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Sustainable Value Chain as a Tool for the Development of ESG-Models of Petrochemical Industries

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ABSTRACT

The article presents the results of a study aimed at substantiating the need to develop the principles of sustainable development in the oil and gas sector of the economy, which, in turn, determines the change of the raw commodity material model of economic development and the transition to the ESG principles of all enterprises within the industry to ensure the targets of the concept of sustainable development. The search for new ways to manage the added value of the oil and gas sector of the economy is determined by the shift of interests towards renewable energy sources, which limits the use of conventional hydrocarbons and, as a result, leads to a reduction in demand for them. Within the framework of a certain problem, the authors consider the value chain of the oil and gas sector of the economy, taking into account the implemented ESG principles, which allows taking into account the interests of all participants: government-business-science-education. The authors define the current state of industrial development at the point of bifurcation, which necessitates the transformation of existing business models by improving the concept of added value through product life cycle assessment. The authors also identified the principle of emergence of ESG-transition of industrial enterprises, contributing to the widespread introduction and implementation of the principles of sustainable development in the oil and gas sector. In addition, the article discusses circular business models involving the practice of increasing the added value of petrochemical industries by transforming the value chain. Taking into account the regularity of added value from the production cycles of Stan Shi's product, the authors constructed a «Smiling curve» of changes in added value for the oil and gas sector of the economy, which once again proves that high added value in the oil and gas sector of the economy is created in the petrochemical industries. Taking into account these circumstances, the authors proposed a sustainable life cycle of products of petrochemical industries (using the example of polypropylene).
Keywords: petrochemical production; ESG models; sustainable development; oil and gas sector of the economy; value chain; Smiling curve; circular business models; low-carbon regulation; ESG transformation

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INTRODUCTION

In today's dynamically changing environment, business development in monopolised industries is a complex task. This is due to the transition to a new technological level involving accelerated innovation progress, automation, and digitalisation of all production processes, which poses certain environmental, social, and managerial threats both for an individual business entity and the economy as a whole. First of all, the changes taking place in the economy will affect the oil and gas sector, as these industries are energy-intensive (due to the geographically limited possibility of using renewable energy sources), import-intensive (as the equipment of oil and gas chemical plants is predominantly imported) and carbon-intensive (due to the fact that the main volume of greenhouse gas emissions along the aggregated value chain falls on the extraction of hydrocarbon raw materials and accounts for 59% (3,297 million tonnes of CO_2)[1] [1–4]. Further, the related industries will be subject to transformation, in particular, machine building. In addition, the global economy is on the threshold of the new industrial period, which implies a shift of interests to product life cycle management. This favours the development of tools for shaping the business models of oil and gas industries by improving the value chain.

The conceptual basis of this study was the theoretical approaches to value formation by A. Smith, D. Riccardo, K. Marx, etc., defining the concept of surplus (added) value, as well as the problems of value chain development reflected in the works of M. Porter, G. Gereffi, M.V. Mayer, and studies of the regularity of changes in added value at different stages of the product life cycle by Stan Shea. [5–9].

[1] Strategy of socio-economic development of the Russian Federation with low greenhouse gas emissions until 2050. URL: http://static.government.ru/media/files/ADKkCzp3fWO32e2yA0BhtIpyzWfHaiUa.pdf (accessed on 05.05.2022).

MAIN PART

According to Stan Shea's research, value added is only created at the ends of the Smiling Curve, i.e., if we talk about the oil and gas sector,— in the oil and gas chemical industries. However, growth points have not yet been reached, so it is advisable to improve the value chains of such industries (*Fig. 1*).

Thus, the improvement of the oil and gas sector value chain management (VAC) should be determined by the reallocation of priorities towards oil and gas chemical (OGC) industries. In addition, the increase of the chain can be achieved only through the organisation of sustainable (circular) petrochemical industries, i.e., through the use of polypropylene processing products in the production process. This is possible only by following ESG principles and introducing them into petrochemical production cycles, which will also contribute to the achievement of sustainable development goals (*Fig. 2*)

The concept of product value creation developed by Michael Porter can be complemented by elements that develop the activities of the OGC industries and increase the value chain, which take into account ESG principles. This will contribute to the importance of the concept of sustainable development of the oil and gas sector of the economy, since the elements introduced in the value chain are consistent with the principles of sustainability and allow the application of circular models in the oil and gas sector of the economy, involving: closed-cycle production; energy substitution technologies, CO_2 capture; extension of the product life cycle. Therefore, when forming an ESG strategy and changing the old model of economic development, it is necessary to take into account the objectives minimising the negative and increasing the positive impact on the value chain. Thus, according to the authors, the priority for the development of ESG models of oil and gas chemical production facilities is: reduction of

