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FOR LAND AND WASTE MANAGEMENT

15.- CE Integration and Final Assessment

Reading: Future CE pathways in Central Asia

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Circular Economy as an Opportunity for Central Asia

Summary Report

May 2024

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Acknowledgments

This report summarizes three Circular Economy Action Plans (CEAPs). The CEAP for the Construction Value Chain in Kazakhstan, finalized in June 2022, is the product of a collaborative effort by the World Bank, Global Factor, and the Centre for Sustainable Production and Consumption in Almaty. The CEAP for the Agri-Food Sector in Uzbekistan, finalized in March 2022, was developed jointly by the World Bank and KPMG. These two CEAPs were supported by the Korea Green Growth Trust Fund. The CEAP for the City of Almaty, finalized in April 2022, was prepared by a core team consisting of the World Bank, Global Factor, Nazarbayev University's Civil and Environmental Engineering Department, and the Centre for Sustainable Production and Consumption in Almaty. It was supported by the Global Program on Sustainability.

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Abbreviations and Acronyms

AIES JSC	Almaty Electric Stations Joint Stock Company
BAU	Business As Usual
BIM	Building Information Modeling
CE	Circular Economy
CEAP	Circular Economy Action Plan
CDW	Construction and Demolition Waste
DMC	Domestic Material Consumption
EPR	Extended Producer Responsibility
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPP	Green Public Procurement
IBT	Ice Bank Tanks
IoT	Internet of Things
MEGNR	Ministry of Ecology and Natural Resources
MIID	Ministry of Industry and Infrastructural Development
MSW	Municipal Solid Waste
NDC	Nationally Determined Contribution
PET	Polyethylene Terephthalate
PPP	Public-Private Partnership
R&D	Research and Development
SMEs	Small and Medium Enterprises
USW	Urban Solid Waste
WWTP	Wastewater Treatment Plant

1. Introduction and Summary

Introduction

The concept of the circular economy (CE) is gaining attention worldwide as a way to promote sustainable development and reduce resource consumption. The CE is an economic system that aims to reduce the use of natural resources and to minimize waste and emissions by keeping materials in use for as long as possible. A CE seeks to minimize the consumption of finite resources by promoting three key principles of waste management and sustainability: 'reduce, reuse, recycle'. This equation stands for reducing resource use and waste generation as well as for extending the lifetime of products and materials by using them for as long as possible. If a product eventually needs to become waste, its materials should be recycled and used for a new purpose. Optimizing resource use in this way is the only strategy which allows for decoupling economic growth from environmental degradation and is critical for the green and low-carbon transition.

The countries in Central Asia are still in the early stages of the CE transition. Central Asia is a region that consists of five countries: Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan. While the concept of the CE is gaining traction globally, its implementation in Central Asia is still in its early stages. In fact, Central Asian countries score low on almost all CE-related indicators. Critical issues across the region include low resource productivity and low recycling rates in the face of resource scarcity. For example, resource productivity in Kazakhstan is around 10 times lower than in the European Union (EU). Recycling of municipal solid waste (MSW) stands at 11.5 percent in Kazakhstan and below 10 percent in Uzbekistan, compared to about 50 percent in the EU. The situation is similar in the Kyrgyz Republic and despite lower waste generation per capita, the recycling rate for different waste streams is low. However, there is growing interest and momentum across the region to explore the potential of CE practices to promote sustainable development and economic growth.

There are multiple gaps and challenges in Central Asian countries with regard to the CE transition. Data gaps make economy-wide and sectoral assessments difficult and pose a key challenge to resource management and related strategies. Generally, waste management remains inadequate, also due to missing infrastructure for the treatment of different waste streams, and offers multiple opportunities for improvement. In addition, the concept of CE is not widespread in Central Asia and CE is not generally addressed at different administrative levels (national, regional, or municipal) or by sectors/value chains. This also translates into a lack of specific regulations and standards to promote the CE as well as into a lack of capacities to support the transition. Similarly, low consumer awareness results in low demand for green and circular products. The fact that the sectors studied for this report (construction and agriculture) are highly fragmented poses an additional obstacle to circular action.

The CE is one of the main potential ways forward for Central Asia on the road toward carbon neutrality. The production of goods and services, including food, for the global economy accounts for nearly half of global greenhouse gas (GHG) emissions. Addressing GHG emissions from industry can be technologically challenging and costly, particularly in sectors such as iron, steel, aluminum, cement, and plastics, which are associated with hard-to-abate emissions related to high-temperature processes, production emissions, and end-of-life emissions. In the food system, food waste is a major source of GHG emissions. But in other sectors, such as construction, the extraction and transportation of new materials is linked to GHG emissions which could be avoided in a CE. An increasing focus on material efficiency and circularity will help align the emissions trajectory of these sectors with the goals of the Paris Agreement.

Reducing material consumption leads to less pollution, waste, and related health impacts and is key to preserving vital ecosystem services and natural resources, including biodiversity. In the linear system, products eventually end up as waste, most of which is landfilled or incinerated. Globally, inadequate solid waste management contributes, among others, to climate change and (marine) plastic pollution. In Central Asia, solid waste harms public health, putting millions at risk due to soil and water contamination and poor air quality. Reducing waste and pollution and associated negative environmental impacts will thus have substantial benefits for public health, including through designing out toxic chemicals. In addition, it is estimated that the extraction and processing of natural resources are responsible for more than 90 percent of biodiversity loss. Decreasing the need for virgin materials can thus make a major contribution to healthy ecosystems and biodiversity preservation.

The circular transition can be a driver of private sector growth and employment in Central Asia. Although there are only few ex post studies to verify growth and job creation potential of CE, it is important to note that technological innovation in resource efficiency can lead to productivity gains. What is certain is that the goal of decoupling natural resource extraction and use from economic output has already led to a range of concrete business applications aimed at closing resource utilization loops and slowing down material use. This is evidenced by the growth of repair and remanufacture services, the birth of the sharing economy, or increase in recycling and reuse rates. In the EU, the Netherlands is one of the leaders in the CE transition. It is estimated that 8 percent of the Dutch workforce is employed in CE jobs, with the biggest concentration in activities that preserve and extend the value of materials already in use, such as reuse and recycling.

Circular Economy Action Plans (CEAPs), such as the ones presented in this report, are essential for charting the way forward in the circular transition. This report summarizes three CEAPs: (a) CEAP for the Construction Value Chain in Kazakhstan, (b) CEAP for the Agri-Food Sector in Uzbekistan, and (c) Support in Financing and Delivering the Circular Economy in Almaty. These three CEAPs help provide the overarching direction for the circular transition in Kazakhstan, Uzbekistan, and Almaty, allowing for general conclusions for the entire region of Central Asia. The theme and focus of the three CEAPs have been selected based on several factors. These include economic importance, employment, material use, carbon footprint, potential for circular improvement (including policy), and stakeholder engagement and buy-in.

The report is targeted at policy makers at national and municipal levels as well as sectoral level experts, associations, business support organizations, and others. The objective is to demonstrate the potential of the CE concept and to inspire further actions and consolidation with regard to sectoral and innovative circular policy development as well as designing of new, circular funding opportunities.

Summary

The report consists of three individual sections on the construction value chain in Kazakhstan, the agricultural value chain in Uzbekistan, and the urban ecosystem in Almaty. These three sections are followed by a chapter with conclusions attempting to draw useful messages to all countries in Central Asia. It is based on the assumption that although each country has its unique characteristics, the construction and agricultural sectors in the region face similar problems. Similarly, it is assumed that some of the challenges for Almaty are shared by other municipalities in the region.

To achieve the long-term goals of the CE transition, it is essential to have action plans for identifying practical next steps. Action plans help identify and guide policy levers while setting a framework for private sector development. Importantly, they are a tool to identify numerous stakeholders involved in the CE transition and to engage them in a way that motivates their contribution and fosters a sense of ownership. In particular, the sectoral action plans presented in

this report will help stakeholders understand the actions that can be undertaken in different stages of respective value chains.

