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Svetlana. A. Linok^{ID 1*}, Yana. N. Linok^{ID 2}¹D. Serikbayev East Kazakhstan technical university, Ust-Kamenogorsk, Kazakhstan²Kazakh-American Free University, Ust-Kamenogorsk, Kazakhstan

The Formation and Development of a Closed-Loop Economy in Germany and Kazakhstan

ABSTRACT. The article addresses the critical issues surrounding the formation and development of a closed-loop economy in both Germany and Kazakhstan. Its primary purpose is to determine the possibilities of implementing the Germany's successful experience in Kazakhstan. The article provides a comprehensive analysis of the system of German legislation related to waste management and circular economy principles, tracing its evolution over time. The main stages of the transition to a closed-loop economy in Germany are highlighted. Its high efficiency and key growth factors are shown. The article examines the current state of Kazakhstan's transition towards a closed-loop economy. The peculiarities of the formation conditions and the main characteristics of the closed-cycle economy in Kazakhstan are revealed. The formation of the necessary legal framework is analyzed. The main problems of waste management are highlighted. A comparative analysis of the features of the transition to a closed-loop economy in Germany and Kazakhstan is carried out to identify the similarities and differences between the two countries' approaches, drawing attention to the lessons Kazakhstan can learn from Germany's experience. Based on this analysis, the article proposes recommendations for improving the effectiveness of the formation of a circular economy in Kazakhstan taking into account the experience of Germany.

KEYWORDS: closed-loop economy, formation and development, features of Germany and Kazakhstan, comparative analysis, proposals.

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* Corresponding author: Linok Svetlana Albertovna, e-mail: lin_svetlana@mail.ru

Линок С.А.  ^{1*}, Линок Я.Н.  ²

¹ Д. Серікбаев атындағы Шығыс Қазақстан техникалық университеті, Өскемен қ., Қазақстан

² Қазақстан-Американдық еркін университеті, Өскемен қ., Қазақстан

Германия мен Қазақстанда тұйық цикл экономикасын қалыптастыру және дамыту

АНДАТПА. Мақала Германия мен Қазақстандағы тұйық циклді экономиканы қалыптастыру және дамыту мәселелеріне арналған. Оның негізгі мақсаты – Германияның осы саладағы табысты тәжірибесін Қазақстанда енгізу мүмкіндіктерін айқындау. Мақалада қалдықтарды басқару және айналмалы экономика қағидаттарына қатысты Германия заңнамасының жүйесіне жан-жақты талдау жасалып, оның уақыт өте келе қалыптасуы мен даму эволюциясы қарастырылады. Германияның тұйық циклді экономикаға көшуінің негізгі кезеңдері айқындалып, оның жоғары тиімділігі мен дамуының басты факторлары көрсетілген. Сонымен қатар, мақалада Қазақстанның тұйық циклді экономикаға көшуінің қазіргі жай-күйі зерттеледі. Қазақстандағы тұйық циклді экономиканың қалыптасу жағдайларының ерекшеліктері мен негізгі сипаттамалары ашып көрсетілген. Қажетті құқықтық базаның қалыптасуы талданып, қалдықтарды басқару саласындағы негізгі мәселелер айқындалған. Германия мен Қазақстанның тұйық циклді экономикаға көшу ерекшеліктеріне салыстырмалы талдау жүргізіліп, екі елдің тәсілдеріндегі ұқсастықтар мен айырмашылықтар анықталған, сондай-ақ Қазақстанның Германия тәжірибесінен ала алатын негізгі сабақтарына назар аударылған. Жүргізілген талдау негізінде мақалада Германия тәжірибесін ескере отырып, Қазақстанда айналмалы экономиканы қалыптастырудың тиімділігін арттыруға бағытталған ұсынымдар ұсынылған.

ТҮЙІН СӨЗДЕР: тұйық циклді экономика, қалыптасуы және дамуы, Германия мен Қазақстанның ерекшеліктері, салыстырмалы талдау, ұсыныстар.

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* Хат-хабаршы авторы: Линок Светлана Альбертовна, e-mail: lin_svetlana@mail.ru

Линок С.А. ^{1*}, Линок Я.Н. ²

¹ Восточно-Казахстанский технический университет им. Д. Серикбаева, г. Усть-Каменогорск, Казахстан

² Казахстанско-Американский Свободный Университет, г. Усть-Каменогорск, Казахстан

Формирование и развитие экономики замкнутого цикла в Германии и Казахстане

АННОТАЦИЯ. Статья посвящена актуальным вопросам формирования и развития экономики замкнутого цикла в Германии и Казахстане. Ее основная цель заключается в определении возможностей внедрения успешного опыта Германии в Казахстане. В статье представлен комплексный анализ системы германского законодательства, связанного с управлением отходами и принципами циркулярной экономики, с прослеживанием ее эволюции во времени. Выделены основные этапы перехода Германии к экономике замкнутого цикла, показаны ее высокая эффективность и ключевые факторы роста. Также в статье рассматривается текущее состояние перехода Казахстана к экономике замкнутого цикла. Раскрываются особенности условий формирования и основные характеристики экономики замкнутого цикла в Казахстане. Анализируется формирование необходимой правовой базы. Выделяются основные проблемы управления отходами. Проведен сравнительный анализ особенностей перехода к экономике замкнутого цикла в Германии и Казахстане с целью выявления сходств и различий в подходах двух стран, при этом особое внимание уделяется урокам, которые Казахстан может извлечь из опыта Германии. На основе проведенного анализа в статье предлагаются рекомендации по повышению эффективности формирования циркулярной экономики в Казахстане с учетом опыта Германии.

