

CIRCULAR APPROACHES TO AGRICULTURAL WASTE MANAGEMENT: COMPARATIVE ANALYSIS OF GERMANY, CHINA, INDIA, THE EUROPEAN UNION AND UZBEKISTAN

Zulfina Nazirova

PhD student

Bukhara State University

E-mail: nazirovazulfina15@gmail.com

Abstract

The article compared circular approaches to agricultural waste management in Germany, China, India, the European Union and Uzbekistan. Scientific publications, institutional reports, government documents and statistics were synthesised. Composting, biofertilizer production, feed use and bioenergy recovery from crop residues, manure and processing byproducts were examined. The analysis highlighted the importance of combining technologies with quality standards, financial incentives, infrastructure and market mechanisms. An integrated biological resource flow management approach was proposed for Uzbekistan. Recommendations addressed separate collection, biogas production, digital monitoring and regional circular clusters. Pilot opportunities in Bukhara were considered, while dedicated quantitative assessment of actual resource potential was identified as necessary.

Keywords: agricultural waste, circular economy, biological resources, composting, biofertilizers, biogas, digital monitoring, regional clusters.

Annotatsiya

Maqolada qishloq xo'jaligi chiqindilarini sirkulyar iqtisodiyot tamoyillari asosida boshqarish yondashuvlari Germaniya, Xitoy, Hindiston, Yevropa Ittifoqi va O'zbekiston misolida qiyosiy o'rganildi. Ilmiy adabiyotlar, institutsional hisobotlar, davlat hujjatlari va statistik ma'lumotlar tizimlashtirildi. O'simlik qoldiqlari, chorvachilik chiqindilari va qayta ishlash yonaki mahsulotlaridan kompost, bioo'g'it, yem hamda bioenergiya olish yo'nalishlari taqqoslandi. Texnologiyalarni sifat standartlari, moliyaviy rag'batlar, infratuzilma va bozor mexanizmlari bilan uyg'unlashtirishning ahamiyati yoritildi. O'zbekiston uchun biologik resurslar oqimlarini yaxlit boshqarishga asoslangan konseptual yondashuv taklif etildi. Alohida yig'ish, biogaz ishlab chiqarish, raqamli monitoring va hududiy sirkulyar klasterlarni rivojlantirish bo'yicha tavsiyalar shakllantirildi. Buxoro viloyatida tajriba loyihalarini tashkil etish imkoniyatlari ko'rib chiqildi. Resurs salohiyatini aniqlash uchun alohida miqdoriy baholash zarurligi ta'kidlandi.

Kalit so'zlar: qishloq xo'jaligi chiqindilari, sirkulyar iqtisodiyot, biologik resurslar, kompostlash, bioo'g'it, biogaz, raqamli monitoring, hududiy klasterlar.

Аннотация

В статье были сопоставлены подходы к управлению сельскохозяйственными отходами на принципах циркулярной экономики в Германии, Китае, Индии, Европейском союзе и Узбекистане. Были систематизированы научные публикации, институциональные отчёты, государственные документы и статистические данные. Сравнивались

направления использования растительных остатков, отходов животноводства и побочных продуктов переработки для получения компоста, биоудобрений, кормов и биоэнергии. Подчёркивалось значение сочетания технологий со стандартами качества, финансовыми стимулами, инфраструктурой и рыночными механизмами. Для Узбекистана был предложен концептуальный подход к комплексному управлению потоками биоресурсов. Были сформулированы рекомендации по раздельному сбору, производству биогаза, цифровому мониторингу и региональным циркулярным кластерам. Рассматривались пилотные проекты в Бухарской области. Была отмечена необходимость отдельной количественной оценки фактического ресурсного потенциала.

Ключевые слова: сельскохозяйственные отходы, циркулярная экономика, биологические ресурсы, компостирование, биоудобрения, биогаз, цифровой мониторинг, региональные кластеры.