There are ample opportunities to introduce CE business models in the construction value chain in Kazakhstan, and the CEAP focuses on adopting relevant regulations and standards, infrastructure investments, and collaboration platforms and pilot projects. Examples of actions include mandatory waste audits as a precondition for demolition permits, renovation of Soviet-era buildings, construction and demolition waste (CDW) recycling centers, and an online portal to support industrial symbiosis. In addition, the CEAP recommends the introduction of market-based incentives such as incineration and landfill taxes. A total of 10 actions are proposed, totaling US$289 million in investments over nine years. Economic benefits amount to US$1.3 billion over the same period—a multiple of the investment needs. Implementation of the CEAP will help reduce CDW generation by 54 percent and total natural resource consumption by 8 percent by 2030. In addition, it can reduce national GHG emissions by 5 percent, compared to business as usual, over the same time frame.

The agri-food value chain in Uzbekistan is characterized by low productivity, high post-harvest losses, water scarcity, and high GHG emissions; the CEAP helps improve performance of the sector in terms of resource efficiency and waste prevention and management. The CEAP proposes 17 actions in the areas of water circularity, bioresource utilization, precision farming, energy efficiency, and sustainable packaging. Examples of concrete actions include the introduction of drip irrigation, eco-friendly wastewater treatment for reuse in agriculture, the substitution of chemical fertilizer with organic compost, manure management for electricity generation, biogas from organic waste, and conversion of polyethylene terephthalate (PET) bottles into synthetic fibers for packaging. While implementation costs are significant (estimated at US$860 million over nine years), the return on investment is almost 100 percent. Moreover, implementing the CEAP will significantly increase the resilience of Uzbekistan's agricultural sector to climate vulnerabilities and shocks, while reducing GHG emissions of the sector by 34 percent.

The CEAP for Almaty addresses excessive waste generation in the city, lack of waste processing infrastructure, and flawed monitoring and evaluation procedures in three key material-intensive sectors: construction, industry, and agriculture and food processing. The focus of the CEAP is on innovative technology, new infrastructure, and waste management improvement. The nine proposed actions include a CDW recycling center in Almaty, the production of modular construction materials, the production of secondary raw materials from ash and slag, and the bioconversion of food waste into animal feed and fertilizer. Total investment needs amount to US$368 million until 2030. The actions proposed by the CEAP would help reduce demand for primary materials by 21 million tons (Mt) by 2031, while reducing CDW generation by 871 tons annually. In addition, Almaty would benefit from increased local production and use of resources.

While the report draws conclusions for the wider region of Central Asia, more research is needed in other countries and sectors, potentially highlighting regional solutions to common challenges in the management of natural resources and waste. Improving data on waste management is critical for assessing the state of circularity in the region and should be a priority before drawing conclusions on next steps. Building upon an improved data basis, future research needs to analyze sectoral barriers and potentials for increasing circularity. Key sectors could be identified by their economic importance, the amount of natural resources used and waste generated, and their potential to become more circular. Such an analysis will allow for identifying common challenges and solutions across the countries of Central Asia, potentially paving the way for streamlined action in support of the CE across the region.

2. Circular Construction Value Chains: The Case of Kazakhstan

Background

Kazakhstan' population and economy are growing, but so is its vulnerability to climate change. For the past few years, Kazakhstan's economy has been growing at an annual rate of 3–4 percent. The economic growth relies on several key sectors, including extraction of mineral resources, construction, agriculture, and transport, which are also among the sectors with the highest carbon footprint. At the same time, the country is vulnerable to climate change, particularly in terms of water scarcity and droughts.

Kazakhstan faces the double challenge of achieving economic development while reducing negative impacts on climate and the natural environment. The pressure to reduce the carbon footprint comes not only from an intrinsic incentive to lower the impacts of climate change but also from the commitments under international obligations such as the Paris Agreement and the Agenda 2030 for Sustainable Development.[1] As a result, Kazakhstan pledged to reach carbon neutrality by 2060—a goal which calls for a transition to net-zero emissions, a more resilient economy, and higher investment across all sectors. CE is an important instrument for this transition.

Yet, Kazakhstan is still in the early stages of the CE transition. The material resource productivity of the country is EUR 0.2 (gross domestic product [GDP]) per kg of domestic material consumption (DMC) compared with an EU27 average of EUR 2.1. On average, the recycling of MSW stands at 11.5 percent compared to more than 45 percent in the EU27.

The Construction Value Chain in Kazakhstan: Circularity and the Case for Action

The construction sector has a significant carbon footprint and at the same time there are tangible opportunities for improvement in terms of circular business models. In Kazakhstan, the construction sector was estimated to consume 65 Mt of materials in 2019, 30 percent of which was imported. Moreover, domestic material extraction and production activities emit 13.9 Mt of CO_2e per year—almost 4 percent of the country's annual emissions. Circularity elements have already been introduced into selected policies, such as the 'Nurly Zher' housing program and the 2021 Environmental Code. All these factors led to the selection of the construction sector as a suitable candidate for the development of a CEAP. The selection was validated at a roundtable held in January 2021 with the Ministry of Ecology and Natural Resources (MEGNR), the Ministry of Industry and Infrastructural Development (MIID),[2] the Bureau of Statistics of the Agency of Strategic Planning and Reforms, and the Ministry of National Economy.

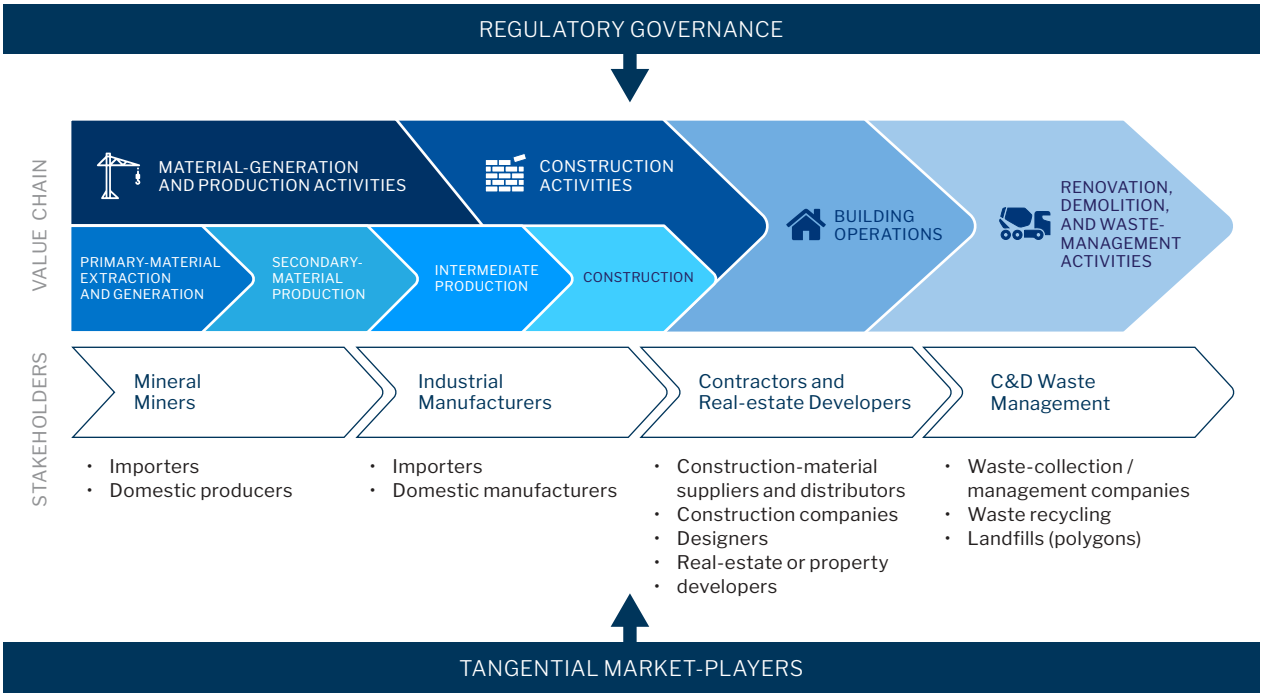
The construction sector in Kazakhstan is fragmented. It consists of 70,000 private and

[1] https://sdgs.un.org/2030agenda.

[2] Reorganized as the Ministry of Transport and the Ministry of Industry and Construction on September 1, 2023.

public entities including mineral miners, industrial manufacturers, contractors and real estate developers, and CDW management service providers. Almost two-thirds of these are real estate developers and one-third are CDW management companies. The value chain of the construction sector and its various stakeholders are shown in Figure 1.