КЛЮЧЕВЫЕ СЛОВА: экономика замкнутого цикла, формирование и развитие, особенности Германии и Казахстана, сравнительный анализ, предложения.

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* Автор-корреспондент: Линок Светлана Альбертовна, e-mail: lin_svetlana@mail.ru

INTRODUCTION

The formation and development of a circular economy is a current trend in many countries, including Germany and Kazakhstan. The volume of the global market for this economy was estimated at \$583.55 billion in 2023 and is projected to grow to almost \$2.9 trillion by 2031. A significant share of this market in 2023 was occupied by the European closed-loop economy market - about 38.8%, with an estimate of \$226.3 billion (Kings Research, 2024).

A closed-loop economy is “an economy based on the renewal of resources, an economy with closed cycles, where the waste of one process becomes the input of another” (Ausharipova & Kulumbetova, 2020), that is, an economy based on the renewal of resources. It is also often called a circular or cyclical economy.

The basic principles of the closed-loop economy are to reduce, reuse, recycle (3R). There are also broader R-concepts.

The transition to a closed-loop economy is due to the exhaustion of natural resources and a shortage of raw materials, the deterioration of the ecological environment, the urbanization of territories, the development of resource-saving technologies and industries for extracting raw materials from waste. It allows, first of all, to use available resources more efficiently, to reduce waste and ensure its recycling, and to reduce the negative impact of production on the environment.

Germany is a recognized leader in the field of circular economy in Europe. Kazakhstan is at the initial stage of forming such an economy, and Germany's experience is of great interest and practical value to it, including from the point of view of developing proposals to improve efficiency and accelerate the formation of key elements of a closed-loop economy in Kazakhstan. This is what this article is devoted to.

Accordingly, the purpose of this study is to consider the experience of the transition to a closed-loop economy in Germany and Kazakhstan, compare the country characteristics of this process, and determine the possibilities of implementing Germany's successful experience in Kazakhstan.

To achieve this goal, it is necessary to solve the following tasks:

- study the experience of transition to a closed-loop economy in Germany;
- analyze the Kazakhstani experience of forming such an economy;
- identify the features of the conditions for forming a closed-loop economy in Kazakhstan;
- carry out a comparative analysis of the formation and development of this economy in Germany and Kazakhstan;
- determine the possibilities of implementing Germany's experience in the context of Kazakhstan;
- provide proposals for an effective transition to a closed-loop economy in Kazakhstan.

LITERATURE REVIEW

Individual elements of a closed-loop economy have existed in practice for a long time (collection and recycling of waste paper, scrap metal, glass, etc.), and its theoretical concept with principles, priorities, and mechanisms was developed relatively recently.

The term “closed-loop economy” (“circular economy”) appeared at the turn of the 80-90s of the XX century. It was first introduced into scientific circulation by D. Pierce, R. Turner, and A. Nies, whose research was related to the problems of waste-free production based on waste reduction and recycling. In recent decades, scientists from different countries, primarily developed ones, have been actively researching the problems of efficient use of resources, reducing the negative impact on the environment and the transition to a closed-loop economy (circular economy). Among them, in particular, K. Bowling, M. Geisdorfer, G. Daly, D. D'Amato, N. Giorgescu, D. Korhonen, D. Kirchherr, P. Lacy, D. Long, Z. Liu, V. Prieto-Sandoval, S. Ritzen, G. Sandstrom, W. Spindler and many others stand out. In 2010, the Ellen MacArthur Foundation was created, which is engaged in the popularization of circular economy ideas. In 2014, it, in particular, created the Circular Economy 100 network, which included 100 global corporations operating in accordance with the principles of the circular economy. There are other successful examples of combining theoretical and applied aspects of this economy.

In recent years, scientists in Kazakhstan have also been actively engaged in research into the closed-loop economy. For example, the works of scientists from Al-Farabi Kazakh National University on the topic of “Development of a Circular Economy in Kazakhstan: Potential, Trends, Prospects”, S. Seifullin Kazakh Agro-Industrial University on the topic of “Analysis of the Problems of Circular Economy Development in the AIC of Kazakhstan with the Development of a Model for Using Its Capabilities in Modern Conditions” and others are well-known. The problems of transition to a closed-loop economy are the subject of articles by D. Ausharipova, E. Akhanov, A. Zhidebekkyzy, S. Zeynolla, L. Kulumbetova, Zh. Temirbulatova, A. Tleppayev and other domestic authors.

