



Management of sustainable industrial development: innovative search for an adaptive approach in Kyrgyzstan

Temirbek S. Bobushev

Kyrgyz Economic University, 58 Togolok Moldo St., 720033 Bishkek, Kyrgyz Republic

ABSTRACT

From 1990 until today, diversification and in some cases a sharp decline of industrial production in Kyrgyzstan have not been properly accompanied by proactive planning and/or management strategies. The adopted 2019-2023 Strategy for Sustainable Industry Development of the Kyrgyz Republic [Decree of the Government of the KR, 2019], including its processing segment, mainly aims to foster the advancement of selected manufacturing sectors and exports, as well as to enhance the competitiveness of Kyrgyz-made industrial goods. Kyrgyzstan's industry represents one of the key elements of the national economy contributing approx. 20.0% to its GDP [NSC, 2021]. As a rule, adaptive management approaches are effectively applied to the operations of existing large industrial enterprises. Thus, it appears imperative to examine to what extent such approaches can be applied while assessing and managing the sustainable development of small- and medium-size industrial operations, and what corresponding restrictions exist. So far, the relevant terms are reflected neither in Kyrgyzstan's production management policies nor programs. A full-fledged application of adaptive management approaches will require significant effort. Therefore, the initial step towards their more systemic exercising could manifest itself in utilizing integrated adaptive management models to ensure achievement of specific goals as to the sustainable industrial and economic development of both Kyrgyzstan and the entire Central Asian Region.

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1. Introduction

The term sustainable development was proposed as a core concept describing the process when human conditions improve along with growing social wellbeing, yet the corresponding environmental impacts remain within the biosphere's capacity to self-restore, i.e. the natural foundation of humankind's existence does not get destroyed. In subsequent years (Brundtland, 1987), the concept's various modifications and application to multiple spheres of social and environmental development were proposed. Presently, sustainable development denotes a set of measures geared towards meeting the current human exigencies while at the same time preserving the environment and resources -- i.e. progressing without compromising the ability of the future generations to satisfy their own needs. The widespread use of the term and concept has led to its overuse and growing ambiguity. Reflecting on the matter has gradually led the author to the conclusion that sustainable development as such should embody a set of constituent elements (blocks) plus a development mechanism ensuring proper interaction among these blocks, as well as their materialization and evolution. Taking into account the above, as well as the current trends in the formation of various approaches to «green» economy, the author came to the most characteristic feature of modern development, i.e. correlation and balance between production and consumption (Bobushev, 2022).

In the current conditions, it appears necessary to apply circular economy methods at the earliest stage of industrial production -- product design -- to foster goods' reuse and recycling at the end of their life cycle. Expanding manufacturing does not always lead to higher consumption, and vice versa the growth in consumption does not always depend on production levels. Stated differently, there is no linear relationship between the two phenomena. Moreover, most often there is no temporal equilibrium in production and consumption dynamics. Apparently, this is due to the different manifestation of factors predetermining their evolution. The former (production) is closely linked to and reliant on resource availability and utilization, manufacturing efficiency and possibility to apply innovative production methods, i.e. technological advancement. The latter (consumption) rests on both economic and social achievements of a society in the manufacturing sector. At the same time, it should be borne in mind that consumption profile and scale largely depend on a nation's traditions and mentality, i.e. the prevailing consumption culture. This said, rational consumption is not always a derivate of production-related achievements. As the demand for goods increases, so does the need for their production. This translates into higher pollutant emissions, soil deterioration, deforestation, and accelerated climate change (Bobushev, 2019). To make optimal decisions re the production-consumption equilibrium, it is necessary to forge innovation-based

adaptive approaches with the aim of advancing manufacturing to best adapt it to the trends in the development of industrial production and current consumption levels. The essence of industrial innovations lies in ensuring a sufficient level/volume of production/services at minimal cost and use of natural resources accompanied by receding atmosphere, water, and land pollution.

Prior to characterizing the current state of Kyrgyzstan's manufacturing sector, it appears reasonable to review the key elements of sustainable industrial development per se. Above all, it is efficient resource use facilitating optimized supply-demand cycles, raw material extraction, as well as component use both in terms of designing final products and their market reuse/recycling. All these should ultimately foster environmental security based on corresponding business models, pollution control through waste reduction and reuse/recycling, as well as cutting-edge technologies for treating chemical emissions and eliminating pollution.

