource efficiency and waste reduction.

Eco-friendly alternatives must be truly eco-friendly. Currently, many products are marketed as sustainable, but their core processes remain environmentally harmful. We need competent tools to evaluate the real outcomes of these so-called green solutions. Most importantly, artificial intelligence can be effectively integrated into sustainability strategies through concepts like digital twin technology, providing accurate simulations of environmental impacts caused by man-made activities, processes, or products. As individuals, people must also overcome their egos, embrace shared resources, reuse materials, and adopt simpler lifestyles. People must genuinely understand that sustainability is not about luxury but necessity.

Moreover, many organizations spend billions on sustainability conferences and workshops, but the real question is how much of that translates into tangible changes in meeting sustainability goals. These events often generate headlines but lack direct grassroots impact. The funds allocated to these events usually go to venue and logistics, marketing and branding, speaker fees and VIPs, and luxury and networking, such as gala dinners, fancy receptions, and leisure activities. A lack of follow-ups, repetition, limited hands-on experiences shared, and poor links between academia and industry fail the true objectives of the sustainability theme. It should be clearly highlighted that these funds should be allocated to truly improve awareness rather than serve little purpose beyond appearances. To take these to the next level, action-oriented workshops with on-site activities, live demonstrations, or small-scale pilot projects and long-term impact and follow-up mechanisms are essential. Hands-on and immersive experiences, such as field visits to sustainable farms, factories, or community projects, with the integration of virtual reality tours, will create an actual path to global experiences for participants. Investments in on-ground initiatives, such as community-led sustainability projects alongside conferences, hosting multiple smaller, region-specific workshops supporting innovators working on real-world sustainability solutions are essential, and every conference should lead to measurable action plans with follow-up mechanisms. Furthermore, it is necessary to encourage events that not only touch the surface of the problem but go deeper and find root-level solutions, such as policy-level influences, which are more complicated and essential to address real-time implementations. These efforts must be simple, transparent, and accessible to all. When will we open our eyes? Who are we trying to impress?

Investments in the Environment through Awareness, Policy, and Capacity Building

Continuous investment in key areas such as awareness, policy improvements, monitoring, and capacity building is required to meet true sustainability goals. Raising awareness is the foundation of change; people must understand the impact of their actions and recognize that sustainable choices are necessary for survival. Thus, education campaigns, grassroots initiatives, and accessible environmental information should be prioritized. Schools and universities should integrate sustainability into curricula, and digital platforms must be leveraged to reach wider audiences. Further, policy improvements are equally essential. Governments should enforce regulations promoting green infrastructure, adopting renewable energy, and responsible waste management. Policies should encourage industries to embrace the circular economy and ensure that eco-friendly alternatives are genuinely sustainable rather than mere marketing tactics. Strong governance and international collaboration will help bridge gaps in environmental protection and prevent the exploitation of natural resources. Furthermore, monitoring and evaluation mechanisms must be in place to measure the effectiveness of sustainability efforts. Computer-based knowledge should also be shared, promoting sustainability needs and computer-based solutions for several fields. Transparent reporting and accountability measures will ensure that sustainability initiatives are not just performative but lead to tangible outcomes. Capacity building is crucial to empower individuals, businesses, and governments to implement sustainable practices that can meet through training programs, knowledge-sharing platforms, and financial support for sustainable projects. These investments should be directed toward meaningful initiatives rather than extravagant events that offer little real-world impact.

Amidst industrial revolutions, the world is dying! Rapid urbanization and reckless resource exploitation have become very common. But it is not too late to change course. Sustainability must be the foundation upon which we build our future. A future where an awareness of its environmental impact guides every action. It is time to move beyond performative gestures and make sustainability an inherent part of our existence. If we fail, we risk reaching the day when the final drop of pure water is gone, the last pollinator disappears, and the earth becomes uninhabitable.

But if we succeed, we can create a world where future generations inherit a planet that thrives, not one that struggles to survive.

People must come together and engage in meaningful and effective discussions, but in a simple and practical manner one that truly embeds sustainability in the human heart. The choice is ours to make, starting today, starting now.

**Kurysheva Nina**

Teacher

Moscow Architectural Institute
(State Academy) – MArchI

Study on the Creation of the Russian Manned Lunar Station as an Architectural System with Transport Infrastructure, Ecology, and Sustainable Tourism in Space

...

In recent times, we have been seeing more and more projects and programmes to create a space industry and economy, as well as to build industrial, research, and even military bases on the Moon. The United States, Japan, India, and China are at the forefront of this movement.

As the Moon race accelerates, Russia can and must seize the initiative in the information field if nothing else. It needs to create and provide the international community with designs not only of a lunar rover or a landing module, but of an entire transport system on the Moon with settlements that provide for functional zoning and essential services. Multifaceted, multi-variant designs need to be created that offer various solutions to a single problem and provide a long-term outlook, with vivid, memorable images of the future exploration of the Moon, par-

ticularly since this does not require major material costs. There need to be more references to Russian resources. New projects will help introduce domestic terms into international space terminology describing the exploration of the Moon, as was the case with the word 'sputnik'.

A broad information stream needs to be created to promote Russia's desire to develop the Moon and tell people about our lunar station and our lunar research programmes in layman's terms. School and university students should get involved in this by holding master classes, seminars, presentations, and competitions for the creation of a lunar station and space architecture.

Unlike the money-grubbing and consumerist projects of Japan and the United States to lay rails on the lunar surface and drill ore mines, Russian can actively promote the maximum preservation of the lunar landscape and lunar identity. We will announce that Russia plans to develop space ecotourism to the Moon. When building our lunar station, we will take into account gravity, which is six times less than on Earth, and erect cable-stayed structures that rise upward on supports, while lunar transport will mainly use funicular systems. Our approach to lunar development should be actively promoted in the international media, since will definitely look more effective and humane than the idea of laying rails on and drilling mines in the lunar surface.

Announcing exciting, humane, eco-friendly lunar projects could become our domestic hobbyhorse.

As an architect, I believe that architecture is currently lacking in outer space. The interior of the ISS is simply a space for survival. Just like in ancient times, when people did not think about beauty, lived in huts, and only cared about survival, we are also at the very beginning of the era of space exploration right now. Over time, however, the desire to make sense of and humanize the space around us led man to the creation of architecture as such. The same thing will happen with the habitable area of outer space.

We can already envision and pitch our Russian Manned Lunar Station (RMLS) not simply as a unit for survival – a cramped space with coils of wires hanging everywhere (although it will be like that at first, of course) – but as a volumetric and spatial work of architectural art that reflects both the latest technologies and symbols of Russian identity and culture.

The architecture of the RMLS should be expressive, recognizable, and reminiscent of images of Russian and Soviet architecture and painting.

Like the Church of the Intercession on the Nerl – an unexplainable miracle that was built in several warm months in 1165, never broken by enemies, time, or floodwaters, and surrounded by endless snow-covered fields – our station, amidst the lunar silence and emptiness, will become a proclamation of our culture and technology. In a word, the Russian dream in outer space!

It is believed that we will build the RMLS after the implementation of the International Scientific Lunar Station (ISLS) programme.

In Soviet times, architects thought about human colonization systems in space. And now the creation of manned facilities in outer space needs to be planned in alliance with architects.

The works of Georgy Krutikov, a 1928 graduate of the Russian State Art and Technical School, are striking for the elegance of his hand-drawn graphics, forward-looking thinking, and vision of space architecture.

There are beautiful compositional solutions for space colonization in the works of Vyacheslav Loktev, a professor, honoured architect of Russia, corresponding member of the Russian Academy of Cosmonautics, laureate of the World Biennale in Sofia, and one of the founders of the new Space Architecture movement.

A project by architect Norman Foster's studio that was commissioned by the European Space Agency is interesting technologically, but uninspiring compositionally: a design for a lunar base that can be built using a 3D printer (<https://archi.ru/world/45840/mezhplanetnyi-masshtab>): only a cylindrical container with inflatable formwork would be delivered to the Moon in a rocket. Following installation, a mixture of lunar soil (regolith) and magnesium oxide would be sprayed onto it using a 3D printer, while a saline solution would serve as 'printer ink'. To prevent the liquid from evaporating in vacuum conditions, it would be applied in minimal doses directly into the regolith layer. Once it is 'printed', you would have a material with large cavities that resembles bird bones in terms of its structure. The base project is designed for four people, and its walls would be able to protect them from very high and low temperatures, cosmic gamma rays, and small meteorites. For now, the main problem remains lunar dust, which is very dangerous for the respiratory tract.

I am an architect, a teacher at the Moscow Architectural Institute, a teacher of the highest qualification category, and a member of the Znanie Society. I am passionate about designing the RMLS as an architectural object that promotes domestic cosmonautics, and have held several presentations and master classes on creating a three-dimensional model of the lunar station. I have a certificate of gratitude from the Znanie Society for participating in the Scientists for Children programme in 2023, and a certificate of gratitude from the Young Building Experts of the Future Forum for holding a master class on creating a lunar station model at the Moscow Manege in 2024. My presentation and master class addressed the following issues:

- What the RMLS station will look like
- How it will differ from the stations of other countries
- What colonization system is preferable on the Moon
- How to protect the lunar surface and what transport to use on the Moon
- How gravity affects structural foundations and architectural space
- What tectonics are
- How to create gravity in space
- Why smart glass is needed on the Moon

Below are my designs of the lunar station that I present to master class participants:

Lunar Station Design No. 1:

The station consists of functional units: residential, a block of offices, suspended gardens, a unit with cinemas, exercise machines, and treadmills, and an agricultural unit, among others.

The station is designed for long-term habitation. The size of the station can be built up with new units, e.g., kindergartens and schools. One of the main requirements for the future station is the interchangeability of its components.

Lunar Station Design No. 2:

The station's facade is made of modern panels that function like smart glass: the panels transmit sunlight and filter dangerous radiation; in the event of increased sunlight, the panels darken themselves; and the panels also function as solar batteries and provide the station with energy. The surface of the panels is extra strong, which guarantees safety in the event meteorites strike.

The station is built upwards and out to the sides to preserve the natural lunar landscape.

The lunar surface is covered by a layer of up to 2 metres of fine dust-like regolith, which is another argument in favour of building a station on supports.

Lunar Station Design No. 3:

The Russian lunar station should be expressive, recognizable, and reminiscent of images of Russian and Soviet architecture and painting. Amidst the lunar silence and emptiness, it will become a proclamation of our culture and technology. In a word, the Russian dream in outer space! It will have everything: universal brotherhood and justice, a revolutionary breakthrough, centuries-old traditions, the Intercession of the Virgin Mary, Malevich's Black Square, brides and grooms will soar above the Lunar City, and there will be cranes flying...

Lunar Station Design No. 4 (Aurora):

The Moon lacks the natural clues of scale that we are accustomed to: there are no trees, clouds, rivers, buildings, or light and spatial depth.

Light facades would be used during the lunar night, which lasts two weeks.

The facades would consist of a system of mirrors that transmit sunlight to the dark side of the Moon.

The complex surfaces and various textures of the lunar station's facades would saturate the Moon with elements that are on a scale with human perception.

The textures of the facades replicate the surfaces of wood, stone, as well as the structure of snowflakes, grass, and other Earth-like structures.

The lunar transport system in the settlement would use cable-stayed structures that rise upward on supports, while lunar transport would mainly use funicular systems.

The master class participants design and construct a model up to 40 cm high using coloured cardboard.

I conduct master classes on creating a three-dimensional model of the RMLS as an architectural object:

On 4 April 2023, as part of the 'Scientists for Schools' campaign organized by the Russian Znanie Society, a master class titled 'Creating a Lunar Station Design' was held at Kerimov Moscow School No. 1538 in class 7A.

A total of 28 students worked on the project. They were divided into teams, each of which was responsible for its own part of the overall model. One person glued the lunar surface, another one glued the elevators and roads of the lunar station. One team glued the office unit, another – residential blocks, and the third – blocks with farms and agricultural fields. The young people also designed recreational spaces on the lunar station, including green boulevards with exercise machines, public spaces, theatres, and cinemas. They were enthusiastic and demonstrated team spirit and creative initiative.

On 9 September 2023, as part of the University Saturdays programme, the Moscow Architectural Institute held a master class titled 'Lunar Station' for students in grades 8-11 and anyone else who was interested.

The station would presumably consist of numerous functional units: a residential block, a block of offices, suspended gardens, a unit with cinemas, exercise machines, and treadmills, and an agricultural unit for growing food products, among others. The station would be ready for the long-term habitation of the Moon trailblazers. The size of the station could be built up with new units with kindergartens and schools.

On 14 March 2024, as part of the Young Building Experts of the Future Forum, the Moscow Manege hosted a master class on creating a model of the lunar station, which was attended by 42 schoolchildren from 10-11 engineering classes of Moscow and students from Moscow Automobile and Road Construction State Technical University. The master class was visited by an unexpected and highly honoured guest: Sergey Avdeyev, a pilot cosmonaut and hero of the Russian Federation.

At the presentation, Kuryshcheva spoke about existing lunar station designs, the state of the lunar soil, and the need to preserve the lunar landscape. She suggested that a lunar station could be built from blocks formed from lunar soil, so that after the lunar objects are dismantled, the blocks could once again be crushed into lunar soil. Blocks could be formed from lunar soil through the electromagnetic adhesion of particles, with the ability to rapidly dissolve the blocks into lunar dust in the future.

Sergey Avdeyev told the audience a lot of interesting facts: there is no magnetic field or strong radiation on the Moon, depressurization is the main problem in space, and a support-free environment is a challenge for people who spend long periods in space. The master class concluded with an exhibition of lunar station models and a discussion of the issues that were addressed.

Here is why we will succeed:

1917: collapse of Russian statehood

20 years later in 1937: the first flight across the North Pole using domestically produced equipment

1943: Battle of Stalingrad

14 years later in 1957: the world's first space satellite

2022: start of the special military operation

13 years later in 2035: the lunar station

**Lashko Olga**

Analyst

Association of Industrial Parks
of Russia

The Infrastructure of Working with a Product: From Primary Production to Re-Introduction into the Economy

Preamble

In the 21st century, the responsible and sustainable use of resources is not just a social trend, but an absolute necessity. The community faces the key task of increasing labour and manufacturing productivity, while also enhancing the social responsibility of both producers and consumers. This cannot be accomplished without taking into account the full work cycle with materials and products. We have learned to produce all kinds of goods, but now the question is why do we need such a high volume of low-quality goods that consume resources not only in production, but, more importantly, in their disposal or re-introduction into production?

The main thematic focus of this essay is investments in the environment, but this subject also concerns both the technological framework and connectivity infrastructure, as well as investments in people. As such, this essay will also consider these issues. Why is investment in the environment the main thematic focus

of the topic? In one way or another, we are entirely surrounded by products: from household items and the building materials used to create spaces, to the general format of cities, including the places where people work, manufacturing sites, different spaces, and the waste management system as a whole.

Most of the issues concerning this topic are addressed as part of the Circular Economy concept and related programmes.

The scope of this essay is broader than this concept and includes such issues as increasing labour productivity and automation, as well as changes in the general employment formats of the population.

The main challenges of creating an environment with a full cycle for working with a product are:

- Maintaining the flexibility of the system (representation of actors, competition, and freedom of choice of niches) while increasing the process control and management segment
- Identifying clear rules for the general 'coexistence' of actors and adjustment mechanisms
- Establishing a new format of infrastructure for manufacturing
- Attracting investment for long-term and labour-intensive infrastructure projects, while also introducing mechanisms and technologies for small volumes of both production and processing
- Digitalization and automated data collection for analysis
- Harmonizing regional, state, supranational, and global programmes

I would also like to point out that this essay requires some revision, as this is just a rough version with a general idea of the concept.

To make things simple, we will divide the general system of working with a product into four main blocks:

1. Materials
2. Production of goods
3. Waste collection infrastructure
4. Re-introduction infrastructure

Let's look at each of these blocks. We will pay particular attention to the second block, since it often falls outside the general scope of such studies.

1. The objective of materials science and related fields should gradually begin to adapt to the extension of the technological and economic model and expand the scope of research that explores the feasibility of unifying materials and how they can be re-introduced into the economy. In 2021, the Russian Environmental Operator created the Consortium for Scientific and Methodological Support for the Transition to a Circular Economy to consolidate efforts for the training of personnel and researchers. But this work needs to be expanded, with greater international cooperation where possible. Scientific work and

research should seamlessly transition to standards and be integrated into production chains.

2. Production facilities are increasingly being set up within organized manufacturing spaces that offer various types of services for residents. These are often industrial parks, technology parks, and special economic zones. Such sites consist of a territory for industrial production as well as scientific and technical activities with infrastructure (transport, utilities), and also often ready-made premises, already in place on the land.

A key feature of an industrial park is that they are developed by specialized management companies based on a unified concept for the development of the territory and the facilities on it.

Having several production facilities in close proximity on a single territory helps industrialists reduce costs by using shared infrastructure and relieves them of having to perform non-core activities related to building and maintaining utility networks.

By 2030, Russia will have some 780 projects that are being created or in operation (assuming the new projects grow at a rate of 8-10% per year, which is lower than the average annual rates of previous years (15-17%), since the market has largely taken shape and the growth rate is gradually decreasing). In 2024, there were a total of 660 industrial parks, industrial production special economic zones, technology development special economic zones, and technology parks in the country, an increase of 460% from 2013.

By 2030, total investments in infrastructure and by residents could exceed RUB 4 trillion. Investments in production have been steadily trending upward at a rate of RUB 125 billion per year on average. Since 2013, resident companies have tripled their investment in infrastructure and production with cumulative investment of RUB 2.7 trillion as of 2024.

The total number of sites with even greater functionality around the world has also been increasing. China is clearly leading the way in this indicator (with more than 2,500 sites), followed by other Asian countries and the United States. Russia is among the leaders in terms of the number of such sites.

The main range of services for residents, in addition to conventional services (access to infrastructure and operational services), are being supplemented by new ones, which is a further step towards their development. The most common services are the inclusion of educational centres and HR training: educational centres are built on the territory of such sites, or the sites themselves are initially connected to scientific and educational centres. A new trend has been the construction of engineering centres and specialized developments centres at such sites. These consolidated spaces could become platforms for the development of automation and robotics and increase labour productivity. Moreover, setting up production facilities within such spaces not only helps to optimize the construction of utility infrastructure and scale it out among residents, but also ensures the sustainable

use of such territories. The next step in their development is to digitalize the work of management companies. The concept of using an open ERP system is currently being developed. This will make it truly possible to properly begin collecting information about what materials residents use and how much, as well as the form of waste that is generated from production.

This step towards digitalization and high-quality data collection will help to understand in real time how much waste is being generated, forecast these volumes for several years ahead, and get a clear understanding of the structure of waste. This will provide brand new opportunities to build infrastructure for the collection, processing, and re-introduction of useful materials into production.

This results in the creation of a kind of data nesting doll with the following parts: manufacturer – management company – data management and redistribution centre – scientific community – waste operators – enterprises that work with useful materials. It is a cyclical chain, on the one hand, but it allows for the exchange of data and information between different actors.

Small and medium-sized enterprises have been joining such sites, which is an important trend.

Programmes to improve labour productivity are being actively developed. This is closely connected with robotics, since industrial and technological sites can be localizers of robotics development centres.

It is important to keep in mind that such a solution will, on the one hand, make it directly possible to set up robot production at a site where manufacturers are already concentrated, and on the other hand, provide a centre that other suppliers of systems and their components can link up to. In addition, it would also take over the function of training and onboarding employees, and provide services for the adaptation of workshops and the entire production process.

At present, the profit margins from integrating robotic systems begin with the production of more than 10,000 units (parts) of a single item per year.

The payback period is approximately 1.5 years in the United States or Europe, and 3.4 years in Russia. Most training programmes target specialists who will develop and produce robotic systems, but not operate them. The robots must be integrated into the production chain, which is an additional cost. There are little expertise about how to optimize production. A robot also needs such infrastructure as parts and consumables, not to mention conveyor belts and delivery. This all creates the need to adapt workshops. A robot is a derivative of a machine, and a machine is a derivative of a drive. The pattern is as follows: drive (engine building) – machine (machine building) – robot. More affordable models are gradually being created and introduced, which makes it possible to integrate robots into small production facilities.

We will combine blocks three ‘waste collection infrastructure’ and four ‘re-introduction infrastructure’, which are important aspects of the block. The technological and infrastructural framework largely aims to work with large volumes of

waste. Developments are gradually appearing that can work in micro collection, sorting, and recycling. Second, countries have regions where burial is the only way to dispose of waste. They do not even have primary sorting or any other formats of disposal, except for burial. It is crucial to create technologies to handle small amounts of waste in hard-to-reach and sparsely populated areas. This is important for all countries. It is also essential to improve the technology and innovativeness of the processes in this block.

The economic and social effects primarily involve improvements to the quality of people's living environment. The environment is a symbiosis of the socio-economic framework. On the one hand, it directly affects the quality of people's lives, while, on the other, it creates opportunities to establish new economic ties and make the space of human activity more flexible.

When developing infrastructure to work with a product - from primary production to re-introduction into the economy - the following principles should be taken into consideration:

- Flexibility combined with a clear description of standards and the speed of their implementation
- Symbiosis of planning, competition, and flexibility
- Localization (a network in small settlements) of production and processing (due to the fact that the human living environment is becoming more heterogeneous)
- Data and analysis for decision-making

Restructuring the system would be a step towards a new technological redistribution. Modern technologies help us progress towards new formats of life and reformat the environment, as we take the next step towards new technologies and reshape our way of life.



GUINEA



Mamadou Sekou Diallo

Representative

Parade (Alternative Russia-Africa Partnership for Economic Development)



Communications in Africa as an Investment Opportunity

Introduction

Africa is a continent of extraordinary cultural, linguistic and economic diversity. In an increasingly interconnected world, investment in communication infrastructure has proved to be a decisive factor for the socio-economic development of African countries. Communication and information technologies (ICT) play a crucial role in improving living conditions, promoting education, and facilitating trade and access to health services. This essay explores the importance, opportunities and challenges of communication investment in Africa.

The rationale for ICT investment

Investing in Africa's communication infrastructure is important for the following reasons:

Access to information

Access to information is a fundamental prerequisite for development. With adequate communication infrastructures, rural and urban populations can access vital information about health, education and the economy. This fosters citizen participation and sustainable development.

Economic growth

ICTs stimulate innovation and productivity. Companies can use the Internet to reach new markets and optimize their operations. Moreover, technology start-ups emerging in countries like Kenya, Nigeria and South Africa contribute to creating a potential entrepreneurial ecosystem.

Investment opportunities

Africa offers a wide range of opportunities for investors in the communications sector:

Mobile and Internet networks

The growth of mobile phone use in Africa is spectacular. According to recent studies, mobile penetration has exceeded 100%. Telephone operators are therefore investing in high-quality networks to meet the growing demand for voice and data services.

Fintech innovations

Africa has seen the advent of many financial innovations, such as mobile banking and digital payment systems. Companies like M-Pesa in Kenya have demonstrated that mobile payment solutions can transform access to financial services for millions of people.

3. Challenges

Nevertheless investing in Africa's communications sector encounters considerable challenges:

Inadequate infrastructure

Despite significant progress, many parts of Africa still do not have reliable communications infrastructure. Difficult access to electricity, poor roads and lack of physical infrastructure complicate the deployment of communication services.

Policies and regulations

Government policies can also handicap ICT development. Restrictive regulations and a lack of support for innovation can slow down the sector's growth. It is

crucial that African governments adopt incentive policies to attract foreign investment and support local businesses.

How to promote investment projects in africa's communications sector for russian partners?

The Russia–Africa Alternative Partnership for Economic Development (PARADE) believes that a strategic plan to attract Russian investors to the communications sector in Africa requires a thoroughly structured approach. Provided below is a step-by-step plan that can serve as a guide:

Strategic Plan to Attract Russian Investors to the Communications Sector in Africa

Objectives and Targets

Identify specific objectives, such as the target amount of investment, type of potential communication projects (infrastructure, digital media, etc.) and the required number of partnerships.

Market Analysis

Identify the needs: carry out an in-depth study of communication needs in various African countries, taking into account existing infrastructures and people's expectations.

Segment the market: identify the most promising market segments, for example, telecommunication services, the media, broadband Internet, etc.

Identification of Local Partners

Identify key players: identify local businesses, regional governments and NGOs that could become potential partners in communication projects.

Establish partnerships: create synergies with solid local partners to ensure project acceptance and enhance credibility.

Value Proposition

Focus on advantages: establish clear value propositions for Russian investors, including strategic benefits (access to new markets and portfolio diversification) and economic benefits (investment profits and contribution to local economic growth).

Promote Russian technologies: champion Russian innovations and technologies in the field of communications based on successful case studies.

Communication Strategy

Awareness campaigns: design targeted communication campaigns to publicize investment opportunities in Africa and the growth potential in the communications sector.

Leverage social and traditional media: promote projects through social media, specialized publications, conferences and workshops.

Engagement Events

Investment Forums: Organize investment forums to bring together Russian investors, African decision-makers and opinion leaders to discuss opportunities in the communications sector.

Site visits: help to arrange visits for Russian investors to potential investment project sites.

Risk Assessment and Mitigations

Risk assessment: identify potential risks associated with investment projects (political instability, economic fluctuations) and put in place mitigation strategies.

Guarantee mechanisms: propose guarantee mechanisms to reassure investors, such as investment insurance or government support.

Performance Monitoring and Evaluation

Progress monitoring: define performance indicators to monitor the progress of investment projects and their impact on local development.

Regular reporting: produce regular reports for Russian investors detailing project progress, challenges and achievements.

The aim of this strategic plan is to establish a clear framework for attracting Russian investors to the communications sector in Africa. By combining in-depth knowledge of the African market with Russian expertise in communications technology, PARADE can play a key role in the mutual development of the regions. Strong commitment, effective communication and strong partnerships are essential to the success of this initiative.

Conclusions

Investment in Africa's communications sector is a key driver of economic development. Despite significant challenges, information and communication technologies offer enormous growth potential. To take full advantage of these opportunities it is essential to strengthen infrastructures, adopt innovation-friendly

policies and secure better access to information. By focusing on these improvements Africa will be able to catch up in the technology race and position itself as a world leader in innovation and sustainable development. The communications industry on the continent has a promising future and the investments made today will be a major contribution to development and prosperity in the years to come.

References

1. <https://www.banquemonddiale.org>
2. <https://www.afdb.org>
3. International Telecommunications Union (ITU) – provides statistical data and analysis regarding digital development in Africa.
4. Organisation for Economic Cooperation and Development (OECD) – publishes studies on communications and technology investment and policy.