Figure 1: Construction Sector Value Chain and Its Stakeholders



Source: Original to this publication based on CEAP for the Construction Value Chain in Kazakhstan (2022).

The circularity performance of the Kazakh construction sector is low. The use of secondary raw materials is not measured but by all evidence, and backed by stakeholders, almost all materials used are primary. Most CDW is landfilled with no information on the recycling rate.

On the positive side, sector-focused regulations and programs in the construction value chain have the potential to strengthen circularity. For example, the Nurly Zher housing program is intended to stimulate the domestic production of building materials, creating a register of best available technologies and promoting the inclusion of materials recycled and recovered from local industry. The 2021 Environmental Code bans landfilling of construction materials and also incorporates CE principles.

Circular Economy Action Plan for the Construction Sector

The CEAP for the construction sector aims to increase material efficiency and competitiveness, prevent waste generation, and promote resilience. This is to be achieved through improved resource productivity, eco-design, and the circular use of resources, thereby minimizing the environmental impacts of Kazakhstan's economy.

The CEAP structure consists of a further elaboration of the challenges facing the construction sector, a detailed explanation of a number of CE actions and initiatives, and a set of technically and financially feasible infrastructure projects (building renovation and waste recycling). The CEAP also includes suggestions for policy changes and a proposal for further technical assistance and investments needed to implement the necessary changes. These are summarized in Table 1.

Table 1: CE Priority Projects in Kazakhstan's Construction Value Chain

Projects/measures	Key issues addressed	Impacts	Investment needs (US$)
Regulations and standards			
Introduce waste audits as a requirement to obtain a demolition or renovation permit	Lack of waste management system Large number of illegal landfills and dumps Data gaps	Reduction of waste sent to landfill Monitoring and control of waste generated in the country	21,768,350
Introduce a CE certification system			19,786,000
Introduce CDW management protocol as a requirement for manufacturing and production in the construction sector			700,000
Infrastructure investments			
Renovation projects for Soviet-era buildings	High volumes of waste generation	Reduction and prevention of waste generation	179,660,000
Gypsum/drywall waste recycling	Lack of infrastructure Lack of waste recovery sorting facilities to recover waste	Waste recovery Increased volumes of recycled material Reduced volumes of waste sent to landfill	2,636,073
CDW recycling centers			48,080,000
Information, collaboration platforms, and pilot projects			
Support national industrial symbiosis portal for stakeholders at all levels of the construction and demolition value chain	Low waste recovery rate High amount of waste streams sent to landfill High amount of waste generation	Reduced waste generation Increased waste recovery/recycled material	2,421,418
Integrate building information modeling (BIM) into residential construction design, management, and CDW management			11,705,120
Assess the use of fly ash from the combustion sector	Lack of infrastructure for waste recovery High-value waste not recovered	Reduced waste sent to landfill Increased recycled material	1,601,794
Replace natural aggregates with furnace slag in pavement construction			1,330,000

Source: Original to this publication based on CEAP for the Construction Value Chain in Kazakhstan (2022).

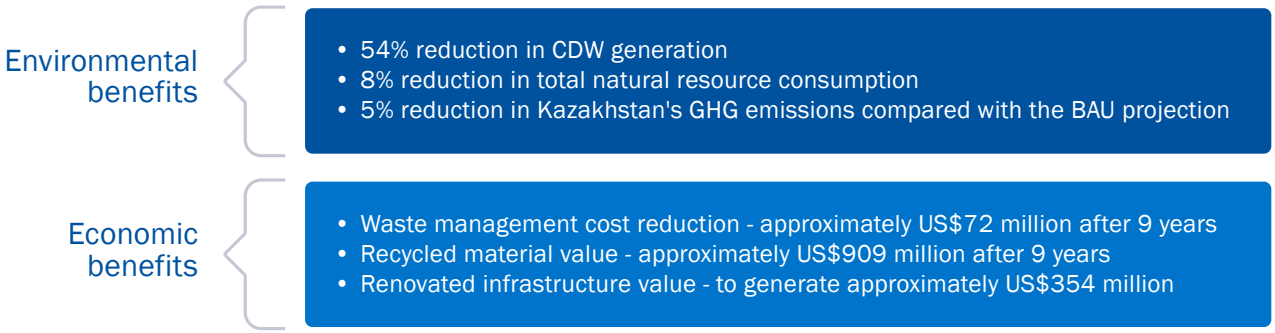
In addition, the CEAP proposes the introduction of market-based incentives. These include introducing incineration or landfill taxes, while at the same time encouraging practices high on the waste hierarchy and the mapping of current illegal CDW management.

The investment needs for the circular transition of the construction sector in Kazakhstan have been estimated at US$289 million, distributed over nine years as follows: US$154 million (Years 1–3), US$66 million (Years 4–6), and US$69 million (Years 7–9). The investment needs have been calculated by project and are listed in Table 1. The biggest investment by far (US$179 million) is needed for the renovation of the Soviet-era buildings followed by the construction of CDW recycling centers (US$48 million). The implementation of the CEAP requires significant resources from public and private sources, domestically and internationally. These could be in the form of subsidies, concessional loans, guarantees, and others and could be accompanies by technical assistance.

At the same time, the potential benefits for Kazakhstan are significant. Costs of US$289 million for the implementation of all actions in the CEAP are met with benefits estimated at US$1.3 billion over nine years. The bulk of these benefits comes from value generation from the sale of secondary raw materials (US$909 million), followed by the increased value of renovated

building (US$354 million) and avoided costs of transportation and landfilling (US$72 million). In addition, Kazakhstan would benefit from substantially reduced CDW generation, natural resource consumption, and GHG emissions (see Figure 2).

Figure 2: Benefits of CEAP Implementation



Source: Original to this publication based on CEAP for the Construction Value Chain in Kazakhstan (2022).

Kazakhstan could benefit greatly from technical assistance interventions to raise and support national capacities for the transition. Concrete technical assistance would be needed with regard to each of the projects listed in Table 1. However, stakeholders in the construction sector also identified the need for further awareness raising on environmental and CE matters. Currently, company environmental objectives exist only to meet legal requirements. There is a need to increase the knowledge of the construction value chain stakeholders about the CE and the potential benefits it can bring.

Relevance for Central Asia

The construction value chain has a significant carbon footprint in all Central Asian countries considering their legacy of Soviet-era buildings. At the same time, it offers tangible opportunities for improvement. Tackling circularity in the construction sector is a precondition to reaching climate neutrality in the future.

Integrating CE into the national and local regulations related to construction is a main enabling factor for the circular transition in Central Asia. Changes could include landfill limitations, requirements for waste audits, introduction of a CE certification system, introduction of a CDW management protocol, introduction of market-based incentives, and others.

Developing a culture of collaboration and ensuring economic interest is a precondition for successful CE transition. The mapping of stakeholders in the four stages of the construction value chain (material production, construction, building operation, renovation/demolition) is essential for drafting a CEAP. Concrete actions need to be taken at various stages: material extraction, building design, and material input (upstream) as well as building energy renovation and development of the market for recycled aggregate and CDW (downstream). This is valid for all countries in Central Asia.

The actions in the CEAP for the construction value chain in Kazakhstan are relevant for the other Central Asian countries, but more research is needed. It is recommended that the precise relevance of each technical and soft measure should be explored additionally based on an analysis of needs. However, key transversal recommendations are also relevant for other Central Asia countries:

- **Integrate a CE monitoring system and track the progress of the transition toward the CE model.** Monitoring of the progress is a precondition for staying on track during the process of circular transition.

- **Strengthen waste management institutional capacity in general and construction waste management capacity in particular.** This includes mainly the capacity to design quality regulatory measures.
- **Improve inadequate infrastructure** through three concrete infrastructure investment projects targeting renovation of Soviet-era buildings and recycling centers for gypsum and CDW waste.
- **Develop the market of recycled aggregate to close the loop and maximize material efficiency in this sector.** The market price for recycled aggregate stands at around US$10 per ton, which generates a potential of around US$90 million in cost recovery, considering the 9 Mt of annual CDW streams.