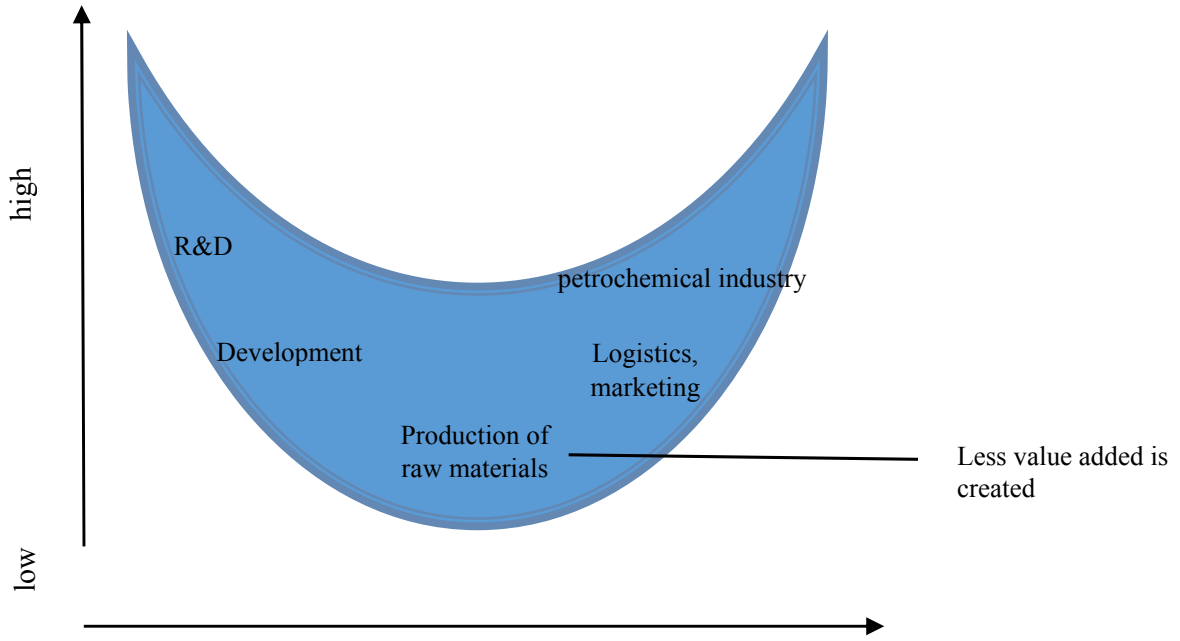

Fig. 1. **Smiling Curve of the added value of the oil and gas sector of the economy**

Source: created by the authors on the basis of Stan Shi's research.

CO_2 emissions; improvement of CO_2 capture technologies; improvement of RES (renewable energy sources) technologies; reduction of injuries; creation of new jobs; increase of transparency of company management actions and openness of indicators for achieving the SDGs; reduction of the corruption component. All this will contribute to the achievement of sustainable development goals [10–12].

The most promising and sustainable business models for the formation of circular value chains of petrochemical industries are product life cycle extension, resource recovery and circular supply (see *the Table below*).

Among circular business models, there are also platforms of product sharing through rent, hire, leasing and the "service instead of product" model, based on the exploitation of the product with the ownership of the product remaining with the manufacturing company. It should be noted that the formation of sustainable business models in oil and gas chemistry achieves the principle of emergence, which consists in the fact that some of the industries that have implemented ESG strategy in their business models create conditions for ESG-transformation of other industries in this market (industry). This contributes to increased competitiveness within the industry, business development and related industries (in particular, mechanical engineering).

According to the authors, ESG-transformation of petrochemical business models is possible when improving the value-added chain by influencing the assessment of the life cycle of petrochemical products, where it is supposed to take into account the dependence of the production impact on the environment throughout the entire cycle of the chain (from production to product utilisation). Thus, the cycles of the value chain where ESG principles are implemented have the least negative impact on the environment, because at each stage it is assumed to evaluate indicators characterising one or more ESG principles, which is in line with the sustainable development goals (*Fig. 3*).