Mendoza Rojas Diego Aimar

Student

National Autonomous
University of Mexico



Cars in the World: From a Socioeconomic Catastrophe to a Dignified Organization of Urban Spaces

Climate change is a real challenge that poses real risks to life on the planet. And we have long known how to control this problem: stop extracting coal, oil and gas. Unfortunately, despite the efforts of organizations and activists, and despite the many international events, conferences, discussions, and publications on the topic, and the scientific advances (which year after year provide new evidence of the gravity of this problem), climate change is proceeding at an accelerated pace due to capital-seeking actions that bring about changes in the chemical composition of the atmosphere. As a result, we are witnessing a socioeconomic catastrophe consisting of a series of interconnected environmental phenomena that are intensifying and occurring with increasing frequency (unprecedented extreme temperatures, mass extinction of species, melting of polar caps, category five hurricanes, etc.).

The cause of this crisis is greenhouse gas (GHG) emissions, which are distributed among five major sectors across the globe: 1) power generation (34%); 2) industrial production (24%); 3) agriculture and farming (22%); 4) transport (15%); and 5) household and commercial activities (6%). At first glance, it would seem that the transport sector does not account for the largest volume of greenhouse gas

emissions. However, the significance of this particular indicator must be clarified. Not only does transport ensure our mobility and maintain the rhythm of everyday urban life – according to Sixth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC) (Minx et al., 2022), it also accounts for 60% of global oil consumption annually. Consequently, the transport sector is a priority for governments, economic entities, representatives of civil society and businesses that strive to ensure optimum living conditions on the planet, as rapidly rising demand accelerates the advance of the climate crisis and exacerbates problems such as low air quality, heavy traffic, heatwaves, stress, depression, premature mortality, etc.

In sum, the socioeconomic catastrophe is caused by a combination of all factors, and cities are of particular importance in this regard. According to the United Nations Human Settlements Programme (UN-Habitat), cities account for 78% of all energy consumption worldwide and 60% of all greenhouse gas emissions, even though they occupy less than 2% of the Earth's surface (UN, 2020). The mobility sector is not a business as such until it is turned into a planned necessity by, among other things, organizing the urban space so as to create the illusion that personal transport is the best means of transportation. The human body has evolved to be resilient and efficient when moving and covering large distances, capable of controlling its own temperature by shedding excess heat through perspiration; a healthy person can cover up to 30 kilometres per day (Fernando Guzmán, 2021). The need has thus emerged to plan and maintain a rate of production that prioritizes mobility in cities with road traffic, driven by the need to travel distances that cannot be covered by foot either due to time, convenience or safety constraints.

Creating an urban environment requires a break with nature and rejection of the concept of city as a space of social comfort; cities turn into structures aimed at extracting ever greater profits, continuously violating the biospheric boundaries of the environment (Diego Chimal, 2022). The starting point here is paving the streets, which prevents rainwater from being absorbed by and replenishing groundwater reserves, directly absorbing the heat of urban environments (Jhon Saxe Fernández, 2023). As for maintenance of the urban environment, we observe the development of infrastructure intended to promote the use of automobiles in society, which, in combination with already existing facilities, such as highways, avenues, roads and peripheral streets, engenders new problems in the transport sector and exacerbates pollution caused by traffic, as the city becomes more hostile to pedestrians and cyclists.

On the other hand, the low cost of energy from petroleum (and its derivatives, such as gasoline used in cars) has led to intensified extraction, which itself damages the environment. Consider the automobile industry: the production process is quite evidently efficient – as evidenced by the global capacity to produce, on average, 260,000 new cars ready to hit urban streets daily (OICA, 2023). However, the associated environmental damage is huge: each car emits an average of 2.35–2.64

kg of carbon dioxide (CO₂) per litre of gasoline consumed, which is equivalent to annual atmospheric emissions of 8 gigatons of carbon dioxide (Oxfam, 2019). This astonishing scale of daily car production and pollution associated with their use is due to three factors: the financial sector; the government; and the population – and a combination of their economic priorities. In reality, the economy of relatively poor countries, such as Mexico, is based on energy colonialism, which involves maintaining the operation of massively polluting enterprises that offer little financial benefit but continue to operate because they ensure a stable and uninterrupted supply to the global market at affordable prices.

Additionally, most GHG emissions in Mexico are produced by the following sectors: road transport (26.2%); power generation (19%); oil and gas (12.1%); industrial production (17.3%); agriculture and farming (12%); land use (4.9%); waste disposal (4.6%); and household and commercial activities (3.9%) (Climático, 2018). This data indicates that the transport sector is the largest polluter in Mexico, although the share of emissions is not uniform across the country: in the capital, Mexico City, private cars account for 71.69% of all emissions within the city (Cambio climático. Las emisiones de la Ciudad de México, 2018).

Pollution generated by cars affects public health, be it in the form of noise, heavy traffic, poor air quality, or traffic accidents. Problems caused by high levels of atmospheric pollution associated with the transport sector include asthma and the overall degradation of respiratory function, especially in children (La destrucción de México, 2009). In addition, these factors increase premature mortality, which substantially affects national GDP: there were 9000 recorded cases of premature death in 2014, costing the economy 45 billion Mexican pesos (approximately \$2.2 billion) (SEMARNAT, 2019 r.). Moreover, according to National Institute of Statistics and Geography estimates, 12 people are killed in Mexico daily in traffic accidents (Gutiérrez, 2023). Further, emissions from diesel vehicles lead to changes in the electrical activity of the heart, justifying the hypothesis that atmospheric pollution reduces the amount of available oxygen and triples cardiac stress during exercise. Other problems include damage to the ears, including deafness, and sleep disturbances caused by noise (Salud, 2024).

For these reasons, an alternative solution for adapting to climate change is gaining in popularity: the electrification of transport. However, there are two reasons why this alternative should be viewed with caution: first, it ignores the fact that carbon dioxide is produced through combustion because in this case it is not obvious, as electric vehicles do not have exhaust pipes that emit greenhouse gases. However, in most poor countries (i.e. in most countries in the world), charging stations still work on fossil fuels (Healy Wehlen, 2014). The second and more important reason is associated with messianic hopes for the implementation of a simplistic technological solution that would not be designed to meet mobility demands but would rather take precedence over economic interests. Meanwhile, technological achievements are, contrary to expectations, often counterproductive, because they

further stimulate the need for long-distance travel, thereby increasing demand for the energy required for such trips.

In addition, the uneven distribution of carbon emissions generated by traffic negates the benefits and efficiency of public transit in cities such as Mexico City, where public transportation is only used by 5% of the population, and up to 92% of residents use personal transport (Secretaría del Medio Ambiente en la CDMX, 2023). It has to do with the fact that belonging to a certain social class opens access to a particular type of consumption and, at the same time, represents a convenient unit of measurement of responsibility for environmental degradation depending on the person's share in the overall energy consumption. The middle class, which has credit cards and a stable salary, eschews public transportation and succumbs to the desire to buy an automobile for everyday needs, which compounds the problems we already know. The environmental catastrophe thus has deep political roots in the form of class divisions. This conclusion is supported by Oxfam data, which indicates that billionaires produce more carbon dioxide emissions in 90 minutes than the average person over a lifetime (Oxfam International, 2024).

Consequently, public transportation in its current form cannot solve the problem caused by the need for mobility and eliminate its consequences by itself. Public transportation produces far less carbon dioxide emissions than private transport, but the environmental crisis calls for better alternatives. Of course, public transportation in cities is a way to combat CO₂ emissions through economic investments in infrastructure and subsidies that will allow public transportation to improve and effectively compete with private cars. This is exemplified by the Moscow Metro, which not only connects city districts through a perfectly planned transport network, but also remains affordable, uses advanced technologies, offers high-speed transit and continuous operation, and boasts traditional architecture, safety, cleanliness, visual attractiveness and the cultural heritage of the Soviet Union. Therefore, investments can ensure stable profits, increase connectivity within cities and contribute to meeting global goals and environmental standards by reducing stress for workers, thereby boosting GDP and reducing noise and air pollution levels.

That said, it is important to note that the problem of pollution nevertheless persists in developed countries, where public transportation in cities is not only modern, but also clean, safe and dignified. This explains the success of the progressive alternative of reorganizing spaces, or constructing "15-minute cities," that could contribute to solving environmental problems through sustainability and the availability of the necessary amenities and leisure infrastructure within comfortable reach on foot or by bicycle. This would reduce the amount of carbon dioxide generated by combustion. Such European solutions have proven useful in other regions of the world, including Latin America. In countries like Mexico, such projects are called utopian. They involve revitalizing urban spaces; reducing the number of trips by private transport; organizing free sporting, cultural and recreational events; maintaining cleanliness and safety; holding workshops organized

by the administration; reducing stress; increasing convenience for residence; and promoting physical activity, including in new formats, which would contribute to reducing gender-based violence and lowering the crime rate (Frida Sánchez, 2024).

To summarize, humankind needs to reduce energy consumption, reject the desire for wealth, build a new relationship with nature, transform cities by reorganizing the urban environment, align state interests with the needs of nature and climate commitments, encourage automobile-free living, and reaffirm our right to a clean environment.

References

1. Minx, J. C., Lamb, W. F., Andrew, R. M., Canadell, J. G., Crippa, M., Döbbling, N., Forster, P., Guizzardi, D., Olivier, J., Pongratz, J., Reisinger, A., Rigby, M., Peters, G., Saunio, M., Smith, S. J., Solazzo, E., & Tian, H. (2022). A comprehensive and synthetic dataset for global, regional and national greenhouse gas emissions by sector 1970–2018 with an extension to 2019. <https://doi.org/10.5281/zenodo.6483002>.
2. United Nations (2020, September 10). Cities and Pollution. United Nations. <https://www.un.org/en/climatechange/climate-solutions/cities-pollution>.
3. Fernando Guzmán. (2021, August 4). Evolución: Responsable de la existencia de algunas disciplinas deportivas - UNAM Global. https://unamglobal.unam.mx/global_revista/evolucion-responsable-de-la-existencia-de-algunas-disciplinas-deportivas/.
4. Diego Chimal (2022). III Coloquio Latinoamericano: Cambio ambiental global, metabolismo social local - YouTube. <https://www.youtube.com/watch?v=i-1rSFqvrwQ&list=PLyE9patTE7d-M5hjRXkrxOBUvgYLM-f6T&index=35>.
5. Jhon Saxe Fernández. (2023, June 1). La Jornada: Ciudades y colapso climático. La Jornada. <https://www.jornada.com.mx/2023/06/01/opinion/O24a1eco>.
6. La destrucción de México: La realidad ambiental del país y el cambio climático. (2009).
7. OICA. (2023). Estadísticas de Producción 2023. <https://www.oica.net/category/production-statistics/2023-statistics/>.
8. Oxfam. (2019, May 7). Vehículos eléctricos: ¿son una opción para mitigar la contaminación? Ingredientes Que Suman. <https://blog.oxfamintermon.org/vehiculos-electricos-son-una-opcion-para-mitigar-la-contaminacion/>.
9. Climático, I. N. de E. y C. (2018, mayo 18). Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero. gob.mx. <http://www.gob.mx/inecc/acciones-y-programas/inventario-nacional-de-emisiones-de-gases-y-compuestos-de-efecto-invernadero>.
10. Cambio climático. Las emisiones de la Ciudad de México. (2018). http://www.data.sedema.cdmx.gob.mx/cambioclimaticocdmx/emisiones_cdmx.html.
11. La destrucción de México: La realidad ambiental del país y el cambio climático. (2009). Greenpeace México. <https://www.greenpeace.org/mexico/publicacion/948/la-destruccion-de-mexico-la-realidad-ambiental-del-pais-y-el-cambio-climatico/>.
12. SEMARNAT. (2019). Impactos en la salud y económicos por contaminación atmosférica en la Región Centro de México. https://apps1.semarnat.gob.mx:8443/dgeia/informe18/tema/recuadros/recuadro1_7.html.
13. Gutiérrez, A. (2023, September 1). Accidentes automovilísticos en México 2023- Gnpautos. mx. Seguro de auto. <https://gnpautos.mx/blog/estadisticas-de-accidentes-de-autos/>.
14. Salud, M. (2024, July 15). Efectos del tráfico sobre la salud. Página de Salud Pública del Ayuntamiento de Madrid. <https://madridsalud.es/efectos-del-traffic-sobre-la-salud/>.

15. Healy Wehlen. (2014). ¿Qué tan limpio es el uso de un auto eléctrico? <https://ibero.mx/prensa/que-tan-limpio-es-el-uso-de-un-auto-electrico>.
16. Secretaría del Medio Ambiente en la CDMX. (2023). INVENTARIO DE EMISIONES DE LA ZONA METROPOLITANA DEL VALLE DE MÉXICO 2020.
17. Oxfam International. (2024, October 28). Los millonarios generan más emisiones de carbono en 90 minutos que una persona promedio en toda su vida. Oxfam International. <https://www.oxfam.org/es/letters-and-statements/los-millonarios-generan-mas-emisiones-de-carbono-en-90-minutos-que-una>.
18. Frida Sánchez. (2024, October 6). ¿En dónde estarán las primeras 16 Utopías que construirá Clara Brugada en CDMX? El Universal. <https://www.eluniversal.com.mx/metropoli/en-donde-estaran-las-primeras-16-utopias-que-construira-clara-brugada-en-cdmx/>.



NIGERIA



Monyem Matthew

Graduate Student



Investing in the Environment

A Gateway to a Resilient and Prosperous Future in 2050 where cities breathe with lush green rooftops, rivers run clean after decades of pollution, and energy systems hum on 100% renewables. This vision is not a utopian fantasy but an achievable reality—if we prioritize strategic investments in the environment today. As climate change accelerates, displacing communities and destabilizing economies, the imperative to redirect capital toward ecological restoration, green technology, and sustainable systems has never been clearer. Environmental investments are no longer a niche concern but the cornerstone of global prosperity. This essay argues that channeling resources into the environment is a transformative strategy that merges economic growth, technological innovation, social equity, and ecological resilience, paving the way for a thriving future.

The Economic Imperative to Green Growth as a Catalyst and the transition to a low-carbon economy is not just an environmental necessity but an unparalleled economic opportunity. Renewable energy for instance, has outpaced fossil fuels in job creation, with the International Renewable Energy Agency (IRENA) reporting 12.7 million jobs in the sector in 2022 a figure projected to triple by 2050. Countries like Denmark, which generates over 50% of its electricity from wind, and Costa Rica, powered by 98% renewables, demonstrate that energy independence is both feasible and profitable. Investments in sustainable agriculture further underscore this potential. Regenerative farming practices, which restore soil health and sequester carbon, could generate \$1.4 trillion annually in ecosystem services, according to the World Business Council for Sustainable Development.

Meanwhile, the circular economy—a system prioritizing reuse and recycling—could unlock \$4.5 trillion in global economic growth by 2030. Companies like Patagonia, which repairs and recycles clothing, and Tesla, whose battery recycling initiatives reduce mining demands, exemplify how circular models drive profitability while slashing waste. Critics often cite upfront costs as a barrier, yet the long-term savings are staggering. The Global Commission on Adaptation estimates that investing \$1.8 trillion in climate resilience by 2030 could yield \$7.1 trillion in net benefits, from avoided disaster recovery to enhanced agricultural productivity.

Technological Frontiers Pioneering the Future; The fusion of technology and environmentalism is birthing groundbreaking solutions. Solar and wind energy, once costly novelties, now undercut fossil fuels in price, with solar panel costs plummeting 82% since 2010. Innovations like perovskite solar cells and floating offshore wind farms promise to further revolutionize energy grids. Emerging technologies amplify this potential. Carbon capture and storage (CCS), though in its infancy, could remove 10 gigatons of CO₂ annually by 2050, according to the IPCC. Direct air capture plants, like Clime-works' facilities in Iceland, already operate at scale, turning captured carbon into stone. Similarly, AI-driven precision agriculture optimizes water and fertilizer use, while vertical farming could reduce land use by 95%, ensuring food security in urban centers. The future beckons with even bolder possibilities like lab-grown meat to curb deforestation, smart grids that balance energy demand in real time, and bioengineered corals that revive dying reefs. Investing in R&D today will catalyze these innovations, positioning nations as leaders in the green economy.

Equity and Justice in Bridging the Climate Divide cannot be underscored. Environmental investments must prioritize equity, as marginalized communities disproportionately bear climate impacts. Low-income neighborhoods often face “energy poverty,” lacking access to affordable renewables, while coastal and indigenous communities endure the brunt of rising seas and deforestation. Initiatives like Kenya's Lake Turkana Wind Power Project, Africa's largest wind farm, illustrate how decentralized renewable energy can empower rural areas, providing jobs and electricity to 1 million people. Similarly, Bangladesh's community-led solar programs have installed over 6 million home systems, uplifting livelihoods while reducing emissions. Policy frameworks must ensure inclusivity. Colombia's 2022 tax reform, which channels \$4 billion annually toward green projects in vulnerable regions, and the U.S. Inflation Reduction Act's \$60 billion for environmental justice, set precedents for equitable investment. By centering marginalized voices, environmental finance becomes a tool for social cohesion.

Ecological Resilience towards Valuing Natural Capital, an Investments in biodiversity and ecosystems are investments in humanity's survival. Forests, wetlands, and oceans provide \$125–140 trillion annually in ecosystem services—from pollination to flood control—yet these systems are crumbling. The Amazon rainforest, a carbon sink vital to global climate stability, has seen deforestation rates soar, risk-

ing a “tipping point” of irreversible degradation. Conservation financing offers a remedy. Costa Rica’s Payment for Ecosystem Services (PES) program, which compensates landowners for reforestation, has doubled forest cover to 60% since the 1980s. The Great Green Wall initiative in Africa aims to restore 100 million hectares of degraded land by 2030, sequestering 250 million tons of CO₂ and creating 10 million jobs. Protecting biodiversity also safeguards against pandemics. Habitat destruction drives zoonotic diseases, as seen with COVID-19. Investing in wildlife corridors and anti-poaching measures, as Rwanda has done for mountain gorillas, preserves ecological balance while boosting tourism revenue.

Policy and Collaboration Orchestrating Global Action has shown that no nation can tackle environmental crises alone. The Paris Agreement’s pledge to limit warming to 1.5°C hinges on collaborative investment. The EU’s Green Deal, a €1 trillion plan to achieve carbon neutrality by 2050, and China’s \$546 billion renewable energy push, demonstrate the scale required. Public-private partnerships are pivotal. Norway’s sovereign wealth fund, the world’s largest, has divested from fossil fuels to invest \$30 billion in renewables. Green bonds, which finance eco-projects, surged to \$2.5 trillion in 2023, with entities like Apple and the World Bank leading issuances. Governments must also phase out harmful subsidies—\$5.9 trillion annually for fossil fuels, per the IMF—and redirect funds toward renewables and conservation. Carbon pricing, adopted by 46 countries, internalizes environmental costs, incentivizing cleaner choices.

Overcoming Challenges from Barriers to Breakthroughs make Skeptics highlight hurdles: political inertia, technological risks, and funding gaps. Yet success stories abound. Morocco’s Noor Ouarzazate Solar Complex, the world’s largest concentrated solar plant, overcame initial costs to power 1.3 million homes and cut emissions by 760,000 tons yearly. Youth activism and shareholder advocacy are shifting corporate priorities. Engine No. 1, a small hedge fund, leveraged climate concerns to elect three directors to Exxon’s board, mandating greener strategies. Such bottom-up pressure ensures accountability.

In conclusion, A Call to Future-Oriented Courage, the path forward demands boldness. Investing in the environment is not a cost but a down payment on a future where economies thrive, communities flourish, and ecosystems regenerate. As stewards of this planet, we hold the power to choose: stagnation in a dying paradigm or innovation in a living one. Let us embrace the latter, forging a legacy of resilience and hope for generations unborn. The time to act is now—our future is written in the investments we make today.



CAMEROON



Ndengwe Francois

Chairman
Diploma of Advanced Studies

African Advisory Board



What climate-energy policy couple for Africa? A sovereignty and development strategy proposal for 21st century's Africa.

Introduction

Africa faces a critical challenge: how to achieve energy sovereignty and industrialization while navigating international climate and energy agendas that marginalize its needs? It is risky to answer that question if one has not set on a scientific basis, the guiding principles for the climate-energy couple in Africa.

A development-oriented energy policy prioritizes economic growth, industrialization, and infrastructure expansion, rather than following the decarbonization framework that is the focus of the international agenda which, by the way, ignores Africa's input. Africa's voice is not heard. That ignorance hinders Africa's progress.

A warning: the expression "economic growth" used in this essay, does not have its usual meaning. Economic growth commonly means GDP growth. For us, economic growth refers to a constrained optimization problem that can be stated as follows: Maximize a quantity B (like Bonth) under the constraint of minimizing a quantity I (like Illth). B and I are aggregates we defined in a previous essay.

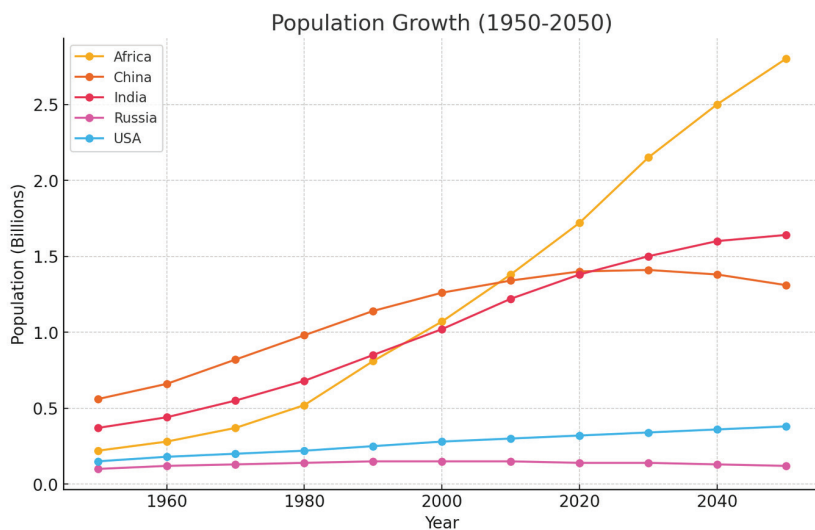
This essay describes the principles of the climate-energy policy we recommend for Africa in the 21st century. That policy highlights energy sources diversification, public investments in infrastructure, and the creation and financing, controlled by Africans, of national and pan-African public research institutions dedicated to the climate-energy couple.

1. Energy Demand Assessment Methodology

1.1. Africa: Energy Deficit and Growing Demand

Per capita energy consumption in Africa is the lowest in the world. The International Energy Agency (IEA, 2022) reports that the continent represents only 4% of global energy demand while it hosts 17% of the world's population. By 2050, the African population is expected to reach 2.5 billion inhabitants (UN, 2022), as urbanization and industrialization further increase the energy demand. Africa's population explosion in the century leading to 2050 is unprecedented in human history. And Africa's population will keep growing until the end of the 21st century. The explosion requires a climate-energy couple policy unseen in any continent in the world. Africans must invent, almost from scratch.

Below are comparative charts that illustrate Africa's demographic mega-explosion:



Source : Calculs de l'auteur à partir des données de l'ONU - <https://population.un.org/wpp/>

Today, two figures and one industrial fact show the magnitude of energy and climate challenges Africa faces. Electricity access: over 600 million Africans lack

electricity, mainly in sub-Saharan Africa (IEA, 2022). Clean cooking: Almost 900 million people depend on traditional biomass, which leads to serious impacts on health and the environment (WHO, 2021). Industrial energy needs: Limited access to electricity in Africa hinders economic growth, industrialization, and job creation.

1.2. How is Energy Demand measured?

Energy demand is usually assessed using models that integrate variables such as Population growth (UN, 2022); Urbanization rate (IEA, 2021); Industrialization and GDP growth (World Bank, 2022); Trends in energy consumption per capita (Smil, 2017); Technological progress in energy efficiency (BP, 2021).

Globally recognized methodologies include: The Kaya identity, which decomposes energy demand into population, GDP per capita, energy intensity and carbon intensity (Kaya and Yokoburi, 1997); The LEAP model (Long-term Planning of energy alternatives), widely used in developing countries to project future energy demand according to different political scenarios (Heaps, 2016); The MARKAL/TIMES model, used by the International Energy Agency (IEA) and various governments to evaluate the transitions of the energy system (Loulou et al., 2005).

1.3. Reference for the Evaluation of Energy Demand

The benchmark for assessing energy demand varies from region to region. In highly industrialized countries, the norm is about 10,000 to 15,000 kWh per capita per year (USA, Europe). In middle-income countries such as China, this is about 5,000 kWh per capita. Africa is currently lagging far behind, with an average of 800 kWh per capita, highlighting its massive energy deficit (IEA, 2022).

To assess the true energy needs of Africa, researchers must quantify the toxicity of “mal-energy” in that continent. Mal-energy refers to harmful energy consumption practices, which include traditional use of biomass (wood, charcoal) that causes deforestation and respiratory diseases; illegal electrical, oil, and gas connections that can cause arson and death. There are also dangerous power grid infrastructures, with frequent power outages which among others kill or destroy food and goods in refrigerators and freezers.

A realistic benchmark for Africa should be at least 3,000 to 5,000 kWh per capita by 2050 to support economic transformation, industrial growth and widespread electrification.

2. Principles for an African Development-oriented Energy Policy

2.1. Diversified Energy Mix

A balanced approach is crucial to ensure Africa’s energy security. Unlike many Western countries that advocate for a rapid transition to renewable energies, Africa must keep consuming fossil fuels, while integrating multiple energy sources, including:

Natural gas: Africa holds 600 trillion cubic feet of natural gas reserves (BP, 2021), which can provide cheap and reliable energy.

Hydropower: The Grand Inga Dam in the Democratic Republic of the Congo has the potential to generate 40 GW—enough to power a large part of Africa.

Solar and Wind: Africa has the highest solar potential in the world, but the installed capacity remains low.

2.2. Infrastructure investments

The lack of modern electricity networks in Africa is a major obstacle to economic development. A development-oriented energy policy must focus on:

Expansion of national networks: Africa only has access to electricity at 50%, compared to 99% in the United States and China (World Bank, 2022).

Regional energy integration: Initiatives such as the West African Energy Pool (WAPP) and the East African Energy Pool (EAPP) should be expanded to reduce energy costs and improve reliability.

Smart Grids: Investing in digital infrastructure will increase energy efficiency and reduce electricity theft.

3. Build and Finance African Energy Independently

A major weakness of the African energy sector is its lack of research and development (R&D). Most African countries rely on foreign expertise, instead of investing in local energy knowledge. To fix that situation, Africa must create national and Pan-African Public Institutions of Energy Research.

4. Three Climate Policy Principles for Africa

Climate change poses an existential threat to Africa, a continent that contributes less than 4% of global greenhouse gas emissions yet endures its devastating impacts. Prolonged droughts, erratic rainfall patterns, rising temperatures, coastal deterioration are among the damages climate change is already inflicting on Africans and their environment. Africa's vulnerability underscores the urgent need for tailored climate policies. Below, we outline critical policy principles. Combined, they aim to address Africa's unique challenges, ensure that Africa's climate policy serves its people, not foreign interests, and secure for Africa an equitable participation in the global climate agenda.