2. Current state of industrial production

The transformation of industrial enterprises as a result of declined production and disruption of economic interconnections that existed inside the former Soviet Union calls for altering the current perceptions of industrial complexes (Bobushev, 2007). Despite the importance and complexity of assessing industrial development trends, it poses a significant challenge due to the absence of this concept -- industrial complex - and its definition, be it in Kyrgyzstan's regulatory documents or in domestic scientific literature published after 1990-1995. Meanwhile, the concept of industrial complex has been and continues to be actively employed in certain countries, for example, US, Russia, China, several EU member-states. It is applying the concept of industrial complex which makes it possible to assess and determine the main tracks for designing and implementing national sustainable industrial development policies.

Today, Kyrgyzstan's main industrial complexes include the Fuel and Energy Complex (FEC) comprising the mining and energy segments. Gold and coal mining are the key contributors to the mining complex output. In the total production volume, the coal mining and, to a much lesser extent, oil and gas subsectors play a sharply auxiliary role, despite the fact that they constitute the strategic sectors in terms of national energy security.

The ongoing transportation infrastructure deficiencies likewise impose significant restrictions on domestic industrial growth by way of creating additional costs for manufacturing enterprises, and thus curbing their competitiveness in domestic and foreign markets. The prospects of boosting domestic coal production are closely linked with the growth in its domestic consumption, i.e. with import

substitution (phaseout) requiring expansion or at least restoration of the previous level of coal production, which will forge a solid foundation for advancing and enhancing Kyrgyzstan's energy sector. By way of illustration, in 2020 Kyrgyzstan produced 2.7 mln tons of coal -- 45% more than in 2016 (NSC, 2020), with almost half (43%) consumed by the domestic market (NSC, 2020). This volume surely exceeds the one produced in 2000 (419.2 thous. tons), but the country is still to reach the consumption (3,742 thous. tons) in 1990 (Bobushev, Otorbaev, 2006]. This subsector is particularly important because even the abundance of mountain rivers -- and thus opportunities to scale-up hydropower -- will not allow Kyrgyzstan ensure its energy security. The ongoing risks of utilizing hydropower are aggravated not only by climate change -- disrupting stable rivers' runoff -- but also by the instability of HPP dams in mountainous seismically active zones. Simultaneously, despite the overall attractiveness of renewable (natural) energies, in the grand scheme of things they are not capable of covering their anticipated share in Kyrgyzstan's energy balance.

The transition to adaptive and sustainable management methods in the FEC should foremost aim to eliminate the significant obstacles constraining the domestic power sector's profitability due to insufficient energy accumulation (storage) infrastructure and high transmission losses. Yet, with the exception of changing heating tariffs, so far state institutions and line departments have not proposed any other solutions to really reform the sector. Mainstreaming adaptive approaches in the power sector should comprise not only enhancing the management systems at industrial enterprises across the country, but also disaggregating heat and energy management systems, as well as rendering opportunities for saving and using these resources economically. Combined, these measures can drastically improve the profitability and efficiency of Kyrgyzstan's FEC.

Despite the importance of domestic FEC in terms of economic development, Kyrgyzstan's Agro-Industrial Complex (AIC) also plays a special role in the national economy. The share of agriculture in Kyrgyzstan's GDP amounts to 14.7% [NSC, 2020], with a significant proportion of production taking place at private farms. In addition, approx. 65% of the citizenry live in rural communities. Of the total number of all the employed, 34% (14% of the total population) are engaged in farming. In developed countries, this indicator amounts to 1-3%. This proves the fact that in Kyrgyzstan agriculture has not only economic, but likewise great social and political importance (Abdurasulov, Y., 2008). Significant employee population, small share of state-owned agricultural enterprises, low profitability and labor productivity in the sector necessitate the elaboration and deployment of adaptive production methods against the background of effectively lacking agricultural production policy, i.e. the sector's development by the residual principle. The lack of specific implementation

mechanisms and insufficiently thought-out agrarian reforms represent the main drawbacks of the adopted laws regulating the domestic agrarian sector. The development of AIC in general, and especially its 1st (production) and 4th (auxiliary industries, including food and light industry; processing, storage, and transportation of products; whole- and retail sale) subsectors (Isaev A.I., 1985), could benefit from the application of the production-processing-procurement-sale model. It could foster bringing the issues associated with the quality and certification requirements for agricultural products to the national level, as well as guarantee compliance of final products to national and international quality standards. The challenges associated with the institutionalization of rural communities and agricultural production inhibit the sector's comprehensive revival and utilization of domestic AIC advantages (Bobushev T.S., 2013).