By now, the concept of transition to a closed-loop economy has acquired a holistic form, and relevant educational literature has appeared. It systematically describes the closed-loop economy model, the stages of its formation, structure, infrastructure, levels, and foreign and domestic experience in creating a closed-loop economy. There are publications on the transition to a circular economy in individual countries and their associations, for example, in Europe and Asia. Among them, there are articles devoted separately to Germany, which created a circular economy, and separately to Kazakhstan, which began to form such an economy.

Thus, H. Mohajan considered Germany is Ahead to Implement Sustainable Circular Economy (Mohajan, 2021), and G. Melles and C. Wölfel with co-authors - Expert and Diffuse Design of a Sustainable Circular Economy in Two German Circular Roadmap Projects (Melles et al., 2022), etc.

Kazakh scientists D.E. Ausharipova, L.B. Kulumbetova, for example, considered the circular economy as a tool for developing “green” business in Kazakhstan (Ausharipova & Kulumbetova, 2020), and in collaboration with E. Tankova - innovative business models for developing environmental entrepreneurship in the waste sector of Kazakhstan (Ausharipova, Kulumbetova & Tankova, 2023), etc.

There are also scientific publications devoted to the closed-loop economy of Germany as part of the EU, as well as elements of such an economy in Kazakhstan in relation to Central Asia and other Asian countries.

Thus, F.J. Castillo-Díaz with co-authors considered Challenges and perspectives of the circular economy in the European Union: A comparative analysis of the member states (Castillo-Díaz et al., 2024), and B. Peyravi, with co-authors - The Circular Economy Practices in the European Union: Eco-Innovation and Sustainable Development (Peyravi et al., 2024), etc. They also present the experience of Germany.

Interesting material on Kazakhstan is presented, for example, in the World Bank report “Circular Economy: A Chance for Central Asia” (World Bank, 2024), the article by A.B. Dolgushin on the specifics of state regulation of the transition to a circular economy in relation to waste in Asian countries (Dolgushin, 2022), etc.

The novelty of this study lies in its specific comparative analysis of the formation and development of a circular economy in Germany, a developed European country, and Kazakhstan, a developing Eurasian state. This will allow, in particular, to identify opportunities for the effective application of best international practices in developing a modern circular economy in Kazakhstan, given its specific circumstances. This approach also determines the practical significance of this study.

MATERIALS AND METHODS

In the process of considering the transition to a circular economy in Germany and Kazakhstan, the following general scientific methods of cognition were used: scientific abstraction, analysis, synthesis, induction, and deduction. In addition, the comparison method (of the experience of different countries), the tabular method (when considering the main indicators of waste collection, sorting and recycling, to compare the main characteristics of the circular cycle in Germany and Kazakhstan), and the analogy method (in developing proposals for the use of German experience in Kazakhstan), statistical research methods (of various elements of the circular economy) were used. The data from expert assessments, legislation and regulatory legal acts (NPA), and statistical and factual materials were used, characterizing the formation and development of the circular economy

in Germany and Kazakhstan.

As was previously noted, Germany was the first European country to begin the transition to a circular economy. In 1972, a waste management law was passed, and Germans began to separately collect plastic, glass, paper, and food waste. Since 1991, “extended producer responsibility” has been introduced for the disposal of used packaging. In 1996, the Law on Closed Cycle of Substances and Waste Management was adopted, and since 2005, the disposal of untreated waste at landfills has been prohibited,

An important step in the development of German circular economy legislation was the Circular Economy Act, adopted in 2012. It highlights its key goals: prevention of waste generation; optimization of the process of waste inclusion in recycling; and more efficient use of natural resources (German Federal Government, 2012). This law also defines the main responsibilities of the circular economy to prevent waste generation, transfer it for recycling, and the need to recycle waste if technically possible and economically feasible.

In further development of the Law on Closed Economic Cycle, the following were subsequently adopted: a regulation on end-of-life vehicles, a law on electronic and electrical equipment, a law on packaging, etc. The law on packaging, for example, stipulates that from 2022 the recycling share must be at least 90% for cardboard and paper, glass, aluminum, and ferrous metals; at least 70% for combined packaging; at least 60% for plastic (German Federal Government, 2017).

The further development of the circular economy in Germany is carried out on the basis of the roadmap for the period up to 2030.

It is also worth noting the increase in target indicators for the preparation of household waste for recycling, which should be at least 60% by weight in total no later than January 1, 2030, and at least 65% no later than the beginning of 2035 (German Federal Government, 2021).