INTRODUCTION

Agriculture is one of the major sectors generating biological residues and by-products throughout production, harvesting, processing, and distribution. Crop residues such as straw, stalks, leaves, husks, and branches, as well as livestock manure and agro-processing by-products, represent substantial quantities of biomass that can either become an environmental burden or serve as valuable secondary resources. The conventional linear model of production, characterized by the extraction of resources, production, consumption, and disposal, is increasingly challenged by resource scarcity, environmental degradation, climate change, and growing pressure on agricultural systems [3]; [12].

The circular economy provides a fundamentally different perspective on these challenges. Instead of treating agricultural residues exclusively as waste, the circular approach considers them as potential inputs for subsequent production processes. Depending on their biological and physical characteristics, agricultural residues can be returned to agricultural soils, transformed into compost or biofertilizers, used as animal feed, processed into bioenergy, or incorporated into other value-added production chains [18].

This approach is particularly relevant to agriculture because biological materials can participate in both technical and biological cycles. The Ellen MacArthur Foundation identifies three core principles of the circular economy: eliminating waste and pollution, circulating products and materials at their highest value, and regenerating nature [4]. In agricultural systems, these principles can be translated into practices such as preventing unnecessary waste generation, returning nutrients to soil, recovering energy from organic residues, and reducing dependence on non-renewable external inputs.

The transition toward circular agricultural production also requires a reconsideration of the concept of agricultural waste management. Waste management should not be limited to collection, transportation, and disposal. Instead, it should encompass a broader system of resource management in which material flows are identified, separated, processed, recovered, and returned to productive use.

International experience demonstrates several approaches to this transition. Germany has developed systems for separate collection and biological treatment of organic waste, including anaerobic digestion and composting. The German Federal Environment Agency reports that almost all digestates are used as fertilizers and that agriculture accounted for approximately 55% of the use of quality-assured compost in 2024 [17].

China provides another important example. Recent research reports that the comprehensive utilization rate of major crop straw in China reached approximately 88.1% in 2024, with utilization pathways including fertilizer, feed, and energy production [19]. This demonstrates the potential of large-scale resource utilization when technological development is combined with government-supported agricultural policies.

India faces a different institutional and environmental context. Crop-residue burning remains an important policy concern, particularly in major rice-producing regions [1; 9]. In response, the Indian government has supported crop-residue management machinery, biomass-based energy, compressed biogas, and other forms of resource utilization. Current government measures provide financial support for agricultural machinery and Custom Hiring Centres designed to facilitate crop-residue management [10].

At the European Union level, circular agricultural development is incorporated into a broader policy framework. The Common Agricultural Policy (CAP) 2023-2027 combines environmental conditionality, eco-schemes, and rural development interventions [5]. The policy links agricultural support with climate action, natural-resource protection, biodiversity, and sustainable agricultural practices. In addition, the EU's 2025 Bioeconomy Strategy emphasizes resource-efficient and circular use of biological resources and encourages higher-value applications of biomass [8].

For Uzbekistan, these international developments are particularly relevant because agriculture constitutes a major component of the national economy and generates considerable volumes of biological residues. According to Uzbekistan's official statistics, the total volume of agricultural production reached 439,948.0 billion soums in 2024, compared with 40,307.9 billion soums in Bukhara region [15]. The scale of agricultural production creates substantial potential for the development of circular resource flows.

The objective of this study is therefore to comparatively analyze agricultural waste management practices in Germany, China, India, the European Union, and Uzbekistan and to identify institutional, technological, and economic mechanisms that may support the transition toward circular agricultural production in Uzbekistan.

LITERATURE REVIEW

The scientific literature on the circular economy provides the conceptual basis for rethinking agricultural waste. Kirchherr, Reike and Hekkert analysed 114 definitions of the circular economy and found that the concept is most frequently described as a combination of reduce, reuse and recycle activities, while the systemic shift that it requires is often underemphasized [11]. The Ellen MacArthur Foundation

distinguishes between technical and biological cycles and argues that biological materials should be safely returned to the biosphere after cascading through different uses [4]. This distinction is particularly important for agriculture, where most residues are organic and can re-enter soil, feed and energy systems.