3. Circular Economy in the Agri-food Value Chain: The Case of Uzbekistan

Background

Uzbekistan's growing economy is increasingly vulnerable to climate change. Both Uzbekistan's population and economy are growing, the latter at around 5 percent annually. Economic growth relies on several main sectors including agriculture, infrastructure, and construction which are among the sectors with the highest carbon footprint. At the same time, the country is vulnerable in terms of climate change and there are risks of water scarcity and desertification. These pose a risk to agricultural production and a threat to the country's food security.

Uzbekistan is a party to the Paris Agreement and to put it into practice a Strategy for the Transition of the Republic of Uzbekistan to a Green Economy for 2019–2030 was adopted. This strategy establishes national targets and measures in terms of energy efficiency, renewable energy sources, sustainability of industrial enterprises, water use efficiency, and the average productivity of basic agricultural products. The country has also adopted a second Nationally Determined Contribution (NDC) document with a commitment to reduce specific GHG emissions per unit of GDP by 35 percent by 2030 and the Solid Waste Management Strategy in the Republic of Uzbekistan 2019–2028. CE actions in the agricultural sector are also enabled by the ambitious Agriculture Development Strategy of the Republic of Uzbekistan for 2020–2030 targeting reduction in GHG emission of agricultural origin by 50 percent and increasing the coverage of water-saving technologies.

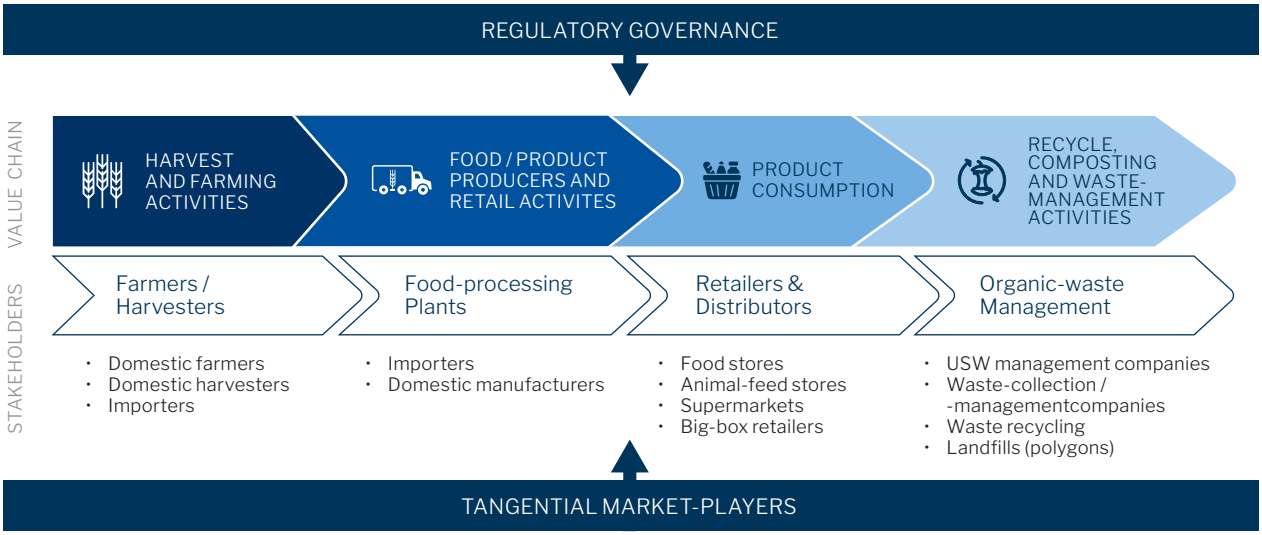
Agri-Food Value Chain in Uzbekistan: Circularity and the Case for Action

Overall, there is scarce data on resource efficiency, the use of secondary raw materials, and waste management. However, existing data and analysis of the agricultural sector show that the circularity interventions are more than necessary to improve the performance of the sector in terms of resource efficiency and waste prevention and management.

Uzbekistan's agriculture sector is responsible for 18 percent of the country's GHG emissions and generates a high volume of waste. However, it also contributes 30 percent of national GDP and employs around 27 percent of the country's economically active population. In 2018, agriculture was also the leading contributor of all economic sectors to gross value added. Nonetheless, it is resource intensive and generates a considerable amount of waste. For example, Uzbekistan's 1,500 existing refrigerated warehouses can accommodate only 4.5 percent of the harvest. This results in 45 percent of the country's most perishable products to be damaged or lost to waste in the post-harvest stages, generating significant economic loss.[3] Additional problems include inefficient farming practices and scalability issues; underdeveloped market for agricultural inputs; restricted access to new technology adoption in farming; lack of adequate support to research; education, extension, and advisory services, and many more. The value chain of Uzbekistan's agricultural sector and its various stakeholders are shown in Figure 3.

[3] https://www.adb.org/sites/default/files/linked-documents/47305-002-sd-01.pdf.

Figure 3: Agricultural Value Chain and its Potential Stakeholders



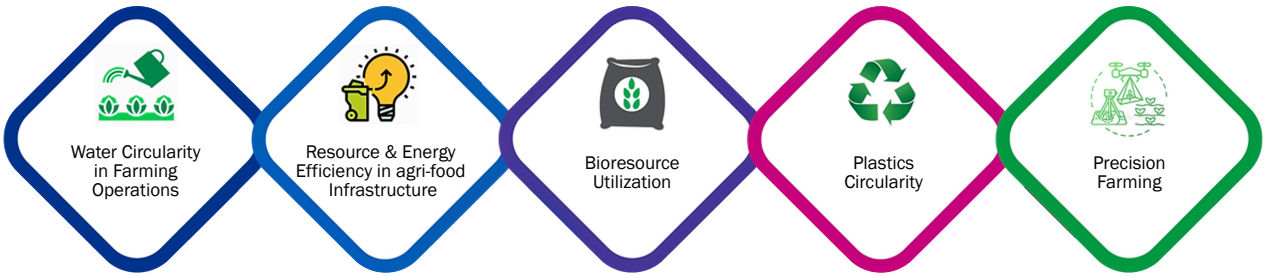
Source: Original to this publication based on CEAP for the Agri-Food Sector in Uzbekistan (2022).

Circular Economy Action Plan for the Agri-Food Sector

CE offers a pathway for Uzbekistan to address development challenges and meet national and sectoral strategic targets. The agricultural sector has been selected for drafting a CEAP due to its importance for both economy and environment as well as its significant potential for implementing CE improvements. The circular transition of the agri-food value chain can potentially address the aforementioned challenges, while unlocking incremental value and growth opportunities in the sector. It is a system solution that tackles climate change challenges, biodiversity loss, waste, and pollution simultaneously. Circularity in the agri-food value chain enables minimizing external inputs, closing nutrient loops, reducing negative discharges to the environment, and valorizing agri-food waste for reuse.

The CEAP identifies five thrust areas along the value chain with the most potent and high-impact solutions to circularity. These thrust areas are water circularity, resource and energy efficiency, bioresource utilization, plastics circularity, and precision farming (see Figure 4). They are also relevant for other Central Asian countries.

Figure 4: Five Thrust Areas of the CEAP for the Agri-Food Sector in Uzbekistan



Source: Original to this publication based on CEAP for the Agri-Food Sector in Uzbekistan (2022).