4.1 Prioritize Climate Adaptation Over Emissions Reduction

Africa's immediate climate challenge lies in adapting to the already unavoidable impacts of climate change. Unlike industrialized nations, where emissions reduction is the primary focus, Africa must prioritize adaptation to safeguard livelihoods, ecosystems, and economies. Investing in climate-resilient agriculture is a

cornerstone of this approach. For example, smallholder farmers, who produce up to 80% of Africa's food, are particularly vulnerable to climate shocks (FAO, 2021). Techniques such as drought-resistant crops, agroforestry, and sustainable irrigation systems can enhance food security. For instance, in Kenya, the adoption of drought-tolerant maize varieties has increased yields by 20-30% during dry seasons (CIMMYT, 2020).

Water management is another critical area. With over 40% of Africa's population facing water scarcity, innovative solutions like rainwater harvesting and groundwater recharge systems are essential (UNEP, 2022). Ethiopia's success in restoring degraded watersheds through community-led initiatives demonstrates the potential of localized adaptation strategies.

Developing early warning systems for extreme weather events is equally vital. According to the World Meteorological Organization (WMO), less than 30% of African countries have robust early warning systems, leaving millions exposed to climate-induced disasters (WMO, 2021). Strengthening these systems can save lives and reduce economic losses. For example, Mozambique's investment in cyclone early warning systems has significantly reduced casualties during recent storms.

4.2 Regulate Carbon Markets to Benefit Africa

Carbon markets present a unique opportunity for Africa to leverage its vast natural resources for climate action and economic development. However, the current global carbon trading landscape often sidelines African nations. Creating African-led carbon trading mechanisms is crucial to ensuring that the continent reaps the benefits of its carbon sinks. Africa is home to the Congo Basin, the world's second-largest rainforest, which sequesters approximately 1.2 billion tons of carbon annually (WRI, 2021). By establishing regional carbon markets, African nations can monetize these ecosystems while promoting sustainable development.

Land sovereignty protections must accompany these efforts to prevent foreign land grabs. In recent years, there has been a surge in "carbon colonialism," where foreign entities acquire large tracts of African land for carbon offset projects, often displacing local communities (Oxfam, 2022). Robust legal frameworks are needed to safeguard land rights and ensure that carbon revenues benefit local populations. For instance, Liberia's Community Rights Law grants indigenous communities' ownership of forest resources, setting a precedent for equitable carbon market participation.

4.3 Demand Climate Justice in Global Forums

Africa's historical contribution to global emissions is minimal, yet the continent faces disproportionate climate impacts. This inequity underscores the need for climate justice in international negotiations. African nations must push for climate debt relief, recognizing the historical responsibility of industrialized nations

for the climate crisis. The concept of climate debt, which includes both emissions debt and adaptation debt, provides a moral and financial basis for reparations (Roberts & Parks, 2009). For example, the African Group of Negotiators has consistently called for developed countries to honor their commitment to provide \$100 billion annually in climate finance, a promise that remains unfulfilled (UNFCCC, 2021).

The Green Climate Fund (GCF) has approved over \$1 billion for African projects, but this is a fraction of the estimated \$50 billion needed annually for adaptation alone (GCF, 2022). African leaders must leverage global forums like the United Nations Climate Change Conferences (COP) to demand fairer financing mechanisms.

Conclusion

Africa must pay sharp attention to her climate-energy couple policy. Couple means that any African energy policy must be conceived within the framework of climate challenges and vice versa. Africa's energy and climate future can be sovereign only if it is centered on development and independent of the climatic constraints foreign interests impose. That development requires African leaders', African communities', Global Africans' collective action, political will, and unwavering commitment in the spirit or renewed Pan-Africanism.



MEXICO



Osorio Salamanca Victor Jair

Student

Student of Geophysical Engineering,
Mexico-Russia House of Culture



Challenges of aquifer overexploitation: a call for equity and sustainable development

Introduction

Water is an essential resource for all living beings, it sustains life on the planet and it has enabled the development of civilization throughout human history. Due to population growth in recent years, groundwater is in high demand, which has led to overexploitation of aquifers in the world and caused damage to ecosystems and people. In my essay, I draw attention to the overexploitation of aquifers in Mexico by supporting my statements with available sources and research data. My goal is to find alternatives to sustainable development: equitable access to water and environmental stewardship.

Basic information on water

Water, composed of one oxygen atom and two hydrogen atoms, is one of the most valuable natural resources. Unlike other resources such as hydrocarbons or minerals, water is essential for life in all its forms. Surface water bodies have become home to a huge diversity of species and support terrestrial ecosystems.

They also play the key role in climate regulation and in such vital processes as photosynthesis (Sposob, 2025).

Water is an essential component for living organisms. In humans, it makes up to 75% of the body and is essential for homeostasis (Martos, 2015). It is also the basis for sustainable development, as it is necessary for agriculture, industry, mining, transportation, and energy production (Sposob, 2025).

In order to understand the challenge addressed here, it is necessary to distinguish the following. The planet's water resources can be divided into two types based on their origin: surface water and groundwater (Ponce, 2007). Surface water includes all water on the Earth's surface, such as rivers, lakes, streams, glaciers, and oceans. Groundwater, on the other hand, is all water below the surface, stored in crevices, and rocks. The geologic structures that contain groundwater are called aquifers, and due to their rocky properties, they can not only hold but also facilitate the flow of water streams (IGME, 2017).

It is important to consider that 97.5% of the planet's water is salty and therefore unsuitable for human consumption. Of 2.5 % of available freshwater, 68.7 % is found in glaciers, 0.8 % in permafrost, 0.4 % in surface water bodies, and the remaining 30 % in aquifers (SEMARNAT, 2018). This demonstrates the importance of groundwater, mainly for human consumption, industry, and agriculture. In addition, access to them is not dependent on seasonal circumstances and they are often less prone to pollution than surface water (IGME, 2018).

Based on this data, one can understand the importance of water in general and groundwater in particular. Let us now take a closer look at the question we are interested in: what is the role of groundwater in Mexico?

Groundwater resources are important for Mexico mainly due to two aspects: the geography of the country and the high dependence of utilities, agriculture, and industry on these resources. In Mexico, water management is the responsibility of CONAGUA, a body that divides the country's territory into 653 aquifers for management purposes. It is estimated that of 100% of water extracted from the subsurface, 70% is used for agriculture and the remaining 30% for municipal and industrial supply.

More than 60% of Mexico, mostly the central and northern regions, has arid and semi-arid climates, making access to surface water bodies difficult (Chávez et al., 2006). It is also important to note that the population in Mexico is geographically disproportionate in terms of water availability, as the central and northern regions where 87% of GDP is produced and 77% of the population is concentrated have 31% of the national water supply, while 23% of the population living in the southeast of the country has 69% of the water supply (Monforte & Cantú, 2009). In this context, aquifers become crucial as they provide about 70% of the water needed by cities and rural communities, home to more than 60 million people, and also drive the country's development by supplying water to key economic sectors.

Having reviewed the above data, let us consider the central issue of this essay – the overexploitation of aquifers in Mexico. In my opinion, two questions can be asked: what is the cause of overexploitation of Mexican aquifers and what are the consequences of overexploitation of Mexican aquifers?

What caused the overexploitation of Mexican aquifers?

Over-exploitation of aquifers is the result of unsustainable water management. However, in order to understand the aquifer management, it is necessary to consider the hydrologic cycle and its role in groundwater recovery. The hydrologic cycle is the repetitive process of water circulation through three states of matter. The cycle begins in the sea where water turns into vapor, which later condenses in the atmosphere and falls as rain or snow. It should be noted, however, that soil and plants play an important role in bringing water vapor into the atmosphere through the so-called evapotranspiration process. When water falls as precipitation on the ground, part of it is consumed by surface water bodies and vegetation, while the other part seeps into the interior of the earth under gravity through the pores of rocks, filling aquifers (IGME, 2018). In this context, there is a term of great importance in groundwater management: the groundwater balance. It refers to the ratio between the inflow (recharge) and outflow (discharge) of water in an aquifer over time. Examples of recharge can be: infiltration of rain and snow water, seepage from surface water bodies under agricultural irrigation, water exchange with the adjacent aquifer; and examples of discharge can be: water withdrawal from wells, evaporation, and runoff into surface water bodies. The water balance is characterized by three states, depending on the interaction of its two components – recharge and discharge. A balance is considered positive when recharge exceeds discharge, allowing the aquifer to recover; a balanced aquifer means that recharge and discharge are equal, meaning a stable water level; finally, a negative balance occurs when discharge exceeds recharge, causing the aquifer to waste water.

Another important factor related to managing an aquifer is the water exchange period, which is the average time that a particle of water will stay in a body of water, in our case – the aquifer. The water exchange period varies depending on water body, but, for reference, the water exchange period in lakes is approximately 17 years, in rivers 15-20 days, in atmospheric waters 8-10 days, and in groundwater tens to thousands of years (IGME, 2018). The latter is extremely important because it means that groundwater has such a long period of water exchange that the stability of the aquifer depends on proper management, otherwise the slow recovery of the resource can lead to the disappearance of the aquifer.

According to Barranco (2018), the first wells were drilled in Mexico in 1847, indicating a long tradition of groundwater use in the country. However, according to the National Institute of Statistics and Geography, the number of overexploited aquifers began to rise sharply in 1975 when 32 such aquifers were recorded. The

trend continued and by 2004 the number had risen to 104. The latest report was prepared by CONAGUA in 2023, and it indicates that a total of 114 aquifers are overexploited.

Obviously, the overexploitation of Mexican aquifers is caused by poor management, but this is only one point of the challenge. Demographic growth in the country over the decades has led to a dramatic increase in the demand for groundwater, mainly in the agricultural, industrial, and municipal sectors. This fact, together with the uneven geographical distribution of the population in terms of water availability, gives rise to a number of causes and consequences resulting in deficiency. Another aggravating factor that cannot be dismissed is the large water concessions that CONAGUA has granted to large private companies. In 1992, the National Waters Law was adopted, breaking the legal framework that had previously allowed concessions only through a presidential mandate. Gómez & Moczuma (2020) note that the passage of the law was in the neoliberal interests of the US, the World Bank, and the International Monetary Fund. As a result, 418,021 concessions were granted to exploit the nation's groundwater.

What are the consequences of overexploitation of Mexican aquifers?

Overexploitation of aquifers has negative consequences beyond the obvious damage to the aquifer itself and to the ecosystem. This situation may cause social, environmental, economic, and health problems for consumers. In general, the most common adverse effects are: water quality degradation, land subsidence, ecosystem disturbance, salt intrusion, and inequities in water supply. I will try to elaborate on each of these, citing real cases that have occurred in the country.

Deterioration of water quality. Over-exploitation of an aquifer causes the water level in the aquifer to drop, as a result, water is extracted from ever greater depths. A study by Huízar et. al (2015) showed that since water is a good solvent, it causes the release of harmful elements that are only found in deep water, leading to the extraction of contaminated water. According to the Aguascalientes State Water Plan 2021-2050, sample analysis shows that groundwater in the overexploited Aguascalientes Valley aquifer contains high levels of arsenic and fluoride, elements harmful to the health of consumers (Aguascalientes, State Government, 2022).

Subsidence. Land subsidence is the gradual lowering of the ground due to soil compaction. This phenomenon can be caused by overexploitation of aquifers because pumping large amounts of water increases the compressibility of the ground, resulting in subsidence. Subsidence is a geologic risk observed in the national capital, increasing at an alarming rate of 40-50 cm per year. Reséndiz et al (2016) conducted a study that has proved connection between overexploitation of the city's aquifers and land subsidence. This situation is worrisome because it causes annual damage to the capital's infrastructure, especially subways and pipelines.

Disturbance of the ecosystem. Groundwater and surface water are closely related, and as we said, water exchange between surface and groundwater bodies allows their preservation. Excessive extraction of water from an aquifer can cause it to no longer feed lagoons and wetlands, and they will disappear. This is what happened to the Churince Lagoon located in Coahuila, Mexico. In a technical report, Hernández (2023) states how overexploitation of the aquifer in the area caused the lagoon to dry up, causing habitat and species, particularly stromatolites, that inhabited the lagoon to disappear.

Saltwater intrusion. Saltwater intrusion is a process affecting aquifers near the sea where saltwater enters a freshwater aquifer, contaminating it and making it unsuitable for public water supply and crop irrigation. This phenomenon can be caused by overexploitation of groundwater. An example of saltwater intrusion in the country is San Quintin, Baja California, an area of great agricultural importance. For these activities and for meeting the water needs of the city of Ensenada, the San Quintin Valley aquifer has been mercilessly exploited due to lack of investment in searching for new alternatives, resulting in saltwater intrusion and consequent loss of water resources (Pombo, 2014).

Inequality in water supply. Excessive aquifer consumption, in addition to all of the above, also causes resource scarcity, mainly in places where groundwater is the only source of supply due to climatic conditions. In such circumstances, large cities and companies, due to their ability to purchase, can advocate their position in negotiations or even demand supplies. However, many minorities do not have the same purchasing and political clout, resulting in inequality in obtaining resources, even though all people have the right to access water. This is the situation with the people of San Cristóbal de las Casas, Chiapas. The government, in its “Wetlands Recovery and Conservation Program”, recognizes the challenge of water scarcity due to many factors, one of which is the concessions granted by CONAGUA to FEMSA Coca-Cola (DEMA, 2019). Since 1995, this company has held a permit allowing it to extract 1.4 million liters of water per day, causing tensions with the population. Even the government of San Cristobal de las Casas has officially asked CONAGUA to cancel the concessions in order to meet needs of the population (Water for All, 2020). It is outrageous that a foreign company can crowd the government agency while ignoring the needs of Mexicans themselves. Clearly, the country has much work to do in the management of national resources in general and groundwater in particular.

Conclusion

In today’s context, full of environmental, socio-economic, and political challenges, it is not easy to look at the invisible resource buried in mother earth. However, only urgent action, in view of the constant threat of resource scarcity and other challenges, can guarantee the preservation of our society as we know it. This

is a reality experienced by each country and Mexico, despite the great diversity and wealth of its natural resources, shall not evade its responsibility.

It is wise to seek alternative solutions to the overexploitation of aquifers in Mexico, as they require a combination of social practices, science, and technology, and collaboration with our leaders. Such an approach is necessary to create a more inclusive, but above all more sustainable future, in which human communities would be built based on the opportunities provided by our planet, and not the other way around.

As the essay shows, overuse of groundwater is affecting the entire country, from the north in Baja California to the south in Chiapas, including the capital, one of the most populated cities in the world. We cannot ignore this challenge. I would like to cite the slogan of the UN World Water Day 2022: “Making the invisible visible.” In promoting an alternative vision of development based on equity and mutual respect, identifying, and highlighting challenge is the first step to solving them.

References

1. Water for all, water for life. (May 3, 2020). San Cristobal de las Casas City Council asks Conagua to revoke the FEMSA-Coca Cola concession. Accessed by <https://aguaparatos.org.mx/ayuntamiento-de-san-cristobal-de-las-casas-pide-a-conagua-revocarconcesion-a-femsa-coca-cola/>
2. Aguascalientes, State Government (2022). State water plan 2021-2050 in the state of Aguascalientes. Aguascalientes: Official Gazette of the State of Aguascalientes.
3. Barranco Salazar, A. R. (2018). Groundwater and its socio-ecological importance. *Universitarios Potosinos*, 227, 16-21.
4. Chávez, R., Lara, F., & Sención, R. (2006). Groundwater in Mexico: current status and challenges for sustainable management. *Geological and Mining Bulletin*, 117(1), 115-126.
5. Directorate of Ecology and Environmental Protection. (2019). Wetland restoration and conservation program. Honorary constitutional city council of San Cristobal de las Casas.
6. Environmental Justice Atlas. (no date). Water extraction: FEMSA Coca-Cola in Chiapas, Mexico. Environmental Justice Atlas. <https://ejatlas.org/print/extractivismo-de-agua-femsa-coca-cola-chiapasmexico>
7. Gómez-Arias, W. A., & Moctezuma, A. (2020). Water millionaires: an approach to water storage in Mexico. *Arguments. Critical Society Studies*, 2(93), 17-38.
8. Geological and Mining Institute of Spain (IGME). (2017). Groundwater data management report. Spanish Agency for International Development Cooperation (AECID).
9. National Institute of Statistics and Geography. (No date). Overexploitation and pollution. Tell me about Mexico. Accessed by <https://cuentame.inegi.org.mx/territorio/agua/sobreexplota.aspx?tema=T>
10. Martos López, Á. (2015). The importance of water on our planet [Master's thesis, University of Jaén]. University of Jaén Repository.
11. Monforte G., Cantú P. C. (2009). The water situation in Mexico. *Science and Technology Culture*, year 6, issue 30, January-February.
12. Pombo, A. (2014). Technological development in San Quintin: a cost-effective solution to water scarcity. Northern Border College. Accessed by <https://www.colef.mx/estemes/>

- tecnificacion-en-sanquintin-una-solucion-rentable-ante-la-escasez-de-agua/
13. Ponce, V. M. (2007). Sustainable groundwater extraction. Accessed by <https://ponce.sdsu.edu/rendimiento.html>
 14. Pronatura Noreste. (2024). Temporal evolution of seeding and water loss in the Churince Lagoon. Accessed by <https://pronaturanoreste.org/wp-content/uploads/2024/08/ReporteChurince-rev-1-ahr-PNE.pdf>
 15. Reséndiz, D., Auvinet, G., & Méndez, É. (2016). Mexico City's subsidence: an un-ecological centuries-old process. Engineering Institute, National Autonomous University of Mexico.
 16. Ministry of Environment and Natural Resources. (2018). Chapter 6: Biodiversity and sustainable use of natural resources. Government of Mexico. <https://apps1.semarnat.gob.mx:8443/dgeia/informe18/tema/capó.html#tema1>
 17. Sposob, G. (2025). The importance of water. Concept. <https://concepto.de/importancia-del-agua/>



ITALY



Pacenza Pierpaolo Maria

Founder

Buran Vetren



INVESTING IN PEOPLE THE KEY TO A SUSTAINABLE AND INCLUSIVE FUTURE THAT STARTS FROM RUSSIA

Foreword

Prerequisites for writing the essay

The development of new human development strategies requires some fundamental prerequisites. First of all, it is necessary to know the key indicators of human capital (level of education, employment rate, quality of health services) and understand their role in the processes of economic growth and social cohesion. Secondly, it is necessary to master the main statistical references (e.g. data from Rosstat, Ministry of Economic Development, World Bank) to assess the demographic and socio-economic situation of the various Russian regions. Finally, it is appropriate to consider how urban planning models can positively affect people's well-being.

Relevance of the topic: challenge and opportunity for Russia

Russia, with its vast territorial extension, is facing a complex scenario: large urban centers in continuous development (Moscow, St. Petersburg, Yekaterinburg)

and large inland or northern areas exposed to the risk of depopulation. The same geopolitical conflicts of recent years have generated, in some regions, a need for reconstruction and economic-social revival. This context represents both a challenge (stemming internal and external emigration, rebuilding devastated territories) and an opportunity (experimenting with innovative solutions of multi-ethnic coexistence and urban development).

Thematic vector: urban planning and human capital

The essay focuses on a specific thematic vector: how to design new urban spaces to promote inclusion, ethnic-religious integration and enhancement of human capital. The Russian Federation serves as an initial application model, offering a vast and diverse "territorial laboratory". The central hypothesis is that, starting from a circular urban planning inspired by the exhibition complex ВДНХ (VDNH), it will be possible to generate social cohesion, economic growth and sustainable development in regions that are still sparsely inhabited or affected by traumatic events.

1. Introduction

Studies conducted globally, including those by the United Nations Development Programme (UNDP, 2022) and the OECD (2023), agree that the main driver of long-term development is human capital. This concept includes the set of competences, knowledge, values, skills and social networks that each individual possesses and shares within a community. Specifically, Russia particularly needs to strengthen and enhance its human capital in two directions:

1. Regenerate areas affected by conflicts or structural crises, so that the local population can return there instead of emigrating elsewhere.
2. To populate the interior and northern territories in a balanced way, supporting the diversification of the economy and the integration of new residents, including legal migrants and other communities willing to settle in Russia.

It is precisely on these assumptions that the proposal for a new circular urban planning, called the NDVH Model, is based, aimed at creating housing centers in which each family, and by extension each ethnic or religious community, can find a balance between maintaining its roots and interacting with different realities.

2. The family as the basis of all investment in human capital

2.1 The family at the centre of the social fabric

In any model of human development, the family represents the original cell: the place where shared values, traditions, culture and basic education are born and transmitted. According to the Russian Institute of Statistics (Rosstat, 2021), regions

with the most support for families (housing policies, birth incentives, education subsidies) have a higher population growth rate and lower incidence of juvenile delinquency. In particular, the following are highlighted:

- Economic support measures: family allowances and deductions for those who reside in areas with development difficulties;
- Childcare services: networks of nursery schools and nursery schools at controlled costs;
- Recognition of the plurality of family models: respect for different religious and cultural traditions, in line with Russia's ethnic diversity.

2.2 Education and training: a collective good

Education – formal and non-formal – is the backbone of human capital. In addition to school education, vocational training and lifelong learning are crucial. Data from the Russian Ministry of Education (2022) show that the 1% increase in spending on advanced technical training generated a 3% increase in labor productivity in strategic sectors (e.g. mechanics, electronics, chemicals). These results confirm the need to invest massively in education, especially in the most peripheral areas, to prevent the flight of talent to large urban centers.

3. The NDVH Model: circular urbanism to integrate different identities

3.1 Origin of the idea and fundamental principles

The NDVH Model is historically inspired by the ВДНХ (VDNH) exhibition complex in Moscow, the "Exhibition of the Achievements of the National Economy" conceived during the Soviet era to highlight the economic, cultural and scientific progress of the various republics of the USSR. Transposing this logic to an urban scale, he imagines a city structured in concentric circles, in which each community (ethnic or religious) has its own identity neighborhood, but can also meet with the others in the central square.

3.2 Urban structure: the three circles

1. First circle: common square
 - o Function of economic exchange (markets, fairs) and cultural exchange (events, festivals).
 - o A "neutral" place of dialogue, where communities exhibit their products and traditions in a climate of cooperative competition.
2. Intermediate circle: ethnic-religious districts
 - o Each community has schools, centers of worship, offices and shops that reflect its own identity.
 - o Open spaces and connecting roads that encourage mutual attendance between neighborhoods.
3. Outer Circle: Advanced Centers

- o Universities, research laboratories, specialized hospitals.
- o Incubators for start-ups in key sectors (information technology, biotechnology, renewable energy), useful for stimulating the economic development of the area.

3.3 Specific applications in Russia

Russia, with its multi-ethnic regions (Dagestan, Tatarstan, Bashkortostan, etc.), is an ideal terrain for experimenting with the NDVH Model. In conflict-affected regions, this model would help integrated urban reconstruction (neighborhoods for each ethnic group, central communal structures, education and health hubs in the outer circle). Similarly, for north-eastern areas in the process of depopulation (e.g. some areas of Yakutia or Eastern Siberia), pilot projects could be launched to attract families from other parts of the Federation (or regular international migrants) with incentives and inclusion programs. Circular urban planning, in this perspective, becomes a factor of demographic stabilization and socio-economic development.

4. Analytical insights: data, predictive models and economic-social impact

4.1 Statistical data on depopulation and potential for revival

- According to Rosstat (2020), about 65% of Russia's territory has a population density of less than 3 inhabitants per km². Many of these territories are rich in natural resources and logistical opportunities (waterways, agricultural potential), but remain severely underused due to a lack of infrastructure and services.
- Surveys by the Institute of Demographic Research (2021) show that 40% of young people born in peripheral regions of Russia move to larger cities before the age of 25, for study or work reasons.

4.2 Projections and predictive models

Some simulation studies (e.g. a simplified predictive model based on Romer's endogenous growth theory) hypothesize that:

- A 2% increase in public spending on training, social housing and the protection of multiculturalism could generate an increase in regional GDP of between 8% and 12% in ten years, depending on the specificities of the territory.
- In post-conflict areas, the introduction of circular centres and integrated ethno-religious neighbourhoods would reduce the rate of local conflict by 25-30% (estimates based on reconstruction experiences in similar contexts, such as the former Yugoslavia), favouring the gradual return of refugees and displaced persons.

4.3 Expected social and economic impact

1. Growth from below: the central square, conceived as a commercial hub, favors the birth of micro-enterprises and local crafts.

2. Maintenance of skills on site: thanks to the presence of universities and technical institutes, young people are not forced to emigrate to the metropolises, fueling a virtuous circle of training and employment.

3. Prevention of ethnic-religious conflicts: regulated coexistence in distinct neighborhoods, but with common meeting spaces, reduces prejudices and creates a more resilient social fabric.

4. Psycho-physical well-being: feeling "at home" with one's culture and religion improves life satisfaction and mental health, as confirmed by the WHO (2021).

5. Expected results

5.1 Russia as an experimental model

The Russian Federation, given the vastness and diversity of its territories, can act as a "laboratory" of experimentation to apply the NDVH Model on a large scale. Such an urban and social solution would provide answers both to the need to rebuild regions affected by recent devastation, and to that of revitalizing inland areas at risk of abandonment.

5.2 Expected results

1. Demographic revival: To curb the exodus of qualified young people and attract new communities of legal immigrants, thanks to adequate infrastructure and support policies.

2. Inclusive economic growth: Small craft businesses, local markets, exchange of skills in research districts.

3. Social stability: Reduction of internal conflicts, greater integration of ethnic and religious minorities, increased sense of belonging.

4. Improvement of services (health, education, welfare): The concentric circle structure facilitates the rational location of schools, hospitals and research centers.