Research on agricultural waste has a long history. A bibliometric review of more than three thousand publications showed that agricultural waste has been studied for over six decades, that research activity accelerated from the late 1990s, and that the United States, India and China lead in publication volume, with cereal crop residues as the dominant subject [3]. The same review notes that recent studies increasingly frame alternative uses of residues within circular economy and bioeconomy approaches [3]. Koul, Yakoob and Shah summarize the main management strategies, including composting, anaerobic digestion, bioenergy production and other valorization routes, and stress their contribution to environmental sustainability [12].

Several authors have attempted to adapt the circular economy framework specifically to the agricultural sector. Velasco-Muñoz and co-authors define circular agriculture through strategies for closing resource loops and review 41 circularity indicators, concluding that internationally recognized standards and appropriate units of measurement are still needed [18]. This measurement gap is relevant for countries that are only beginning to monitor agricultural material flows.

Country-level studies show how circular principles are implemented in practice. For China, Wang and co-authors report that the comprehensive utilization rate of major crop straw reached 88.1% in 2024, with fertilizer, feed and energy as the main pathways, and describe the technologies and equipment that support this system [19]. A life cycle assessment of rice straw returning found that straw incorporation improves soil organic matter and microbial indicators, but also involves costs, greenhouse-gas emissions and pest and disease risks that depend on the technique used [16]. For India, Bhuvaneshwari, Hettiarachchi and Meegoda examine the policy challenges of crop-residue burning and discuss alternative uses of residues as potential solutions [1].

For Uzbekistan, the literature is mainly represented by policy and institutional documents. The Strategy for the transition to a green economy for 2019-2030 set the general direction for resource efficiency [21], the World Bank identified the agri-food sector as a priority area for circular economy development [20], and the Third Nationally Determined Contribution includes circular measures in agriculture [13]. However, comparative studies that connect international experience with the specific conditions of Uzbek agriculture remain limited. The present study addresses this gap.

METHODOLOGY

The study applies a comparative and analytical research methodology to examine agricultural waste management within the framework of the circular economy. Germany, China, India, the European Union, and Uzbekistan were selected as comparative cases because they represent different levels of technological development, institutional capacity, agricultural structures, and approaches to resource management.

The research was conducted through four main stages.

First, relevant scientific publications, international institutional reports, government documents, policy strategies, and statistical information concerning agricultural waste, crop residues, biomass utilization, composting, anaerobic digestion, bioenergy, and circular economy development were collected and systematized.

Second, the main agricultural waste management practices implemented in the selected countries and the European Union were identified. Particular attention was given to the transformation of agricultural residues into secondary resources rather than their simple disposal.

Third, a comparative analysis was conducted according to common analytical dimensions:

1. agricultural waste prevention and reduction;
2. reuse and recycling of biological materials;
3. composting and biofertilizer production;
4. biomass and biogas utilization;
5. technological and infrastructural capacity;
6. government regulation and economic support;
7. farmer and stakeholder participation;
8. integration of circular economy and bioeconomy principles.

Fourth, the identified international practices were compared with the current development context of Uzbekistan in order to identify potentially adaptable mechanisms.

The research does not attempt to establish a universal ranking of countries. Instead, it examines the specific mechanisms used in each context and evaluates their relevance to the transition toward circular agricultural production.

The analytical framework is based on the principle that agricultural waste management effectiveness depends on the interaction of technological, economic, institutional, and organizational factors. Consequently, the study considers not only waste-treatment technologies but also the mechanisms that determine whether recovered materials can be returned to productive use.

ANALYSIS AND RESULTS

International approaches to agricultural waste management

The comparative analysis demonstrates that agricultural waste management systems increasingly move beyond conventional disposal approaches toward resource recovery and circular utilization.