Table 2: CE Priority Projects in Uzbekistan Agri-Food Sector

Projects/measures	Key issues addressed	Impacts	Investment needs (US$)
Water circularity in farming operations			
Drip irrigation programming systems	Water scarcity Water intensity 95 percent of agricultural output is produced on irrigated land	GHG reduction of more than 2.2 million tCO_2 Water savings of 433 million liters	350,000,000
Tensiometers to check the level of humidity in the root area			
Eco-friendly wastewater treatment for safe reuse in agriculture			
Use of internet of things (IoT)-based closed-circuit systems to maximize water efficiency			
Bioresource utilization			
Substituting baby corn husk with silk and baby corn fodder as animal feed	Post-harvest losses Food waste due to inadequate and inefficient cold chain Wasteful production and consumption processes	GHG reduction of more than 13.3 million tCO_2 Water savings	40,000,000
Substituting grains used for animal feed with discarded processed potato crop			
Piloting anaerobic digestors in tomato farming clusters to generate energy and heat			
Developing composting			
Implementing manure management practices including generation of electricity from cow manure			
Precision farming			
Using IoT-based and remote sensing-based services	Efficiency of the irrigation system Optimization of fertilizers and other chemicals	GHG reduction of more than 16.7 million tCO_2 Various other resource water savings	28,000,000
Resource and energy efficiency for the agri-food value chain			
Energy-efficient nutrient removal of sludge from municipal wastewater treatment plants (WWTPs)	Sanitation conditions of WWTPs Storage and transportation of perishable goods Particularly relevant as the government intends to triple the number of 1,500 existing refrigerated warehouses	GHG reduction of more than 1.5 million tCO_2 Various other energy and resource savings	382,000,000
Replacement of existing inefficient Ice Bank Tanks (IBT)			
Anaerobic treatment of organic waste to capture methane and use it to generate electricity in dairy, poultry, and beef/meat industry			
Installation of desuperheater in refrigeration system to extract waste heat			
Solar water heater for dairy, poultry, and beef/meat processing industries			
Sustainable packaging solutions			
Converting agriculture and food industry sludge obtained from WWTP to bioplastics		GHG reduction potential of 440,687 tCO_2.	32,200,000
Converting PET bottles generated from urban region into synthetic fibers			Requires initial investments but could generate revenue of up to 276 million

Source: Original to this publication based on CEAP for the Agri-Food Sector in Uzbekistan (2022).

The total costs of implementing the actions proposed in the CEAP amount to US$860 million over nine years, but these costs are met with significant benefits. With regard to financing the above solutions, a number of models could be applied such as public-private partnerships (PPP), leveraging of private capital, working with international donors, creation of investment vehicles, and others. In fact, 42 percent of the estimated costs could be financed by the private sector, with a significantly high return on investment—estimated at 100 percent. The overall benefits of the projects and measures listed above include a reduction of CO_2 emissions by 34 million tons, more than 0.5 billion liters of water savings, and other resource efficiency gains. GHG emissions from the agricultural sector could be reduced by 34 percent, while the share of renewable energy sources in agricultural energy demand could be increased to 5 percent, with large potentials for additional scale-up. In addition, CEAP implementation will enhance the resilience of Uzbekistan's agricultural sector to climatic vulnerabilities and shocks. In terms of employment, CEAP implementation has been estimated to create up to 46,000 jobs in Uzbekistan.

For all thrust areas and measures, the CEAP has identified relevant policy support and regulatory interventions including the adoption of new legislation, introduction of tax incentives, implementation of capacity-building programs, and others. Overall, all the interventions should also be accompanied with capacity building and awareness raising as well as the implementation of different activities to drive innovation, knowledge exchange, and close cooperation between technical institutions. The Ministry of Agriculture, Ministry of Finance, and Ministry of Investment and Foreign Trade will be the primary institutions in charge of circular solutions in the agri-food sector, supported by a number of other institutions.

CEAP implementation relies on the collaborative work of several institutions in charge of different aspects of the program. These include a number of ministers dealing with economic development, agriculture, water resources, investments and foreign trade, energy, innovative development, and finance.

Relevance for Central Asia

CE in the agri-food sector offers an opportunity for other Central Asian countries to meet national and sectoral strategic targets and strive for a shift of the mindset toward a systemic approach. Agriculture offers concrete possibilities for circularity which would help achieve different national climate and sectoral targets across Central Asia. Circularity in the agri-food value chain will also help minimize external inputs, close nutrient loops, reduce negative discharges to the environment, and valorize agri-food waste for reuse. It will also make the sector more resilient to climate change.

Integrating circularity in the national agricultural vision as well as into different regulations is a precondition for making the agriculture value chain more circular. Work for the preparation of the CEAP for Uzbekistan (and Almaty, see below) could serve as an inspiration for this integration. Regulatory barriers to implement the foreseen measures need to be removed. Foreseen measures include the adoption of new legislation, introduction of tax incentives, implementation of capacity-building programs, and others.

As in other sectors, developing a culture of collaboration and ensuring economic interest is a precondition for a successful CE transition. The mapping of stakeholders in the four stages of the agriculture value chain (harvest and farming activities, production and retail, consumption, and recycling/composting) is essential for drafting sectoral CEAPs across the region and for their successful implementation.

The circular transition in the agricultural value chain is associated with five key areas of intervention, applicable to countries in Central Asia to a varying extent. These five thrust areas are water circularity in farming operations, resource and energy efficiency for the whole agri-food value chain, bioresource utilization, plastics circularity, and precision farming. The development of the agri-food sector across countries of Central Asia is comparable and most

of the suggested actions would be relevant for the other Central Asian countries. Nevertheless, the agri-food sector is dependent on climatic conditions and therefore the necessary policy interventions will vary and depend on individual analysis.

Overall, all the interventions should also be accompanied by capacity building and awareness raising as well as the implementation of different activities to drive innovation. These include research and development (R&D) and knowledge exchange, close cooperation between technical institutions, and others. A share of these could come through technical assistance.

4. Circular Economy at the City Level: The Case of Almaty

Background

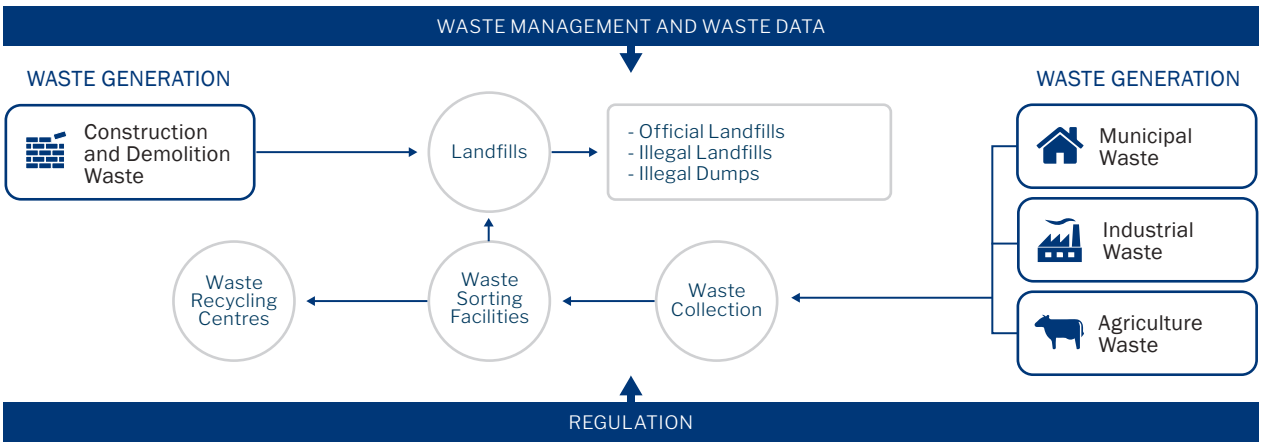
Cities play a central role in the transition to the CE. They have direct agency on different circular actions such as improving their overall energy and resource efficiency, decreasing waste generation, and reducing their carbon footprint. In addition to being home to an increasing share of the population, cities have the technological, human, and financial capital to implement the circular transition. Cities can also be frontrunner role models and inspire national action. While priority sectors can vary from city to city (depending on the city economy and baseline), the construction, industry, and agriculture sectors prioritized in Almaty are consistently among the highest GHG emitting sectors. These three sectors have also been identified within a CE Opportunities Study conducted in 2019.[4]

Almaty has 1.9 million inhabitants, and it produces almost 20 percent of the national GDP of Kazakhstan. Climate change is becoming a serious issue and the city is frequently hit by extreme weather and droughts. Moreover, there is significant air pollution due to the transportation, industrial, and mining sectors. Water pollution is due to industrial and agricultural activities.

Excessive waste generation, the lack of waste processing infrastructure, and flawed monitoring and evaluation procedures in Almaty pose a challenge to closing loops and recovering resources. Almaty recycles 14 percent of MSW, industry recycles 56 percent of industrial waste while in the construction sector the figure is close to zero. There are additional issues related to accumulated industrial waste. In general, waste management takes place through 61 waste collector companies at the city level (out of which one collects 70 percent of the total volume), in one official and in 25 unauthorized landfills and illegal dumpsites.

The different waste streams and ways of handling are illustrated in Figure 5.