The transition to a closed-loop economy in Germany began in the 70s and 80s with waste management, then the emphasis began to be on waste-free production, and over the past 15 years on achieving sustainable economic growth with maximum conservation of natural resources through the development of alternative sources, green innovations, and the industrial paradigm. This was reflected in the evolution of the relevant German legislation.

The country's waste processing and disposal system has become a high-tech industry. This has been achieved through the development and implementation of a national model for the transition to a circular economy, which includes the following stages:

1. Mainly unorganized disposal. It involves non-compliance with the principles of environmental protection, hygiene of urban space, and insignificant collection of valuable materials for recycling by the so-called informal sector.
2. Organized landfills (reliable waste collection and improved storage facilities). Includes primarily the construction of organized storage facilities and manual sorting of waste at special points.
3. Separate collection and sorting of waste. It includes: the use of different containers for different types of waste; the use of sorting units; and the creation of processing and sale of secondary raw materials.
4. The creation of a material recycling system. At this stage: technologies for separating types of plastic are used; units for obtaining biogas and/or compost from biowaste are used; units for incinerating waste to generate thermal energy are used, etc.
5. The use of waste as a resource (the closed-loop economy proper). Waste is mainly recycled and used to generate energy; untreated household waste is not received in storage facilities; a small amount of waste ends up in storage facilities without harming the environment. (Taskin, 2024)

Since the 1970s, Germany has purposefully, consistently, and effectively gone through all these five stages and currently has a closed-loop economy.

When creating and improving the recycling and disposal industry, the following steps were taken:

Firstly, political and strategic management has been implemented. This means creating the necessary legislative framework and regulatory legal acts, as well as government agencies that carry

out the appropriate implementation and control, determining those responsible for recycling and disposal of waste.

Secondly, social development has been carried out. It includes the formation of environmental awareness of people and continuous training of personnel in this industry.

Thirdly, determining and analyzing costs and financing. This involves obtaining possible subsidies, grants, benefits, compensation for the costs of waste processing and recycling enterprises, finding and attracting sponsors, etc.

Fourthly, stimulating the waste recycling market. This step involves implementing programs to support investments in the waste processing and recycling industry, reducing the tax burden, and identifying stable markets for the sale of secondary raw materials.

Fifthly, technical capabilities. This includes separate waste collection, the use of modern technologies for recycling various types of waste, and the availability of specialized waste storage facilities. (Taskin, 2024)

As a result, Germany is currently the leader among EU countries in terms of closed-loop economy development. It collects 100% of waste using a separate method, 64% of household waste is recycled, 79% of all waste is reused, 14% of the necessary raw materials are extracted from waste, etc. It is no coincidence that a quarter of the world market for waste recycling equipment is produced in Germany (Taskin, 2024).

The use of secondary raw materials significantly reduces, in particular, the use of energy: in the production of aluminum - by more than 90%, steel - by about 50%, and glass - by 35% (Taskin, 2024). For Germany - an industrially developed country specializing primarily in metallurgy and mechanical engineering - this allows for a significant reduction in the volume of extraction of natural resources.

Each state of the Federal Republic of Germany makes great efforts to develop a circular economy. This experience is widely covered in German economic literature. Thus, M. Kruse, J. Wedemeier consider Circular economy in Germany: A methodology to assess the circular economy performance of NUTS3 regions (Kruse & Wedemeier, 2022), etc.

For example, in Saxony, the state government will provide more than 18 million euros from the budget by 2027 to support circular economy projects in addition to the 70 million euros allocated by the EU. In 2021, the Innovation Advisory Board submitted a report to the state government entitled "Mission Saxony 2038", in which the circular economy is singled out (among 10 points), as it may have great potential for the successful structural development of Saxony (Krechmer, 2023).

Germany has many successful companies involved in waste recycling and disposal. Many scientific articles are devoted to the analysis of their activities (Giménez Leal et al., 2024; Schmidt et al., 2021).

Thus, the most important driving forces for the development of a closed-loop economy in Germany are primarily the federal and state governments, the country's enterprises, and, of course, society and the population.

Germany's successful experience in the formation and development of a circular economy is widely used by European and other countries. In our opinion, this requires studying this experience in Kazakhstan, taking into account the specifics of the country's socio-economic development and mandatory adaptation to national characteristics.

As was previously noted, in developed countries, the transition to a circular economy began in the 70s of the last century due to a significant aggravation of environmental problems. Experience shows that the circular economy develops most effectively, as noted in the literature (Dolgushin, 2022), in those countries where there is a deficit of minerals and other natural resources. These are primarily European countries (Germany, the Netherlands, France, and others), some Asian countries - Japan, and South Korea first of all. Germany is one of the most developed countries in the world (GDP per capita, according to 2023 data, was 54,343.23 US dollars). The country mainly has a developed high-tech, manufacturing industry - metallurgy and mechanical engineering, including automotive and shipbuilding, chemical industry, electronics industry, and automation, and the mining industry is much less developed due to a weak raw material base. A special prerequisite for the development of a circular economy is the territorial factor. For countries with a high population

density and a lack of free space for waste disposal, the transition to a circular economy is especially important and, in fact, inevitable. In addition, short distances between waste management facilities reduce logistics costs and make waste processing and disposal cheaper, which also stimulates this process.