Innovation-based adaptive approaches in agriculture should, first of all, rely on the broad development of farming businesses, i.e. creating suitable conditions for expanding agricultural processing subsectors. The processing and standardization of agricultural raw materials will ensure high product quality and possibilities to export them. Stimulating farming businesses will stimulate the agricultural production specialization not only in Kyrgyzstan, but within the Central Asian Region (CAR). In its turn, this will make the production of goods and services more efficient, as it will be done at relatively low cost as per the principle of comparative (relative) advantage. The main feature of production comparative advantage is its dependence solely on relative costs (Bobushev, 2007) , primarily constituting transportation costs.

The expanding international trade, strengthened internationalization and globalization of world economies, a growing number of contract-based unions and business-related travelling not only contribute to but also represent a steady trend in the development and upgrading of the transportation complex. Despite the high cost of creating, rehabilitating and operating transportation infrastructure in mountainous Kyrgyzstan, the process of advancing the transportation system -- within the domestic Transport and Tourism Complex (TTC) -- represents an important source and foundation of the economic growth of both Kyrgyzstan and the entire CAR. TTC's share in Kyrgyzstan's GDP is 25.2% (National accounts of the Kyrgyz Republic, 2021). Analyzing the state of the transportation infrastructure involves a systems-based assessment of its development. Essentially, it means that a country's transportation infrastructure network can serve an element of a regional transportation system. In this light, the spatial development of Kyrgyzstan's domestic transportation infrastructure and its involvement in a regional one can and should be logically arranged via a network of transport and logistics centers/hubs. Such a network may consist of a number of key elements, including the development of different transportation modes, roads, logistics entities, and export insurance systems.

As part of an adaptive approach to improve the efficiency of the transportation infrastructure, especially the rehabilitation and/or increased operating life of various road types in extreme natural conditions (mountainous and desert territories), foremost highways, it is necessary to use new pavement technologies. The service life of roads, especially in urban conditions, is currently known to not exceed 2-5 years. This is true for state highways in Kyrgyzstan characterized by severe unprofitability and inefficiency. It is critical to apply new technologies in the transportation network and road construction, including flyovers, cableways, logistics nodes and transport hubs. The latter can be freed of warehouse functions and used mainly for transshipment operations, which is also very important and necessary.

The transportation and tourism sectors interact and impact each other in multiple ways. In addition, as part of its industrial development, Kyrgyzstan plans to create and develop various industrial enterprises to provide tourism infrastructure, as well as promote the production of touristic souvenirs. However, the enhancement of tourism infrastructure appears a higher priority.

At present, the tourism industry is one of the most significant sectors of global and national economies, representing a complex mechanism greatly influencing the structure and nature of country-specific economic developments. Tourism development not only affects a country's economic performance, but also stimulates progress in multiple economic sectors: transportation, communications, trade, infrastructure construction, and recreation. In view of the aforesaid, the upgrading of agriculture along with the development of industrial production can lead to increased productivity, consumption, and tourist flows. It is precisely these directions of economic development which represent the most advanced stages of economic restructuring.

The ongoing tourism sector development distributes the global tourist flows among geographical areas, countries, and regions heterogeneously. Most of the tourist population traditionally prefers European and Asian countries. Along with these regions, the tourist flows to new and previously unpopular areas are growing also. In such conditions, the growing tourist service requirements naturally represent an important consumption criterion. This trend has been especially observed in recent years. The level of service in traditionally touristic countries around the world is known among tourists. This gives them the opportunity to compare the service quality offered in different countries and demand more. Thus, to ensure the sustainable development of Kyrgyzstan and CAR, the target countries should concentrate their economic, social and political efforts on the sustainable economic development of the Central Asian Region. The development of the tourism sector can and should become an indicator of that.

3. Methods of Research

The set of management theory concepts, approaches, and provisions applied within this research draws on the basic schemes of formalizing and organizing actual data. Some approaches are conventional but not actively applied at present; others require slightly different views on the essence of the subject-matter under discussion. This research has ultimately allowed proposing an approach enabling the identification of the main features, linkages, and consistencies of a unified production-consumption system.

The identification of industrial complexes inside various economic sectors as industrial and infrastructure enterprises aims to satisfy a system of needs within society. This approach also ensures monitoring of the state and performance of industrial complexes, as well as designing policies fostering sustainable development.