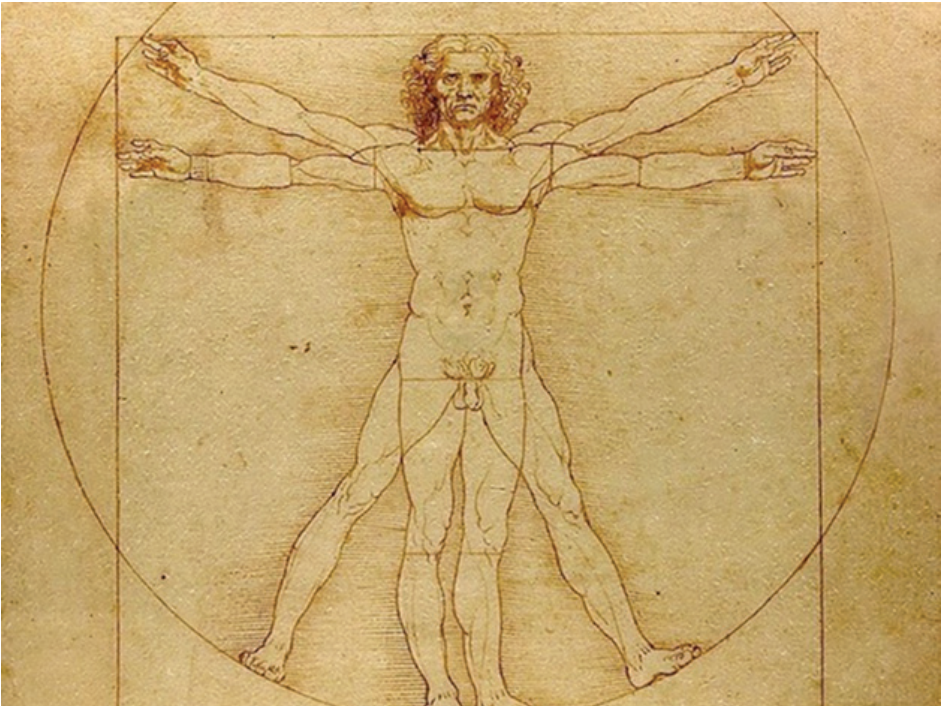
5.3 Towards a new global growth platform

Investing in people does not only mean providing economic resources or opening training centers; it implies the construction of a physical and cultural environment that enhances the individual as a bearer of unique identity and potential. The NDVH Model offers a concrete example of how urban planning can intersect with family policies, education and multiculturalism, giving life to cohesive, innovative communities ready to contribute to the development of the country. The Russian experience, if crowned with success, can inspire other realities – even outside the Federation – confirming that the road to an inclusive and sustainable future passes through the recognition of diversity and by investing in the skills and dignity of each person.

Final Conclusions

Russia is called upon to carry out a twofold task: to restore conflict-affected territories and to develop its sparsely populated interior areas in a sustainable way. By proposing a circular and integrated urban planning, the NDVH Model focuses on the individual, his family, his cultural and religious identity, and creates the conditions for a vibrant local economy and peaceful coexistence. Data and simulations indicate that the impact of these policies could be significant, with direct benefits (GDP growth, increased employment, return of young people) and indirect benefits (social cohesion, conflict prevention, better mental and physical well-being).

If implemented with determination, the project will become a catalyst for innovation and development not only for the Russian Federation but, potentially, for all those countries that wish to focus on people as a primary resource for a sustainable and inclusive future.



Statistics and Graphics Appendix

6.1 Figure 1 – Population density in some regions of the Russian Federation (Rosstat, 2020)

| Density (inhab. per km²)
 Region 2010 2020
 South Siberia 10 9
 Siberia North 3 2
 Far East 2 2
 Yakutia 1 1
 Tatarstan 55 55

Interpretation:

- There is a slight decrease in population in the northern and eastern regions (South Siberia, Northern Siberia), where the density has gone from 10 inhabitants/km² to 9 and from 3 inhabitants/km² to 2.
- Tatarstan maintains a stable and relatively high density (55 inhabitants/km²), also thanks to policies to support families and the development of university campuses.

Figure 2 – Regional GDP growth projection with the introduction of the NDVH Model

(Simulated scenario, Ministry of Economic Development, 2023)

Base Scenario (without NDVH): +2% p.a.

Scenario with moderate NDVH: +3.5% per annum

Scenario with advanced NDVH: +4.0% p.a.

- Base scenario: Standard growth, due to current trends (industrial investment and natural resources).
- Moderate NDVH scenario: some areas partially apply the model, with limited interventions (construction of ethnic-religious neighborhoods and some common services).
- Advanced NDVH scenario: full implementation of the circle structure, integration of family policies, education incentives and economic support to immigrant communities.

Table 1 – Expected benefits of the application of the NDVH Model in post-conflict areas

Rate reduction	Population increase	GDP growth
resident conflict	(5 years)	(10 years)

Ex-conflict areas (without NDVH) 0% +2% +2.0%

Ex-conflict areas (NDVH moderate) -25% +10% +3.5%

Ex-conflict areas (NDVH advanced) -30% +15% +4.0%

Interpretation:

- The partial or advanced implementation of the NDVH shows a positive impact both on the rate of conflict and on the ability to attract new residents, with significant repercussions on local GDP in the long term.

Essential Bibliography

- Rosstat (2020). Statistical Yearbook of the Russian Federation.
- Ministry of Economic Development (2023). Regional Growth Projections.
- Institute of Demographic Research (2021). Demographic Trends in Russia.
- OECD (2023). Education at a Glance: OECD Indicators.
- WHO (2021). Mental Health and Social Cohesion Briefs.
- UNDP (2022). Human Development Report.



Ponomareva Natalia

Head of Department

Belarusian National Technical
University



Toward Positive Impact. Corporate Social Responsibility as a Norm. “Investment into Environment” thematic vector

Today's global development problems such as growing inequality and deteriorating environmental conditions, and the dynamics of production and consumption create new needs for developing sustainable business models. McKinsey claims that over 50% of CEOs they surveyed believe that business sustainability, environmental management, and social responsibility are “very” or “extremely” important among their key tasks.

Corporate Social Responsibility (corporate responsibility) is most often interpreted as businesses voluntarily contributing to social, economic, and environmental development of society; this contribution is directly linked to the company's operations and goes beyond the legally required minimum.

Corporate Social Responsibility (CSO) can be take the forms of economic, environmental, ethical, and philanthropic responsibility. The main purpose of working on the corporate social responsibility is performing internal and external social tasks that have a positive effect on the company's image and increase brand loyalty [1].

In a market economy, a socially responsible company will gain the best competitive edge by adhering to sustainable development principles in its operations, which will potentially give it the following advantages:

- more efficient risk management;
- better operational efficiency, smaller operation costs;
- getting access to capital, increasing market value;
- creating new opportunities by introducing innovations;
- brand differentiation;
- developing human capital.

Therefore, we can say that developing corporate social responsibility ensures long-term sustainable development.

Corporate sustainability as new business philosophy has the necessary potential to efficiently integrate companies into implementing their society's sustainable development strategy. Corporate sustainability can be termed the "microeconomic" level of the macroeconomic corporate sustainability concept. Corporate sustainability essentially is a corporate management model that spans a given company's economic, social, and environmental short-term and long-term activities and determines its strategy.

Companies introduce sustainable development principles by supporting ESG initiatives. ESG is an approach to doing business whereby managerial decisions are made with account for social and environmental factors that could turn out to constitute both risks and opportunities. ESG risks are three groups of corporate risks: environmental (E - Environmental), social (S - Social), and corporate governance risks (G - Corporate Governance). By accounting for ESG factors, businesses can gain certain advantages such as creating the image of a socially responsible brand, improving investment appeal, getting a better global competitive edge, and expanding international cooperation opportunities.

We agree with A. N. Kosko that "sustainable development" is a comprehensive term that entails a harmonious development of both ESG aspects (society, environment, economy), and the CSO, even though the two do differ in certain aspects. If we are talking about a company that is sustainably developing on the market, it means this company has integrated all those aspects into its business processes and regulates them via its brand politics. The main purpose of such companies is to have its operations exert a positive effect on the world [2].

Both concepts remain relevant today and are actively supported by international organizations of different scale. Clearly, one concept cannot be implemented without the other, and companies work on both concepts simultaneously. Currently, CIS countries are interested in promoting CSO and ESG principles in their business processes and brand politics. This is quite logical since introducing the above-described principles into business operations benefits both the company itself, and society at large.

Currently, about 100 Belarusian companies claim to be socially responsible, yet only 28 organizations – parties to the UN Global Compact base their operations on the sustainable development concept.

For instance, Betera, a bookmaking company, has for several years been implementing measures connected with the sustainable development concept. Betera is running the “green office” project, holds environmental conferences, promotes sports among socially vulnerable children. In July 2022, together with its partners, Betera launched the Real Recycle permanent project intended to attract attention to re-using second-hand items. Participants in the Real Recycle projects recycle old advertising banners, corporate office supplies, branded merchandize, and other items or else take them to special facilities that care for orphaned children [12].

Major Belarusian retailers Green and Euroopt are examples of introducing the ESG concept in retail operations. GRINroznitsa was the first to sign an agreement on mutual social responsibility and interactions in environment. In its report on re-using waste, Green reports having collected and recycled far more plastics, waste oil, and food waste in 2023 than in 2022; it collected 454.466 tons of food waste in 2022, and 828.227 tons in 2023. Eurotorg, Belarus’s largest retailer, provides reusable bags to shops. Currently, discussions are underway on transitioning to e-vehicles.

Telecommunications companies also implement certain ESG initiatives. Mobile TeleSystems (MTS) replaces climate control systems that contain ozone-destrating substances with state-of-the-art efficient systems using safe coolants. A1 unitary enterprise uses three-pronged measures to implement the company’s 2021-2025 environmental strategy that reduces waste footprint, improves energy efficiency, and cuts carbon emissions. In April 2021, A1 launched the A1garod project: it started a vegetable garden on the roof of their headquarters in Minsk. Its volunteer employees grow vegetables and greens. The project is unique in that the vegetable garden in a busy city downtown still is not affected by heavy metals and city dust since the garden is on the 10th floor, and harmful compounds reach only the 3rd floor.

A1 vigorously supports projects intended to create a barrier-free environment both for its clients and employees. One example of such support is the operations of the Inclusive Barista coffeehouse chain that employs only people with disabilities. This initiative aims to create jobs for people with disabilities and ensure equal opportunities for employment and professional development.

Green banking is a promising component of shaping sustainable financing market in a given country. Green banking is an integral element of corporate social responsibility in banking: banks should act in such a way as to ensure long-term economic indicators while avoiding socially harmful or environmentally wasteful conduct [13]. Belarusian banks accounting for environmental factors reduces environmental impact, promotes using recycled materials, and entails analyzing environmental risks.

MTBank was among the first to support introducing the CSO concept; it signed an agreement with the Northern Environmental Financial Corporation (NEFCO) to fund energy efficient projects. In addition to publishing its annual report that includes “Corporate Governance” and “ESG Agenda” sections, Sber Bank also practices waste sorting, cuts its carbon footprint, and does charity work. Belarusbank has implemented about 30 in-house programs intended to expand the range of methods for training qualified personnel. Bank BelVEB developed a Corporate Responsibility Strategy. Belinvestbank that positions itself as an “Eco-Logical bank,” funded the construction of a photovoltaic power plant and a wind power plant. Additionally, the bank is planning to issue green bonds. Alfa Bank seeks to move away from using paper documents and has accordingly transitioned to digital signatures and biometrics.

BIK Ratings compiled an ESG ranking of Belarusian companies; the leaders among the top 20 are Sber Bank, BSB Bank, and Belinvestbank with ratings of 81.8, 71.5, and 64.0 respectively. On average, businesses have the lowest ratings in environmental factors: the average figure among the top 20 companies was merely 34.5. Governance factors got the highest average rating of 53.9.

Today, demand for environmentally-friendliness has become a marketing trend. A consumer behavior study New York University did in 2013-2018 showed that “green” goods positioned as environmentally friendly do not merely sell better, they are preferred.

The market of goods and services is full of organizations that position themselves as environmentally friendly. It would be logical to identify four types of such organizations based on their contribution to resolving environmental problems:

1. Organizations that introduce environmentally-friendly technologies at certain stages of the life cycle of their goods or services. For instance, they have their own waste disposal facility or manufacture a line of clothing from recycled plastic. For instance, Alivaria, a Belarusian brewery, working jointly with Green retail chain, installed Second-PET, a reverse vending machine, that accepts PET bottles and aluminum cans to be recycled in exchange for discount coupons to be used in the retail chain. Used containers are collected and recycled to become soccer uniforms, garden furniture, etc. The company also uses “green” refrigerating equipment that uses ozone-safe propane coolant (instead of Freon). Currently, 59% of Alivaria’s refrigerating equipment uses “green” technologies.
2. Organizations that introduce environmentally-friendly technologies at every stage of the life cycle, which has been confirmed by an independent party. We can cite the example of Tiden, a coffee house opened in Minsk in 2019. First, the coffee house operates on Zero Waste philosophy: sustainable consumption and zero-waste life style, i.e. the coffee house rejects everything “superfluous”: packaging, disposable items, and things that cannot be recycled. Second, Zero Waste principles can be seen not only in making and serving coffee and related goods, but also in the eco-shop located in the coffee house; the

shop sells reusable goods (for instance, shoppers made by visually impaired people). Third, the coffee house collects those materials that cannot be recycled in Belarus. They have a container for plastic cards (recycling them requires separating metal chips from PVC), and a container for used tooth brushes. Items collected in both containers are sent to a Moscow recycling facility. Fourth, Tiden supports the My Cup, Please movement intended to promote and make fashionable and popular the trend of bringing one's own cup to buy coffee to-go thereby reducing the number of paper cups that are not recycled in Belarus.

3. Organizations that operate in environmental preservation. For instance, BEL-GIPS-ECO that works in containerized waste paper collection and promotes waste sorting. This project's unique feature is that in addition to waste paper they also accept books to be recycled.
4. Organizations and individuals engaged in the so-called environmental awareness work or offering business environmentalization services, for instance, eco journalists and eco bloggers. Belarus has the online magazine ECOIDEA giving advice on environmentally-friendly life style, explaining why it is important, and offering suggestions on how to introduce environmentally-friendly habits into one's life.

Therefore, introducing corporate social responsibility principles and ESG initiatives into a company's operations has a key role in today's business and is becoming a norm. Companies that are aware of the importance of social responsibility improve their reputation or bolster their relations with clients, partners, or employees. Businesses should seek to be profitable, to cut and offset their negative environmental impact, and to have a positive effect on society, consumers, employees, and the planet.

References

1. What is Corporate Social Responsibility? [in Russian] / EcoVadis [electronic resource]. - Available at: <https://ecovadis.com/ru/glossary/social-responsibility>. - Accessed on March: 01, 2025.
2. Kosko A.N. What is the Difference between ESG and CSO? [in Russian] / A.N. Kosko [electronic resource]. - Available at: <https://aser.by/materialy/v-chem-raznica-mezhdu-esg-i-kso>. - Accessed on March: 01, 2025.



Radaeva Galina

President

Union of professional participants of the franchising market



Development of Small Towns for the Systemic Establishment of Family Spirit and the Sustainability of Society

Prerequisites for writing essays and the relevance of the topic (in terms of challenge/opportunity)

Over the past five years, there has been increasing demand among citizens to move outside of large cities and visit tourist sites that are far away from the hustle and bustle of the city. This trend has resulted in developers building new cities from scratch in wide open areas or reconsidering the development of a small settlement/tourist centre. Systematic approaches to both the methods used to achieve socioeconomic results and managing the territories with this new way of life have not yet taken shape.

The key trend in urbanism for the near future is sustainable development, a concept in which a comfortable environment is combined with a desire for carbon neutrality, energy efficiency, and ensuring that people are in their proper place. This is the whole idea behind the harmonious coexistence of humans with nature. The concepts of new cities have already started being implemented. Such examples include: Dobrograd (Vladimir Region), “Grad na Nerl” (Ivanovo Region), Arc-toria (Moscow Region), and others.

The modern world shows that we are doing something wrong. Humanity has been unable to find a formula for harmonious cooperation, yet still has to decide how to go on living. Family breakdowns, conflicts, loss of values, loneliness, poverty, environmental disasters, high mortality, epidemics, and a reduction in fertile soil all lead to the need to create a new way of life.

In this regard, the challenge is the need for a new way of life based on technology, a shared consumption economy, a cooperative model of social organization, and a different approach to parliamentarism the election and appointment of city/territory heads.

Emphasis on economic and social aspects

*A key condition for changes: MATERIAL DEVELOPMENT SHOULD NOT EXCEED SPIRITUAL DEVELOPMENT *From Decree 809 of the President of the Russian Federation*

The main thing in all concepts is not to change the city, but ourselves and to allow our children to take part in creating a living environment with the principle of “I came up with it, they supported me, jointly implemented it, and I want to live here and build on what has been created”.

What social issues are being addressed:

- Health and increasing reproductive age and active longevity
- Preservation and strengthening of spiritual and moral family values, as well as ensuring their transmission from generation to generation
- Revival of rural areas and land use
- Unity of peoples and patriotic upbringing. Preservation of Russia’s historical and cultural heritage
- Food safety and the development of deep processing
- Acquisition of knowledge and skills and the development of professional and managerial qualities and skills among rural residents
- A more prominent role for social partnership, the idea of creative work and mutual assistance, and unity for universal prosperity

What international cooperation issues are being addressed:

- Creation of a new way of life and a model for its scaling
- Development and improvement of the quality of human capital
- Development of human potential through IT projects
- Creation of a safe information space
- Greater international prestige of the Russian Federation and the return of repatriates from other countries to work the land/in villages

What economic issues are being addressed:

- Organic urban growth because cities are a concentration of opportunities to both earn and spend
- Use of green technologies in construction, the application of all human experience (both centuries-old and ultra-modern) in saving heat (and coolness), the consideration of landscape and climate features, and the use of precise modern technologies.
- Development of agricultural production as a chain of food safety for families
- Agritourism as an integral part of the territory
- Technopark for the development of production and entrepreneurship

A key condition for a project's success is to combine the scientific base with actual practice and create laboratories, a family fund, a knowledge base, and inventions in a particular territory.

Territory management and institutional change of the parliamentary system.

The creation of the Council of Families, as well as the IT Platform for the heads of families to participate in voting/proposals (family personal account), including election procedures, will encourage the fostering of the value of family, the provision of timely and effective feedback from the country's population, and their active participation in the implementation of national projects and state ideas.

Examination of the principles of communal law in the system of local self-government.

Special aspects of the IT platform to consider family opinions:

1. The website should provide the opportunity to inform the population about the projects and ideas being implemented, as well as strategies for the further development of the territory/state in a timely and high-quality manner. In addition, all innovations should be described clearly, accessible, and as understandable as possible for the population, which itself can participate in their implementation.
2. The platform should provide the opportunity to not only view the essence and goals of each innovation, but also the timeframe for its implementation and all the necessary funding.
3. The Family Council will select projects for implementation by general online voting, which will be conducted until a certain period and take into account the majority vote. For example, a project will be approved for implementation with the support of over 60% of the population. Moreover, each family can search for this project in the system, track the process of its implementation,

and see what difficulties arise in the process and, if necessary, make suggestions or provide assistance.

General conclusions and anticipated results

Families are actively participating in the social life of their territories and the country as a whole, and the development of the institution of the family is being encouraged. The country is becoming more unified through families and communities. A caring attitude is being cultivated towards the place where you live and take part in its development. Through labour and new technologies, conditions are being created for the full realization of human potential and the exchange of experience (tourism). Tourism is enriching the life experience instead of just being a form of entertainment.



Rahymov Serdar

Department for Mass and
Cultural Events

"Silk Road" State Enterprise of the Ministry
of Foreign Affairs of Turkmenistan



Green infrastructure and smart urbanism: integrating environmentally adaptive technologies in the spatial development of the region's first smart city of Arkadag

Key words: green infrastructure, sustainable development, city of Arkadag, environment, urbanization, smart technologies

Abstract

The paper provides an overview of Turkmenistan's environmental policy and the national environmental protection strategy that aim to preserve and augment the rich diversity and beauty of its nature, protect the environment and promote sustainable development. Further discussion covers Turkmenistan's history of designing its green infrastructure concept and the way it was incorporated in urban development programs illustrated by the case study of the new smart city of Arkadag. The analysis also considers some aspects of the city's design including advanced information and communication technologies, clean public transport, green spaces and digital services contributing to a sustainable and comfortable urban environment.

Among its priorities, the national policy of the Government of Turkmenistan seeks to preserve and enhance the rich diversity and beauty of nature, substantially increase the quality of the environment and living conditions for people, and shape a balanced environment-oriented model for developing the economy and competitive manufacturing businesses. So, while implementing its national environmental protection strategy, Turkmenistan closely engages with major international organizations, first and foremost, the United Nations.

Turkmenistan views climate action as an essential part of sustainable development. The National Strategy of Turkmenistan on Climate Change adopted in 2012 marked the beginning of Turkmenistan's journey towards full engagement in the global climate agenda. The next important milestone was the Paris Climate Agreement ratified by Turkmenistan in 2016 and followed up, in keeping with these commitments, by a new version of the National Strategy of Turkmenistan on Climate Change approved in 2019.

One of the key aspects of global climate action is Turkmenistan's contribution to the international efforts to cut methane emissions. It is known that Turkmenistan announced its support for the new Global Methane Pledge (GMP) at the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow, and expressed its interest in reviewing the document in detail and taking part in its implementation. At COP28, Turkmenistan announced its accession to the GMP.

Located in the arid zone, Turkmenistan clearly feels the effects of climate change and, therefore, pays special attention to measures of climate change adaptation and mitigation not only in the environmental, but also in economic and social dimensions.

To promote environmental well-being, both nationally and globally, Turkmenistan has been successfully implementing its long-term comprehensive National Forestry Program, which involves annual nationwide tree-planting campaigns where people plant 3 million saplings every year across the country. Over the last 30 years, over 170 million trees (mostly coniferous and deciduous species) have been planted in Turkmenistan.

Vigorous efforts are underway to create green belts and woodlands amid swiftly expanding industrial infrastructure, sprawling transport networks, fast-growing cities and emerging new communities.

Modern cities face the challenges of steeply growing populations, industrialization, environmental problems, and the shortage or depletion of energy sources. To address these issues, urban planners have, in the recent decades, adopted new strategies and concepts based on the increasingly popular green building designs and urban greening to provide a more sustainable environment and higher quality of life.

Green infrastructure (GI) is a network that provides the "ingredients" for solving urban and climatic challenges by building with nature.¹

1 Foster J., Foster H., Lowe A., Winkelman S. The Value of Green Infrastructure for Urban Climate Adaptation. The Center for Clean Air Policy, 2011 (February).

The main components of this approach include stormwater management, better air quality, climate adaptation, sustainable energy production, the reduction of heat loss, building energy-saving facilities, increasing biodiversity, clean food production, and sustainable use of water and soils [8].

According to the definition of the European Commission,² healthy ecosystems as elements of green infrastructure provide the so-called “free” benefits to the urban environment and population (ecosystem services): air purification, water filtering, nutrient cycles, disaster control, including floods and storms, and supporting biodiversity and stability of soil biota, etc.

Turkmenistan takes a proactive approach to environmental challenges, promoting the use of advanced and environmentally safe technologies in industrial and civil construction, as demonstrated by the environmental potential of its megaproject, the city of Arkadag. Built in just a few years, the new city conducted its inaugural ceremony on 29 June 2023. Arkadag is a benchmark model of a smart city that integrates digital, advanced information/communication, and green technologies. Its design shows a strong emphasis on green solutions. The siting of the city was based on a thorough analysis of the natural landscape and climate factors. Importantly, Arkadag encapsulates the achievements of the independent and consistently neutral Turkmenistan in its recent history. The new city is designed for a population of 70,000 people distributed across a total area of 950 hectares within the limits mapped on the site plan.



Fig. 1. Map of Arkadag

2 EC. European Commission. Green Infrastructure – Enhancing Europe’s Natural Capital. Brussels, 2013 (May).

Today, Arkadag is known around the world as the center of green innovation. For example, for better water management, Arkadag has a rainwater and stormwater harvesting system that allows water to be reused for irrigating the green spaces. The city is surrounded by an expanding green belt covering 2,370 hectares. A mudflow protection system is under construction to mitigate the hazards of the city's foothill location.

Arkadag provides a safe and comfortable urban environment with its advanced ICT solutions, green public transport, multiple green spaces, and digital services. Sustainability of a smart city largely relies on digital technology to maintain a healthy environment, including, for example, replacement of conventional transport systems with more progressive electric vehicles and buses that, in the near future, will form the basis of a clean and sustainable urban environment. By the time of its opening, Arkadag had joined the project "Development of sustainable, green, climate-friendly cities with innovative solutions in OSCE region" and received 21 international awards.

As noted above, the city joint the climate-friendly cities project because its design includes the following key GI elements:

- Green buildings designed for low emissions (5–10% below standard levels) and energy use (20–25% lower), and fitted with resource-saving equipment (thermostats, LED lighting, smart lighting controls, rainwater harvesting, and reuse systems). The overall design approach is based on the 3R concept (Reduce, Reuse, and Recycle).
- Green transport: electric buses, electric and hybrid vehicles that have been introduced and are successfully operating in the new city. Their primary advantage is near-zero CO₂ and other emissions. An extensive network of bike paths indicates massive transition to bicycle mobility. In this context, it would be relevant to mention a UN resolution adopted on Turkmenistan's initiative to declare June 3 as World Bicycle Day.

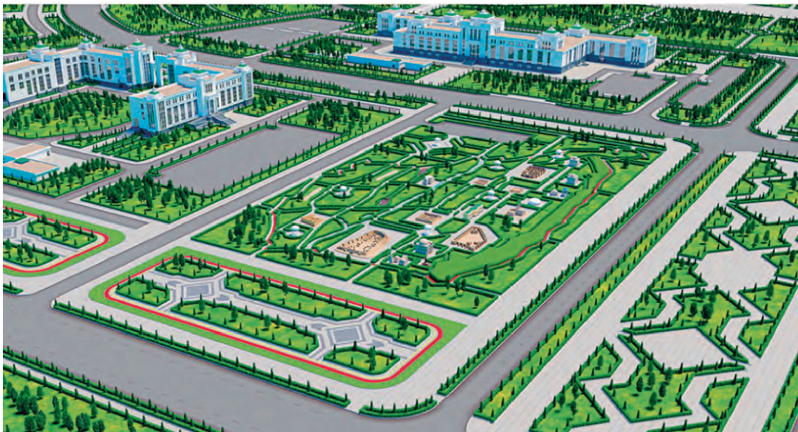


Fig. 2. 3D model of Arkadag's Park of History and Culture

- Green transport routes and green corridors where planted vegetation creates a special microclimate that enhances residents' health and wellbeing, as well as their emotional bonds with the city (sense of place, local identity, etc.). These elements are represented by the green belt. Hundreds of thousands of new coniferous saplings, oaks and other trees were planted in the city, which boasts several parks complete with smart fountain systems, producing beneficial effects on people, as well as the urban flora and fauna. For 33 years since becoming independent, Turkmenistan has conducted nationwide tree-planting campaigns and community-wide Cleanup Saturdays that take place twice a year.

Phase 1 of the Arkadag project included construction of 336 facilities of community infrastructure and other types of sites. Currently, Phase 2 is underway to complete the city, combining the best traditions of the national architecture with contemporary urban planning trends. Residential housing, community facilities and administrative buildings incorporate state-of-the-art innovative solutions. Smart houses are the key hallmark of Arkadag designed as a smart city.