With this in mind, the model of circular cycles of polymer production (high value-

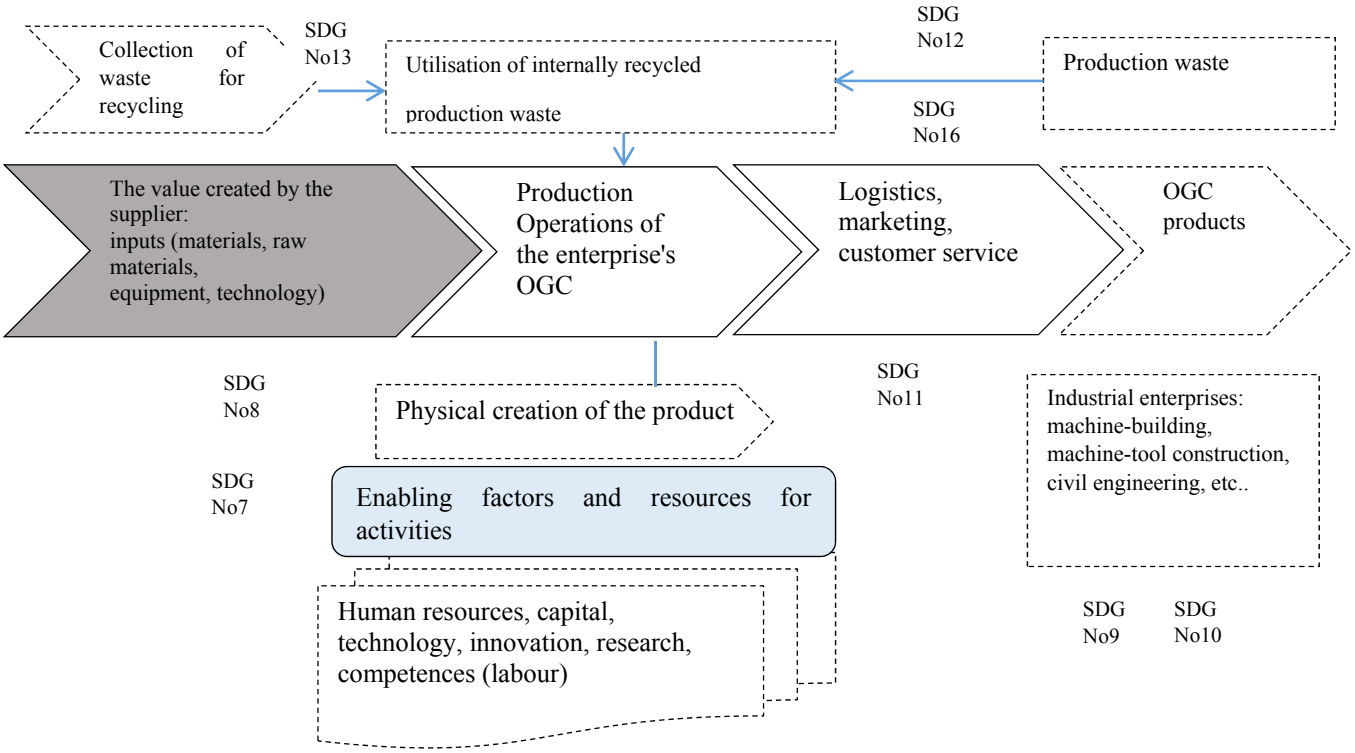

Fig. 2. **Sustainable value chain of products of petrochemical industries**

Source: developed by the authors on the basis of M. Porter's value creation system.

added products of OGC industries) assumes the use of not only hydrocarbons but also recycled raw materials in the main production. Today, the use of recycled materials is limited in high value-added production (in particular, in oil and gas chemistry), which hinders the increase in added value.

CONCLUSIONS AND RECOMMENDATIONS

Further development of the industry is impossible without a transition to a more sustainable model (*Fig. 4*).

To achieve the goals of sustainable development and accelerated implementation of ESG principles in the practice of domestic oil and gas chemical industries, it is necessary to replace the existing business models with circular ones, such as the model of product life cycle extension (use for synthesis of polymer products not only traditional sources of raw materials: oil, gas, straight-run petrol, but also processing products obtained as a result of treatment of recycled polymer waste); the model of resource recovery (organisation of closed-cycle production); circular supply (transformation of the energy balance within the enterprise: replacement of traditional sources with renewable ones, reduction of energy intensity of production facilities, application of energy substitution technologies). This creates new opportunities for improving the value chain of petrochemical production. Thus, when the value chain is supplemented with the cycle of production of goods from recycled materials, the first one increases, hence the added value of the oil and gas sector of the economy and industry as a whole increases. However, the transformation of the existing model of development of domestic oil and gas chemical industries is complicated by the inconsistency of the goals of the "state-business-education-science" spiral defined in the strategic documents