Figure 5: Almaty Waste Streams



Source: Original to this publication based on CEAP for Almaty (2022).

[4] https://shiftingparadigms.nl/wp-content/uploads/2019/02/Circular-Economy-opportunities-in-Almaty-Web-spread-20190627-1.pdf.

Circular actions at the urban level are also necessary to achieve national commitments. The implementation of CE in Almaty will benefit the achievement of national policies, including under the Paris Agreement as well as Kazakhstan's national strategic frameworks such as the Strategy on Achieving Carbon Neutrality by 2060,[5] the 5-year 'Zhasyl (Green) Kazakhstan' National Project,[6] the Environmental Code of the Republic of Kazakhstan (2021),[7] Concept for Transition of the Republic of Kazakhstan to Green Economy - 2050,[8] the Almaty-2050 Development Strategy,[9] and the Almaty Green City Action Plan.[10]

Priority Sectors for the Circular Economy Action Plan: Circularity and the Case for Action

The construction, agriculture, and industry sectors have been selected for inclusion in the CEAP based on their carbon intensity and potential for improvement. Fossil fuels, biomass, and carbon-intensive construction materials are the main resources used in the city, most of which are imported. Food value chains, construction, and industrial processing are the most material-intensive sectors. Agriculture, resource extraction, the utilities industry, and construction have the greatest environmental impact. Based on the aforementioned CE Opportunities Study for Almaty, construction, industry, and agriculture were chosen as priority sectors for transition to a CE:

- **Construction:** The construction sector has a large carbon footprint. Most of its GHGs are generated outside Almaty city in the cement kilns and blast furnaces that produce construction materials. As the city is growing, new construction is inevitable.
- **Industry:** The main drivers for the growth of industrial activity are machine building, food processing, and the production of construction materials. New national regulations and city policies could accelerate initiatives that extract and retain value from residues.
- **Agriculture:** The national government supports Almaty's goal to double its agricultural production and processing capacity. The additional capacity will produce new organic residues.

Sectoral barriers and enablers—from legal to economic and technological—were identified with local stakeholders. In the construction sector, the low cost of landfilling waste is reflected in the low recycling rate for CDW. Almaty lacks the quality infrastructure and rules and standards to certify alternative construction materials. Stakeholders also noted that material processing processes, construction methods, and recycling technologies are obsolete. Despite the 2021 Environmental Code, the industry sector still lacks a waste categorization system and a defined methodology for waste treatment processes, as illustrated by the number of illegal landfills in Almaty. In addition, the government framework for monitoring and evaluating industry activities is outdated. In the agriculture sector, current standards, legislation, and rules do not allow for or do not consider waste stream material recovery activities. As a result of the lack of regulatory incentives to innovate and introduce new processes in agriculture, the sector has fallen behind and agricultural workers, experts, and technologies are not up to date. Stakeholders recognize the need for innovation within the sector.

The methodology for defining the CE actions in Almaty includes seven steps: a policy framework analysis, a description of the value chain, a material flow analysis, the identification of policy gaps, the definition of projects, the prioritization of projects, and an investment needs analysis. The steps are shown in Figure 6.

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5 https://adilet.zan.kz/rus/docs/U2300000121.

6 https://primeminister.kz/en/news/alikhan-smailov-orders-to-develop-action-plans-to-improve-environment-in-each-region-2574922.

7 https://adilet.zan.kz/rus/docs/K2100000400. Unofficial English translation: https://wecoop.eu/wp-content/uploads/2021/04/2021-KZ-ENV-Code_full-text_en.pdf.

8 https://www.oneplanetnetwork.org/knowledge-centre/resources/concept-transition-republic-kazakhstan-green-economy. Site includes download link to Concept.

9 https://almatydc.kz/en/press/news/o-strategii-razvitiya-almaty-2050.

10 https://ebrdgreencities.com/assets/Uploads/PDF/GCAP-Almaty-EN.pdf?vid=3.

Figure 6: Methodology for Defining CE Actions

Source: Original elaboration for this publication.

A Multi-Criteria Matrix was used to rank the CE projects, based on their potential social-economic benefits for businesses. The economic, social, and environmental aspects of the projects were evaluated, as well as the cross-cutting characteristics related to feasibility. The overall benefits of the projects include improved resource efficiency for the city, extension of the life of the products, and decreased air pollution. The precise GHG reduction potential is to be explored at a later stage.

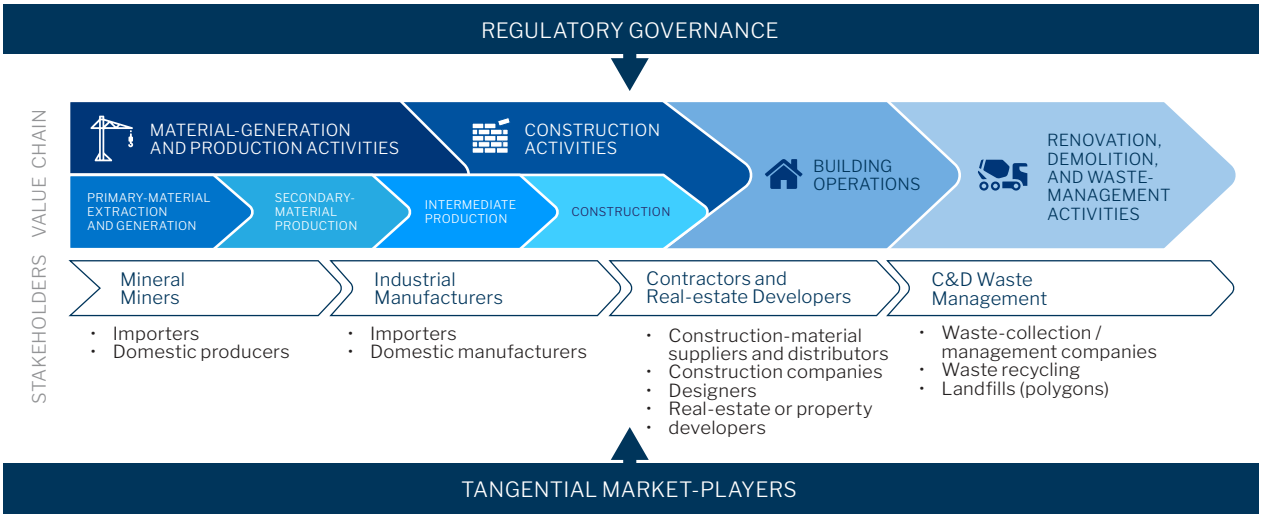
The Construction Sector in Almaty: Circularity and the Case for Action

Spatial development of Almaty is characterized by insufficient effective planning solutions and weak regulation in urban planning policy. More than 100,000 people do not have water supply and sewer systems cover only 79 percent of the population.

Almaty's built environment is highly energy intensive because of its aging infrastructure. Moreover, as the city is growing, there is a need for new construction and renovation of existing infrastructure. Hence, the sector has great potential for circularity in all life cycle phases of construction. There are no policies on CE in the sector yet and there are no requirements and methodologies regarding the reduction of waste generation along the construction and demolition value chain. The accreditations and rules that authorize new alternative safe materials for construction are missing.

The construction value chain consists of four stages: material generation (primary and secondary); construction; building operations; and renovation, demolition, and waste management activities. Each stage is associated with respective stakeholders from miners and importers through industrial manufacturers, contractors and real estate developers, and CDW management companies (see Figure 7).

Figure 7: Construction Sector Value Chain and Its Stakeholders



Source: Original to this publication based on CEAP for the City of Almaty (2022).