In Germany, the population density is high - 236.6 people / km² (as of 2023), settlements are located close to each other and there are no places for waste landfills.

On the contrary, the Republic of Kazakhstan is a developing country (GDP per capita, as of 2023, was 12,918.87 USD), supplying the world market with raw materials - oil, metals, etc. There are and are developing rich deposits of ores of various metals - lead, zinc, uranium, chromium, gold, copper, molybdenum, aluminum, iron, titanium, rare earth elements, and non-metallic minerals - oil, coal, phosphorites, and others.

In this regard, it should be borne in mind that the widespread use of the closed-loop economy model in the world brings certain negative external effects to Kazakhstan, as an exporting country of raw materials. This is a possible reduction in the country's income due to a reduction in mining, as well as a corresponding reduction in employment in the extractive sector of the Kazakh economy.

The country's territory is one of the largest in the world. There are free places for waste disposal. At the same time, the population density is low (7.46 people/km² – as of 2023), and the distances between cities, other settlements, and, consequently, waste management facilities are usually large. All these factors hinder the formation of a circular economy in Kazakhstan from an economic point of view.

The main prerequisites for the transition to a circular economy in Kazakhstan are not economic, but environmental and social factors. These are environmental pollution from industrial waste, especially accumulated near mining and metallurgical, oil-producing, and refining enterprises, depletion of landfill capacity for the disposal of consumer waste, the growth of unauthorized landfills, etc.

According to published data (Inform.kz, 2025), by 2024, the country has accumulated more than 125 million tons of garbage. The volume of municipal waste removed has been growing in recent years. In 2022, it amounted to 3.8 million tons, in 2023 - 4.1 million tons, and in 2024 - 4.8 million tons. Therefore, this indicator increased by 1 million tons, or 26.3%, only in the period from 2022 to 2024.

Currently, there are 2,973 landfills of solid household waste (MSW) in Kazakhstan, of which only 608 (20.4%) comply with sanitary and environmental standards. In Ust-Kamenogorsk, for example, the landfill ran out of resources 5 years ago, but a location for a new one has not yet been selected. In addition, in 2024 alone, 4,886 unauthorized landfills were identified in Kazakhstan, of which 93% were eliminated. In the East Kazakhstan region, the rate of control of such landfills is even lower - 75% (Inform.kz, 2025).

Waste management in Kazakhstan is characterized by statistical data presented in Table 1.

Table 1. Key indicators of waste collection, sorting, and recycling in Kazakhstan, 2021-2024.

№	Indicators	2021	2022	2023	2024
1	Volume of received waste, thousand tons	3922,1	4003,4	4514,0	4541,8
2	Volume of sorted waste, thousand tons	1191,7	1223,8	1307,8	1320,1
3	Volume of waste sent to third-party organizations for processing, thousand tons	393,7	392,0	358,9	588,2
4	Processed to obtain products (secondary raw materials), thousand tons	18,1	23,3	31,2	49,2
<i>Note: Compiled by the authors using data from the Bureau of National statistics of Agency for Strategic planning and reforms of the Republic of Kazakhstan (n.d.).</i>					

An analysis of the presented data shows that the volume of incoming waste in 2024 increased by 619.7 thousand tons (15.8%) compared to 2021. The volume of sorted waste in these years also increased by 128.4 thousand tons, or 10.8%. Accordingly, the share of sorted waste in the total volume

was: 30.4% in 2021, 30.6% in 2022, 29.0% in 2023, and 29.1% in 2024, i.e., it remained approximately at the same level. The indicator “processed to obtain products (secondary raw materials)” increased significantly in 2024 (49.2 thousand tons) compared to 2021 (18.1 thousand tons) – approximately 2.7 times. However, in absolute and relative terms, it is insignificant compared to the above indicators.

To effectively manage them, there are more than 50 plastic recycling enterprises, about 40 factories accept the waste paper for recycling, 7 - glass, and about 20 - rubber products (Inform.kz, 2025). In 2024, a factory that recycles batteries was opened in Almaty. It should be noted that waste recycling enterprises in the country are mainly concentrated in Almaty, and it is usually unprofitable to transport raw materials there from other regions of Kazakhstan, primarily due to high logistics costs.

Thus, in general, the Republic of Kazakhstan has its peculiarities of the conditions for the formation of a closed-cycle economy and is at the initial stage of implementing the principles of the circular economy. There are only some elements of such an economy in the country, in particular, certain types of waste are processed.