Germany

The German approach illustrates the integration of organic waste treatment with nutrient and resource recovery. Separate collection and biological treatment enable organic materials to be processed through composting and anaerobic digestion. According to the German Federal Environment Agency, digestates are used predominantly as fertilizers, while approximately 55% of quality-assured compost was used in agriculture in 2024 [17].

This mechanism is particularly relevant from a circular economy perspective because it establishes a biological cycle: organic residues are processed into compost

or digestate, and nutrients are subsequently returned to agricultural soils. Thus, the process simultaneously contributes to waste reduction, nutrient recycling, and partial substitution of mineral fertilizers.

The German case demonstrates that technological infrastructure alone is insufficient. The effectiveness of organic-resource recovery also depends on separate collection, quality standards, regulatory requirements, and established markets for recovered products.

China

China demonstrates the potential of large-scale crop-residue utilization. Recent research indicates that the comprehensive utilization rate of major crop straw reached approximately 88.1% in 2024 [19]. Fertilizer use represented the largest utilization pathway, followed by feed and energy applications.

The Chinese model is significant because it incorporates agricultural residues into multiple resource pathways rather than relying on a single treatment technology. Crop residues may be returned to agricultural land, processed into feed, or used for energy production.

However, the Chinese case also illustrates the importance of selecting the appropriate utilization pathway for specific residues and regional conditions. Recent research has noted that field return constitutes a major share of straw utilization, while the allocation of straw between soil management and bioenergy requires careful consideration of environmental and resource-efficiency outcomes [14]; [16].

Consequently, the Chinese experience suggests that high utilization rates should not be interpreted simply as evidence of optimal circularity. The quality, environmental consequences, and economic value of each utilization pathway also need to be considered.

India

India represents a different type of agricultural waste management challenge, particularly due to crop-residue burning in several agricultural regions. Government policy has therefore focused on reducing open burning while promoting alternative uses of crop residues [1]; [9].

Current measures include financial assistance for agricultural machinery used in crop-residue management and higher levels of support for organizations establishing Custom Hiring Centres. The National Bioenergy Programme also supports biomass-based power generation, briquette and pellet production, and compressed biogas plants [10].

Government initiatives also promote in-situ and ex-situ residue management. In-situ approaches include incorporation of residues into soil and the use of decomposers, while ex-situ pathways include animal feed, mushroom cultivation, biomass energy, and other applications [2].

The Indian case therefore demonstrates the importance of combining environmental regulation with economic incentives and access to machinery. Farmers require not only regulatory pressure to reduce burning but also practical and economically viable alternatives for managing residues.

European Union

The European Union demonstrates a more systemic approach in which agricultural waste and resource management are incorporated into broader agricultural, environmental, and bioeconomy policies.

Under the CAP 2023-2027, environmental conditionality links agricultural support with environmental requirements, while eco-schemes provide incentives for farmers adopting practices that contribute to climate and environmental objectives [5].

The EU also applies restrictions on burning arable stubble through GAEC 3 and promotes soil-management practices that preserve organic matter and reduce environmental pressures [6]; [7].

The 2025 EU Bioeconomy Strategy further strengthens this approach by emphasizing resource-efficient and circular use of biological resources and encouraging higher-value applications of biomass [8].

Therefore, the European model demonstrates the integration of agricultural waste management with environmental regulation, financial support, soil management, climate policy, and bioeconomy development.

Uzbekistan

Uzbekistan possesses substantial potential for circular agricultural resource management. The country's agricultural sector generates crop residues, livestock manure, and agro-processing by-products that can potentially be incorporated into biological and energy cycles.