Table

Types of business models that take into account ESG principles in petrochemical industries

Type of business model	Characteristics	Practice
Business model of product lifecycle extension	Applicable in various industries, it implies early identification of problems (regarding repair, reconstruction, modernisation). For example, in order to increase the service life of equipment, it is necessary to carry out timely maintenance	It is used for oil and gas chemical production; it involves construction of polymer processing plants to obtain secondary raw materials or upgrading of pyrolysis facilities to produce polypropylene with the ability to process recyclable materials
Resources Recovery	Applicable to industries in which the production of a commodity is carried out through a closed cycle	Renewable production and consumption concept involving the use of Vivilen brand plastic waste and recyclable materials in production; actively implemented in SIBUR Group's business model (in the long term, it is planned to use 100,000 tonnes of polymer waste annually in the production process in own projects and projects with partners).
Circular supplies	Replacing traditional resources with renewable sources	SIBUR is integrating the use of oil and gas by-products into its business models to reduce CO_2 emissions. Petrochemical leaders in Russia have also implemented an automated energy balance system to track and reduce energy intensity in production

Source: created by the authors according to the data of petrochemical industries.

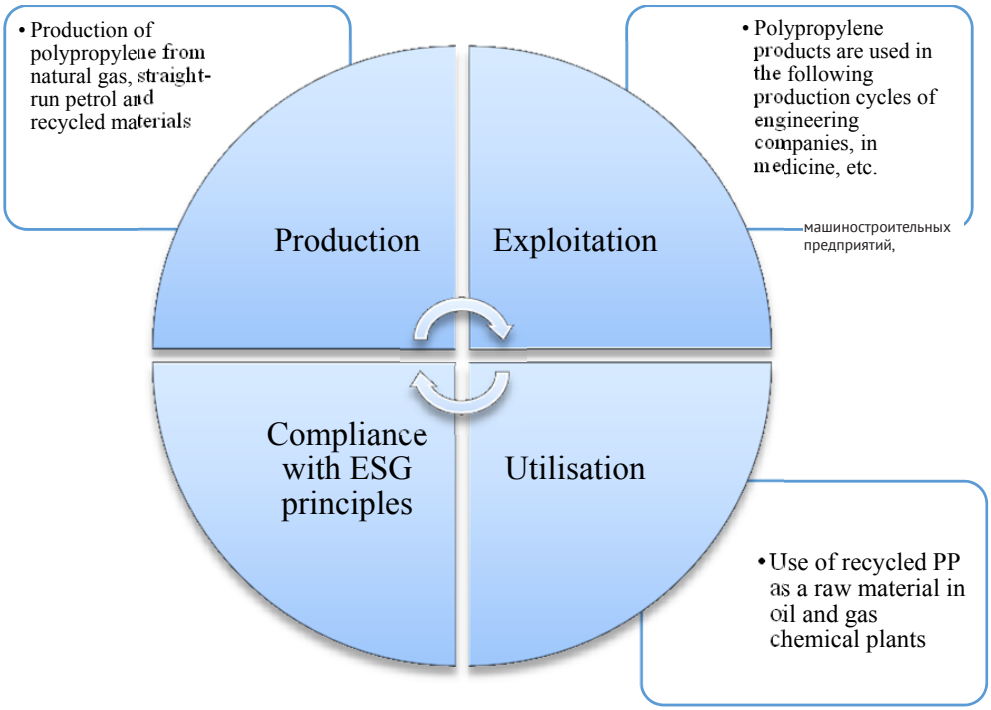

Fig. 3. **Circular life cycle of products with high added value in the oil and gas sector (on the example of polypropylene), taking into account the principles of ESG**

Source: developed by the authors.