Along with diverse comforts providing better quality of life for the residents, smart houses also have a smart home control system that operates via the Internet and supports automatic and uninterrupted functioning of all the utility services and safety functions. Such houses and their systems can be controlled remotely from a smartphone. Arkadag's communications infrastructure includes fiber-optic cables that support broadband Internet connectivity.

In 2024, Arkadag won the most coveted Smart City Excellence Award at the World Smart City Expo 2024 in South Korea, Foreign City Award and WSCE 2024 Contribution Award, and was also awarded the Quality Choice Prize 2024 (Diamond Category) by Vienna-based European Society for Quality Research (ESQR). This demonstrates the growing recognition of Arkadag's prominent standing as a smart city on both the regional and global levels.



Fig.3. Arkadag's award certificates

The idea itself of building a city in Turkmenistan that would be architecturally and technologically unique has come through as yet another powerful proof of Turkmenistan's strategic vision as a highly developed country.

As a result of the noble undertakings by the National Leader of the Turkmen People, Chairman of the People's Council of Turkmenistan, continued by his worthy successor, President Serdar Berdimukhamedov, Arkadag has evolved into one of the best planned and most comfortable cities for life, work and recreation in line with the highest modern standards.

Built in one the most scenic parts of Kopet Dagħ, Arkadag is a showcase of environmental well-being not only for the cities and villages of our country, but also for the neighboring regions.

References

1. The National Strategy of Turkmenistan on Climate Change. The Academy of Sciences of Turkmenistan, Ashgabat, 2013.
2. Serdar Berdimukhamedov. Anau: Culture from the Depths of Millennia. Ashgabat, 2024
3. The Forest Code of Turkmenistan. Ashgabat, 2013.
4. Novikov, Yu.V. Ecology: the Environment and People: Textbook. M., 2006.
5. Turkmenistan (newspaper) No. 231 (30836), 11.09.2023
6. Nikolaev, V.A. Fundamentals of Agricultural Landscapes / Nikolaev, V.A. // Agricultural Landscape Studies: Concept, Methodology, Regional Problems. M.: MSU, 1992. pp. 3-57.
7. Environmental Infrastructure: Textbook / Lysenko, I.O., Okrut, S.V., Zelenskaya, T.G. et al. Stavropol: AGRUS, 2013, 120 p.
8. EPA. United States Environmental Protection Agency. What is Green Infrastructure? - Electronic text data. - Mode of access: [http:// water.epa.gov/infrastructure/greeninfrastructure/ gi_what.cfm](http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm) (date of access: 22.04.2015). - Title from screen.



MEXICO



Reverte Arun

Doctoral Student in
Biochemical Sciences

National Autonomous
University of Mexico



Live green Creating a generation of communities in harmony with nature through the restoration of destroyed soils and ecosystems

It is no secret that humanity is facing numerous problems. There is an all-pervasive lack of awareness in society, and this has serious consequences. People have forgotten that they are part of a global system, a biosphere, or set of ecosystems and organisms that are in a state of constant interaction, influencing and affecting one another.

The impact that human insensitivity has had on the health of the planet is truly something to behold. The excessive use of natural resources in the name of consumerism that encourages people to consume more and more to fill an inner void created by a system that is only interested in selling more products, even at the cost of human life itself, has caused environmental disasters.

Particularly frightening examples of this include deforestation, the overexploitation of soils, and other processes associated with soil degradation and the destruction of ecosystems.

As we can see, the degradation of the planet comes from a lack of awareness among people and a profound disconnection between human beings and life. This

degenerates into a sick and gluttonous system that feeds on the consumption and labour of the ignorant masses. Therefore, as I see it, there are two possible solutions to this problem:

1. Contribute to the millennia-long work of reviving and shaping awareness in people.
2. Restore soils and ecosystems that have been destroyed.

One concrete solution would be to create communities that are able to satisfy their needs using technology (including biotechnology) and at the same time are fully integrated into the natural ecosystem (forests, scrubland, etc.). Such communities will be designed for people who enjoy caring for the environment and want to live in harmony with it, cultivate their mind and expand their spirit. It is not about forcing people to think differently, but about showing them that there are other ways that they can live and satisfy their needs (internal and external).

To achieve this goal, the project will have two main strategic directions:

1. Soil and ecosystem regeneration using the achievements of physics, chemistry, and biology. This will involve, first of all, a physical, chemical, and biological analysis of the soil, followed by treatment with whatever is required to create the desired ecosystem (or soil type).
2. Designing habitats for communities living in balance with nature. This will involve the creation of natural and technological environments that promote the development of (non-dogmatic) consciousness and the restoration of the human being's connection with natural life. Project concepts will vary depending on the tastes and needs of different population groups. These could be taken from the realm of fantasy (elven, medieval, crystalline, etc.), places of meditation (in the middle of mountains or in a humid climate), science cities (colonies where scientists live and carry out their research), art communes (designed in such a way as to heighten members' sense of beauty and inspire creativity), autonomous houses for workers, etc. Let us consider these two strategic directions in general terms.

Soil and ecosystem regeneration

One of the most important aspects of this project is that the communities will be built on land that has been damaged by deforestation, overconsumption of natural resources, desertification, erosion, chemical and metal pollution, and so on. What is interesting about this is that the idea is to not only build communities that live in harmony with nature, but also to save and revive damaged lands and thus contribute to the gradual restoration of the planet's health.

At the beginning of each project, a comprehensive soil analysis will be carried out to determine its physical properties (density, moisture, colour, etc.), chemical properties (acidity, nutrient content, presence of heavy metals and harmful chemicals, etc.), and biological properties (determination of biological species, their con-

centration and role in the ecosystem). Then, depending on the ecosystem that is being created, the necessary elements will be added to the soil for effective regeneration. This will involve, first of all, mechanical treatment of the land (removing or adding stones, water, or whatever is necessary), followed by chemical treatment (adding the required nutrients in precise quantities), and finally biological treatment (introducing biological species that are required for the creation of the appropriate microecosystem).

The last stage, biological treatment, is of singular importance, since it is one of the main problems encountered in the process of soil regeneration. In addition, numerous studies have proven the crucial importance of micro-ecosystems in the creation of macro-ecosystems. The populations of organisms in individual micro-ecosystems will vary greatly from one soil to another (both in abundance and diversity), and these features also determine the type of ecosystem (forest, grassland, swamp, etc.). It is thus of utmost importance to “plant” the appropriate microorganisms to create the desired ecosystem.

In terms of physical and chemical properties, it is simply a matter of adding and removing whatever is necessary to create optimal soil conditions, and although different soils have their own characteristics. In most cases, it is necessary to ensure basic properties such as porosity (for proper filtration, root anchorage, and nutrient retention), a balanced composition of plant nutrients, adequate moisture, the absence of contaminants, etc. However, as we mentioned in the previous paragraph, the biological factors will be different for each ecosystem and soil type, meaning that a specific and tailored approach is required – this is the only way to achieve the goal in an efficient manner.

Microsystems contain extremely important interacting organisms without which it is impossible to achieve the necessary soil composition. For example, we know that fungal mycelium serves to transport nutrients (including signalling molecules) between fungi and plants; it also secretes and excretes substances that affect other species of microorganisms. Different types of bacteria interact through quorum sensing and other mechanisms, not only with each other, but also with other organisms (fungi, protists, plants, bacteriophages, etc.).

On the other hand, several studies confirm the existence of a hierarchy in the types of organisms that form micro-ecosystems. Bacteriophage communities determine bacterial communities, which, in turn, interact and determine communities of a wide variety of biological species (fungi, plants, etc.). This makes for a finely tuned and wide-range interaction between the various participants in the soil micro-ecosystem, which is why the biological factor is so important for the effective regeneration of certain types of soil. This entire structure is determined through a soil analysis of existing ecosystems in order to be able to reproduce its properties for the purpose of restoring degraded soils.

The appropriate plant species are then planted to generate the desired ecosystem. If necessary, measures can be taken to retain moisture, stimulate rainfall,

etc. In short, by adding the necessary elements to the system, an autonomous community will be created on the damaged soil.

Designing habitats for communities living in balance with nature

This aspect of the initiative is of utmost importance and will involve architects, engineers, designers, artists, biologists, and other specialists.

This is the creative part of the project, designed to make dreams come true, and involves the people who design the neighbourhoods and micro-cities of the new land. The technical part concerns issues of self-sufficiency (sufficient energy, food, and other resources), infrastructure (piping systems, bioreactors, bridges, etc.), and architecture (the construction of residential and/or other buildings). Meanwhile, the creative part (the design) involves producing images and mock-ups (drawings, models, etc.) and building the required communities. For example, when designing a community in the style of The Shire from Tolkien's *The Lord of the Rings* and other works would require that the spaces are perfect in terms of their dimensions, aesthetics, architecture, and functional purpose, and that they are perfectly in harmony with the natural environment.

Selling the product

One of the main features of the initiative is the focus on adapting to the system instead of fighting it. As such, it is not a matter of creating communities that seek to isolate themselves from the system. Rather, it is about creating communities that are in balance with and respect nature, about creating favourable environments for the development of sensitivity and spirit.

On the other hand, creating communities on damaged soils serves a dual purpose: 1) to improve the health of the planet; and 2) to purchase land at low prices, which will significantly reduce costs.

The product is aimed at the general public, private investors, governments, companies, NGOs, etc.:

1. The general public. The creative team designs neighbourhoods that will include houses, cabins, and apartments that can be put up for sale. The next stage is to attract investments of financing to purchase the land, although deals can also be reached with the owners. This is followed by the pre-sale of residential properties (buyers typically pay between 30% and 50% of the total cost). Part of the proceeds is used to purchase the land, take care of any legal issues, and formalize ownership rights. The remaining funds are used to start construction and pay the first part of the earnings. Upon receipt of the second part of the payment, construction is completed and the project participants receive the remainder that is due.
2. Investors. Private equity can be used to conclude contracts with developers,

provided that the activities of such developers will be in the interests of the people and the planet.

3. Governments, companies, and NGOs.

As we noted at the beginning of this paper, damage to soils and ecosystems is a fundamental problem in the modern world, and numerous agencies and organizations are interested in solving it. Many governments are implementing reforestation, environmental protection, and community development programmes and may contract companies to carry out such projects. Many companies want to do their part for the improvement of the planet and sponsor these kinds of projects through various mechanisms. And many NGOs work to restore ecosystems, build communities, and enhance cultural development and may purchase services from the project described for a variety of purposes.

It is important to note that creating communities from scratch will not be the only outcome of this project. Soils are also regenerated for agricultural purposes, existing communities are modified to make them more aesthetically pleasing and self-sufficient, soils are analysed to determine their “footprint,” packages of micro-organisms are made up for subsequent sale, and so on.

Conclusion

The project we have described seeks to create dream communities that promote respect for nature, develop culture, and raise people’s awareness. It will also help restore damaged soils and ecosystems, helping to improve the planet’s health.



MEXICO



Rosalina Baez Martinez

Teacher

National Autonomous
University of Mexico



Live green Creating a generation of communities in harmony with nature through the restoration of destroyed soils and ecosystems

Introduction

The objective of this analysis is to identify factors threatening the environment in the long term for humanity and other species on Earth, including animal and plant life across all habitats, and also to propose solutions, such as Strategic Sustainable Knowledge Partnerships, to preserve the environment and mitigate human impact that could be applied in every country worldwide.

The first step towards modern concepts of sustainability was made in the 19th century when ecology began to develop as a science. But it was only after the end of the World War II that first informed discussions took place regarding environmental policy within the framework of the United Nations and other international organizations. In the 1960s, intellectuals joined efforts to harmonize the concepts of economic growth and ecological balance, creating the term eco-development in the process.

However, the future of the global environment is a highly complex issue due to the multitude of factors that come into play, such as: climate change, air, water and land pollution, loss of biodiversity, deforestation, etc.

1. Subject Background and Relevance

Some of the first voices, warning about consequences of damaging the environment and calling to take more care of our planet, were raised back in the 19th century with the emergence of ecology as a first step towards the modern concepts of sustainability. But it was not until the end of the World War II that first informed discussions took place regarding environmental policy and became part of the agenda at the United Nations and other international organizations. In the 1960s, intellectuals joined efforts to harmonize the concepts of economic growth and ecological balance, combining them into “eco-development”. The term was introduced by the UN and is attributed to Maurice Strong, who organized the 1972 UN Conference on the Human Environment in Stockholm and the Earth Summit in Rio de Janeiro in 1992 (López, Victor 2009), where the interests of the international community were expressed regarding the need to implement environmental improvement processes. These discussions also led to the establishment of first multidisciplinary groups and institutions formally charged with proposing alternative solutions to environmental problems. The concept of eco-development was the precursor to what was later termed sustainable development.

In 1992, at the Earth Summit in Rio de Janeiro, formally known as the UN Conference on Environment and Development (UNCED), “sustainable development” was given its most comprehensive definition: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (López Victor, 2009). The UNCED also adopted the Rio Declaration on Environment and Development (Rio Declaration of 1992) signed by 150 member-countries, and resulted in the first formal commitment to sustainable development in nine priority areas. In addition, it agreed Agenda 21 for each country as a way to ensure sustainable future of the nations.

It is also important to remember that in 1987 the UN's World Commission for Environment and Development released the report *Our Common Future*, known as the Brundtland Report, after the Commission's chairwoman, Gro Harlem Brundtland. The report gave a stark warning that humanity must change its modes of life and business interaction if it did not want to see the coming of an era marked by unacceptable human suffering and ecological degradation (Report of the World Commission on Environment and Development: *Our Common Future*, 1987). This document also provided the above-quoted definition of Sustainable Development, the attainment of which involved three major phases to:

1. Investigate the critical issues of development and the environment and make proposals to address them.

2. Propose new forms of international cooperation to influence development and environmental policymaking.
3. Engage individuals, companies and governments in efforts to protect the environment.

This was followed up with summits, intergovernmental meetings and international forums, focused on finding ways to act on the three objectives listed above that are still relevant today, and to identify effective solutions for safeguarding the environment. Among many important events in the history of international cooperation on sustainable development, a key milestone was the Paris Agreement adopted in 2015 and ratified by many UN members since 2016. This international treaty on climate change laid the groundwork for Agenda 2030, recently updated as Agenda 2045, which defines 17 goals and 169 targets of sustainable development, all of them designed to preserve the environment and protect humanity and all life on Earth.

But the future of the global environment is a complex issue involving multiple factors, such as climate change, pollution of air, water and land, loss of biodiversity, deforestation, etc.

Clearly, climate change is one of the biggest threats to the environment affected by rising global temperatures due to greenhouse gas emissions. Nowadays, the climate is characterized by dramatic seasonal shifts and extreme weather conditions, including more intense hurricanes, prolonged droughts and very strong heat waves.

Regarding biodiversity, the Pulse 2024 report reveals a staggering 73% decline in global wildlife populations over the past 50 years. Freshwater species have suffered the greatest decline of 85%, followed by terrestrial (69%) and marine (56%) populations. As biodiversity reaches a critical tipping point, urgent action is needed to protect ecosystems and ensure a sustainable future. Note that, at this rate, the loss of biodiversity threatens not only ecosystems, but our own survival as well.

As for deforestation, the Forest Pulse Report and the State of the World's Forests report show that deforestation rates have slowed down in comparison with previous decades. However, forest fires in 2023 affected 6,687 million hectares of forests worldwide, releasing 6,687 megatons of carbon dioxide. It is critical to consider the balance between deforestation that reduces absorption of carbon dioxide and is harmful to wildlife, and the needs of agriculture, which feeds the entire population of our planet and is essential to its survival.

Finally, air, water and soil pollution has increased. According to Digital Ecology, in 2024, the rate of global pollution has become critical and a major concern for scientists and policymakers. According to recent reports, air pollution is estimated to have reached an average of 29% in urban areas, edging up from 27% in 2020. This uptick is partly due to the post-pandemic economic recovery and increased industrial activity. Water pollution data is also alarming as 20% of the world's freshwater sources are contaminated with chemical and biological agents. Given that this

parameter was only 15% in 2019, this indicates a worrying trend that underscores the need to implement more effective water conservation and treatment measures.

Reports on solid waste pollution also paint a grim picture. In 2024, the world produced approximately 2.01 billion tons of waste per year, an increase of 10% over 2020. Listed below are some key facts about waste management in today's world:

- Only 13 % of this waste is properly recycled.
- 50% of plastic waste ends up in landfills or the environment.
- Waste incineration contributes significantly to air pollution.

It is evident that the issue of environmental protection urgently calls for short, medium and long-term solutions.

Proposal for a conservation/mitigation solution and conclusions

It should be noted that the following proposal, based on my doctoral research, sets out a potential solution for conservation of the environment and mitigation of human impact that can be replicated across all countries worldwide subject to the political will of their governments.

The proposal is to create Sustainable Strategic Knowledge Partnerships. Due to the constraints of the essay format, I will describe them only briefly without specifying the roles of each participant. Such Partnerships require the full participation of all institutions within the global community: 1. Universities and research centers, 2. NGOs (civil associations and foundations), 3. Business community, 4. Government, including federal, regional and municipal levels, and 5. International organizations.

These Sustainable Strategic Knowledge Partnerships should come up with their respective national projects as part of strategic national plans that would ensure continuity without limiting the development of the countries.

To conclude, it can be said that there is no lack of proposed solutions to tackle environmental challenges. However, without adequate political alignment between nations around the world, these solutions cannot be effectively implemented, jeopardizing natural conservation and impact mitigation efforts as well as the very survival of life of Earth. So we must act now – as if we ought to have done it yesterday.

References

1. López, Víctor Manuel, (2009). Sustainability and Sustainable Development: Origin, Conceptual Precision and Operational Methodology, pp. 16-17.
2. Rio Declaration on Environment and Development, United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, reaffirming the Declaration of the United Nations Conference on the Human Environment adopted in Stockholm on 16 June 1972.

3. Report of the World Commission on Environment and Development: Our Common Future, Alianza, Madrid, 1987.
4. https://ecologiadigital.bio/cuanta-contaminacion-hay-actualmente-en-el-mundo-y-cuales-son-sus-consecuencias/#porcentaje_de_contaminacion_en_el_mundo_2024_como_se_compara_con_a_os_anteriores
5. <https://www.wwf.org.mx/?391453/Informe-Planeta-Vivo-2024> Informe planeta vivo 2014
6. <https://gfr.wri.org/es/latest-analysis-deforestation-trends> Informe de Forest Pulse 2024
7. Doctoral Thesis: Rosalina Báez Martínez. Energy Sustainability Strategy for Federal Passenger Transportation Companies in Mexico. UNAM



GERMANY



Rudat Axel

Independent Researcher



Investing in Environment

Let us discuss some *positive* implications of the global climate change.

Introduction

Global climate change is one of the biggest problems of our time. Its impact on the environment, society and economy can be already seen and felt and occasionally cause fear and panic. We can even hear statements like: “Now the planet is no longer warming up, it’s boiling!” However irresponsible or unrealistic, such outbursts of alarm only make it harder to understand with unbiased clarity what is really happening as well as to respond to climate change with sensible solutions. There are many different views on the causes of and human contribution to climate change. Conventional models assume a direct correlation between growing CO₂ levels and global warming. The rising content of carbon dioxide in the atmosphere is usually attributed to industrial production which has been growing steadily since the middle of the nineteenth century.

This narrative has been exploited to build a colossal global industry and invest billions of dollars into combating climate change. The effect, though, has been minimal so far as temperatures and atmospheric CO₂ are still on the rise. There are a number of reasons for the upward change in global temperatures and CO₂ levels, including natural causes, such as:

- solar activity,
- volcanic activity,

- changes in the Earth's orbital movement,
- ocean water circulation, and other factors.

Historically, the predominant climate on Earth was rather warm. Such hot periods account for about 80–90% of the planet's history. For example, the average temperature in the Cretaceous, a period from 145 to 65 million years ago, was approximately 8–9°C above today's benchmark (https://commons.wikimedia.org/wiki/File:All_palaeotemps.png), whereas CO₂ levels were 3 to 4 times higher (https://commons.wikimedia.org/wiki/File:Phanerozoic_Carbon_Dioxide.png) and the Earth's poles were completely free of ice. Nevertheless, this did not lead to any global climate catastrophe. Wildlife and vegetation flourished and biomass production was enormous. For the global climate, it makes no difference whether rising CO₂ and related temperature increases are the result of volcanic activity, changes in the Earth's orbit, solar activity or industrial CO₂ emissions. Fluctuations in temperature and CO₂ concentration throughout the history of the Earth are part of the natural process, sort of a breathing cycle of the planet.

Hypothesis

Global climate change is a natural part of Earth history. Most of the time, the planet was dominated by a warm climate and Earth was often ice-free. So, it would seem that fighting and trying to reverse global climate change with questionable methods and humongous expenditure of resources makes little sense. Negative and alarmist news are totally unhelpful. It would be much wiser to think ahead and be proactive. Counterintuitively, climate change may also have its upsides that could be useful for us.

Let us consider two factors to identify potential positive effects of climate change and ways of leveraging them to shape a better future for humanity.

Climate Change and CO₂

Carbon dioxide (CO₂) is the second most important greenhouse gas after water vapor and is considered to be the primary cause of climate change. At the same time, CO₂ is an essential resource for all the plant life on Earth. All the green plants, algae and plankton need CO₂ for photosynthesis to produce carbohydrates and, consequently, organic materials. Ultimately, our entire diet depends on plant photosynthesis. Besides, the same process generates oxygen, which is so vital for us. At present, the CO₂ concentration in the atmosphere is about 400 ppm. However, its optimal concentration that maximizes the effectiveness of photosynthesis is three times higher! This is why the CO₂ level in greenhouses is deliberately raised to 1200 ppm as this considerably increases plant productivity. The current CO₂ concentration in the Earth's atmosphere is generally too low for supporting the most effective photosynthesis. It means that the planet's vegetation is actually "starved" like a human being who receives only a fraction of the normal daily intake of calories.

It would be fair to assume that an increase in the atmospheric CO₂ content up to the ideal photosynthesis level would be a powerful boost to the productivity of agriculture, forestry and gardening. In fact, even between 1982 and 2009, the greening of the Earth increased by up to 50%. Notably, 70% of this global growth in green vegetation cover was driven by the fertilization effect of CO₂ contained in the atmosphere (Zhu, Z. et al., 2016; Nature, Climate Change, Vol. 6).

Hence, more benefits – as increased agricultural productivity would help to cut down on fertilizers that pose a threat to ground water. It would also allow people to expand organic and environmentally-friendly cultivation of foods that are healthier and better quality for human diet.

So how can we deal with CO₂ in a positive way?

There is no need to be afraid of CO₂. This gas is neither toxic, nor a natural hazard. It is a natural gas which is essential to life as food for plants. CO₂ is not an enemy and we do not need to fight it, wasting millions of dollars on its capture and underground storage. Higher CO₂ concentrations can help us to make the world greener and healthier. We can support nature by implementing large-scale reforestation programs as well as by creating more parks and green spaces in cities. More CO₂ and more green vegetation can foster a beneficial bond and symbiosis, significantly improving the human habitat.

Climate Change and the Weather

People feel that climate is changing primarily due to unstable weather conditions. Over the last 150 years, Europeans have got used to a relatively established seasonal cycle with snowy and frosty winters and mild warm summers. Now, however, people notice that snow is becoming increasingly scarce in winter, while summer is getting hotter. They find this change unsettling. In the past, Europe already witnessed similar change, but in reverse, that started in the early 14th century when the climate in Europe cooled rapidly, marking the beginning of the so-called Little Ice Age, which lasted till the middle of the 19th century. How did people react back then? When it got colder at the beginning of this regional cooling, people's response was quick and simple: they started building bigger stoves and wearing warmer clothes.

Today, again, we have to deal with climate change, which is partially responsible for natural disasters, such as floods and hurricanes. But such disasters are also part of the Earth's history. They have always accompanied climate shifts and are in no way unique to our times.

Today we are trying to resort to risky, unsafe and expensive measures to stop and reverse climate change. However, all those billions of dollars sunk into projects to combat climate change so far have not yielded any tangible results. Maybe this money could have been put to better use, say, in infrastructure projects. The world's current population totals over 8 billion people who are most densely packed in large areas along rivers and ocean coasts. For decades, riverbanks have been progressively encased in concrete without the much-needed engineered floodplains

with dykes and flood barriers. This is why there are so many human casualties and material damage to buildings during flood disasters.

Therefore, steps should be taken to remediate coastal areas and create controlled flooding areas. At the same time, cities need to expand their drainage and sewerage systems. This would cost much less than cleanup operations after natural disasters, not to mention the cost of human suffering that could be avoided. One successful example is Japan's G-Cans project (Shutoken Gaikaku Hosuiro or G-Cans), the world's largest underground floodwater diversion facility located north of Tokyo (<https://edition.cnn.com/2012/10/31/world/asia/japan-flood-tunnel/index.html>). At the cost of \$2 billion, this flood defense system makes a lot more economic and practical sense than multiple dubious investments in unpredictable climate change management.

Rising temperatures will certainly result in more abundant precipitation in the future. This might be a blessing for arid and semi-arid regions of the planet. Combined with the carbon fertilization effect produced by atmospheric CO₂, this could help to reclaim barren landscapes and restore agriculture, opening new prospects for local communities in the future. Thus, increased precipitation can have its upsides. This was exactly the case of a heavy rainfall in northwestern Sahara in September 2024 when dried-up lakes and riverbeds filled with water and the desert burst with lush vegetation incredibly quickly (<https://www.ndtv.com/world-news/sahara-desert-turns-green-nasa-shares-stunning-image-of-transformation-6644222>).

Global warming could also benefit the northern regions of our planet. Higher temperatures translate into milder winters and shorter heating seasons, helping to lower energy consumption for heating. This is good for the environment because heating systems generate a lot of heat that escapes into the global climate system. Perhaps, in the future, we are going to turn on air conditioning a little more often than now. But modern AC systems are four times more efficient than heaters because instead of producing heat they absorb it from the air like refrigerators and, therefore, do not release any additional thermal energy into the global climate system.

Another benefit of global warming concerns human health as cold is more dangerous for people than warm weather. A team of researchers (Zhao et al., *The Lancet Planetary Health*, 2021, vol. 5, 7; 415-425) have analyzed mortality data for 43 countries between 2000 and 2019. According to this study, which covered nearly half of the world's population, about 5 million people die every year due to adverse thermal conditions, of which, surprisingly, 4.5 million die of cold compared to 0.5 million victims of heatwaves.