The World Bank's Circular Economy Action Plan for Uzbekistan's agri-food sector identifies agriculture as a priority area for circular economy development and highlights five major areas of intervention: water circularity, resource and energy efficiency, bioresource utilization, plastics circularity, and precision farming. The report emphasizes that circularity in the agri-food value chain can reduce external inputs, close nutrient loops, reduce environmental discharges, and increase the value obtained from agricultural and food waste [20].

Uzbekistan's Third Nationally Determined Contribution also recognizes circular economy measures in agriculture. It identifies 17 measures related to areas including water circulation, bioresource utilization, precision farming, energy efficiency, and environmentally sustainable packaging. The document also identifies livestock manure as a potential feedstock for biogas production and the associated biofertilizer as an input for agricultural soils [13].

These policy developments indicate that circular economy principles are increasingly being incorporated into the national agricultural development agenda. Nevertheless, the transformation of these principles into widespread agricultural practice requires further development of collection systems, processing infrastructure, financing mechanisms, technological capacity, and market demand for secondary biological resources.

Comparative assessment

The main findings of the comparative analysis are summarized in Table 1.

Table 1

Comparative characteristics of agricultural waste management approaches¹

Analytical dimension	Germany	China	India	European Union	Uzbekistan
Crop-residue utilization	Recycling, composting and energy recovery	Large-scale multi-pathway utilization	In-situ and ex-situ management	Integrated resource and soil management	Significant development potential
Compost/biofertilizer	Established	Developed	Developing	Supported through sustainable nutrient management	Emerging
Biogas/biomass	Established infrastructure	Important utilization pathway	Expanding through bioenergy programmes	Integrated into bioeconomy and energy policy	High potential
Government support	Regulation and quality standards	Strong policy and programme support	Financial incentives and machinery support	CAP, eco-schemes and rural development	Increasing policy support
Open residue burning	Strong restrictions	Reduction through utilization policies	Major policy concern in selected regions	Restricted under CAP rules	Scope for further improvement
Circular-economy integration	Integrated resource recovery	Rapidly expanding	Developing	Systematically integrated into policy	Emerging/expanding
Main strategic emphasis	Nutrient and energy recovery	Large-scale resource utilization	Alternatives to residue burning	Sustainable agriculture and bioeconomy	Resource efficiency and bioresource utilization

The comparison demonstrates that the selected cases differ considerably in their institutional and technological configurations. Nevertheless, several common characteristics can be identified.

First, successful agricultural waste management systems increasingly treat biological residues as resources rather than as materials requiring disposal.

Second, technological solutions are most effective when combined with economic and institutional mechanisms. Germany illustrates the importance of quality standards and established markets for recovered organic products, while India demonstrates the role of financial incentives and machinery-access mechanisms.

Third, China demonstrates the importance of large-scale resource utilization systems, while the European Union demonstrates how environmental requirements can be integrated into agricultural financial-support mechanisms.

¹ Source: compiled by the authors based on the analyzed scientific literature, official policy documents, and statistical sources.

Fourth, the cases demonstrate that agricultural waste management should be connected with other sectors, including energy, livestock production, fertilizer markets, food processing, and rural development.

Authorial interpretation of the comparative results

The comparative findings indicate that the transition toward circular agricultural production can be understood as a gradual movement through four interconnected stages:

disposal → recycling → resource recovery → circular integration.

At the first stage, agricultural residues are primarily regarded as waste requiring removal. At the second stage, selected residues are recycled or reused. The third stage focuses on recovering material, nutrient, and energy value from agricultural residues. The fourth and most comprehensive stage integrates recovered resources into interconnected agricultural value chains.

This interpretation is particularly relevant for Uzbekistan. The objective should not simply be to increase the quantity of agricultural waste that is processed. Rather, the management system should maximize the economic, environmental, and agricultural value obtained from each resource flow.

For example, crop residues may be allocated among several pathways depending on their characteristics: soil incorporation, composting, animal feed, bioenergy, or processing into value-added products. Similarly, livestock manure may be processed through anaerobic digestion, with biogas used for energy and digestate returned to agricultural land as a nutrient source.