4. Results and Discussions

Population growth and consumer habits are rightfully considered among the main causes of global climate change and other environmental processes taking place at the present stage of our planet's development. To respond to these challenges, novel approaches to economic development are required, i.e. such development should assume the transformation of industrial production as well as overcoming the environmental consequences of irrational nature management. In this regard, industrial production innovations should gradually lead to a change in consumption per se -- subject of long-time debate and discussions - yet not only in terms of its mere reduction, although limiting consumption might also be necessary albeit inconvenient.

Changing consumption scale and profile is a matter of influencing consumer habits and overall lifestyles. Thus, there is a need for a broader mainstreaming of the pro-environmental agenda within the framework of economic reforms and public eco-interventions, which still remain meager. Hence, the growing environmental pollution and greenhouse gas emissions, reduction of green space (including forests), as well as the adverse changes in natural ecosystems and climate, and their consequences.

The critical nature of the decision to reduce consumption lies in the fact that the only real way to significantly cut it is to eliminate the root cause of the problem. Enacting a policy to downsize individual requirements for limited resources may work to an extent, but in most cases is unlikely to address the core underlying factor. Restricting the privacy and freedom of citizens, especially in developed countries -- where everyone is entitled to a generally high standard of living and enjoyment of life -- may require a huge and probably unacceptable price, although in reality it

is only a matter of altering high consumption habits actively cultivated in developed countries. Irrespective of how one interprets the freedom of unlimited consumption in such countries, the prime cause is still the same, and it is it that ultimately leads to environmental changes.

On the one hand, under the current socio-economic systems, state institutions are unlikely to actually restrict consumption through interventionist measures since their key objectives include creating new jobs, increasing employment, household incomes, consumption, investment, and state budget tax revenues. On the other hand, according to the currently dominating formula of state interventionism, entrepreneurship and, broadly speaking, any economic activity is stimulated under corresponding unemployment and poverty reduction strategies.

In certain cases, publicly commissioned and funded social media campaigns promote specific and selected pro-environmental measures, indicating the need to reach sustainable development goals. However, large-scale actions by public authorities leading to substantial consumption reduction with the aim of limiting natural resource use, waste generation, and pollutant release are quite rare or even absent. In light of these circumstances and considering the example of Kyrgyzstan -- specifically, the prospects of its domestic industrial development -- an adaptive approach to stimulating such production, as it appears, should be based on the conventional models of integrated multi-purpose industrial complexes in energy, agriculture, transportation, and tourism sectors.

5. Conclusion

Industrial production and consumption basically refer to the «use of services and auxiliary products» satisfying basic human needs and providing a better quality of human life. As the demand for goods increases, the need for their production also grows. This translates into mounting pollutant emissions, land deterioration, deforestation, and accelerated climate change. As part of an overall environment protection strategy, the production of goods and services should warrant efficient use of natural resources, as well as reduction of waste and pollutant emissions throughout the entire production cycle. In turn, this requires changing the way industrial production and consumption of goods and resources operate to ensure food security and shifting towards a more resource-efficient economy. Thuswise, the paramount objective of the current stage of human evolution should be the transition to more sustainable models of industrial production and consumption. Transition to sustainable industrial production and consumption of goods/services within industrial complexes is crucial to reduce the negative impacts on climate and environment, as well as human health. In other words, sustainable industrial production and

consumption are about doing more and better with less, as well as about decoupling economic growth and environmental degradation, improving resource efficiency, and promoting sustainable lifestyles. Sustainable production inside industrial complexes and sustainable consumption can also significantly contribute to poverty reduction and transition to a low-carbon and «green» economy. In its turn, sustainable consumption means ensuring sustainable environmental activities, inter alia a broader use of renewables and resource-efficient goods and services. Sustainable consumption is driven by many complex and interrelated factors, including demographics, incomes and prices, technologies, trade and tourism, politics and infrastructure, as well as a wide spectrum of social, cultural and psychological factors. Against this background, industrial operations inside various economic sectors including extractive industries, agriculture, energy, transportation and tourism directly impact the majority of environmental processes caused by such production (Bobushev T.S., 2022). That said, it is the scale and nature of consumption that constitute the fundamental causal factors and drivers of change in industrial manufacturing. It is consumption that primarily imposes direct and indirect pressures on the environment as a result of utilizing resources and services.

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