Conclusions

While the current climate change is largely linked to human activity, natural factors still play a major role in climate processes. It is important to understand

these natural factors and how their complex interplay affects our climate. The history of the Earth shows that climate changes have always been part of our planet's existence. Through cold and warm periods, humanity has always been flexible and creative in adapting to those changes with the help of engineering and construction solutions. The question still remains whether human interference can stop and reverse such a complex process as global climate change. But first of all, we should learn to view the ongoing climate change without constant anxiety and negativity, and without looking back and trying to mothball previous climate conditions. Moreover, climate change can bring benefits for human development going forward. It is up to us to act responsibly and with foresight. With technological and architectural solutions, we can take advantage of the present and future effects of climate change for the good of humanity.



ITALY



Serafini Stefano

Rechearch Director
Doctor

International Society
of Biourbanism



Biourbanism for creating comfortable cities for people, free society, and healthy environment

The basis for this submission is our recent publication: Modonesi, C., Serafini, S. & Giuliani, A. (2024) Neither ecosystems nor machine: The city as a cultural organism. *Journal of Biourbanism*, 10(1-2), pp. 139-151. Please refer to it for bibliography and further study of the submission.

Our submission highlights the fundamental comparability of urban and biological systems. Real cities and real organisms (as opposed to modern urban projects and robots that are linear simulations of complex human societies and living beings, respectively) develop due to the interaction between a certain set of internal response patterns and the environment. As in case of an organism development, interaction between a complex system and the environment defines its structure and functions. Modern major cities no longer interact with their natural environment, and they are “dematerialized” to such an extent that they became fully dependent on global sources of food, energy, even thought and government unrelated to their location. In fact, they are similar to organisms, whose life activity is maintained by external devices. In view of all this, it is offered to recover the vital link between cities and rural and natural environment that paves the way towards the future urban civilization.

Cities are complex systems with their own specific characteristics and needs, thus, they require continuous bilateral contact with the environment.

The works of Nobel laureate Ilya Prigogine contributed to wide acknowledgment of the fact that ecosystems are complex nonlinear systems, the metastable nature of which (i. e. ability to fluctuate between different configurations) constitutes their normal condition. It is no coincidence that what is meant here are systems at the edge of chaos, which means a special type of dynamic equilibrium balancing between the order and randomness. Such an approach allows us to see the biodynamic contact plane as a place where interaction between the system and the environment occurs with time.

The systemic paradigm implies that while randomness and instability are in the realm of chance, the order and negentropy are the properties required to allow the system to maintain its individuality. It is the balance of these two components that allows the system to survive by adapting to the changing demands of its environment. Within the framework of this scenario there appears the vector of time. There appears a direction that depends on the free energy model applicable to ecosystems. In fact, thermodynamic equilibrium, which means reaching a certain configuration (energy minimum), is only possible in case of ideal closed systems. On the contrary, real systems, such as lakes, savannas, forests, etc., are open systems and they are maintained in the state of imbalance by the flow of external energy passing through them. In such cases stability is impossible, and what is meant here is stationary (more precisely, quasi-stationary) systems that disperse the energy flow passing through them in the optimal way (minimum entropy production). It is here that system complexity comes into play and launches the processes leading to ordered structures that ensure the existence of ordered configurations.

In our model, a city is a rather special case of a complex system: a cultural organism, which corresponds to the paradigm of biodynamic interface. According to this paradigm, trajectory of cities' development results from constant interaction between the urban organism and its environment. At the same time, complex systems cannot interact directly and require common "interface", even if partially autonomous, featuring special dynamic character (let us remember biological membranes that regulate exchanges between cells and their microenvironment). In a city, such interface is the border between densely built-up urban areas and surrounding rural area. Blurring of this border (and, thus, uncertainty of this interface location) is the major challenge of our time.

In Italian cities of late Middle Ages, centers of social aggregation and economic activity, as well as connection to the rural environment, were of great importance. "City" and "village" were clearly separated, but at the same time dynamically connected. What is more important, areas outside the city walls had the same "cultural" value as urban spaces. Cities ensured multilevel interaction between all urban institutions and various social classes, as well as con-

tinuous bilateral flow of information from rural area and back through city walls and gates that were the biodynamic interface between the city and the environment.

The situation in modern large cities is totally different. Here “village” and “city” are no longer at the same level. The border between city and village is getting blurred: rural area is subjected to metastatic invasion of the city that happens simultaneously with internal destruction of mediation levels and geometric connections within the city. As cities grow, encroaching on the rural area, vast land lots get built-up under the model of low-density development.

Countryside spaces for various purposes, such as residential houses, shopping malls, places of recreation, and public parks are separated from each other due to the restrictions imposed by local governments and zoning regulations. In such cases, construction of new infrastructure for suburbanites is required. As a result, significant portion of transport, in particular, to provide essential items, is represented by cars. New suburbs are always rather boring and uniform as compared to the diversity of traditional cities, where the urban landscape is definitely more welcoming. Besides, most of the suburbs suffer from lack and/or low quality of services.

In fact, modern cities have lost their autonomy and essence: they no longer define their own destiny, as resources and decisions defining their life activity come from outside. Indeed, urban life functions “broke out” beyond previously existing city boundaries and turned into a dematerialized landscape known as the global world. Cities no longer import food, materials, energy, and services from their surroundings. They are now dependent on foreign and distant sources. Thus, the link between a city and its environment is violated and turns into mere relation between spaces deprived of any special sense. Inhabitants of ancient cities cared about the health of their agricultural lands, as they provided the citizens with food. They maintained security and order in community themselves. In short, inhabitants of a city were its citizens in the full sense of that word, and their ethics and habitat were truly “civil”. On the contrary, relations of the inhabitants or, rather, temporary residents of modern global cities with the “urban system” are exclusively of consumer and aesthetic nature. Modern temporary residents of a city have no connection with the “life of the city”, as similarly to “tourists” they do not participate in its construction and maintenance, but just use it. More and more often people live in fragmented urban districts described by poverty, instability, and social conflicts. The neoliberal turn of the new millennium has placed class power in the hands of the richest elites of global capitalism. Within few decades, new super billionaires emerged in many parts of the world, including regions that are still considered to be “poor” or “developing.” Results of such situation are indelibly imprinted in the spaces of our concrete and high-tech cities having no connection to the natural environment and more and more transforming into fortified cells, gated communities, and privatized

public spaces: in other words, into cities controlled by cameras, fences, and restricted access areas. In many countries, cities are declining aesthetically and socially. At the same time, physically and socially isolated areas are being created, which increases the distressing sense of the existence of many independent “microstates”.

Crisis of modern urban environment gets largely aggravated by the probable approach of the world to a turning point, as majority of people live in cities and megacities or their suburbs. At present, over 50% out of 8 billion people populating the world live in highly urbanized areas: it is expected that by the middle of this century this percentage will increase up to 70%. It shall be mentioned that in total the urbanized surface of the planet is 3% of the overall area of the Earth’s surface. This means that enormous amount of people occupies an extremely limited part of the globe with all the ensuing consequences. Such an impressive concentration of people entails critical management and organizational challenges, as well as unpredictable amount of energy related, social, and medical challenges.

Deteriorated condition of the environment typical for many cities of the Western world is often associated with high expenses on public healthcare, especially for those who are not responsible for deterioration of the environment. Increased impact of hazardous and/or carcinogenic substances at home, at work or while traveling around the city causes increased morbidity among the most vulnerable groups of the population. The fight against cancer and other degenerative diseases cannot be left to the medical sector alone. Central and regional authorities shall fight diseases with the use of state measures aimed at primary prevention, i. e. by way of elimination and reduction of the causes of diseases. Urban policy shall ensure reduced socio-economic gap between citizens and abandonment of decisions in favor of market pressure and to the detriment of public health and social justice. Urban planning must take into account the issues of public healthcare and combine theoretical and pragmatic aspects of systems theory, ecology, geography, biology, philosophy, and social sciences.

One of the most promising ways to overcome current local and global urban challenges should be efficient interaction of cities with rural and natural environment. This offer is rather simple and compliant with the need to focus urban planning on what is important for people. It is necessary for us to fulfill basic human needs without distorting the ecological and social context in which communities are living. “Vision” of the territory based on the understanding of “urban space” is required. This concept shall be freed from the dominance of excessive construction, private speculations that are contrary to common interests, focus on road transport, and generally the idea that there cannot be a strong and trusting relationship between the city and the natural environment. In short, these are small and medium size cities with clear borders surrounded by associated landscape where enough food and energy are produced for the residents, and

population of which enables deliberative democracy based on ecological and civil dialogue. Such cities could independently define their own destiny, as their vital functions (“organs”) would not be external: they would also have a real local economy, and their citizens could develop ecological and civil relations based on agriculture and related professions, including the service sector. Common ecological and civil language develops in the area of civil activity, politics, economics, and architecture, as evidenced not only by 2000 years of Mediterranean urbanism, but also the forms of relation arising in squats and slums around the world. Failure in usage of this language causes disasters at the urban, social, and environmental levels. Ecological and civil language is the main property of a real and living bio-urbanized city.



Serebryakov Kirill

GR Specialist

Saint-Petersburg State
University of Aerospace
Instrumentation



Investments in the environment, corporate social responsibility, sustainable development, a new platform for global growth

In the age of global change and challenges, when sustainable development becomes not simply a trend but a vital necessity, the idea of creating comfortable, safe and sustainable living conditions becomes especially relevant. The new platform for global growth imposes a serious challenge on businesses: revisit their role in society and actively contribute to creation. Today, corporate social responsibility is no longer viewed as a nice statement or a marketing trick; it becomes a real standard that determines the level of long-term success and competitive standing of companies.

Today's world is facing unprecedented challenges, including climate change, social inequality and geopolitical instability. These factors adversely affect people's quality of life, economic productivity and sustainability of development. Under these conditions, business, with its substantial resources, technologies and innovation potential, can and must play a key role in solving these problems. (World Economic Forum, "The Global Risks Report 2023"). Corporate social responsibility becomes not simply a good will gesture but a strategic imperative that opens new avenues for growth and development. Responsible business nurtures the trust of consumers, attracts talents, boosts investor loyalty and improves corporate reputation, which ultimately has a beneficial effect on financial indicators.

We assume that corporate social responsibility-based investment initiatives and solutions implemented under the new platform for global growth can contribute to establishing more comfortable, sustainable and safe living environment. This hypothesis is corroborated by numerous studies demonstrating a positive relationship between corporate social responsibility and sustainable development.

According to a McKinsey study (Measuring the value of stakeholder capitalism, 2020), companies implementing social responsibility programmes have higher revenue and profit growth rates than non-aligned businesses. The reason behind this trend is that the consumers increasingly prefer brands that care about the environment and society, and investors pay more attention to ESG (environmental, social, governance) factors when making investment decisions.

Moreover, corporate social responsibility is an important driver that helps to build a more sustainable and inclusive economy. Investments in education, health-care, infrastructure and other socially important projects reduce social inequality, improve living standards and create new jobs. (UNDP, “Sustainable Development Goals Report 2022”).

Corporate social responsibility has an important impact on both the economic and social environment. For instance, companies that are guided by social responsibility principles gain a competitive edge, and investors increasingly prefer companies with high ESG indicators.

In addition, solving social and environmental problems serves as a catalyst to innovation and the development of new technologies. Socially responsible business strives to guarantee equal opportunities for all members of society by building systemic and institutional trust between business, government and society. Finally, we would like to add that by solving social problems we would ease social tensions and increase social stability.

There is a range of vectors that define a successful socially oriented business strategy. First, the development of “green” energy, whereby investments in renewable energy (solar, wind, hydro) help reduce the dependency on fossil fuels, slash greenhouse gas emissions and create new jobs in the economy. (IRENA, Renewable Energy Statistics 2023). Second, it is important to mention the environmentally friendly technologies. For example, investments in the development and implementation of green technologies in industry, transport and agriculture help reduce their negative environmental impact and improve the quality of life among the population.

Third, investments in education and science increase the population’s education level, help develop the national innovation potential and create new opportunities for economic growth. Fourth, the development of social infrastructure that comes with education and science (medical facilities, educational institutions, sports facilities, cultural centres) would improve the standards of living and make people’s life much more comfortable.

Fifth, corporate social responsibility (CSR) initiatives launched by many big factories to alleviate social issues in their respective regions help develop the local communities, encouraging local civil society and effective resolution of local issues.

An emphasis on effectiveness and comprehensive programmes, orientation towards public values and civil society involvement – all these trends herald a transition to coordination-based government. The state interested in ensuring controllability is looking for new forms of interaction with society, based on cooperation rather than subordination. Emerging political networks bring together various decision-making centres and harmonize social connections using social management techniques (Smorgunov, 2009: 229).

The coordination-based government, which builds its platform on the basis of ESG principles, relies upon a political network model that is based on interdependence, relaxed government control and interactive collaboration. However, it is important to differentiate between resource-seeking networks and networks aimed at sharing responsibility and maintaining a balance of interests. Structural network properties, such as centralization and decentralization, greatly affect the nature of participant interactions and the effectiveness of decisions made.

A key element of coordination-based government is knowledge, which is subject to management technologies aimed at supporting interactions between network participants in the process knowledge production, reproduction and circulation. The concept of governance stresses the importance of interactions and the government's desire to play the coordinator role in a multilevel management system, which contributes to the eventual development of collective goals and harmonization of connections with state policy goals and social responsibility of all actors involved in dialogue platforms (Smorgunov, 2011: 89).

The focus on people also catalyzed the search for new “points of comfort” in customer interactions. Companies are trying to retain the attention of customers, especially from among the new alpha generation, which is highly loyal to digital platforms they got accustomed to at an early age. This forces businesses to create comprehensive ecosystems of services and solutions, which becomes a “new normalcy” and forces governments to adapt by offering similar integrated approaches and deepening cooperation with business in order to solve social issues, giving an extra push to the “coordination-based” approach.

Corporate social responsibility has become a prologue to a transition from lobbying to building long-term constructive relationships with government authorities, which led to the development of GR management. A turn toward human-centred approaches in business gave an impetus to fundamental political management concepts, changing approaches to management and making them more sensitive to KPIs and social effects. This encouraged the development of new public management and governance concepts, helping to strengthen public trust in political institutions and unite citizens in efforts to face global challenges.

So, to summarize, it should be mentioned that investments in the environment based on corporate social responsibility principles are a key driver of sustainable development and creation of comfortable, safe and sustainable living conditions. Corporate social responsibility has to be a new standard on which the company's success and competitiveness in the long run will hinge. ESG principles, both now and in the future, help improve the quality of life in various communities, reduce social inequality, boost economic productivity, improve social stability and strengthen systemic trust of the traditional tripartite model participants – business, government and society – ultimately creating a strong and inclusive national economy.

References

1. L.V. Smorgunov. In search of controllability: transformations of public administration theory in the 21st century (article in Russian) // Vestnik Sankt-Peterburgskogo Universiteta. Series 6: Philosophy. Culturology. Politics. Law. International relations. 2011. No. 4. pp. 85-96.
2. L.V. Smorgunov. From intervention to coordination: a renaissance of the state and transformation of the modes of interaction between the state and society (article in Russian) // Gosudarstvennoye upravleniye v XXI veke. 2009. No. 3. pp. 226-245.
3. World Economic Forum, The Global Risks Report 2023 (<https://www.weforum.org/reports/global-risks-report-2023/>)
4. McKinsey, Measuring the value of stakeholder capitalism (2020)
5. UNDP, Sustainable Development Goals Report 2022 (<https://www.un.org/sustainabledevelopment/progress-report/>)
6. IRENA, Renewable Energy Statistics 2023 (<https://www.irena.org/Statistics>)



INDIA



Sharma Anusha

Student

Daulat Ram College,
University of Delhi



Investments in Environment-Path towards Sustainable Growth

Thematic Vector

This essay explores the need for sustainability in our approach to global development by altering simple aspects of our activities and our viewpoint towards environment at a fundamental and psychology level by focusing on laying the groundwork.

It examines our existing views on the topic of environment preservation and the possible approaches we can take to bring about the possibility of actual change.

Preamble

With the need for growth there is also a need for sustainability and protection of the Environment so that the future generations can also experience and utilize the gifts our environment bestows upon us, growth without sustainability poses a big problem and hence this topic is of much importance.

But even with this understanding, growth is not seen to be cooperating with the approach of sustainable development and thus there is a need for investment in environment.

Revealing the Core of the Hypothesis

- 1. Changes in Mindset:** Our approach towards the environment and our habit of talking it for granted needs to be changed at the fundamental level, that is, by focusing on the very future of our world, the children. By this I mean, incorporating sustainability and environmental protection as a habit for them. This can be achieved by making changes in their school curriculum by including activities that regularly promote them to clean the environment and keep it clean and by teaching them that it is not “People or the Environment”, it is “ People and the Environment “, by showing them that man and nature go hand in hand.

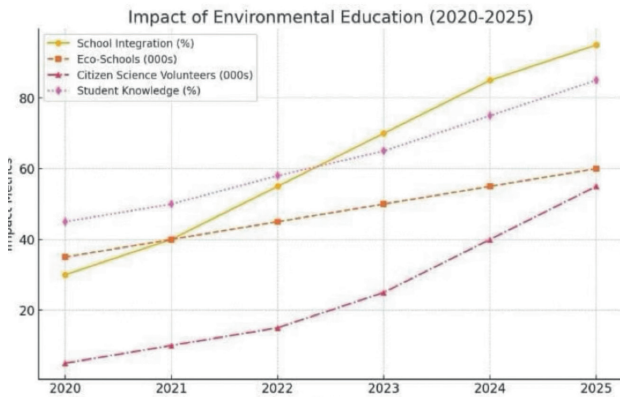


Figure-1

- 2. Substituting Plastic (Researching Alternatives):** Although it is well known that plastic, a non-biodegradable item, is bad for the environment its production is in no way on the path of decline.

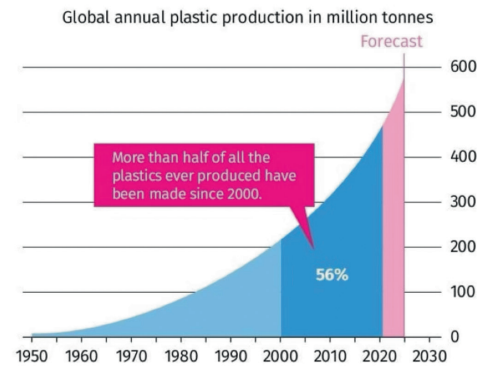


Figure-2

3. Harvesting Rainwater (Conserving water): Aside from this, the simple practice of harvesting rainwater can make significant changes in the environment. By making huge rain water harvesters and supplying that water for agricultural and industrial purposes, while prohibiting the use of groundwater by imposing heavy fines can reduce the growing problem of groundwater depletion.

According to a research done in 2023 it was seen that:

- The annual average rainfall of India is of 1,180 mm according to the annual data received from Meteorological Department.
- Out of which only 8% is harvested.
- Harvesting rainwater is an efficient way of water conservation and can help reduce flooding and water pollution
- Harvested rainwater can fulfill about 70% of a household's need.

4. Rewarding Sustainable Practices: Humans, by nature, are driven by self-interest. They hesitate to do things just for the sake of betterment if it does not benefit them. Every act of their "Goodwill" Is a way to derive self-satisfaction if not monetary benefits. Taking this in consideration, tax reductions can be given to households that use solar panels and use renewable energy sources, along with industries which do the same along with proper waste treatment. This practice is already in place yet it lacks advertising and thus remains hidden and unknown, in turn not influencing the public. And so proper distribution of information is necessary.

The Green Credit Programme (GCP) was introduced by the Indian Government on 12th October 2023 under the Environment Protection Act of 1986. It was introduced with the aim to encourage voluntary plantation activity across India. This GCP is one example of increasing voluntary sustainable activities by giving incentives.

5. Working with the Youth – the Role of NSS: The 10th BRICS Environment Ministers Meeting was held on 28 June 2024, under the chairship of the Minister of Natural Resources and Ecology of the Russian Federation Alexander Kozlov in Nizhny Novgorod. In this meeting, experts discussed various topics, out of which in this strategy I will be discussing about the topic they discussed-"The role of youth in solving environmental problems".

While concluding this meeting, Mr. Alexander Kozlov commented that Russia was hoping for the support of BRICS member countries in its initiative to create a BRICS Environmental Youth Network. This aimed in involving school and college going students in the implementation of an environment policy going beyond the basic volunteering activities.

Indian government has put forth the NSS (National Service Scheme) which is a scheme most, if not all, Indian colleges follow, in this there are students which volunteer in various NGOs and do cleaning drives. This is a good ini-

tiative which teaches the youth to take action and teaches them responsibility (regarding society and environment) and compassion. This can be a good step towards the involvement of youth in government policy implementations and can give youth both the experience and the platform to express their views and ideas.

- 6. Promoting and Supporting Sustainable Businesses:** Many sustainable small businesses are emerging from around the world, these brands should be recognized by the government and promoted around the globe. By making them more accessible (reducing their import/export and travel cost), and making them affordable many people would opt for the more sustainable and economical approach. And if these small businesses are protected and promoted, it would inspire many more similar inventions.

According to a survey conducted throughout the U.S. in 2022, it was discovered that about 65% of small businesses are trying to reduce their environmental impacts.

How many small businesses are taking steps to reduce their environmental impact?

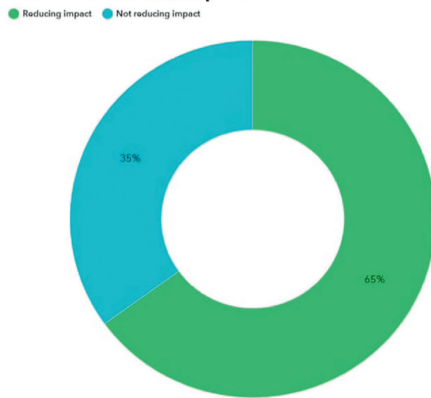


Figure-5

- 7. Soft Influencing through Media:** There are ways to influence the people without directly telling of forcing them to do something. And what is that? By soft influencing. Just as states and countries give out cash prizes for making movies in their areas to indirectly promote tourism, the same approach can be taken in this aspect. Giving discreet or public cash prizes to movies that casually show houses with solar panels and shows the character using public transport instead of private vehicles and other sustainable approaches can influence the people far better than outright preaching for the betterment of

our environment. Many of our habits are influenced just from the media we consume. So if the movies and media subtly points towards environmental protection, people will likely be convinced as they will believe it was their idea. According to a paper written on behavioral sciences in May 2020, it was stated that a significant portion of Russia's population (mainly the people aging 18-19) considers cinema as a means of social and individual transformation and they make up a large amount of its audience.

Considering what we know from before about the Russia's wish of increasing youth engagement in solving environmental issues and making them more conscious towards the environment, this can be a significant strategy that could work in their favor.

Social and Economic Effects

By following these strategies, the standard of living can witness drastic improvement. This will also help in creating more jobs of regulation, routine check-ups and many more. Because of the creation of jobs, the economy will also benefit. BRICS (Brazil, Russia, India, China and South Africa) is an informal alliance of developing countries and will benefit from these strategies to bring forward desirable change.

Expected Results and General Conclusions

In conclusion, a change in attitude towards the environment will be the first step into achieving sustainability. With a focus on education, practical measures, and proactive policies we can work towards a world where growth and sustainability can coexist. The expected outcomes are mitigated environmental harm, improved coping ability to climate change, and a more just and affluent society.

Bibliography

1. BRICS Education
2. BRICS Environment Ministers Discuss New Environmental Projects and Adopt Final Statement
3. BRICS Bio-Based Plastics – Exploring Innovations in Bio-Based Plastics for Sustainable Packaging 01-09-2023 - Arhive
4. Sustainable Development: Green Giants: BRICS Countries Leading the Charge in Sustainable Development
5. Green Credit Programme
6. Report on Alternative Products and Technologies to Plastics and their Applications
7. Rainwater Harvesting Guide: Process, Statistics, Benefits, Case Studies
8. Impact of Films: Changes in Young People's Attitudes after Watching a Movie
9. How to develop a small business sustainability plan



CANADA



Steele Jason

Freelancer



Reassessing Climate Science: The Dominance of Solar Forcing Over Anthropogenic CO₂ Models

Preamble: A Critical Reevaluation of Climate Science

The stability of Earth's climate is governed by complex interactions between astrophysical and geophysical factors. However, mainstream climate models disproportionately attribute global temperature dynamics to anthropogenic CO₂ emissions. This focus has shaped both scientific discourse and policy frameworks, despite empirical challenges necessitating a paradigm shift in climate science.

Recent advancements in observational astrophysics and laboratory-based thermal physics reveal limitations in Kirchhoff's Law of Thermal Emission, which assumes that emissivity and absorptivity of a body in thermal equilibrium are equal and independent of material composition[1]. These limitations affect climate models by introducing errors in energy balance equations and misrepresenting the role of greenhouse gases in radiative transfer. However, experimental findings indicate that emissivity is material-dependent, leading to significant errors in climate models relying on conventional radiative transfer equations[2].

Moreover, high-precision space-based solar observations have provided a refined understanding of the Sun's role in Earth's climate system. Solar spectral

emissions, heliospheric conditions, and planetary atmospheric responses must now be integrated into climate modeling to replace outdated assumptions that have guided environmental policies for decades.

This study examines the scientific, economic, and environmental implications of these findings, advocating for a reallocation of climate research funding toward solar observation, predictive analytics, and planetary resilience infrastructure. Failure to adapt to these discoveries may lead to ineffective policies that misallocate economic resources and fail to mitigate real climate risks.

Reevaluating Kirchhoff's Law and Its Implications for Climate Modeling

Empirical Refutations of Kirchhoff's Assumptions

- Kirchhoff's Law postulates that blackbody radiation is independent of the material properties of the emitting cavity[3]. Pierre-Marie Robitaille's extensive research has demonstrated otherwise:
- Cavity radiation is inherently material-dependent, invalidating models that assume universal emissivity[4].
- Highly reflective surfaces do not conform to blackbody emissive properties, contradicting Kirchhoff's assumption of radiative equilibrium[5].
- Experimental data deviates from Planckian blackbody expectations, indicating fundamental errors in climate models that rely on Kirchhoffian assumptions[6].

These findings challenge the foundational radiative assumptions embedded in General Circulation Models (GCMs) such as CMIP6, which inform the IPCC's climate projections and shape international policy decisions by influencing emission targets, carbon taxation frameworks, and global climate agreements[7]. Empirical studies demonstrate that these models inaccurately assume uniform blackbody emissivity, leading to miscalculations in energy balance equations and climate sensitivity projections[8]. Consequently, standard parameterizations of atmospheric absorption coefficients, emissivity distributions, and heat redistribution mechanisms require recalibration to align with empirical evidence[9].

Implications for CO₂-Based Climate Models

The misapplication of Kirchhoff's Law in climate models has led to a systematic overestimation of CO₂'s radiative forcing. Empirical studies suggest that radiative impact projections may be inflated by 30% to 50%[10]. This miscalculation contributes to exaggerated climate sensitivity estimates, underscoring the need for a comprehensive revision of predictive climate frameworks[10].