Thus, the appropriate model for Uzbekistan should be based on integrated resource-flow management rather than on a single waste-treatment technology.

Discussion

The results confirm that agricultural waste management is increasingly shifting from a linear disposal model toward circular resource management. This transformation is consistent with the broader principles of circular economy theory, particularly the elimination of waste and pollution, circulation of materials, and regeneration of natural systems [4]; [11].

The international cases demonstrate that there is no single universal model of agricultural circularity. Germany emphasizes structured organic-waste treatment and nutrient recovery. China demonstrates large-scale utilization of crop residues through several pathways. India emphasizes the transition away from open burning through financial support, machinery, and biomass utilization. The European Union integrates circularity into agricultural, environmental, climate, and bioeconomy policy.

These differences are important for Uzbekistan because direct replication of any individual foreign model would not necessarily correspond to national conditions. Uzbekistan's agricultural structure, regional specialization, farm organization, water availability, infrastructure, technological access, and market conditions require context-specific adaptation.

The World Bank's identification of bioresource utilization as one of five priority areas in the Uzbek agri-food circular economy framework provides an important institutional basis for such adaptation [20].

The results also suggest that agricultural waste should be considered within a wider regional circular value-chain model. For example, crop-producing farms can supply residues to processing facilities; livestock farms can provide manure for biogas production; biogas facilities can generate energy; and digestate can be returned to agricultural land as fertilizer.

Such an interconnected model could reduce dependence on external inputs while creating additional economic opportunities in rural areas.

For Bukhara region in particular, the scale of agricultural production provides a relevant economic basis for exploring such approaches. Official statistics report agricultural production of 40,307.9 billion soums in the region in 2024 [15]. However, the economic scale of agricultural production should not be interpreted as a direct measure of waste generation. A separate assessment of crop-specific residue coefficients, livestock numbers, processing volumes, and regional material flows would be necessary to quantify the actual resource potential.

The comparative analysis therefore supports the development of an integrated agricultural waste management framework for Uzbekistan based on several interconnected components:

1. prevention and reduction of unnecessary waste generation;
2. separate collection and classification of biological residues;
3. development of composting and biofertilizer systems;
4. expansion of anaerobic digestion and biogas production;
5. development of markets for secondary biological resources;
6. digital monitoring of agricultural material flows;
7. financial incentives for farmers and agricultural enterprises;
8. development of regional circular agricultural clusters.

Such a framework would correspond to the principles of the circular economy while also reflecting the specific characteristics of Uzbekistan's agricultural sector.

CONCLUSION AND SUGGESTIONS

The study demonstrates that agricultural waste management is undergoing a conceptual transition from conventional disposal toward circular resource management. The comparative analysis of Germany, China, India, the European Union, and Uzbekistan shows that effective systems combine technological solutions with institutional regulation, economic incentives, infrastructure, market mechanisms, and stakeholder participation.

Germany demonstrates the potential of integrating organic waste treatment with nutrient recovery and agricultural application. China demonstrates the potential of large-scale utilization of crop residues through fertilizer, feed, energy, and other pathways. India's experience highlights the importance of combining crop-residue management with financial incentives, machinery access, and biomass-based energy development. The European Union demonstrates how circularity can be integrated into

agricultural policy through environmental conditionality, eco-schemes, rural development, and bioeconomy strategies.

For Uzbekistan, the available evidence indicates significant potential for the development of circular agricultural resource systems. Existing national and international policy frameworks already identify bioresource utilization, resource efficiency, nutrient cycling, and circular agriculture as important areas of development.

However, the transition requires more than the introduction of individual recycling or waste-treatment technologies. It requires an integrated management model that connects agricultural production, waste collection, processing, energy generation, fertilizer production, livestock systems, food processing, and rural markets.

The proposed conceptual transition can therefore be summarized as:

Agricultural residues → resource recovery → value-added processing →
reintegration into production → circular agricultural value chain.