The Republic of Kazakhstan announced its intention to form a circular economy in 2023 when adopting the Concept for the Transition to a Green Economy. In section 3.5. “Waste management system” of this Concept (Pravitel'stvo Respubliki Kazakhstan, 2013), it is determined that Kazakhstan needs to re-form a waste management system due to the lack of an organizational and legal framework required for its optimal functioning. At the same time, separate elements of the 3R principles are used: reduce (reduction of resource consumption in the production of goods) - reuse (reuse) - and recycle (recycling).

To implement the Concept, the Government of the country has consistently approved two Action Plans, which define tasks for improving the waste management system. So, in the Plan for the period from 2013 to 2020, tasks were set, for example, for the separate collection of household waste from consumers. The Plan for 2021-2030 includes the following activities: development of special support measures for the development of the waste management industry, including its processing; development of organic waste processing to produce biogas; construction of biogas plants at sewage treatment plants and poultry farms (Dolgushin, 2022).

In 2015-2016, the principle of extended producer responsibility (EPR) was introduced in Kazakhstan. In this regard, relevant amendments were made to the Environmental Code of the Republic of Kazakhstan, Government resolutions “On approval of the Rules for the implementation of extended obligations of producers (importers)” and “On the definition of the EPR operator (importers)” were adopted. At the same time, the main focus was on the recycling fee that manufacturers and importers of products must pay to the private enterprise Operator ROP LLP.

In fact, EPR is a broader concept that includes the obligations of manufacturers and importers of goods that have lost their consumer properties to collect, transport, process, neutralize, use, and dispose of waste subject to the terms of EPR. In 2022, the functions of the ROP operator were transferred to Zhasyl Damu JSC, a state-owned company specializing in the disposal of hazardous waste. This is due, in particular, to the negative reaction of the Kazakh society to the activities of Operator ROP LLP, followed by the long-term conviction of a number of its leaders for embezzlement of budget funds on an especially large scale.

In Kazakhstan, there are also separate activities of various government programs that comply with the principles of a closed-loop economy. However, they do not contain a systematic and integrated approach to the implementation of the transition to a circular economy, and there is no separate independent program for the closed-loop economy.

So, in 2021, the Government of the country adopted the National Project “Zhasyl Kazakhstan” (“Green Kazakhstan”), aimed at improving the environmental situation and creating a favorable living environment for the population. Among other things, it sets out tasks to improve the efficiency of waste management.

Kazakhstan is currently implementing the following initiatives to facilitate the transition to a closed-loop economy:

- A carbon neutrality strategy by 2060, focused on reducing carbon emissions and developing circular business models.

- The concept of “Taza Kazakhstan” (2024-2029), is aimed at creating an ecological culture and increasing waste recycling.

- National standards for the circular economy, developed by the Technical Committee on Sustainable Production and Consumption.

Analysis in the field of solid waste in Kazakhstan reveals several waste management problems:

- annual increase in the generation and accumulation of household waste;
- non-compliance of most landfills with the requirements, the presence of open landfills;
- low level of solid waste sorting and processing;
- inefficiency of attempts at separate collection of household waste in some cities;
- provision of waste collection and disposal services only to the population of large cities;
- lack of environmental awareness and culture of consumer waste management among the majority of the population;
- the presence of corruption risks in this area.

In this regard, the results of the project to assess the need for green economy training among civil servants in Kazakhstan (with the support and coordination of UNITAR, UNDP (GIZ), and the national coordinator of PAGE), implemented in 2021 by the Academy of Public Administration under the President of the Republic of Kazakhstan, are of great interest (UN PAGE, 2023).

The target audience of this survey was representatives of government agencies at the national and local levels in all regions of Kazakhstan. Representatives of those structures that are associated with the implementation of measures for the transition to a green economy, the key instrument of which is a closed-loop economy, were selected.

A total of 266 people were interviewed, of which 79% (210 people) were experts and specialists, and 21% (56 people) were heads of departments. Respondents are employed in various sectors of the economy related to the implementation of green economy principles, from energy to waste management.

Only 29 of the respondents were well acquainted with the Concept of Transition to a green economy, 1/3 of the respondents indicated average awareness, and 1/3 indicated a lack of knowledge about this strategic document. More than half of the respondents (53%) found it difficult to answer the question about the potential benefits of a green economy.

At the same time, according to government officials, there are serious barriers to the transition to a green economy in Kazakhstan. However, out of 264 respondents, 178 people (67%) could not identify specific barriers. Corruption risks were mentioned among the alleged barriers.

Civil servants rated their level of knowledge on key competencies in this environment as quite low, and only 12% of the respondents had the necessary competencies at a productive level.

Regarding the level of awareness among the population, the majority of respondents noted that the majority of the population cares only about household needs and does not actively participate in projects on waste separation, waste-free production, etc.

Thus, the ecological consciousness of the population has not been formed in Kazakhstan, and government officials dealing with the problems of the green economy are insufficiently trained. It is no coincidence that attempts to introduce separate garbage collection in 2018-2019 in Astana, Aktobe, Semey, Turkestan and Ust-Kamenogorsk did not bring success. This also indicates that society is poorly prepared for the transition to a circular economy.