Modern climate models attempt to integrate feedback mechanisms, yet they fail to account for material-dependent radiative transfer, which significantly alters the projected role of greenhouse gases. These findings suggest that the heat-trap-

ping capacity of CO₂ has been overestimated, requiring a reassessment of alternative climatic drivers[11]. Additionally, reconstructions of past climate events based on greenhouse gas models must be reexamined in light of these new findings[12].

Solar Forcing as the Dominant Climate Modulator

Empirical Correlations Between Solar Variability and Climate Trends

A substantial body of evidence indicates that fluctuations in solar activity, rather than anthropogenic CO₂ emissions, serve as the primary determinant of major climatic shifts:

- **The Maunder Minimum (1645–1715) and the Corresponding Little Ice Age:** A period of significantly reduced solar activity that coincided with the coldest phase of the Little Ice Age, suggesting a link between diminished solar irradiance and cooler climatic conditions[13].
- **Satellite Measurements Confirming Correlations Between Solar Irradiance and Atmospheric Temperatures:** Since 1978, satellites measuring Total Solar Irradiance (TSI) have revealed fluctuations of $\pm 0.1\%$ over the 11-year solar cycle, correlating with atmospheric temperature changes[14].
- **Geomagnetic Activity and Solar Cycle Synchrony:** Periods of low solar activity, such as the Maunder Minimum, have been linked to increased cosmic ray influx due to a weakened solar magnetic field, impacting cloud formation and climate[15].
- **Ice Core Analyses Showing Temperature Shifts Preceding CO₂ Changes:** Ice core records demonstrate that historical temperature changes often preceded shifts in atmospheric CO₂ levels, indicating that temperature variations may have driven feedback mechanisms affecting CO₂ concentrations[16].

Advancing Predictive Modeling of Solar Forcing

To improve climate forecasting, predictive models must systematically compare solar variability against CO₂ radiative forcing. Existing models such as the Community Earth System Model (CESM) and the Max Planck Institute Earth System Model (MPI-ESM) should be adapted to integrate:

1. High-resolution solar spectral variability data[17].
2. Refined radiative transfer equations that account for material-dependent emissivity[18].
3. Heliospheric influences on atmospheric dynamics[19].

These modifications will enhance the accuracy of climate predictions, reducing reliance on CO₂-centric frameworks and ensuring a more comprehensive representation of solar forcing.

Strategic Reallocation of Climate Research Priorities

Investment in Solar Observatories and Climate Resilience

Given the clear dominance of solar variability in climate modulation, scientific priorities must pivot toward:

- High-resolution solar observatories for real-time spectral and irradiance fluctuation measurements[20].
- Integration of solar physics into next-generation climate models to improve predictive accuracy[21].
- Development of geomagnetic resilience infrastructure[22].
- AI-driven predictive analytics for long-term climate forecasting[23].

Economic and Policy Implications

- CO₂-focused mitigation strategies introduce systemic economic inefficiencies when solar variability is the dominant climatic driver[24].
- Strategic investments in solar research will enhance forecasting accuracy and optimize resource allocation across multiple sectors[25].
- Financial projections suggest that reallocating even 20% of global climate funds toward heliophysics and solar forecasting—based on economic modeling of historical investment trends in climate research—could significantly improve predictive accuracy and resilience strategies, yielding higher returns in climate adaptation resilience than CO₂ mitigation schemes[26].

Conclusion and Expected Outcomes

Empirical evidence refuting Kirchhoff's Law and demonstrating the dominant role of solar forcing in climate variability necessitates a fundamental restructuring of climate science. Future research must transition from CO₂-centric models to frameworks integrating empirical solar physics, heliospheric interactions, and atmospheric dynamics.

This transition presents significant challenges due to institutional inertia and funding structures invested in CO₂-driven research. Overcoming these barriers requires targeted policy reforms, increased funding for alternative climate models, and interdisciplinary collaboration to integrate solar physics into climate forecasting. Addressing these concerns requires international collaboration, interdisciplinary research, and policy reforms that prioritize empirical validation. By reallocating climate research funds toward solar physics, we can enhance climate prediction accuracy, optimize economic resources, and develop more effective adaptation strategies.

References

1. Kirchhoff, G. (1860). "On the relation between the radiating and the absorbing powers of different bodies for light and heat." *Philosophical Magazine*, ser. 4, v. 20, 1-21.
2. Planck, M. (1914). *The Theory of Heat Radiation*. P. Blakiston's Son & Co., Philadelphia, PA.
3. De Vos, J.C. (1954). "Evaluation of the Quality of a Blackbody." *Physica*, 20, 669-689.
4. Lummer, O. & Pringsheim, E. (1901). "Kritisches zur schwarzen Strahlung." *Annalen der Physik*, 6, 192-210.
5. Rubens, H. & Kurlbaum, F. (1901). "On the heat radiation of long wave-length emitted by black bodies at different temperatures." *Astrophysical Journal*, 74, 335-348.
6. Robitaille, P.-M. (2003). "On the validity of Kirchhoff's law of thermal emission." *Progress in Physics*, 2, 22-23.
7. Robitaille, P.-M. (2019). "Further insights on Kirchhoff's law and blackbody radiation: Experimental confirmation that cavity radiation is material-dependent." *Progress in Physics*, 15(2), 87-99.
8. van Wijngaarden, W. A., & Happer, W. (2020). "Dependence of Earth's Thermal Radiation on Five Most Abundant Greenhouse Gases." arXiv preprint, arXiv:2006.03098.
9. Scafetta, N., & West, B. J. (2007). "Phenomenological reconstructions of the solar signature in the Northern Hemisphere surface temperature records since 1600." *Journal of Geophysical Research: Atmospheres*, 112(D24).
10. Eddy, J. A. (1976). "The Maunder Minimum." *Science*, 192(4245), 1189-1202.
11. Usoskin, I. G., Solanki, S. K., & Kovaltsov, G. A. (2007). "Grand minima and maxima of solar activity: New observational constraints." *Astronomy & Astrophysics*, 471(1), 301-309.
12. Lean, J. L., Rottman, G. J., Harder, J. W., & Kopp, G. (2005). "SORCE contributions to new understanding of global change and solar variability." *Solar Physics*, 230(1-2), 27-53.
13. Scafetta, N. (2010). "Empirical evidence for a celestial origin of the climate oscillations and its implications." *Journal of Atmospheric and Solar-Terrestrial Physics*, 72(13), 951-970.
14. Courtillot, V., Gallet, Y., Le Mouél, J.-L., Genevey, A., & Tapponnier, P. (2007). "Are there connections between the Earth's magnetic field and climate?" *Earth and Planetary Science Letters*, 253(3-4), 328-339.
15. Miyahara, H., Masuda, K., & Muraki, Y. (2006). "Variation of solar activity from the viewpoint of radiocarbon in tree rings." *Advances in Space Research*, 38(5), 1459-1462.
16. Caillon, N., Severinghaus, J. P., Jouzel, J., Barnola, J. M., Kang, J., & Lipenkov, V. Y. (2003). "Timing of Atmospheric CO₂ and Antarctic Temperature Changes Across Termination III." *Science*, 299(5613), 1728-1731.
17. Shakun, J. D., Clark, P. U., He, F., Marcott, S. A., Mix, A. C., Liu, Z., Otto-Bliesner, B. L., Schmittner, A., & Bard, E. (2012). "Global warming preceded by increasing carbon dioxide concentrations during the last deglaciation." *Nature*, 484(7392), 49-54.
18. Soon, W., & Legates, D. R. (2013). "Solar irradiance modulation of equator-to-pole (Arctic) temperature gradients: Empirical evidence for climate variation on multi-decadal timescales." *Journal of Atmospheric and Solar-Terrestrial Physics*, 93, 45-56.
19. Haigh, J. D. (2007). "The Sun and the Earth's Climate." *Living Reviews in Solar Physics*, 4(1), 2.
20. Lockwood, M. (2012). "Solar influence on global and regional climates." *Surveys in Geophysics*, 33(3-4), 503-534.
21. Lomborg, B. (2020). *False Alarm: How Climate Change Panic Costs Us Trillions, Hurts the Poor, and Fails to Fix the Planet*. Basic Books.
22. Tol, R. S. J. (2012). "On the Uncertainty of Climate Change Policy." *Environmental and Resource Economics*, 53, 109-123.
23. Svensmark, H. (2007). "Cosmoclimatology: a new theory emerges." *Astronomy & Geophysics*, 48(1), 1.18-1.24.

24. Robitaille, P.-M. & Robitaille, J.L. (2015). "The Theory of Heat Radiation" revisited: A commentary on the validity of Kirchhoff's law of thermal emission and Max Planck's claim of universality." *Progress in Physics*, 11(2), 120-132.
25. Robitaille, P.-M. & Crothers, S.J. (2019). "Eddington's Mass-Luminosity Relationship: A Violation of the Laws of Thermodynamics." OSS19 Meeting of The American Physical Society.
26. Rolnick, D., et al. (2019). "Tackling Climate Change with Machine Learning." arXiv preprint, arXiv:1906.05433.



CHINA



Sun Jiachen

Student

Shandong normal university



What is the Relationship of Energy Transition and Green, Low-Carbon, High-Quality? Based on the DID method

1. Introduction and literature review

In 2015, the 21st United Nations Climate Change Conference adopted the Paris Agreement, in order to keep the increase in average temperature of global below 2°C during the 21st century and limiting warming to 1.5°C over pre-industrialized water. To facilitate the execution of Paris Agreement and promote China's concurrent objectives of achieving peak carbon emissions and attaining carbon neutrality, transform China's industrial structure, energy framework, and consumption and production patterns is imperative. This fundamental shift to a green and low-carbon economy necessitates an energy transformation as a critical factor in realizing these dual-carbon goals. Energy transition signifies the evolution of human energy utilization patterns, progressing from firewood to coal, then subsequently from coal to oil and gas, followed by a shift from oil and gas to renewable energy sources, ultimately advancing from carbon-based fuels to carbon-free alternatives. This transformation of the energy system encompasses essential components such as forms of energy, employed technologies, structural changes in energy sources, management strategies, and related

aspects. In the energy sector, China has implemented a number of policies designed to achieve the energy system transformation of green and low-carbon, comprising “*the Opinions on Improving the Institutional Mechanisms and Policies and Measures for the Green and Low-Carbon Transformation of Energy*” “*the 14th Five-Year Plan for a Modern Energy System*”, and “*the Medium- and Long-Term Plan for the Development of the Hydrogen Energy Industry (2021-2035)*”. The report of the 20th CPC National Congress advocates for the further advancement of the energy revolution, encourages the formulation and establishment of a new and renewable energy system, facilitate the low-carbon and efficient use of energy.

In the 4th meeting on the comprehensive deepening of reform, the central government proposed to concentrate on critical field of social and economic progression and to establish a spatial framework for green, low-carbon, and high-quality development (hereafter referred to as G-LC-HQ). The relationship between energy transition and G-LC-HQ has attracted considerable scholarly attention in recent years, leading to the emergence of two primary viewpoints: First, the promotion theory, which posits that advancements in new and clean energy can stimulate economic growth and enhance sustainable development. Second, the inhibition theory posits that the energy transition incurs economic costs and suggests that clean energy may not effectively facilitate green and low-carbon development due to various economic and social conditions.

The new-energy model city (hereafter referred to as NEC) represents a significant pilot policy and institutional initiative for China’s energy transition. Panel data spanning the years 2005 to 2020 from 270 prefecture-level cities is utilized in this paper, employs the super-efficient SBM model to measure GTFP for assessing urban G-LC-HQ levels, and applies Difference-in-Differences (DID), models of mediating effect moderating effect to quantitatively evaluate enhancement effects, mechanisms, and heterogeneous influences of the NEC on urban G-LC-HQ. There are three marginal contributions: ① In measuring GTFP, non-expected outputs encompass not only the conventional three waste outputs but also carbon emissions, thereby providing a more comprehensive assessment of urban G-LC-HQ levels. ② By employing green technological innovation and foreign direct investment (FDI) to form mediating variables, along with digital economy as a moderating variable, we investigate the transmission mechanisms and moderating effects of energy transformation on enhancing urban G-LC-HQ, aiming to offer optimized pathways for energy transition in other cities. ③ We analyze the heterogeneous impacts of energy transition across different geographical locations, levels of financial development, and environmental system foundations; comprehensively summarizing the experiences of demonstration cities to provide differentiated policy implementation strategies for establishing NECs.

2. Institutional context, theoretical analysis and research hypotheses

2.1. Institutional Context

In 2001, China accessed to the WTO, the country has experienced rapid economic growth, maintaining double-digit GDP growth rates for an extended period. However, this development has been excessively dependent on traditional fossil energy sources—particularly coal—resulting in increased greenhouse gas emissions and exacerbating issues such as climate change and environmental pollution. Between 2010 and 2013, haze events occurred consecutively in numerous cities across the country, with widespread and persistent hazy conditions prevalent during winter in the eastern and central of China. This phenomenon significantly compromised travel safety and adversely affected residents' health, posing challenges to the advancement of sustainable economy and society. This captured the attention of government. China has increasingly prioritized the promotion and application of new and renewable energy sources. The report from the 18th Party Congress in 2012 emphasized the need to “facilitate energy production and consumption revolution, regulate total energy consumption, support the advancement of energy-saving and low-carbon sectors as well as new and renewable energy sources, and ensure national energy security.” Furthermore, it identified energy transformation and development as a critical component of ecological civilization construction. In 2013, the Third Plenary Session of the 18th Central Committee of the Communist Party of China proposed the concepts of “enhancing the system for energy, water, and land conservation and intensive utilization” as well as “ensuring the market plays a crucial role in energy distribution”. In 2014, General Secretary Xi Jinping put forth a new energy security strategy of “four revolutions and one cooperation”, revolutions in energy consumption, supply, technology and institutions, and the strengthening of all-round international cooperation.

To establish a resource-conserving and environment-friendly society and accurately handle the relationship among social progress, economic development, resource utilization, and environmental protection, the National Energy Administration promulgated “The Announcement of the National Energy Administration on the Establishment of NEC (Industrial Parks) List (The First Batch Notice)” in 2014. The announcement compiled the development plans of 81 NECs, mandating the demonstration cities to take sustainable development as the objective, establish the strategy of giving priority to the advancement of renewable energy, make full use of local renewable energy sources including biomass energy, geothermal energy, solar energy, wind energy, etc., and actively facilitate the utilization of all kinds of new energy sources and renewable energy technologies in construction, transportation, heating, power supply of cities, etc., and enhance the renewable energy sources utilization rate. It incorporated new energy construction into urban development planning and annual plans and put forward binding targets. The set percentage of energy substitution targets was completed in 2015 and the construction of NEC with low-carbon, harmonious and sustainable development was expedited.

2.2. Theoretical analysis and research hypotheses

Energy transition policies are, to a certain extent, binding and guiding, and are characterized by distinct environmental regulation. In the short term, the pressure to limit and phase out production in traditional energy sectors has altered the original production methods of the industries, while giving rise to so-called “brown unemployment” within these industries. Meanwhile, the advancement of new energy sources, coupled with innovations in production processes and equipment to support them, has entailed larger production costs for enterprises, reduced enterprise competitiveness, and had a very limited impact on output growth or even been unfavorable to economic growth. However, in the long run, the energy transition is bound to trigger the new energy integration into the traditional energy industry, achieving the substitution and driving the progress of related industries, for instance new energy equipment manufacturing, electric vehicles, new materials, smart grids, and so forth. These industries development rapidly can generate a large number of new employments. At the same time, the energy transition policy offers corresponding financial and technical support to the demonstration city, strengthens the endogenous power of G-LC-HQ, and stimulates enterprises to undertake technological innovation to transform the production process, so that while ensuring the desired output, it can also effectively decrease environmental pollution and carbon emissions.

H1.: The energy transition will promote urban G-LC-HQ.

Energy transition promotes the innovation of urban green technology, which in turn boosts G-LC-HQ. Green technology innovation has dual externalities, namely, technology and environment. Due to the characteristics of “high investment, difficult technology and long return cycle”, it leads to its inherent drawbacks under the market economic system. Therefore, environmental regulation has become a considerable impetus for green technology innovation. Energy transition, as a flexible command-based environmental regulation, can facilitate energy technology innovation throughout the energy sector, generating an innovation compensation effect. At the macro level, the advancement, production and transportation of new energy require sophisticated production technologies. Consequently, various types of investment bodies can promote the concentration of talents with high-tech or high-end skills, research and development capital and other innovation factors, thereby enhancing the city’s degree of green technological innovation. At the micro level, the NEC will compel enterprises to adopt green production approaches and undertake green technological innovation through the incentives and constraints imposed by local governments, thereby enhancing the vitality of green innovation.

In the process of China’s high-quality development, the resource environment represents the strategic capital for the development of economic. Green technology innovation can generate economic value directly, while also alleviating CO₂ and the existence of spatial correlation effects. The introduction of new technologies makes a positive contribution to enhancing production efficiency, reducing costs,

expanding market size, providing new employment opportunities, etc., and injecting impetus into economic growth. For instance, green technological innovation can transform the manufacturing processes and flows of enterprises, lower the cost of pollution control, and develop green products. It can also significantly mitigate the impact of product production and consumption on the environment, conserve production resources, and enhance enterprises' market competitiveness. In accordance with the foregoing analysis, this study advances the ensuing research hypotheses.

H2.: The energy transition can contribute to urban G-LC-HQ by facilitating green technology innovation.

The energy transition attracts FDI, which in turn promotes G-LC-HQ. The execution of the NEC will be straightforwardly associated with attracting FDI about the new energy industry into the region. "NECs Evaluation Indicator System and Explanation (Trial)" stipulates that NECs should meet the conditions that the energy consumption of per-unit industrial added value above the magnitude falls below the "mean level" of the province where they are located, or the decrease in energy consumption per unit above the scale in the Eleventh Five-Year Plan exceeds the mean rate of decrease in energy consumption per unit above the scale of the province where they are located. Although, in accordance with the "pollution refuge" hypothesis, NECs will encounter greater environmental regulatory pressures under strict target requirements, which will exert a "squeeze effect" on enterprises closely related to traditional energy sources. However, in the long term, the implementation of the NEC broadens the path for enterprises to reduce energy consumption, lowers the "environmental cost" for enterprises, facilitates the advancement of low-energy consumption and high value-added enterprises, and enhances the efficiency of energy utilization and attracts more FDI in clean technologies.

Over the past few years, with the intensification of the globalization process, global economic and social development has been unfolding at an unprecedented pace, and one of the notable trends is the growing impact of FDI on national economies. The resource advantages of investors in aspects such as technology, capital, and management experience frequently offer robust support for the economic growth and progression of the host country, and directly exert an influence on the level of G-LC-HQ of the host country. Specifically, on the one hand, in the view of technological innovation, FDI can enhance the effectiveness of the green economy by stimulating autonomous and imitative innovation to reduce energy consumption and save innovation costs, which in turn generates spillover effects to boost economic development. On the other hand, in the viewpoint of industrial structure optimization, FDI inflows can accelerate the optimization and advancement for the industrial structure of the host country, reduce the amount of high-energy-consuming and high-carbon-emitting enterprises, and accelerate the host country's abilities to enhance environmental quality and raise economic development level. In accordance with the foregoing analysis, this study advances the ensuing research hypotheses.

H3.: The energy transition can facilitate urban G-LC-HQ by attracting FDI.

Amid the advancement of cloud computing, artificial intelligence big data et al., countries across the globe are encountering a profound revolution in information technology. The digital economy has arisen as a significant engine of the global economy. Different levels of digital economy evolution can bring about different influence on the energy transition in promoting G-LC-HQ. The digital economy has transformed traditional production model, which can realize inter-temporal information processing and data dissemination, and enhance the efficiency of factor allocation such as research and evolution throughout the transformation process of enterprises, thus facilitating the driving impact of energy transformation on urban G-LC-HQ. During the process of energy transition, many small and medium-sized enterprises (SMEs) face pressure to transform and face operational risks, and the advancement of the enterprise digital economy should send out positive signals to talents in other regions, leading to an inflow of talent resources to enhance the degree of enterprise innovation. The advancement of the digital government not only hastens the landing speed of new energy industry projects but also optimizes the regional business environment. The approval time and process for traditional energy companies in their transformation to new energy in new businesses are reduced. The reduction of institutional transaction costs stimulates the innovation vitality of the enterprise. Digital inclusive finance breaks the temporal and spatial limitations of traditional finance and enhances financial services efficiency, thereby being able to broaden the financing channels of the new energy industry and reduce financing costs. The key to energy transformation and upgrading resides in the combination with digital technology, which can be extensively applied to high-efficiency photovoltaic, large-capacity wind power, new energy exploration and exploitation, and complex grid operation and control, etc. Strengthen the upstream and downstream synergetic collaboration of the new energy industry chain to facilitate energy transformation and upgrading through energy digital industrialization, so as to promote the urban G-LC-HQ. In accordance with the foregoing analysis, this study advances the ensuing research hypotheses.

H4.: Digital economy positively regulates the energy transition's promotion for urban G-LC-HQ.

Although the energy transition can promote urban G-LC-HQ in multiple ways, heterogeneity exists in the effectiveness of policies among cities in different regions due to the variations in regional conditions. Firstly, the influence of energy transition on urban G-LC-HQ may vary significantly among eastern, central, western, and northeastern cities due to dissimilar economic bases, energy structures, and development orientations. Secondly, the construction of NECs demands a substantial amount of financial support from each city. As a result, the NEC effects among cities with diverse levels of financial development are heterogeneous. energy transition, as an environmental regulation, different environmental institutional bases will bring

about certain differences in response to policy shocks. In accordance with the foregoing analysis, this study advances the ensuing research hypotheses.

3. Model Construction and Variable Selection

3.1. Basic Regression Model

In this paper, the implementation of the policy of creating NECs is utilized as a quasi-natural experiment to investigate the influence of energy transition on the city's G-LC-HQ using DID. The model is established.

$$gtfp_i = \alpha_0 + \hat{\alpha}_1 did_i + \ddot{\alpha} X_i + \ddot{e}_i + \zeta_i + \hat{\alpha}_0$$

In eq. (1), is an explanatory variable denoting the GTFP of city in year , is a core explanatory variable representing whether or not the innovative NEC is carried out in year in region. If the policy is implemented in a certain city, the variable is attributed a value of 1 for the year of implementation and the following years, or else, it is attributed a value of 0; represents a series of control variables representing the effects of year on city in year; and are year fixed effects and city fixed effects, respectively; stands for a random error term; and denotes the coefficients of the constant term and the control variables; and is the coefficient of the core explanatory variables.

3.2. Variable Measurement and Data Sources

3.2.1. Explained variable: GTFP

We construct a super-efficient SBM-GML model taking non-desired outputs into account and employ Matlab to measure urban GTFP. Drawing on existing studies, this paper measures inputs from three perspectives: labor, capital, and energy. Labor inputs are measured by the employee headcount per unit by the end of the year and the amounts of industrial enterprises above scale. Capital inputs are gauged by fixed asset investment, land supply area for urban construction, and scientific expenditures. Energy inputs are quantified by overall energy consumption. Desired output () is measured by real GDP and total social consumption, and non-desired output indicators () are assessed through sulfur dioxide, emissions of wastewater, dust, and carbon dioxide. The model is established as follows:

$$\rho = \min \frac{\frac{1}{m} \sum_{i=1}^m \frac{\bar{x}_i}{x_{ik}}}{\frac{1}{s_1 + s_2} \left(\sum_{r=1}^{s_1} \frac{y_r^g}{y_{rk}^g} + \sum_{j=1}^{s_2} \frac{y_j^b}{y_{jk}^b} \right)}$$

$$s.t. \cdot \left\{ \begin{array}{l} x_k = X\lambda + S^-, y_k^g = Y^g\lambda - S^g, y_k^b = Y^b\lambda - S^b \\ \bar{x} \geq \sum_{j=1, \neq 0}^n \lambda_j x_j, \bar{y}^g \leq \sum_{j=1, \neq 0}^n \lambda_j y_j^g, \bar{y}^b \leq \sum_{j=1, \neq 0}^n \lambda_j y_j^b \\ \bar{x} \geq x_k, \bar{y}^g \leq y_k^g, \bar{y}^b \geq y_k^b \\ \sum_{j=1, \neq 0}^n \lambda_j = 1, S^- \geq 0, S^g \geq 0, S^b \geq 0, \bar{y}^g \geq 0, \lambda \geq 0 \end{array} \right.$$

where p denotes the target efficiency value, n represents the quantity of decision-making (DMU) units, k is DMU being evaluated, each DUM has inputs, s_1 represents the quantity of desired output metrics, s_2 represents the quantity of non-desired output metrics, and is the decision-making unit.

4. Mechanism analysis

According to H2 and H3, energy transition promotes urban G-LC-HQ through enhancing green technology innovation and FDI. To validate H2 and H3, this study develops a mediation effect model based on the benchmark regression model. Meanwhile, it employs DID of estimation, and the model is defined as follows:

$$\begin{aligned}
 gtfp_i &= \hat{a}_0 + \hat{a}_1 did_i + \hat{a} X_i + \hat{e}_i + \zeta_i + \hat{a} \\
 med_i &= \hat{a}_2 + \hat{a}_3 did_i + \hat{a}_4 X_i + \hat{e}_i + \zeta_i + \hat{a} \\
 gtfp_i &= \hat{a}_3 + \mathbf{b}_3 did_i + \mathbf{b}_4 med_i + \mathbf{d}_3 X_i + \hat{e}_i + \zeta_i + \hat{a}
 \end{aligned}$$

Where represents the mediating variable, encompassing green technology innovation and FDI. Table 5 presents the estimation results for green technology innovation as a mediating variable. Reg 1 reveals that the coefficient of impact for green technology innovation on GTFP is 0.0151, which is significantly positive at the 5% confidence level, suggesting that green technology innovation can substantially enhance urban G-LC-HQ. As shown in Reg 2, the core explanatory variables for green technology innovation passed the significance test at the 5% level, suggesting that energy transition can facilitate green technology innovation. The outcomes of Reg 3 presented that the energy transition coefficient is smaller than the coefficient of the baseline regression model. Therefore, green technology innovation exhibits a mediating effect and thereby validating H2.

Variable	Reg 1	Reg 2	Reg 3
	GTFP	GTI	GTFP
ET		1.122** (0.473)	0.106** (0.0443)
GTI	0.0151** (0.00627)		0.0129** (0.00635)
Constant	2.884 (2.171)	39.89** (19.09)	3.115 (2.141)
City FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	3111	3160	3111
R ²	0.690	0.680	0.692

Table 5. Regression results of the test of the mechanism of the impact of energy transition on the GTFP of cities (green technology innovation)

Note: ***, **, and * denote 1%, 5%, and 10% significance levels; values in parentheses indicate robust standard errors.