For Uzbekistan, particularly at the regional level, the development of such systems could contribute to more efficient use of biological resources, reduction of environmental pressures, diversification of rural economic activities, and gradual advancement toward a circular agricultural economy.

Based on the results of the study, the following recommendations are proposed for Uzbekistan:

1. to introduce separate collection and classification of crop residues, livestock manure and agro-processing by-products at farm and district level;
2. to support composting, biofertilizer production and the return of digestate to agricultural land, drawing on the German experience of quality standards for recovered organic products;
3. to provide financial incentives and access to residue-management machinery for farmers, following the Indian model of Custom Hiring Centres;
4. to link agricultural support measures with environmental requirements, such as restrictions on open residue burning and soil-protection practices, as in the EU Common Agricultural Policy;
5. to develop pilot regional circular agricultural clusters, including in Bukhara region, that connect crop and livestock farms with biogas, compost and processing facilities;
6. to establish digital monitoring of agricultural material flows as a basis for quantifying the resource potential of agricultural waste.

Future research should focus on the quantitative assessment of agricultural waste flows in Uzbekistan and its regions, including crop-specific residue generation, livestock manure potential, processing by-products, economic value, greenhouse-gas implications, and the feasibility of regional circular agricultural clusters.

REFERENCES

1. Bhuvaneshwari, S., Hettiarachchi, H., & Meegoda, J. N. (2019). Crop residue burning in India: Policy challenges and potential solutions. *International Journal of Environmental Research and Public Health*, 16(5), 832.
<https://doi.org/10.3390/ijerph16050832>

2. Department of Information and Publicity, Government of Goa. (2024). Burning crop residues harms environment.
3. Duque-Acevedo, M., Belmonte-Ureña, L. J., Cortés-García, F. J., & Camacho-Ferre, F. (2020). Agricultural waste: Review of the evolution, approaches and perspectives on alternative uses. *Global Ecology and Conservation*, 22, e00902. <https://doi.org/10.1016/j.gecco.2020.e00902>
4. Ellen MacArthur Foundation. (2013). Towards the circular economy. Vol. 1: An economic and business rationale for an accelerated transition. Ellen MacArthur Foundation.
5. European Commission. (n.d.). CAP and the environment: An environmentally sustainable Common Agricultural Policy. Directorate-General for Agriculture and Rural Development.
6. European Commission. (n.d.). Clean air - Agriculture and rural development. Directorate-General for Agriculture and Rural Development.
7. European Commission. (n.d.). Soil - Agriculture and rural development. Directorate-General for Agriculture and Rural Development.
8. European Commission. (2025). Bioeconomy strategy: Strategy for a competitive and sustainable EU bioeconomy. European Commission.
9. Government of India, Press Information Bureau. (2024). Air pollution caused by stubble burning. Ministry of Environment, Forest and Climate Change.
10. Government of India, Press Information Bureau. (2026). Initiatives taken to integrate bioenergy for mitigation of air pollution and augment waste management strategies.
11. Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221-232. <https://doi.org/10.1016/j.resconrec.2017.09.005>
12. Koul, B., Yakoob, M., & Shah, M. P. (2022). Agricultural waste management strategies for environmental sustainability. *Environmental Research*, 206, 112285. <https://doi.org/10.1016/j.envres.2021.112285>
13. Republic of Uzbekistan. (2025). Third Nationally Determined Contribution of the Republic of Uzbekistan. UNFCCC.
14. Scenario-based synergistic assessment of crop straw allocation for GHG mitigation and sustainable resource use in China. (2026). ScienceDirect.
15. Statistics Agency under the President of the Republic of Uzbekistan. (2025). Total volume of agricultural production (annual). SIAT Open Data.
16. Tang, Z., Zhang, X., Chen, R., Ge, C., Tang, J., Du, Y., Jiang, P., Fang, X., Zheng, H., & Zhang, C. (2024). A comprehensive assessment of rice straw returning in China based on life cycle assessment method: Implications on soil, crops, and environment. *Agriculture*, 14(7), 972. <https://doi.org/10.3390/agriculture14070972>
17. Umweltbundesamt. (2025). Bioabfälle. German Environment Agency.
18. Velasco-Muñoz, J. F., Mendoza, J. M. F., Aznar-Sánchez, J. A., & Gallego-Schmid, A. (2021). Circular economy implementation in the agricultural sector:

Definition, strategies and indicators. Resources, Conservation and Recycling, 170, 105618. <https://doi.org/10.1016/j.resconrec.2021.105618>

19. Wang, Q., Qin, Y., Wei, Y., Ye, S., Wang, Y., Tong, T., Ji, Z., & Ouyang, Y. (2025). Key technologies and equipment for straw utilization in agriculture. Agronomy, 15(9), 2219. <https://doi.org/10.3390/agronomy15092219>

20. World Bank. (2024). Circular economy as an opportunity for Central Asia. World Bank.

21. Resolution of the President of the Republic of Uzbekistan No. PQ-4477 of October 4, 2019 "On approval of the Strategy for the transition of the Republic of Uzbekistan to a green economy for the period 2019-2030". <https://lex.uz/docs/4539502>



Marketing

ilmiy, amaliy va ommabop jurnali

Muharrir:
Ingliz tili muharriri:
Rus tili muharriri:
Musahhih:
Sahifalovchi va dizaynerlar:

Turobova Hulkar Rustamovna
Oripov Mahmud Ashurovich
Xidirova Gavxar Rustamovna
Qudratov Aziz Dehqonboyevich
Sadikov Shoxrux Shuxratovich
Abidjonov Nodirbek Odijon o'g'li

2026-YIL, 24-25-SENTABR, MAXSUS-SON, III-IV-SEKSIYALAR

© Materiallar ko'chirib bosilganda "Marketing" ilmiy, amaliy va ommabop jurnali manba sifatida ko'rsatilishi shart. Jurnalda bosilgan material va reklamalardagi dalillarning aniqligiga mualliflar mas'ul. Tahririyat fikri har vaqt ham mualliflar fikriga mos kelavermasligi mumkin. Tahririyatga yuborilgan materiallar qaytarilmaydi.

Mazkur jurnalda maqolalar chop etish uchun quyidagi havolalarga murojaat qilish mumkin. Ilmiy maqola, ommabop maqola, reklama, hikoya va boshqa ilmiy-ijodiy materiallar yuborishingiz mumkin.

Materiallar va reklamalar pullik asosda chop etiladi.

Elektron pochta: info@marketingjournal.uz
Bot: [@marketinjournalbot](https://t.me/@marketinjournalbot)
Tel.: +99890 5125464, +998939266610

Jurnalning rasmiy sayti: <https://marketingjournal.uz>

Marketing jurnali O'zbekiston Respublikasi Oliy ta'lim, fan va innovatsiyalar vazirligi huzuridagi **Oliy attestatsiya komissiyasi rayosatining 2024-yil 04-oktabrdagi 362/5 sonli qarori** bilan milliy ilmiy nashrlar ro'yxatiga kiritilgan



"Marketing" ilmiy, amaliy va ommabop jurnali 2024-yil 15-martdan O'zbekiston Respublikasi Prezidenti Administratsiyasi huzuridagi Axborot va ommaviy kommunikatsiyalar agentligi tomonidan **C-5669517** reyestr raqami tartibi bo'yicha ro'yxatdan o'tkazilgan. **Litsenziya raqami: №240874**



"Marketing" ilmiy, amaliy va ommabop jurnalining xalqaro darajasi: **9710**. GOCT 7.56-2002 "Seriya nashrlarning xalqaro standart raqamlanishi" davlatlaro standartlari talablari. **Berilgan ISSN tartib raqami: 3060-4621**