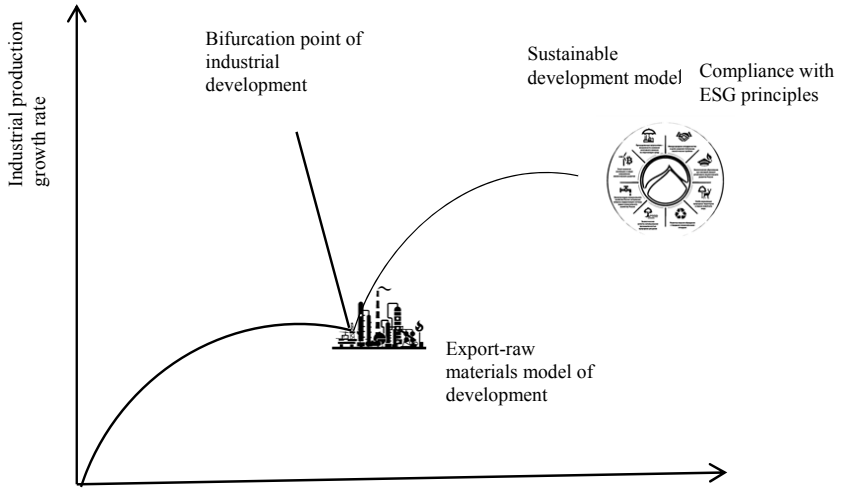

Fig. 4. **The point of bifurcation of the current state of development of the national economy, in particular the non-resource sector of the economy**

Source: developed by the authors.

of sustainable development of the Russian Federation. This contributes to the delay in the transition to a sustainable development model. In addition, when changing the raw material model, oil and gas chemical business can compete both within the industry and on the global market, as compliance with ESG principles creates new points of growth not only for production facilities, but also for the entire national economy.

REFERENCES

1. Vechkasova M. ESG-transformation of Russian petrochemical industries based on a targeted approach. *Human Progress*. 2023;9(1):4. (In Russ.). DOI: 10.34709/IM.191.4
2. Vechkasova M.V., Deberdieva E.M., Basueva S.N. Target approach in the study of the development of high-value-added industries in the oil and gas sector of the economy. *Industrial'naya ekonomika = Industrial Economics*. 2022;1(4):6–13. (In Russ.). DOI: 10.47576/2712–7559_2022_4_1_6
3. Vechkasova M.V. Regulation of the development of high-value-added industries in the oil and gas sector of the economy. Cand. econ. sci. diss. Synopsis. Tyumen; 2022. 28 p. (In Russ.).
4. Kapitsa S.P., Kurdyumov S.P., Malinetskii G.G. Synergetics and future forecasts. 3rd ed. Moscow: Editorial URSS; 2003. 288 p. (In Russ.).
5. Porter M.E. Competitive advantage: Creating and sustaining superior performance. New York, NY: The Free Press; 1998. 592 p. (Russ. ed.: Porter M. Konkurentnoe preimushchestvo: Kak dostich' vysokogo rezul'tata i obespechit' ego ustoichivost'. Moscow: Alpina Publisher; 2016. 1321 p.).
6. Porter M. The economic performance of regions. *Regional Studies*. 2003;37(6–7):549–578. DOI: 10.1080/0034340032000108688
7. Smith A. Recherches sur la nature et les causes de la richesse des nations. (In 5 vols.). Paris: Agasse; 1802. 2569 p.
8. Ricardo D. On the principles of political economy and taxation. London: John Murrey; 1817. 589 p. (Russ. ed.: Ricardo D. Nachala politicheskoi ekonomii i nalogovogo oblozheniya. Izbrannoe. Moscow: Eksmo; 2007. 960 p.).

9. Kaplinsky R. Global value chains: Where they came from, where they are going and why this is important. Innovation, Knowledge, Development Working Paper. 2013;(68). URL: https://www.open.ac.uk/ikd/sites/www.open.ac.uk.ikd/files/files/working-papers/ikd-working-paper-68.pdf
10. Novikova N. V. Cyclic-wave methodology of the study of new industrialization. In: Economic, social and spiritual renewal as the basis of the new industrialization of Russia. Proc. 5th Ural sci. readings of professors and doctoral students of social sciences. Yekaterinburg: Ural State University of Economics; 2018:93–102. (In Russ.).
11. North D. Institutional change: A framework of analysis. In: Braybrooke D., ed. Social rules: Origin, character, logic, change. New York, Abingdon: Routledge; 1996:189–202. (Russ. ed.: North D. Institutsional'nye izmeneniya: ramki analiza. *Voprosy ekonomiki.* 1997;(3):6–17.).
12. Osipov Yu. M. Neo-industrialization: Essence, meaning and implementation mechanisms. *Filosofiya khozyaistva = Philosophy of Economy.* 2013;(3):283–288. (In Russ.).

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M.V. Vechkasova — development of the general concept of the study, processing of the results of the study.
A.A. Zubarev — development of the structure of the article.
S.Yu. Shevchenko — formulating the relevance of the study.

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