Table 6 presents the estimation outcomes of FDI as a mediating variable. From the results of Reg 1, the effect of FDI on GTFP is significantly positive at the 10% confidence level, suggesting that FDI can contribute to the city's G-LC-HQ. As shown in Reg 2, the effect of energy transition on FDI was significant at the 1% level, suggesting that energy transition can attract FDI. Reg 3 shows that after controlling for FDI, the coefficient of energy transition on GTFP is smaller than that in the baseline regression. Therefore, FDI also has a partial mediating effect, and H3 is verified.

Variable	Reg 1	Reg 2	Reg 3
	GTFP	FDI	GTFP
ET		1.386* (0.741)	0.121*** (0.0418)
FDI	0.00577* (0.00315)		0.00498 (0.00321)
Constant	3.537* (2.079)	-71.84* (36.83)	3.635* (2.019)
City FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	3113	3,165	3,113
R ²	0.690	0.797	0.693

Table 6. Regression results of the test of the mechanism of the impact of energy transition on the GTFP of cities (FDI)

Note: ***, **, and * denote 1%, 5%, and 10% significance levels; values in parentheses indicate robust standard errors

5. Analysis of moderating effects

The preceding analysis indicates that the digital economy enhances the influence of energy transition on G-LC-HQ, so this study adopts a moderating effect model to analyze the role of the digital economy as a moderator.

$$gfp_i = g_0 + g_1 did_i + g_2 dig_i + g_3 did_i * dig_i + g_4 X_i + \ddot{e}_i + \zeta_i + \hat{a}_i$$

In Eq. (8), is the digital economy, and the remaining variables align with those in the baseline regression, which can be used to judge the moderating effect of the digital economy based on the positive and negative coefficients of the interaction terms between the core explanatory variables and the digital economy and

significance. Using eq. 8 to estimate the effect of the digital economy on the energy transition and its implications for the city's G-LC-HQ. The results of the regression analysis are presented in Table 7. Reg 1 indicates that the impact of the core explanatory variables on GTFP is significantly positive at the 1% confidence level, after accounting for the level of digital economy development. From reg 2, it is evident that after adding the interaction term between the core explanatory variables and the digital economy again, the effect of the core explanatory variables on GTFP is significantly positive at 10% confidence interval. The interaction term among the digital economy and the core explanatory variables is significant at 5% confidence interval, and the signs of the coefficients for this interaction term are consistent with those of the core explanatory variables, indicating that the digital economy enhances the energy transition in relation to the city's G-LC-HQ. H4 is verified.

Variable	Reg 1	Reg 2
	GTFP	GTFP
ET	0.118***(0.0433)	0.0679*(0.0397)
Dig	0.0689**(0.0303)	0.0590*(0.0309)
Interaction		0.104**(0.0525)
Constant	3.512*(2.039)	3.457*(2.043)
City FE	YES	YES
Year FE	YES	YES
Observations	3123	3123
R ²	0.697	0.698

Table 7. Regression results of the test of the moderating effect of energy transition on GTFP of cities (digital economy)

Note: ***, **, and * denote 1%, 5%, and 10% significance levels; values in parentheses indicate robust standard errors. The interaction term uses the product of DID and the digital economy.

6. Research findings and policy recommendations

6.1. Findings

This study utilizes panel data from 270 prefecture-level cities spanning the years 2005 to 2020 to assess the GTFP and evaluate the level of G-LC-HQ in these cities through the application of the super-efficient SBM model. Additionally, the DID, along with mediating and moderating effect models, is employed to quantitatively assess the upgrading effect, elucidate the mechanisms of action, and analyze the heterogeneous impacts of energy transition on the G-LC-HQ of cities. The primary findings are as follows: First, the implementation of NEC has significantly enhanced GTFP and fostered G-LC-HQ. Second, green technology innovation and

FDI serve as mediating factors. The energy transition enhances urban G-LC-HQ by fostering green technology innovation and attracting FDI. Third, the interaction term between the digital economy and energy transition is significantly positive at the 5% confidence level, suggesting that the digital economy can effectively enhance the impact of energy transition on promoting urban G-LC-HQ. Fourth, the energy transition positively influences the G-LC-HQ of cities situated in the western and northeastern regions. The energy transition significantly enhances the G-LC-HQ of cities characterized by high levels of financial development and strong environmental protection priorities, whereas its impact on the G-LC-HQ of cities with low financial development and limited environmental protection priorities is not statistically significant.

6.2. Policy recommendations

First, the government should establish a robust evaluation framework to synthesize successful experiences of energy transition in NECs and broaden the scope of these demonstration initiatives. The findings of this study demonstrate that NEC significantly contributes to the enhancement of urban G-LC-HQ, which is critically important for China's economic transformation and the advancement of ecological civilization. The successes and failures in the execution of NEC should be thoroughly analyzed, with replicable cases developed for extension to additional cities that possess the necessary conditions and capabilities. Simultaneously, it is essential to enhance synergistic linkages and knowledge sharing between demonstration cities and their neighboring counterparts, as well as to strengthen collaborative efforts in the new energy sector among cities and enterprises, thereby maximizing the policy impact of NEC construction.

Second, the mechanism analysis presented in this study indicates that energy transition can enhance urban G-LC-HQ by fostering green technological innovation and attracting FDI, while the digital economy serves to amplify the upgrading effect of energy transition on urban G-LC-HQ. The government should enhance the long-term monitoring mechanism that integrates incentives and constraints, while intensifying environmental protection efforts and pollution penalties for demonstration cities. Concurrently, it is essential to increase policy subsidies and tax incentives to bolster enterprises' enthusiasm for engaging in green technological innovation. Enhance international cooperation in new energy across all dimensions, strengthen the construction of digital infrastructure, and facilitate the digital transformation of the energy sector.



Vanyushkin Alexander

Professor

V.I. Vernadsky Crimean
Federal University



Eco-Cities Economy Clustering as a Prerequisite for Scaling their Development

Preamble. Relevance

Global recognition of the extent of environmental challenges, their critical nature, and the need to address them as soon as possible led to the 2015 UN recommendations on 17 Sustainable Development Goals (SDGs), seven of which (No. 11 to No. 15, No. 6 and No. 7) are directly related to the environment. The awareness of the fact that one of the significant sources of environmental challenges are large cities and urban agglomerations led to the emergence of the trend of *eco-cities* in the late twentieth century, first in developed countries and then in a number of developing countries. Urbanists and architects since the beginning of the 20th century have been proposing different concepts for improvement of urban ecology. Thus, we can say that the concept of “garden city” by E. Howard gets a second life in the 21st century. Several concepts are close to it in meaning: “green”, “eco”, “15-minute” city, “urban villages”, “eco-settlements”, etc. They have a number of fundamental points in common: increasing the share of green areas, prohibition of cars within residential areas and the use of electric transport, including public transport, renewable energy sources

(RES), waste management and recycling, including water waste, multi-functionality of the territory (including agriculture, sometimes organic), prohibition of the location of environmentally polluting industry.

As the practice of establishment of eco-cities around the world has demonstrated, the main and still unresolved problem of their development is their *poor scalability* due to *weak economy* and *difficulties in providing employment* for residents in the same territory, on one hand, and *very high investment costs for construction of the required infrastructure*, on the other hand. This problem shows precisely the *unsustainability of eco-cities (their economies)*.

The same can be said about new urban micro-districts and quarters developed within existing cities in accordance with the eco-city concept. As a rule, such new-fashioned projects, implemented by developers responsive to new trends in the housing market, have an increased cost of 1 m², compared to conventional housing in the mass segment. Therefore, it can be purchased by wealthy people (at least middle class), employed in a well-paid job or running their own business (including small or medium-sized) outside the territory of new urban micro-districts or quarters. This *prevents the scaling up* of such practices to the rest of the city or the development of new eco-cities because effective property demand is usually limited and very sensitive to business downturns and crises. Furthermore, the employment of residents outside the territory in scaling up eco-districts to the city level will interfere with the preservation of comfort and ecology by increasing pendulum migration and harmful motor vehicle emissions. Another development model – “eco-settlements” – is also suffering from its own deficiencies. Due to its specificity (emphasis on health and spiritual practices, organic farming and limitation of amenities), it is intended for a limited number of people. Therefore, the size of eco-settlements is even smaller than new urban “eco” micro-districts and quarters.

Well, how can we resolve the situation? Often, the solution is within the challenge itself. In this case, it means that *it is necessary to develop the economics of new eco-districts and entire eco-cities during their development*. Firstly, *it is necessary to develop the industrial structure*. Given the prohibition of most types of industry in an eco-city/ district, a *limited list of industries is available*. Nevertheless, it can *provide a self-sufficient economic basis for the eco-city/ district*. It includes the following sectors: agriculture and processing (food industry), tourism (accommodation and catering (catering), entertainment and leisure), medicine and health, creative industries (fashion, design, IT, advertising and PR, cinema, video, music and sound recording (audio), book publishing, etc.).

One of the key features of this list of sectors is the possibility of their *mutual complementation*, which is a necessary prerequisite for *clustering (cluster formation)*. It is necessary to *develop local quasi value-added chains*, i. e. to determine which industries will be “related and supporting” (according to M. Porter’s terminology of the ‘rhombus’ determinants of a country’s competitiveness), and which

will produce final products/services, including those supplied outside the eco-city/district. Within the above list of sectors, different variants are possible. For example, fashion / design / IT / cinema / music as the final link of a quasi-value-added chain, and they are supported by industries such as advertising, tourism, agriculture and processing, medicine, and health and wellness. Another variant is also possible where the main role of the final link of the quasi value-added chain will be played by the sphere of medicine and healthy lifestyle, and all other sectors will be “related supporting”, i. e. aiming to work for the main sector. Such division of eco-city economic sectors into major and minor ones should be accompanied by a *decrease in prices for products/services of intermediate links* of the quasi value-added chain. Then it is possible to obtain *synergetic effects*, which are essential for the success of any clusters.

Secondly, to elaborate in detail the *financing* of the construction of the eco-city with *its expensive infrastructure*. It includes both justification of the *funding structure* as well as *financing instruments and mechanisms*. Naturally, it is also necessary to calculate *payback periods* for project developers.

Thus, our *hypothesis* is as follows. At the eco-city/district masterplan development stage we should consider the outlines of its economy: sectoral structure (from the above list), identification of the main and supporting industries comprising the local quasi value-added chain and clusters, construction funding, including justification of the funding sources, instruments and mechanisms, and calculation of payback periods, which can increase the probability of successful implementation and scaling.

Hypothesis explanation

Over the last 50 years, the world has accumulated some experience in construction of eco-settlements: several dozens of projects have been implemented. However, the scale of these projects is very moderate: as a rule, within the range of 50 to 800 houses [1, p. 26]. The popular eco-settlement “Dobrograd” in Russia has only 134 residents. In the UK, two residential areas in the suburbs of London with 1500 and 3000 houses, grouped in clusters around green spaces, have been built according to eco-standards. At the same time, in India, the number of residents of only one eco-settlement reached 50 thousand people [1, p. 30]. In Russia, the Sber City eco-city with a capacity of 70 thousand people (investment of 200 billion rubles) is being constructed in 2020 in the Moscow region under the aegis of Sber [2]. In China, since 2007, construction of the eco-city “Sino-Singapore-Tianjin” with a capacity of 350 thousand people (30 km² area) has started in 150 km from Beijing and 45 km from Tianjin. At the end of 2018, this eco-city had more than 100 thousand residents. [3].

However, it should be noted that 50 thousand people is the limit of the population of a small town that makes it a whole with the natural environment. In a city

with a population of 100,000 – 250,000 people, a “balance of nature and built-up area” can be developed. A large city with a population of more than 250,000 people can only maintain “individual inclusions of nature in the urbanized environment” [1 p. 53].

It implies that there are environmental constraints to scaling eco-cities to the specified sizes, in addition to funding concerns.

Creative industries, mentioned in clause 3 as one of the key sectors of the eco-city, are experiencing rapid development around the world. However, their share in the economies of the world’s countries is rather small. According to the National Research University Higher School of Economics, the share of creative industries in GDP is: 2.7% in the Russian Federation, 4.2% in the USA, and 4.3% in China [4]. Creative industries are not important on their own but rather in their interaction with the rest of the economic sectors. It also concerns the eco-city / district. It is proved that the development of creative industries increases the cost of 1 m² of housing in the territory, which may interest developers of eco-cities. Creative industries also contribute to the development of tourism with all its components, including within the eco-city.

As for the second fundamental problem of *eco-city development*, i. e. *funding organization*, there are a number of *positive trends*. First of all, there are significant investments in green infrastructure, including in BRICS countries. In China and India, for example, investments in renewable (green) energy (RE) totaled 890 billion dollars and 68 billion dollars in 2023. In Brazil, renewable energy accounted for 90% of electricity generation. In India – 30% (world average) [5]. During one of the BRICS summits, it was estimated that BRICS countries will need from 6 to 8 trillion dollars per year to implement environmental projects. The World Bank estimates that China needs to invest 17 trillion dollars by 2060 to achieve “0” level of emissions. [6]. China intends to invest 6 trillion dollars in environmental projects in the next 5 years. China is the world’s largest producer of solar panels (80%), electric cars (2/3), as well as wind turbines and lithium-ion batteries [7]. BRICS countries are already implementing climate policies, including within the framework of the ESG trend. This policy includes: targets for reducing greenhouse gas emissions and decarbonization of certain sectors of the economy through the development of renewable energy sources and increasing energy efficiency, growth in the production of biofuels, hydrogen, and the use of electric vehicles [8]. The number of people employed in renewable energy (green jobs) is also growing in BRICS countries: in China – 13.8 million people, in Brazil – 1 million people, in India – only 0.1 million people. [9, p.6].

Another positive trend is the development of “*green finance*” in BRICS countries, i. e. lending, issuing green bonds for the implementation of “*green environmental projects*”, which is in line with the ESG agenda. At the beginning of 2021, the volume of the market of “green” loans in China amounted to 1.8 trillion dollars, the market of “green” bonds – 190 billion dollars. [10, p. 80]. By the beginning of

2023, these markets have grown well: up to 3.5 trillion dollars and 208 billion dollars [11]. Areas of financing: green energy, eco transport, clean water resources. At the beginning of 2020, the volume of green bonds issue was: in India – 10.3 billion dollars, in Brazil – 4.5 billion dollars [10, p. 81].

“Green” finance is also provided by the BRICS New Development Bank (NDB) (up to 40% of the total, i. e. 12 billion dollars) [7].

Existing “green” finance instruments should also be used to attract investments in the construction of eco-cities / districts.

Another useful trend is the development and implementation of *waste recycling technologies*. The problem of overfilling landfills and recycling of waste is relevant for BRICS countries. For example, Russia annually generates more than 250 million tons of organic waste, and the total area of landfills and dumps is 4 million hectares [12]. Existing technologies of waste recycling technologies provide the following: raw materials for animal fodder production, biogas, and energy (heat and electricity), fertilizers and nutrient soils for agriculture. All these technologies should be introduced within the framework of development of eco-cities/districts.

Economic and social effects for the BRICS countries. The dynamics of the amount of green funding, as well as data on the cost of construction (using the example of Sber City) mentioned in Section 4, provide possible rates of eco-city construction in each of BRICS countries. *Assume* that BRICS countries will allocate 20-25% of “green” financing for the construction of eco-cities. Furthermore, *assume* an average construction period and occupancy of a large eco-city by residents – 10 years, payback period of investments (in infrastructure) – 20 years, and 12-15 years for clustering of eco-city economies. Then in China it is possible to build up to 100 eco-cities with a population of 70,000 people (as in “Sber City”) or 25 cities with a population of 250,000 people (ecological “limit” of population, see clause 4). The number of 100 eco-cities is obtained by dividing the share of 20% of the annual growth of “green” financing in China of 1 trillion dollars (i.e. 200 billion dollars) by the cost of construction of an eco-city (as in the example of “Sber City”) of 2 billion dollars. Then the annual population growth of eco-cities in China will be: $100 * 70,000 \text{ people} / 10 \text{ years} = 700,000 \text{ people}$, of which 50% employed – 350,000 people (number of new jobs – social effect). The economic impact after achievement of payback on investment (in 20 years) from 100 eco-cities in China will be 10 billion dollars (200 billion dollars / 20 years) without clustering their economies, and with it – 13-16 billion dollars (200 billion dollars / 12-15 years).

In other BRICS countries, the amount of “green” financing is two times more modest and, most likely, will allow the construction of no more than one eco-city at a time. In this case, the annual population growth of eco-cities would amount to 70,000 people and 35,000 new jobs (social effect). The economic effect after

achievement of return on investment (in 20 years) from one eco-city in each BRICS country, except China, will be 100 million dollars without clustering of its economy, and 130-160 million dollars – with clustering.

General findings. Expected outcome

Thus, our hypothesis is as follows: elaboration of economic contours at the stage of eco-city/ district master plan development: sectoral structure, allocation of main and supporting industries, local quasi value-added chain and clusters, construction funding, including justification of the structure of sources, instruments and financing mechanisms, calculation of payback periods, could increase the probability of successful implementation and scaling, which was confirmed in a very small scale, limited by the framework of existing “green” instruments in BRICS countries. The expected economic effects for BRICS countries were as follows: 13-16 billion dollars for China and 130-160 million dollars for the rest of BRICS countries. The expected social effects for BRICS countries are as follows: 350,000 new jobs per year for China and 35,000 jobs per year for other BRICS countries. Significant increases in the expected social and economic effects of eco-cities in BRICS countries require a (two-)fold increase in “green” financing.

References

1. Grigoriev V.A., Ogorodnikov I.A. Ecologization of Cities in the World, Russia, Siberia. Siberian Branch of the Russian Academy of Sciences. URL: <https://dront.ru/wp-content/uploads/2016/12/ecologizatsia-gorodov.pdf>
2. Shchukin A. From the City of Millionaires to Sber City. URL: <https://monocle.ru/expert/2023/24/ot-goroda-millionerov-k-sbersiti/?ysclid=m7x48a7azx376997785>
3. Perepelitsa R. Description of Sino-Singapore Tianjin Eco-City in China. URL: <https://hpb-s.com/news/smart-city-china/>
4. Petrova V., Butrin D. There is a Place for Creativity in GDP. // Kommersant. 08.09.2023. URL: <https://www.kommersant.ru/doc/4929650>
5. Glushkov K., Sokolova G. et al. GreenTech in the BRICS Countries. // SBER. URL: <https://sber-greentech.tass.ru/>
6. Green Horizons of BRICS: Who Will Become the Global Leader of the New Economy. // RBC Industry. 18.10.2023. URL: <https://www.rbc.ru/industries/news/651fbbc19a7947008ce7ba1f>
7. Lysikova O. The Growing Role of “Green” Technologies in the Context of the Global Transition to Sustainable Development. // Russian International Affairs Council. URL: https://russiancouncil.ru/analytics-and-comments/columns/sandbox/innovatsii-dlya-ustoychivogo-budushchego-klyucheve-ye-napravleniya-razvitiya-zelenykh-tekhnologiy-stra/?sphrase_id=183324522&ysclid=m7wzgoohtx404009983
8. Makarov I.A., Khlebnova A.D., Shuranova A.A. On the Way to Global Green Leadership: Priorities of BRICS Cooperation on Climate Change. // National Research University Higher School of Economics. Centre for International and Comparative Legal Studies. URL: https://we.hse.ru/data/2024/08/28/1888748429/На%20пути%20к%20глобальному%20зеленому%20лидерству_Доклад%20ЦМСПИ_ВШЭ.pdf?ysclid=m7wzkg0vuz576333145
9. Ermolaeva Yu.V. Green Jobs in the Green Energy Agenda in the BRICS States. // Education

- and Law. 2022. No. 6. URL: <https://cyberleninka.ru/article/n/zelenye-rabochie-mesta-v-zelenoy-energeticheskoy-povestke-v-gosudarstvah-briks/viewer>
10. Khudyakova L., Urumov T. "Green" Financing in the BRICS Countries. // *World Economy and International Relations*. 2021. V. 65. No. 9. URL: https://www.imemo.ru/en/index.php?page_id=1248&file=https://www.imemo.ru/files/File/magazines/meimo/O9_2021/O9-KHUDYAKOVA.pdf
 11. Edovina T. Green Valleys with Chinese Accent. // *Kommersant*. 08.09.2023. URL: <https://www.kommersant.ru/doc/6199881?erid=4CQwVszH9pUkpk5w5ba&ysclid=m7x0nlj2oo222781068>
 12. Seleznev M. Cities of the Future and Food Banks: What Eco Projects are Realized by Regions and Businesses. // *RBC Trends*. 05.10.2022. URL: <https://trends.rbc.ru/trends/green/cmrm/633590189a7947802c28cb59>



USA



Zreda Marek

Ph.D., Specialist in Hydrology
and Geological Sciences



Transforming Global Water Management: From Storage Depletion to Sustainable Flux Utilization

Preamble

Water is essential for human survival, agriculture, industry, and ecosystems, yet its scarcity has become a critical global challenge. Climate change, population growth, and unsustainable water management practices have exacerbated this issue, particularly in the Global South and East. According to Worldometer, 786 million people lack access to safe drinking water, and 841 thousand people die annually from water-related diseases. Traditional extraction from finite reservoirs such as ground water and lakes leads to depletion, land subsidence, and environmental degradation, perpetuating a flawed paradigm of water scarcity as a crisis of insufficient supply.

Earth possesses abundant renewable water resources—approximately 500,000 km³ circulates through the global hydrological cycle annually, of which humanity utilizes only 1%. To ensure long-term security, we must transition from depleting finite reserves to harnessing renewable fluxes—precipitation, glacial melt, river outflows, and atmospheric water. This essay explores how technological advancements can facilitate this transition, securing water resources while mitigating risks such as rising sea levels and groundwater depletion.

Core Hypothesis

The hypothesis of this essay is that innovative technologies—such as floating water bags for ocean precipitation capture, horizontal drilling for modern qanat systems, and atmospheric water harvesting—offer sustainable solutions to water scarcity. Redistributing fresh water from abundant sources (e.g., icebergs, high-precipitation zones, and atmospheric moisture) to stressed regions can mitigate climate change impacts, reduce sea-level rise, and improve quality of life. While requiring significant investment in research, infrastructure, and international collaboration, the benefits—including poverty reduction, improved public health, and economic growth—outweigh the costs.

Analytical Insights and Predictive Models

The global water cycle circulates approximately 500,000 km³ annually, yet humanity utilizes only 1%. Water scarcity persists not due to uneven distribution and inefficient management. The proposed solution involves Capture, Storage, and Transport (CST) technologies—floating water bags, horizontal drilling, and atmospheric harvesting—to redistribute fresh water from regions of abundance to stressed regions.

Capturing 1000 km³ annually—equivalent to almost 3 mm of sea-level rise—could:

Reduce Sea-Level Rise: Preventing 1000 km³ from entering oceans could offset a significant portion of the current 3.3 mm/year rise, protecting coastal cities.

Enhance Water Security: The captured water could improve agriculture, reduce poverty, and enhance public health.

Stimulate Economic Growth: Investments in CST technologies could create jobs, drive innovation, and cut economic losses from water scarcity.

The estimated cost of capturing 1000 km³ annually is \$1 trillion—half of global military spending and 1% of global GDP. Despite its magnitude, the long-term benefits—climate mitigation, economic growth, and poverty reduction—justify the investment.

Technological Solutions

Floating Water Bags

Flexible, saltwater-resistant polymer bags can store millions of liters of water, capturing ocean precipitation from high-rainfall zones. Transport via ships or pipelines could bring freshwater to arid regions.

Horizontal Drilling for Modern Qanats

GPS-guided drilling can create underground tunnels transporting water from renewable sources to dry areas, minimizing evaporation and environmental dis-

ruption. These techniques, proven in oil and gas extraction, could optimize water distribution.

Iceberg Towing and Melting

Stabilizing icebergs with nets, isolating them from ocean water, and towing them to water-scarce areas is a feasible, though energy-intensive, strategy explored by nations like the UAE.

Atmospheric Water Harvesting

Fog nets and solar-powered generators extract moisture from humid air, offering a decentralized water source in arid regions. A novel approach involves cooling humid air in deep ocean waters, condensing it, and collecting the liquid water in floating bags.

Smart Water Grids

IoT sensors and AI optimize real-time water distribution, detecting leaks, predicting demand, and reducing waste. This enhances efficiency, lowers costs, and ensures reliable access.

Economic Aspects

Comparison with Military Spending

With global military spending at \$2 trillion in 2021, diverting one-tenth to CST technologies could capture and distribute 200 km³ of water annually, providing for 600 million people and mitigating 0.55 mm of sea-level rise.

Contrast with Other Major Spending

Healthcare: Global public healthcare spending is \$5.77 trillion annually. Investing in water security would reduce water-related diseases, saving billions in healthcare costs.

Education: Global public education spending is \$3.90 trillion annually. Improved water access would enhance educational outcomes, particularly for girls in developing countries who often miss school due to water collection duties.

Food Security: The global cost of obesity-related diseases is \$224 billion annually, while 11.2 million people die of hunger each year. Addressing water scarcity would improve food security and reduce these costs.

Economic and Social Effects

The economic and social impacts of implementing CST technologies are profound. First, reducing sea-level rise by capturing 1000 km³ of water annually would protect coastal cities from flooding, saving trillions of dollars in infrastructure damage. Second, replenishing groundwater supplies could reduce or stop subsidence, particularly in vulnerable coastal areas. Third, providing clean water to regions in need would improve public health, reduce water-related diseases, and enhance agricultural productivity, leading to economic growth and poverty reduction.

Moreover, the redistribution of water could alleviate conflicts over water resources, which are a growing source of tension in many parts of the world. By ensuring equitable access to water, we can promote peace and stability, particularly in regions prone to water scarcity and political instability.

General Conclusions and Expected Results

Technological solutions for water resource management—redistributing fresh-water from areas of abundance to scarcity—offer a promising path forward. While CST technologies require significant investment and international cooperation, the benefits are immense.

Expected Results

Mitigation of Sea-Level Rise: Capturing 1000 km³ annually could reduce sea-level rise by 3 mm/year.

Reducing Subsidence: Replenishing groundwater reservoirs could halt land subsidence in vulnerable coastal areas.

Improving Public Health: Clean water access would reduce disease and enhance well-being.

Boosting Economic Growth: Water security supports agriculture, poverty reduction, and industry development.

Reducing Conflict: Equitable water access fosters stability in regions prone to resource disputes.

Investing in water technology is essential for a sustainable, equitable future. By prioritizing these innovations, we can address one of the most pressing global challenges and ensure long-term water security.

Autonomous Noncommercial Organization
«Directorate of the Exhibition of Achievements "Russia"»
National Centre RUSSIA

Essay Collection "Investing in the Environment." –
Moscow: Tipographiya STD RF LLC, 2025. – 248 pp.–
Print run: 150 copies. – Digital version available at:
dialog.russia.ru