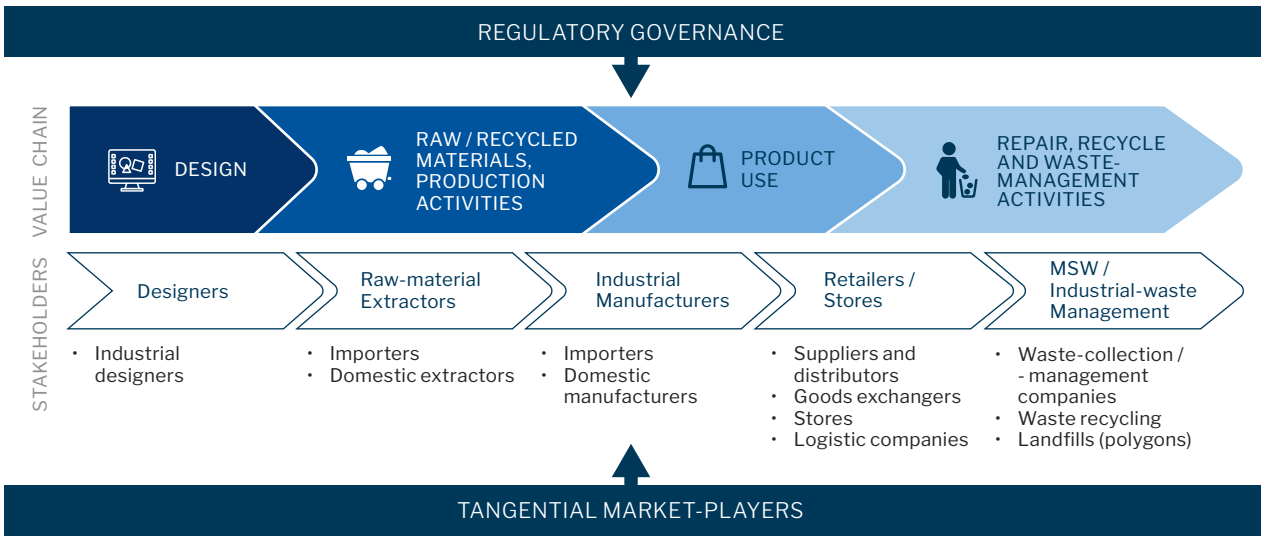
The concrete actions proposed for the construction sector in Almaty are presented in Table 3.

The Industry Sector in Almaty: Circularity and the Case for Action

Industry generated more than 5 percent of the national GDP in 2019. Almaty is a major industrial center with the food and beverage industry accounting for about one-third of its industrial activities. There are no policies on CE in the sector yet and there are a number of illegal waste streams detected around Almaty. Almaty's industry boasts a large number of small and medium enterprises (SMEs).

The industry value chain consists of five stages: design; sourcing of raw materials; production; use; and repair, recycling, and waste management activities. Each stage is associated with respective stakeholders—designers, raw material extractors, industrial manufacturers, retailers, and operators of MSW and industrial waste (see Figure 8).

Figure 8: Industry Sector Value Chain and its Potential Stakeholders



Source: Original to this publication based on CEAP for the City of Almaty (2022).

Considering the situation and the stakeholder needs in the industrial value chain, a number of CE projects have been identified, as shown in Table 3.

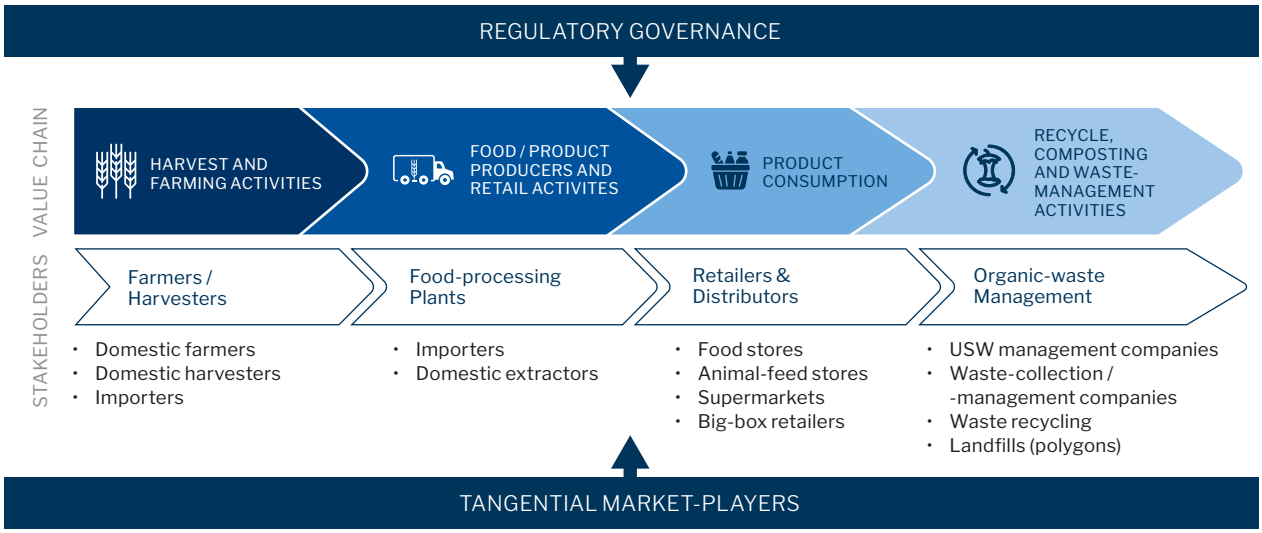
The Agri-Food Sector in Almaty: Circularity and the Case for Action

Agriculture is an important sector for Kazakhstan and Almaty and has been a key sector in national and local development plans. The ambition is to increase agriculture's contribution to the GDP by five times and also enhance food sovereignty for Almaty.

The Almaty 2050 Development Strategy does not mention CE explicitly, but its goals are aligned with it. Additionally, norms on organic agriculture are already in place. However, waste streams are not controlled and waste quality cannot be guaranteed. Organic waste is not separated on-site, which lowers its quality. Moreover, the law does not allow the use of organic waste as fertilizer.

The agriculture sector value chain consists of four stages (harvest and farming activities, production and retail, consumption, and recycling/composting) with respective stakeholders associated with these stages—farmers, food processing plants, retailers, and organic waste management operators. The analysis in the CEAP focuses on the first and fourth stage (see Figure 9).

Figure 9: Agriculture Sector Value Chain and its Potential Stakeholders



Source: Original to this publication based on CEAP for the City of Almaty (2022).

Specific CE actions proposed for the agriculture sector are presented in Table 3.

Circular Economy Action Plan for Almaty

Considering the situation and the city needs in the three value chains, a number of CE projects have been identified for each of the three sectors. These are presented in Table 3.

Table 3: Projects/Measures Identified in the CEAP for the City of Almaty

Projects/measures	Key issues addressed	Impacts	Investment needs (US$)
Construction sector			
The Almaty CDW - Recycling Center (CON 1)	Infrastructure gap Lack of recycling centers Scalable solution	Will improve the resource efficiency of the city Job creation	5,000,000
Modular building production - Design for Disassembly (CON 2)	Waste generation Short product life Scalable solution Adaptable solution	Extend the life of the products Waste prevention	48,700,000
Establishment of a plant for production of construction material from plastic waste (CON 3)	Plastic waste is abundant Plastic pollution	Resources recovery Pollution reduction	2,600,000
Industry			
Construction of a plant for 100 percent processing of ash storage facilities at co-generator of heat and power (Almaty-2 thermal power plant) of Almaty Electric Stations Joint Stock Company (AIES JSC) and production of marketable products (IND 1)	Resource utilization	Upcycling solution Decreasing of air pollution Revenue generation Job creation	278,600,000
Integrated digital system of municipal waste management for Almaty agglomeration (IND 2)	Statistical data at city-level waste streams are poor	Better data availability Scalable solution	22,600,000

Projects/measures	Key issues addressed	Impacts	Investment needs (US$)
A complex for the industrial production of compost and artificial soils from biodegradable waste (IND 3)	High volumes of biodegradable waste	GHG emission reduction Job opportunities Synergy with other sectors and the agriculture sector	7,900,000
Agriculture and food processing			
Bioconversion of food waste into animal feed and fertilizers with the help of black soldier fly larvae (Hermetia illucens) (AGR 1)	Food waste utilization Applicable to other regions		1,200,000
Organic rural bio-factories (AGR 2)	Adaptable to different type of farms and crops.	Increased resilience of local farmers	257,000
Technopark of green innovations: Bioconversion of fallen leaves and plant residues of Almaty city into organic fertilizers (AGR 3)	Low levels of innovation Applicable to other regions		647,000

Source: Original to this publication based on CEAP for the City of Almaty (2022).

