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# LITHIUM NATURAL RESOURCES AS A FACTOR OF SUSTAINABLE DEVELOPMENT IN CASPIAN REGION

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## Abstract

The work deals with the general problem of maintaining sustainable development in the transition to the new 5th technological paradigm. The achievement of the overall Sustainable Development Goals depends to a large extent on the fundamental Schumpeter-Kondratieff cycles. The shift in the paradigm is causing oil, as the backbone of the 4th technological paradigm, to lose its key role in the new environment. This poses a sustainable development challenge for the Caspian region, whose economy is based on oil and gas extraction. Innovative, knowledge-intensive, information and digital technologies are playing a leading role in the new paradigm. The implementation of these technologies depends primarily on the use of advanced lithium-type chemical current sources. The Caspian Sea region has a unique opportunity to solve the problem by developing its own natural hydro-mineral reserves of lithium. There are 56 lithium deposits already explored on the territory of Dagestan. Integrated development of these deposits using high-tech, knowledge-intensive physical and chemical methods will make it possible to extract on an industrial scale not only lithium carbonate, but also a whole range of minerals – burnt magnesia, food salt, technical iodine, bromine and calcium hypochlorite. A detailed analysis of the proposed solution shows the real possibility for the Caspian region to maintain a state of sustainable development in the transition to a new technological paradigm. The realization of these opportunities is not only of regional importance, but will contribute to strategic objectives nationwide.



*Keywords:* Caspian region, lithium, sustainable development, technological paradigm

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# 1. Introduction

The concept of sustainable development is one of the main socio-economic paradigms of modern society. The problem is a global concern. The 2017 General Assembly of the UN set out a plan of action for the coming period and identified common goals for the global community. The assembly's decision was enshrined in a special document, a set of 17 specific goals – the SDGs (Karnib, 2017).

# 2. Problem Statement

The SDGs cover various areas of society, the economy, the environment, culture, health, science, etc. These goals are interlinked with each other, and economics plays a defining role among them. However, we must consider that the economy has several problems of its own. Above all, it is the fundamental unevenness of its development.

But, at the same time, it is possible to identify certain regular cyclicalities in these irregularities. The best known cycles are short-term Kitchin cycles (~3...5 years), medium-term Juggernaut cycles (~7...11 years) and Smith cycles (~20 years). A generalization of these cycles is the long Schumpeter-Kondratieff cycles (K-waves, ~50...60 years) (Dudin, 2017).

# 3. Research Questions

## 3.1. Cycle-change phase as a source of instability

The long Schumpeter-Kondratieff cycles are the most significant in the evolutionary process. They are fundamental and result from the continuous development and accumulation of new technologies. After reaching a certain critical level, a phase of complete structural restructuring of the paradigm will inevitably occur (Ololade, 2017; Perez, 2009). The process is cyclical in nature.

We should recognize that cyclicality alone does not mean a violation of the principles of sustainable development. But in periods of transition, the elements of a new paradigm are just taking shape, and certain risks arise. The process of such restructuring entails the demise of obsolete technologies and the emergence of new elements of an emerging technological paradigm. Corresponding mathematical models clearly describe such situations when moments of bifurcation occur at singular points with the danger of destroying the structure of the economy (Vasilyeva et al., 2019).

The above discussion shows that economics is of paramount importance in addressing the overall problem of sustainable development. Special attention should be paid to periods of shifting economic paradigms.

## 3.2. Specifics of the transition to the new 5th paradigm

The modern world community is now entering the transition period described above, from the 4th technological paradigm to the next, 5th paradigm. This comes with all sorts of risks of loss of sustainability. It is important to consider that a new paradigm is taking shape on a fundamentally new basis of basic science, using innovative approaches. This was highlighted at a recent UNESCO (2022)

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congress, and the year 2022 has been declared as International Year of Basic Sciences for Sustainable Development.

This statement of the problem, in line with the principles of globalization, is rather generalized internationally. But the resolution of particular issues of the general problem must be sought in the context of the specificities of each region individually.

## 4. Purpose of the Study

This paper aims to examine how sustainable development can be sustained in the current stage of transition to the 5th technological paradigm for the specific Caspian Sea region.

The relevance of the problem to this particular region is due to the entire course of the development of the Caspian Sea region. Until now, the rich resources of the Caspian oil and gas province have provided a solid basis for sustainable development in the region. It was oil, as the backbone of the entire fuel and energy complex, that played a key role in the passing paradigm. In the emerging paradigm, oil is beginning to lose its defining role.