RESULTS AND DISCUSSION

As noted, in order to ensure a successful transition to a closed-loop economy, the study and use of the best international experience is of great importance in Kazakhstan. Of particular interest in this regard, in particular, is the experience of Germany, where this economy is formed on a systematic basis and is the basis for the sustainable development of the country.

In order to increase the effectiveness of further steps towards the formation of a closed-loop economy in Kazakhstan, it is advisable, in our opinion, to compare the characteristics of the transition

in Germany and our country. The results of a comparative analysis of the formation and development of a closed-loop economy are presented in Table 2.

Table 2. Formation and development of a closed-loop economy in Germany and Kazakhstan: a comparative analysis

Main characteristics	Germany	Kazakhstan
Reasons for the transition to a closed-loop economy		
The initial reason for the transition to a closed-loop economy	The aggravation of environmental problems	The aggravation of environmental problems. The global experience of the transition to a closed-loop economy
The main reasons for the current transition to a closed-loop economy (by priority)	Economic, environmental, and social reasons	Environmental, social, and economic reasons
The beginning of the transition to a closed-loop economy		
The beginning of the transition to a closed-loop economy	The beginning of the 70s of the XX century	The beginning of the 10s of the XXI century
Adoption of the first law on the closed-loop economy	1972: Waste Management Act	2013: Concept for the transition of the Republic of Kazakhstan to a green economy (section on waste management system)
Conditions for the formation and development of a closed-loop economy		
The level of socio-economic development	Developed country	Developing country
Availability of minerals and other natural resources	The minerals have mostly been exhausted, and their extraction and primary processing are insufficient for the country's economy.	Large reserves, mining, and processing of minerals, significantly exceed domestic consumption
Position on the global raw materials market	Importing raw materials country	Exporting raw materials country
Population density	High	Low
Availability of free territories for waste disposal	Nonexistent	Exist
The main steps for the formation and development of a closed-loop economy		
The existence of a system of laws and regulations that ensure the transition to a closed-loop economy	The system of laws and regulations has been formed and is developing	The system has not been formed, there is a separate section of the Concept for the transition of the Republic of Kazakhstan to a green economy, and several regulations on waste sorting and recycling (on extended producer responsibility, etc.).

		There is no law on the closed-loop economy.
Implementation of legislative and regulatory requirements for a closed-loop economy	High efficiency, implementation, and effectiveness	Incomplete performance, low implementation, and effectiveness. The presence of corruption risks
Availability of government agencies responsible for the implementation and control of the transition to a closed-loop economy (with trained civil servants)	Government agencies have been formed. Government officials in the closed-loop economy are trained	Government agencies have not been fully formed, and civil servants are insufficiently trained
Implementation of the Extended Producer Responsibility (EPR) system	The EPR system is implemented	The EPR system is implemented with special features, including the significant role of recycling collection (for cars)
The presence of ecological awareness among the population and a modern waste management culture (separate garbage collection, etc.)	Formed	Some measures are being taken to create environmental awareness and a modern waste management culture among the population.
Compliance of landfills of solid household waste (MSW) with modern sanitary and environmental requirements	Comply with the standards	A small part of MSW complies with the standards
The presence of unauthorized landfills	Nonexistent	They are available in large numbers, but they are not completely eliminated
Availability of a system of waste sorting and processing enterprises throughout the country for all major types of waste	The system exists	The system of waste sorting and processing enterprises has not been formed (most enterprises operate in Almaty)
The level of waste sorting and recycling	Very high	Low
Creation of a waste recycling market	The market has been created, and its development is being stimulated	There are minor elements of this market
The key conclusion		
The level of development of the closed-loop economy	A closed-loop economy has been formed and is developing	In the initial stage of the formation of a closed-loop economy, there are some of its elements
<i>Note: compiled by the authors.</i>		

A comparative analysis of the formation and development of a closed-loop economy in Germany and Kazakhstan shows both common and distinct main characteristics.

In both Germany and Kazakhstan, the initial reason for this transition to a closed-loop economy was the aggravation of environmental problems. At the same time, the priority reason for Germany is currently economic necessity, while for Kazakhstan there are still environmental problems.

Germany and Kazakhstan have completely different conditions for the formation and development of a closed-cycle economy, that is, the level of socio-economic development, the availability of minerals, and the territorial factor. The timing of the beginning of the transition to such an economy also differs significantly: in Germany since 1972, in Kazakhstan - since 2013, 4 decades later.

The main steps towards the formation and development of a closed-loop economy in Germany and Kazakhstan are usually taken in the same direction. This is due to the fact that they are universal and generally binding for all countries. However, their consistency, consistency, development, execution, and implementation effectiveness differ significantly. Accordingly, the results are fundamentally different. In Germany, a closed-loop economy has been formed and is successfully developing. In Kazakhstan, the initial stage of the formation of such an economy is underway, there are only certain elements of a closed-cycle economy.