The estimated discounted net investment is US$368 million until 2030, which equals to 1.1 percent of Almaty's GDP. Projects in the industrial sector account for most of the investment (84 percent), followed by those in the construction sector (15 percent) and in the agricultural sector (1 percent). Private investment represents the major share of the investments that corresponds to almost 90 percent of their total value. It is followed by public funds that cover an estimated 6.2 percent. The actions proposed under the CEAP would help reduce demand for primary materials by 21 million tons by 2031, while reducing CDW generation by 871 tons annually. In addition, Almaty would benefit from increased local production and use of resources as well as from the creation of 375 new jobs.

One of the actions proposed in the CEAP for Almaty is currently under development. It is the construction of a bottom ash processing plant near the city's Almaty-2 thermal power plant. As announced in June 2023, with private investments of about US$21 million, a bottom ash processing plant will be built with a capacity of 300,000 tons per year, which may gradually be increased to a capacity of 1 million tons per year (equivalent to 100 percent of ash produced by the Almaty-2 thermal power plant and dumped into storage facilities annually). Processing of the bottom ash will result in various products, which can be used in metallurgical and construction industries, as well as for heating.

Relevance for other Central Asian cities

Cities in Central Asia should make use of the territorial capital. It holds significant assets that are key building blocks on the road to a CE. This capital varies across territories (for example, geographical location, natural resources, social capital, and institutions), its economic role in the cities and regions, and how much it can be levera-ged to foster transition to the CE. Being able to realize the potential of the territorial capital depends on a number of factors including policy, institutions, political will, and the financial context.

The CE transition at the urban level represents a significant opportunity for Central Asian cities in terms of improving their overall energy and resource efficiency, decreasing waste generation and land take and biodiversity loss, and ultimately reducing their carbon footprint from multiple activities. Cities represent the right scale and possess the necessary ecosystem to implement the transition. Approaching CE through the city prism is complementary to addressing it through a sectoral / value chain viewpoint.

Each city needs to prioritize intervention sectors in line with the weight of individual sectors and their carbon footprint, the city strategic documents and climate plans, the city capabilities, and so on. Waste management remains a central horizontal area for improvement in the process of circular transition. Construction and industry are also sectors with significant leverage, as demonstrated by Almaty. These two sectors also lend themselves to CE interventions and business models.

Cities need to integrate CE consistently and systematically into local strategic documents. Sectoral regulations need to be amended (for example, with the goal of allowing the use of waste as secondary raw materials) to unblock changes and to create the necessary incentive framework.

Almaty could serve as a potentially good and inspirational example of circular transition for other municipalities in Central Asia. The three sectors covered in the CEAP—construction, industry, and agriculture—share similar problems and challenges in all Central Asia countries without exception. Nevertheless, the replicability of individual measures should be investigated, and they should be adapted to the local circumstances.

5. Conclusions and the Way Forward

The Importance of Circular Economy Action Plans

CE offers an impactful pathway for Central Asia countries to address development challenges and meet international obligations as well as national and sectoral strategic targets. CE is a system solution framework that tackles global challenges such as climate change, biodiversity loss, waste, and pollution. It leads to decoupling of economic activity from the consumption of finite resources and is a resilient system that is good for business, people, and the environment. At the same time, CE is an opportunity for job creation for Central Asia.

CEAPs, such as the ones presented in this report, are essential for charting the way forward in the circular transition. CEAPs help provide the overarching direction for the circular transition in Kazakhstan, Uzbekistan, and Almaty as well as investment security for the private sector. There are different ways to identify the focus of CEAPs; in the case of the three CEAPs presented in this report, focus sectors were selected based on economic importance, employment, material use, carbon footprint, potential for circular improvement (including policy), and stakeholder engagement and buy-in.

CEAPs have become possible due to significant stakeholder engagement and bottom-up buy-in. In general, this is a precondition for circular transition in Central Asian countries, cities, sectors, and value chains. The participation of business intermediaries at the local level is of utmost importance as they are close to the local stakeholders. At the same time, the CE planning process has been instrumental in raising awareness of the stakeholders about the existing opportunities and aligning them behind priority actions.

Drivers of the Circular Transition

The circular transition in the construction, industry, and agriculture sectors is hampered by economic, market failure, and regulatory failure barriers. There is a need to adopt a program for overcoming these, starting with the key market and regulatory failures. It is also necessary to adopt a life cycle approach to accelerate the CE transition and use mandatory and voluntary mechanisms such as green public procurement (GPP), environmental labeling or standards, extended producer responsibility (EPR) schemes, and others. As waste prevention and management is central to circular transition in all sectors and governance levels, it would be advisable to consider additional bans on landfilling and mandatory requirements for segregation of waste. In addition, taxation of primary raw materials should be considered.

In addition to regulatory pressure as a factor for unlocking the circular transition, the economic motivation of companies and other market players is of significant importance. Hence, there is a need for policy makers to introduce market and fiscal incentives that can strengthen the company motivation and reward front-runners. The economic gains of companies and the positive social impact on society due to CE measures should be constantly highlighted and communicated to create an additional momentum for change.

The circular transition in all sectors covered by the three CEAPs and governance levels requires significant financing from public and private sources accompanied by guidance and technical assistance. Often the business case for circular business models is still not clear which sometimes prevents the active participation of private capital. Therefore, the role of public funding is highly important. Demonstrating the economic benefit of CE will eventually increase the funding flows.

For export-oriented or foreign-owned opera-

tors in the construction and agri-food sectors, pressure from the value chain or the mother companies is crucial. Programs that bring together local suppliers with international companies could be introduced so that Central Asia can benefit from good international practices.

Availability of data on waste generation and management, resource efficiency, and secondary materials is key to understanding material flows. Hence, there is a need to implement a comprehensive monitoring and reporting system of waste generation and treatment, supported by appropriate methodologies and responsible institutions.

The circular transition requires targeted activities to build the necessary skills for introducing resource efficiency measures and new circular business models. It is also a question of mindset shift to prioritize and emphasize the transition to circularity. Upskilling should happen at all governance levels as well as at sectoral/value chain level.

Way Forward

The success of the CEAPs presented in this report depends on their level of implementation. All three CEAPs present numerous actions discussed and confirmed with relevant stakeholders. These can be implemented individually or in their entirety. While each action will bring respective sectors closer to circularity, only the implementation of all actions will allow the achievement of the full benefits described in each CEAP. Since the economic benefits are estimated to surmount economic costs considerably, there is a clear case for implementing as many actions as possible. However, even where actions should not be implemented in the short to medium term, the CEAPs contribute to the analysis of CE in the respective sectors as well as to the ongoing debate about sustainable development and decoupling economic growth from environmental degradation.

The analysis undertaken for the three CEAPs needs to be expanded to cover more sectors and more countries of Central Asia to facilitate the CE transition across the region. The countries of Central Asia have many commonalities as well as differences. While it is possible to draw conclusions from the sector- and country-specific CEAPs presented in this report for other countries in Central Asia, further analysis is required covering the key sectors in all five countries of Central Asia. Sectors could be selected based on similar criteria used in the CEAPs presented above, including economic importance, employment, material use, carbon footprint, potential for circular improvement (including policy), and stakeholder engagement and buy-in. Identifying the key sectors in each of the five Central Asian countries together with concrete actions to support circularity in these sectors will provide the basis for the transformation of the entire region to a more CE.

Based on additional analysis, measures can be identified which could be implemented at the regional level. Where challenges affect multiple countries (for example, in waste management), regional approaches could be identified which could reduce the costs of individual countries for advancing circularity. For example, awareness-raising campaigns for consumers could be coordinated and common programs for capacity building could be designed—regional in nature but tailored to specific country contexts. In terms of investment, regional recycling centers could be an option to reduce costs in waste management. Depending on the concrete actions or measures, two or more countries could coordinate efforts toward their implementation. In other cases, a national approach may be more effective and would need to be identified on a country-by-country basis.

Addressing data gaps is an essential prerequisite for any future work on the CE in Central Asia. Given that CE-related data are scarce, incomplete, and unreliable in all countries across Central Asia, any future work in support of the CE transition will need to address data gaps to reach sound and evidence-based conclusions. There are numerous methodologies available internationally which can be applied to produce relevant data (for example, as developed by Eurostat), but it is important that data are comparable across the region and internationally to identify challenges and measure progress.

Circular Economy as an Opportunity for Central Asia

Summary Report

May 2024

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