The current situation is fraught with serious repercussions and a total loss of sustainability for the region. This paper seeks to identify what the region can realistically do to preserve the principles of sustainable development in a changing technological paradigm.

## 5. Research Methods

When considering the sustainable development of the Caspian region in the present historical period, it is necessary to establish what points are key in forming the core of the new paradigm. Next, we need to look at the region's specific capacities to implement the identified key points of the paradigm.

### 5.1. Lithium as the 'new oil' in the 5th paradigm

At present, the 4th stage of technological paradigm still retains a fairly prominent role in the global economy. But, at the same time, elements of a new paradigm are emerging in technologically advanced countries, based on advances in the basic sciences using innovative solutions. This makes it possible to identify and point out promising breakthrough areas for development. These include, above all, information and computing technology, microelectronic systems, internet networks, telecommunications and navigation, robotics and other innovations.

A modern power supply is a critical and prerequisite for such solutions. Nowadays, the use of lithium sources is already becoming an established standard for various devices and systems in our everyday lives, but also in industrial production and transport. Oil loses its leading role in such an environment. In the new paradigm, the key role, that of 'new oil', will belong to lithium power sources.

Lithium, apart from its fundamental role in power generation, has unique properties as an additive for materials operated under extreme conditions, for space, and in nuclear and fusion power (Calisaya-Azpilcueta et al., 2020). These advantages of lithium ensure its key role not only in the transition to the 5th technological paradigm, but also in the longer term.

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The consideration above shows that one major key point in this transition period is inextricably linked to lithium. Consequently, the development of lithium fisheries is becoming an urgent strategic objective today.

### 5.2. World lithium production

When considering lithium production, it is important to consider that, until recently, lithium had a relatively modest place in the economy. Lithium has mainly been used for highly specialized purposes as a modifying agent in the development of various materials. Such materials with different specific properties are used in spacecraft construction, for military applications and in the nuclear industry. At the same time, the global production of lithium raw materials was very limited and mostly located in the former Soviet Union for domestic consumption. After the collapse of the USSR, lithium production was completely frozen (UNESCO, 2022).

The global economy is currently witnessing a lithium boom, the lithium revolution, due to the mentioned transition to a new technological paradigm. Global lithium production has tripled over the past 10 years and continues to increase at an accelerating rate. Large-scale development of lithium raw material deposits in the form of highly concentrated mineral springs and lakes is now concentrated in Chile, Argentina, Australia and China (Calisaya-Azpilcueta et al., 2020).

Russia in the current situation has to export lithium raw materials from abroad. With the new demands of an emerging technological paradigm, lithium production could be a solution to the problem of sustainable development. For the Caspian region, with the impending loss of the key role of oil, such an opportunity is particularly important.

## 6. Findings

### 6.1. Lithium deposits in Dagestan

As indicated above, it is possible to maintain the Caspian region's key role in the new technological paradigm by establishing and developing its own production of lithium raw materials. The region is rich in natural resources to meet this challenge. Moreover, Russia as a whole has huge reserves of lithium raw materials, amounting to 1/3 of the world's reserves. Moreover, we should note that a fairly large proportion of these reserves are concentrated in the Caspian Sea region.

For example, there are 56 already explored hydromineral deposits of lithium in Dagestan (Ramazanov et al., 2016).

### 6.2. Opportunities for the development and exploitation of the Berikeyskoye field

Scientists in geology have initiated a business plan for the development and exploitation of a promising deposit in Derbent district – the Berikeyskoye field of iodine-bromine groundwater (Institute of Geology, DSC, M.K. Kurbanov, V.I. Cherkashin). Integrated development of this deposit will make it possible to extract on an industrial scale not only lithium carbonate, but also a whole range of minerals – burnt magnesia, food salt, technical iodine, bromine and calcium hypochlorite.

The design of the development involved full respect for the environment. Now all that remains is to implement this plan with the participation of the relevant government agencies and business entities. In addition, the authors of the project believe that it would make sense to build a lithium battery and battery factory in the region, which would undoubtedly increase the profitability of the project. This will enable a production of lithium raw materials, which will be a significant step in addressing sustainability not only in this region, but also nationwide.

## 7. Conclusion

The development and exploitation of lithium raw materials in Dagestan will enable the Caspian region to move from the 4th to the 5th technological paradigm without losing its key role and will allow the necessary principles of sustainable development to be followed. The problem is of a long-term strategic nature and can be solved successfully with domestic natural resources and the support of the relevant agencies.

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