Speaking about the differences in the main characteristics of the closed-loop economy and its elements in Germany and Kazakhstan, it should be noted that some of them cannot be changed. This is primarily the availability of minerals and the position on the world market of raw materials, the territorial factor is population density.

The difference in key steps for the formation and development of a closed-loop economy is mainly due to the different levels of socio-economic development, the duration of the period, and the effectiveness of the transition to a closed-loop economy. These factors are variables.

Accordingly, knowing and using the successful experience of the transition to a closed-loop economy in Germany, it is possible to implement it to a certain extent in Kazakhstan. This will make it possible to accelerate and more effectively form a circular economy in Kazakhstan as it develops, taking into account, of course, country specifics.

Accordingly, Kazakhstan needs to create the following prerequisites for an effective transition to a closed-loop economy:

- development of the legislative and regulatory framework in the field of closed-loop economics, including the Circular Economy Act;
- identification of the competent state authorities responsible for waste processing and disposal, monitoring the implementation of relevant legislation and regulations;
- formation of a modern polygon system in the country;
- creation of waste recycling enterprises in all regions of the country;
- raising the level of self-awareness and education of representatives of the Kazakh society in the field of circular economy;
- development and adoption of state support measures for enterprises operating in accordance with the basic principles of the circular economy;
- popularization of business operating on the principles of 3R;
- support and promotion of research activities in the circular economy.

CONCLUSION

The transition to a circular economy is a current global trend in both developed and developing countries. In Germany, its development began in the 1970s with the adoption of the first laws on separate waste collection and sorting.

Over the past decades, the country has developed a system of relevant legislation, developed an effective public policy, created a waste management system and modern infrastructure, and strengthened environmental awareness among the population. As a result, the circular economy has become the foundation of Germany's sustainable development.

Kazakhstan has its own peculiarities of conditions for the formation of a closed-cycle economy and is at the initial stage of implementing the circularity of the economy. There are some elements of this economy in the country, including the recycling of certain types of waste. An appropriate legislative framework is being formed. However, many waste management problems have not been solved. The ecological awareness of the population has not been formed, and many government officials involved in the transition to a circular economy are not sufficiently prepared for this process.

The formation of a closed-cycle economy in the Republic of Kazakhstan should be carried out on a systematic basis, in stages. To do this, it is advisable to use the best international experience, including Germany.

A comparative analysis of the formation and development of a closed-loop economy in Germany and Kazakhstan shows both common and distinct main characteristics.

The initial reason for the transition to this economy in both countries was the aggravation of environmental problems. The main steps towards the transition to such an economy in Germany and Kazakhstan are usually taken in the same direction.

However, their consistency, consistency, development, execution, and effectiveness vary significantly. In Germany, a closed-loop economy has been formed and is successfully developing. In Kazakhstan, the initial stage of its formation is underway, and there are certain elements of a closed-cycle economy. Germany and Kazakhstan have different conditions for the formation and development of a closed-cycle economy: the level of socio-economic development, the availability of minerals, and the territorial factor.

Kazakhstan will continue to develop a closed-loop economy, using German experience, among other things. It is necessary to develop the legislative framework, form a modern landfill system, increase the environmental awareness of the population, and create other prerequisites for the transition to a circular economy.

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Information about the authors

Svetlana Albertovna Linok – Candidate Of Political Sciences, D. Serikbayev East Kazakhstan technical university, Ust-Kamenogorsk, Kazakhstan, e-mail: lin_svetlana@mail.ru, ORCID: <https://orcid.org/0009-0005-5016-899X>

Yana Nikolayevna Linok – student, Kazakh-American free university, Ust-Kamenogorsk, Kazakhstan, e-mail: linok_yana@bk.ru, ORCID: <https://orcid.org/0009-0008-0857-577X>

Авторлар туралы мәліметтер

Линок Светлана Альбертовна – саяси ғылымдардың кандидаты, Д. Серікбаев атындағы Шығыс Қазақстан техникалық университеті, Өскемен қ., Қазақстан, e-mail: lin_svetlana@mail.ru, ORCID: <https://orcid.org/0009-0005-5016-899X>

Линок Яна Николаевна - студент, Қазақстан-Американдық еркін университеті, Өскемен қ., Қазақстан, e-mail: linok_yana@bk.ru, ORCID: <https://orcid.org/0009-0008-0857-577X>

Сведения об авторах

Линок Светлана Альбертовна – кандидат политических наук, Восточно-Казахстанский технический университет им. Д. Серикбаева, г.Усть-Каменогорск, Казахстан, e-mail: lin_svetlana@mail.ru, ORCID: <https://orcid.org/0009-0005-5016-899X>

Линок Яна Николаевна – студент, Казахстанско-Американский свободный университет, г.Усть-Каменогорск, Казахстан, e-mail: linok_yana@bk.ru, ORCID: <https://orcid.org/0009-0008-0857-577X>